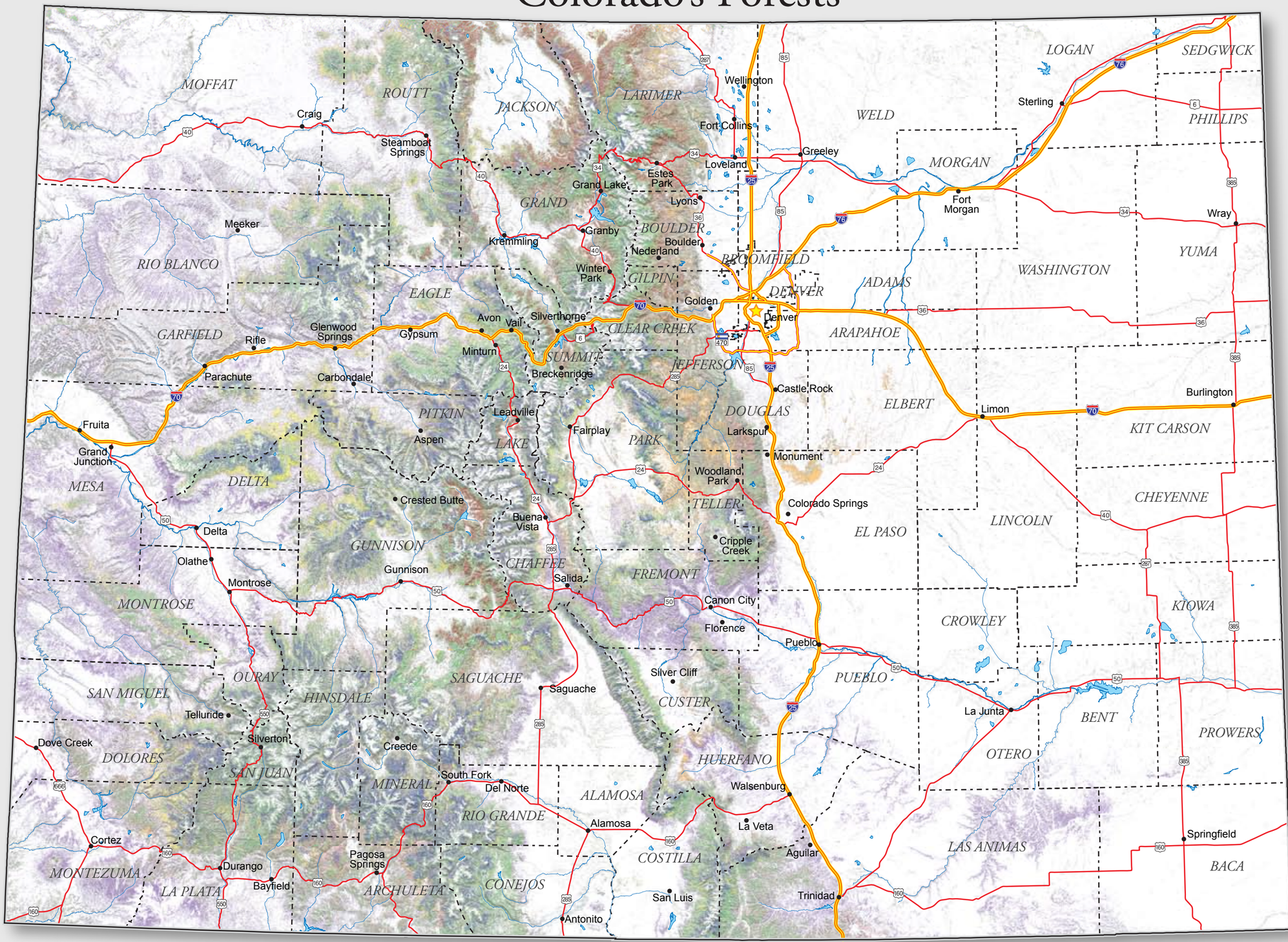
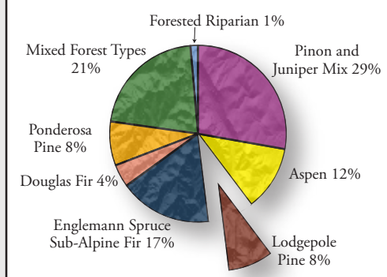
1 - General Information

Colorado's Forests



- Pinon and Juniper Mix 5,313,000 Acres
- Aspen 2,244,000 Acres
- Ponderosa Pine 1,568,000 Acres
- Engelman Spruce and Sub-Alpine Fir 3,208,000 Acres
- Douglas Fir 825,000 Acres
- Lodgepole Pine 1,517,000 Acres
- Mixed Forest Types 4,045,000 Acres
- Forested Riparian 232,000 Acres



- Interstate
- US Highway
- County
- Cities
- Lakes
- Streams

Map created by the Colorado State Forest Service, December 2006. Vegetation data from "Colorado Vegetation Classification Project," produced January 2004 by Colorado Division of Wildlife and U.S. Bureau of Land Management.

High Elevation Forest Vegetation

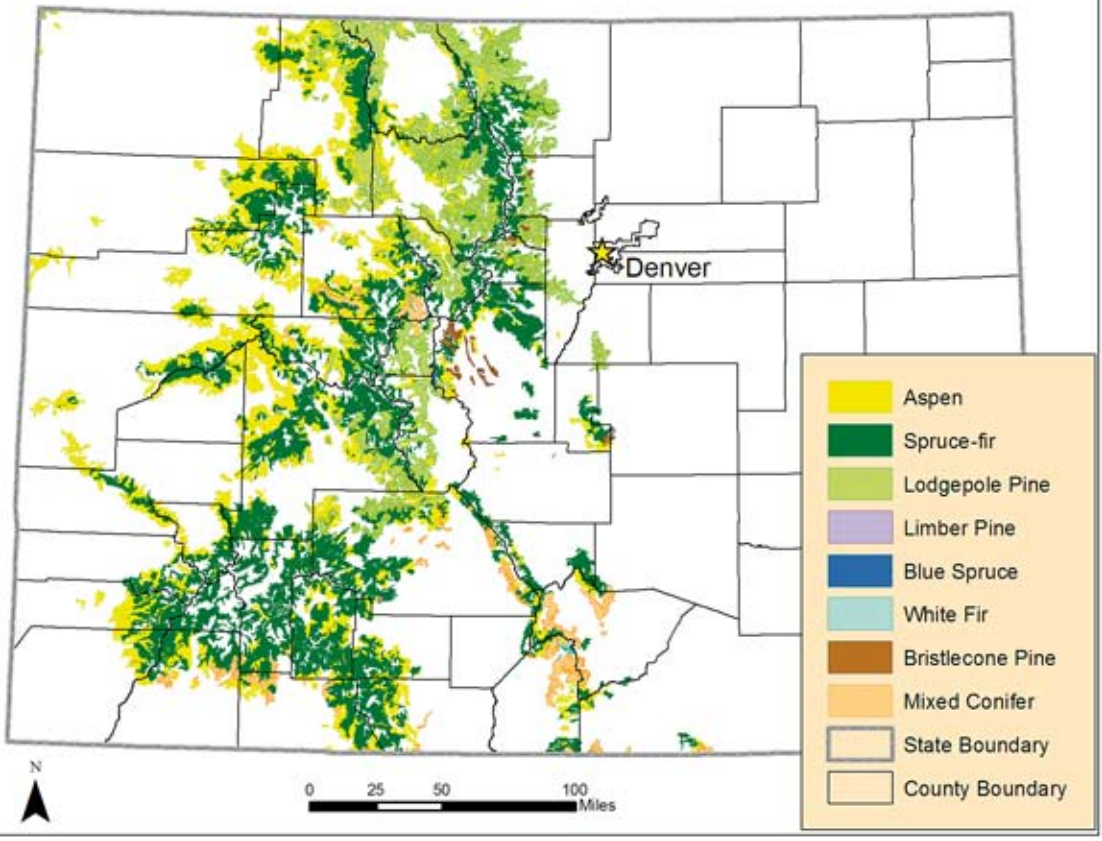
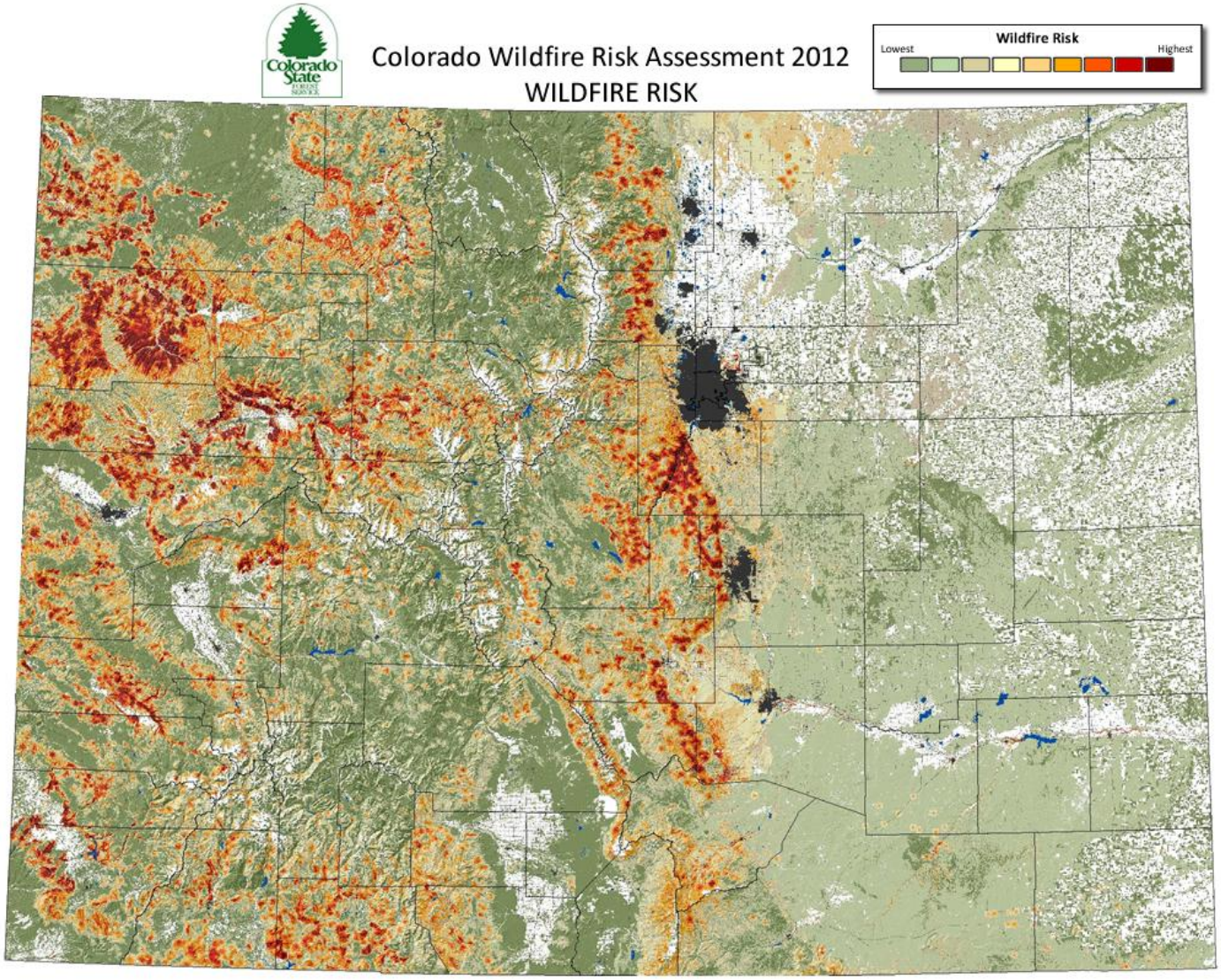


Figure 13. Colorado Wildfire Risk



Wildfire in Colorado

Preliminary Report on the 2012 Wildfire Season

May 8, 2013

Colorado Division of Fire Prevention and Control
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A Wildland Fires by County
B Colorado's Largest Wildfires

Credits

National Interagency Fire Center; U.S. Forest Service; Colorado State Forest Service; Division of Fire Prevention and Control (NFIRS); Rocky Mountain Insurance Information Association; National Wildfire Coordinating Group website (Historical Incident ICS-209 Reports); Denver Post; Inciweb Incident Information System: http://inciweb.org and Always Remember website: http://wlfalwaysremember.org.

Special thanks to Cpt. Kevin Michalak and FF Robert Kriegbaum for researching and compiling historical wildfire information.

The "Unprecedented" Wildfire Season

December 31, 2012 – The Fern Lake Fire is not out; but snowfall in the park has reduced the fire's spread and its potential to spread to very low. According to a Rocky Mountain National Park spokesperson, the fire is "smoldering in an area that's difficult to access among dense areas of trees and plant matter that has built up on a landscape unscathed by fire in more than 800 years." The spokesperson added that it may continue to burn and create visible smoke, particularly in the Forest Canyon area, through the winter.

Thus, the 2012 calendar came to an end, and the 2012 wildfire season did not.

Smoke from wildfires became a regular smell in the air across Colorado's Front Range this summer. Ash falling from the skies wasn't uncommon. Residents were evacuating homes due to fire, sometimes being allowed to return home and then having to evacuate again.

Prior to 2012 many considered 2002 the year's worst for wildfires. In that year of widespread drought, the Hayman Fire and the Missionary Ridge Fire burned a combined 211,000 acres, and were just two of many fires across the state that occurred.

The 2002 Hayman Fire still ranks as the largest fire in state history. That blaze burned 137,760 acres southwest of Denver, and resulted in 5 deaths, 16 injuries and 133 homes destroyed.

This editorial cartoon published on June 27, 2012 by Dave Granlund sums up the 2012 wildland fire season in Colorado. Courtesy: Dave Granlund

The High Park Fire (Larimer County) in June of 2012 is considered to be the second largest fire in state history. That fire burned 87,284 acres, killed 1 person, and destroyed 259 homes.

During the 2012 wildfire season, the state saw:

- Destruction of more than 347 homes in the Waldo Canyon Fire – the largest number of homes destroyed by a single fire in state history.
- The most expensive wildfire season in Colorado history in terms of insured losses. Preliminary damage estimates from insurance claims currently total $449.7 million.
- The fourth largest fire in recorded Colorado history (Last Chance Fire). The Last Chance Fire, a grass fire in Washington County, burned 45,000 acres in a single day on June 25, 2012.
- The most deaths of residents inside a burn area in a fire in state history (3 civilian fatalities in Lower North Fork Fire).

- An evacuation of the whole northwestern quadrant of the city of Colorado Springs (over 32,000 residents), which was the largest single-area mandatory evacuation ever due to a fire in the state.

For 2012, Colorado fire departments reported 6,459 wildland fires through the National Fire Incident Reporting System (NFIRS). These fires destroyed more than 648 structures, killed 6 civilians, burned more than 259,451 acres and have caused at least $538 million in property losses.

Emergency Fire Fund (EFF) Fires

The Emergency Fire Fund (EFF) was established in 1967 by a few counties that recognized that some wildfires may exceed the counties' resources and abilities to manage them. Participation in the EFF is voluntary. A 10-person committee, composed of county commissioners, sheriffs, fire chiefs and the Director of the Division of Fire Prevention and Control (DFPC), oversees the administration of the fund. Currently, 43 Colorado counties and the Denver Water Board contribute to EFF. The total annual amount contributed to the EFF is $1 million.

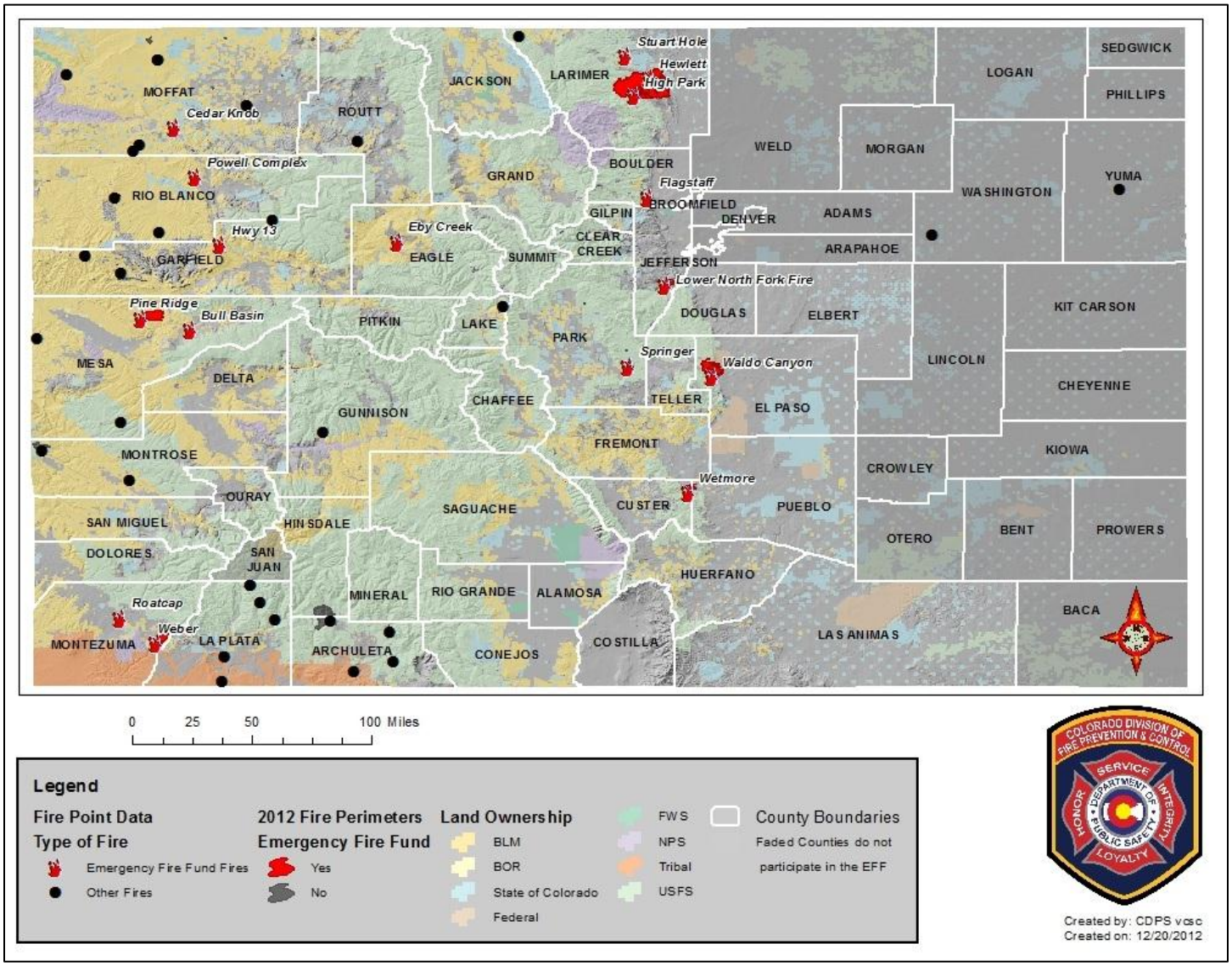
In 2012, there were a total of 16 fires qualifying for EFF. The total suppression costs for these fires (state share) are estimated to be $48.1 million.

Emergency Fire Fund Fires - 2012

Fire	Location	Month	Size (acres)	Homes Lost	Fatalities	Est. Cost Suppression
Lower North Fork*	Jefferson County	March	4,140	27	3	$5,165,000
Hewlett	Larimer County	May	7,685	0	0	$1,000,000
Stuart Hole	Larimer County	June	227	0	0	$200,000
High Park *	Larimer County	June	87,284	259	1	$25,100,000
Springer	Park County	June	1,145	0	0	$600,000
Weber *	Montezuma County	June	10,133	0	0	$2,135,000
Waldo Canyon *	El Paso County	June	18,247	346	2	$6,470,000
Flagstaff	Boulder County	June	300	0	0	$2,500,000
Pine Ridge	Mesa County	July	13,920	0	0	$500,000
Eby Creek	Eagle County	July	8	0	0	Unknown
Bull Basin	Mesa County	July	20	0	0	$200,000
Powell Complex	Rio Blanco	July	1,650	0	0	$210,000
Cedar Knob/Cold	Moffat County	July	1,056	0	0	$110,000
Highway 13	Garfield County	October	991	0	0	$150,000
Wetmore *	Custer & Pueblo	October	1,998	15	0	$3,515,000
Roatcap	Montezuma	October	400	0	0	$250,000
		Totals	**149,204**	**647**	**6**	**$48,105,000**

* FEMA FMAG qualifying fires.

Emergency Fire Fund Fires - 2012



Fire Management Assistance Grant (FMAG) Fires

When an uncontrolled wildfire poses an imminent threat to life and property and could result in a major disaster declaration, DFPC requests federal fire management assistance through the Fire Management Assistance Grant (FMAG) Program administered by the Federal Emergency Management Agency. If awarded, FMAGs provide for up to 75 percent of eligible costs in the suppression of catastrophic wildfires.

In 2012, there were 5 fires in Colorado that qualified for federal fire management assistance through the FMAG program. It is anticipated that the State will be reimbursed approximately $25 million from FEMA for these fires.

Fire Management Assistance Grant (FMAG) Fires - 2012

Fire	County	Size (acres)	Homes Lost	Fatalities	Est. Cost Suppression	Est. FEMA Reimbursement
Lower North Fork	Jefferson	4,140	27	3	$5,165,000	$3,000,000
High Park	Larimer	87,284	259	1	$25,100,000	$15,000,000
Weber	Montezuma	10,133	0	0	$2,135,000	$1,281,000
Waldo Canyon	El Paso	18,247	346	2	$6,470,000	$3,705,000
Wetmore	Custer	1,998	15	0	$3,515,000	$2,109,000
	Totals	**121,802**	**647**	**6**	**$42,385,000**	**$25,095,000**

Insured Losses[1]

The 2012 Wildfire Season took a devastating toll on Colorado residents, burning more than 600 homes and personal property. While the claims and rebuilding process continues, preliminary damage estimates now total $449.7 million from insurance claims that include smoke damage, additional living expenses, damaged and destroyed homes, as well as personal belongings and vehicles.

The estimated insured losses make the Waldo Canyon Fire in Colorado Springs the most expensive wildfire in Colorado's history, with insurance costs totaling more than $352.6 million from approximately 4,300 claims filed so far. Officials put the number of homes destroyed at 346. The High Park Fire near Fort Collins burned 259 homes and based on the nearly 850 insurance claims filed so far the insurance costs are estimated at $97.1 million. These estimates do not include commercial losses, nor do they account for the cost of firefighting or wildfire rehabilitation and recovery.

Previously, the most expensive wildfire in Colorado state history was the September 2010 Fourmile Canyon Fire that burned 169 homes and other personal property in the foothills just northwest of Boulder. Damage estimates totaled $217 million ($229.1 million in 2012 dollars) from insurance claims that included smoke damage, additional living expenses, damaged and destroyed homes, as well as personal belongings and vehicles.

The overall estimated cost of the 2002 Colorado wildfire season including the Iron Mountain, Coal Seam, Missionary Ridge and Hayman Fires was $70.3 million in insured losses ($90.0 million in 2012 dollars). Companies took in about 1,236 claims for the Hayman and Missionary Ridge Fires at an estimated cost of $56.4 million.

Wildfire insurance costs hinge on a number of factors, including the number of primary homes in the area (as compared to vacation homes and cabins), their estimated value and the amount of insurance coverage on the properties.

[1] The wildfire insurance loss information for this report was provided by the Rocky Mountain Insurance Information Association (RMIIA). See: http://www.rmiia.org/Catastrophes_and_Statistics/Wildfire.asp.

Colorado Wildfire Insured Losses

Year	Fire	Insured Loss ($ Millions)	2012 Dollars ($ Millions)*
2012	Waldo Canyon, Colorado Springs	$352.6	$352.6
2012	High Park, near Fort Collins	$97.1	$97.1
2010	Fourmile Canyon, northwest of Boulder	$217.0	$229.1
2002	Hayman, southwest of Denver	$38.7	$49.5
2002	Missionary Ridge, near Durango	$17.7	$22.7
2002	Coal Seam, Glenwood Springs	$6.4	$8.2
2002	Iron Mountain, near Cañon City	$7.5	$9.6

*2012 estimated cost calculations based on the Consumer Price Index.

Wildfire Emergency Response Fund (WERF)

The Wildfire Emergency Response Fund (WERF) was created to assist local jurisdictions with initial attack wildland fire response on state and private lands within the state of Colorado. Any County Sheriff, municipal fire department, or fire protection district within Colorado may request WERF as the official Requesting Agency. WERF will reimburse, if funds are available, the Requesting Agency the cost of eligible wildland firefighting resources. Eligible costs under Sec. 24-33.5-1226, C.R.S., include:

(a) The first aerial tanker flight or the first hour of a firefighting helicopter to a wildfire; and
(b) The employment of wildfire hand crews to fight a wildfire for the first two days of a wildfire, with a preference for the use of wildfire hand crews from the inmate disaster relief program.

As the 2012 fire season progressed at record pace, Governor Hickenlooper acted to enhance initial attack in order to help prevent small fires from growing into large fires. On July 18, 2012, DFPC implemented enhanced use of the Wildfire Emergency Response Fund by doubling the amount for the resources listed above.

As of November 9, 2012, WERF was utilized on a total of fifty-two fires and enhanced WERF was utilized on nineteen of these fires. The DFPC believes that without use of WERF and specifically “enhanced WERF”, several of these fires would have qualified as Emergency Fire Fund fires. This would have negatively impacted the Disaster Emergency Fund and require additional transfers from the General Fund.

Statutory Change of Authorities

On July 1, 2012, the State responsibilities for wildland fire management and prescribed fire transferred from Colorado State University to the Colorado Department of Public Safety under its Division of Fire Prevention and Control. This was a result of legislative action in the form of HB 12-1283. The new organization for wildland fire management is described in the next section of this report.

The Division of Fire Prevention & Control – Born from the Ashes of Tragedy

It is a well-known fact that, throughout history, much of the legislation that is drafted and passed into law is a result of tragedy. Such is the case of the legislation that created the Division of Fire Prevention and Control in the Colorado Department of Public Safety.

An airtanker drops retardant on Tuesday, March 27, 2012 on the Lower North Fork Fire in Jefferson County – Denver Post photo

On March 26, 2012, a wildfire occurred in the foothills of Jefferson County, Colorado. This fire, called the Lower North Fork fire, burned for a week and resulted in the tragic deaths of three people, the loss of 24 structures and the scorching of 4,140 acres in a populated area near Conifer, Colorado. At the peak of the fire, over 900 homes in the area were evacuated.

As a result of this wildfire, Governor John Hickenlooper and Colorado State University (CSU) President Tony Frank requested a thorough examination of the state's emergency response capabilities. The team was directed to review the structure of the emergency coordination between the State Forest Service and the Division of Emergency Management—and their processes and communication systems—in order to improve the state's response to fires and protect people and property.

After careful analysis, the review team recommended that the prescribed fire and wildfire management portions of the Colorado State Forest Service (CSFS) in CSU be moved into the Division of Fire Safety, within the Colorado Department of Public Safety (CDPS), and the Division of Emergency Management (DEM), within the Department of Local Affairs (DOLA), also be moved into the CDPS.

This reorganization was codified in HB12-1283, "Concerning the Department of Public Safety, and, in Connection Therewith, Renaming and Reorganizing Certain Existing Entities, and Making and Reducing Appropriations." The purpose of HB12-1283 is to enhance Colorado's ability to prepare for, and respond to fire and other emergencies by creating a single point of authority for fire and by consolidating the State's homeland security and emergency management functions in the CDPS.

HB12-1283, which was signed by Gov. Hickenlooper on June 4, 2012, created the Division of Fire Prevention and Control (DFPC) from the former Division of Fire Safety and transferred the fire responsibilities from CSU/CSFS effective July 1, 2012.

To accomplish the orderly transfer of responsibilities from CSU/CSFS, a Transition Advisory Committee (TAC) was established from employees of the two agencies and representatives of federal, state, local, and private sector stakeholder organizations.

The inaugural meeting of the TAC was held on May 25, 2012 at the CSFS facilities on the CSU Foothills Campus in Fort Collins. At this meeting the TAC embarked on the historic task of creating a new model of "Cooperative Fire Protection" in Colorado, by taking this organization, born from the ashes of tragedy, and guiding its transformation.

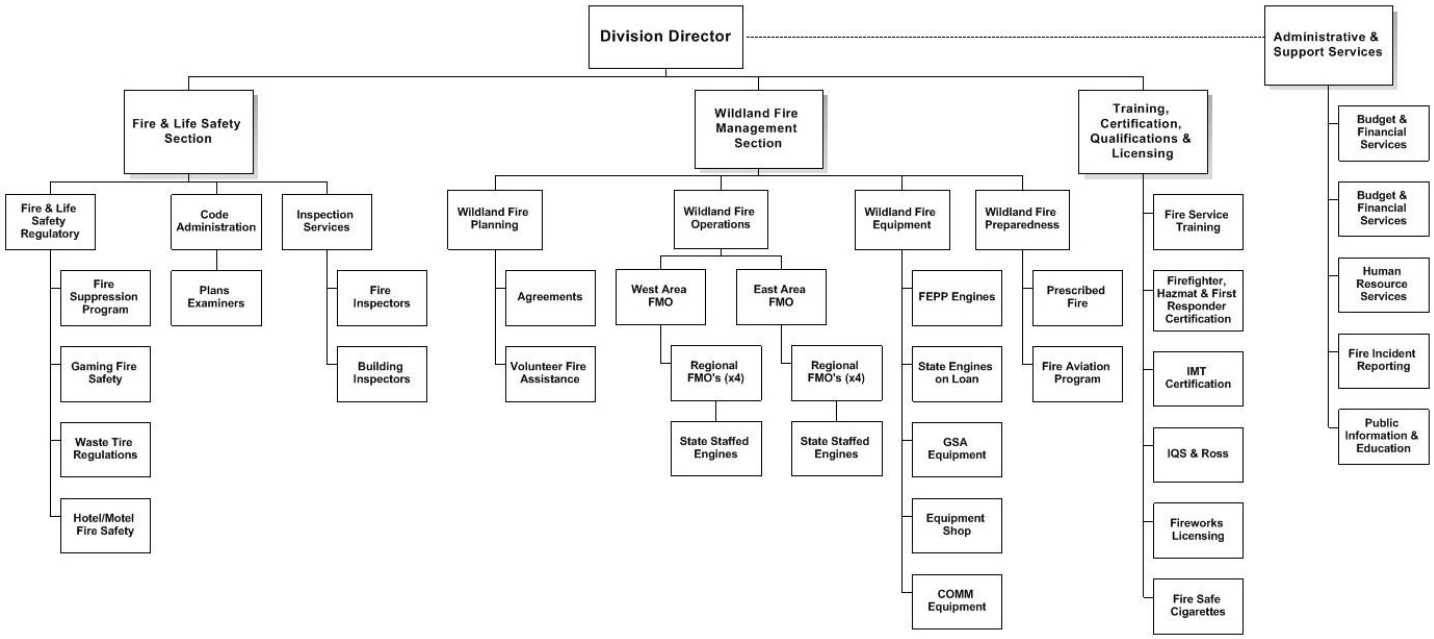
DFPC Mission Statement

The mission of the Colorado Division of Fire Prevention and Control is to safeguard those that live, work, learn and play in Colorado, by reducing threats to lives, property and the environment. The Division safeguards the public through: fire prevention and code enforcement; wildfire preparedness, response, suppression, coordination, and management; training and certification; public information and education; and technical assistance to local governments.

This mission is accomplished through the development and maintenance of relationships and cooperative delivery of various statewide fire prevention, protection and suppression programs that support local governments as well as state and federal agencies for delivery of services to the citizens of Colorado.

Over the course of the next several weeks, during one of the worst wildland fire seasons in Colorado's history, the TAC and its subcommittees met many times to make recommendations concerning the transition. The principal goal of the TAC during this time was to ensure that when the transition occurred on July 1, the new organization was capable of fulfilling the state's responsibilities with respect to wildland fires, namely to assist with fires that exceed local capabilities.

Division of Fire Prevention and Control (DFPC)
Organizational Chart



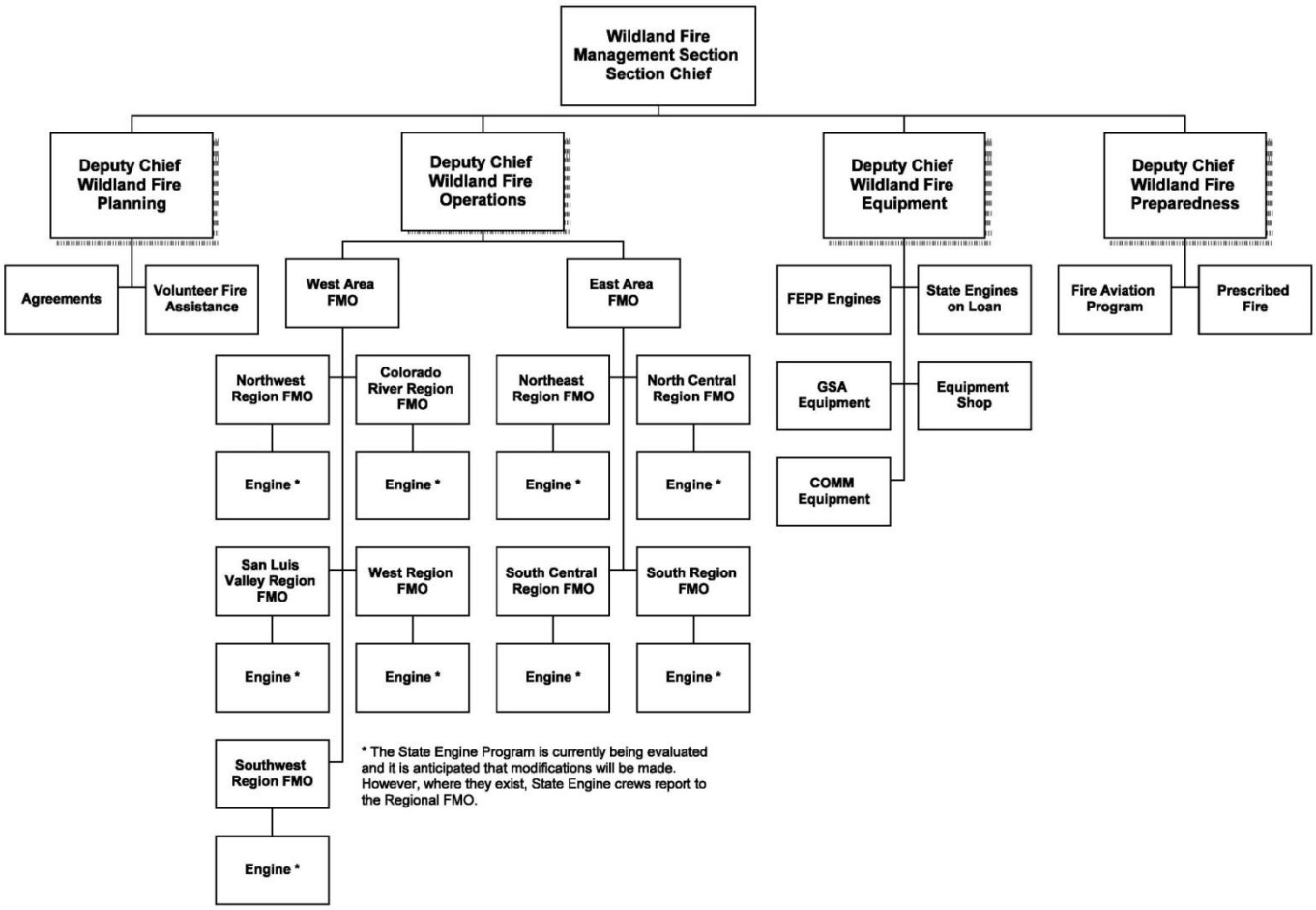
The Division of Fire Prevention and Control is currently organized into three sections and one branch: the Fire and Life Safety Section, the Wildland Fire Management Section, the Training, Certification and Qualifications Section, and the Administrative and Support Services Branch.

The Fire and Life Safety Section is responsible for the Division's building code, fire code and life safety regulatory programs, including: the School Safety Program, the Fire Suppression Program, the Limited Gaming Fire Safety Program, the Hotel and Motel Fire Safety Program, and the Waste Tire Regulatory Program.

Within the Training, Certification, Qualifications and Licensing Section are the Fire Service Training Program; the Firefighter, Hazardous Materials Responder, and Emergency Medical First Responder Certification Programs; the All-Hazard IMT Training and Certification Programs; the NWCG Training and Incident Qualifications System (IQS); the Fire Safe Cigarette Program and the Fireworks Licensing Program. The Administrative and Support Services Branch supervises the Division's strategic planning, budget and financial services; human resources; fire incident reporting; and public information and education responsibilities.

DFPC Wildland Fire Management Section Organizational Chart

The DFPC Wildland Fire Management Section (WFMS) is separated into four branches: Planning, Operations, Preparedness, and Logistics (Fire Apparatus and Equipment).



Wildland Fire Operations

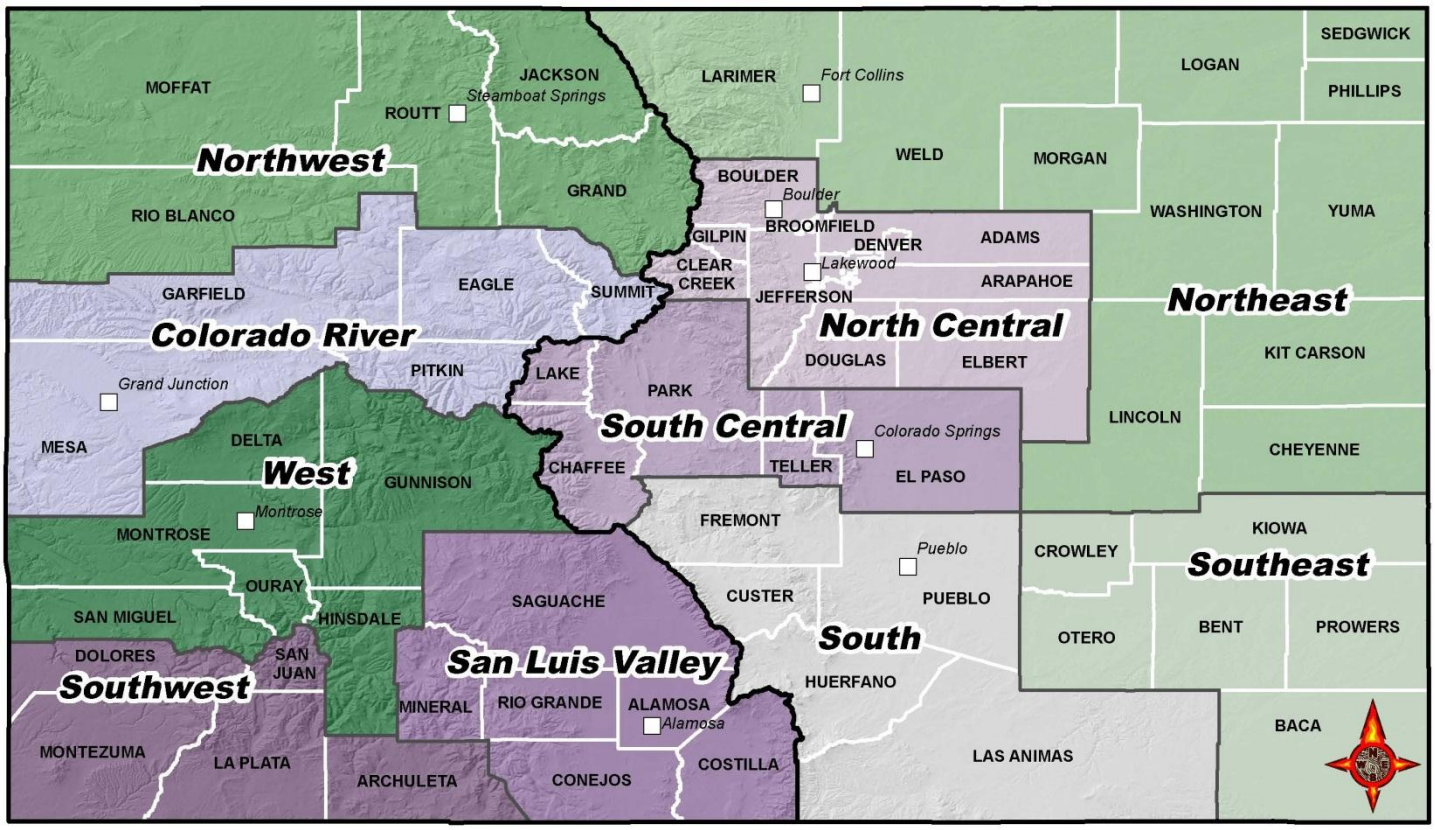
Under the Colorado State Forest Service, wildland fire management service, support, and programs were implemented and delivered to counties and fire districts through a combination of staff members from 17 CSFS District Offices and 4 CSFS Fire Management Officer (FMO) positions. This workload consists of 2 key areas: (1) day-to-day assistance, coordination and administration; and (2) state assistance, response and management during incidents.

Since the duties performed by CSFS District Offices were considered collateral, none of those personnel transferred to the DFPC. Thus, with only the 4 FMO positions transferring, the challenge is to efficiently and effectively maintain viable levels of service and support.

DFPC Fire Management Regions

An analysis was conducted to determine the best distribution of Fire Management Officers (FMOs) to effectively provide rapid response to incidents in support of counties, sheriffs and local fire chiefs; while performing day to day duties, coordination and administration. This analysis resulted in development of the following Fire Management Regions, which are based on the State All-Hazard Regions, with certain exceptions. The Division currently has a total of 8 Regional FMOs to cover the State's 10 Fire Management Regions, with 2 Area FMO positions serving in supervisory and backfill role.

Division of Fire Prevention and Control
Fire Management Regions



DFPC plans to add an FMO to the Southwest Region in early 2013 and is evaluating how to best address the workload and the complexity of fires in the North Central Region. Furthermore, it is anticipated that during active fire seasons, additional experienced and trained state personnel will be needed for Fire Duty Officer and initial response roles. This need was addressed during the second half of the 2012 fire season by maintaining an MOU with CSFS that provided for the response of a qualified "Line Officer" to fires when needed.

Wildland Fire Management Section Workload Indicators

Following are the workload indicators (number of fires and number of days on incidents) for the Wildland Fire Management Section for 2012. It is important to remember that several of the listed positions did not exist prior to July 1, 2012.

	# of Fires	# of Days on Incidents
Operations Section		
Operations Deputy Chief	1	4
West Area FMO	11	32
Northwest Region FMO	2	6
San Luis Valley Region FMO	2	7
East Area FMO	4	38
Northeast Region FMO	6	26
South Central Region FMO	8	29
South Area FMO	3	32
	37	174
State Engine Assignments		
Boulder Engine 621	4	9
Canon City Engine 641	2	15
Fort Collins Engine 44	8	47
Fort Collins Engine 622	12	70
Golden Engine	3	29
Greeley Fire E-624*	5	52
Littleton Fire E-741*	10	88
	44	310
Preparedness Deputy Chief	3	39
Planning Deputy Chief	5	30
Equipment (Shop)	11	110
Support Services	0	0
DFPC Totals:	**100**	**663**

* Cooperator staffed

Fire Aviation Program

For the past several years, the Colorado State Forest Service (CSFS) annually procured Single Engine Air Tanker (SEAT) aircraft on an "Invitation for Bid to Provide Single Engine Air Tanker" contract. Per this contract, SEATs were available to the State of Colorado on an "Exclusive-Use" basis during the wildland fire season. Under the Exclusive Use contract, the SEATs could not leave the State for Interagency use without permission of the contracting authority.

For the 2012 fire season, the CSFS opted not to go with an Exclusive Use contract, but rather was part of a regional interagency joint use agreement for SEATs, that were based out of the State of Colorado. To ensure that Colorado had more say in the operational control of the SEATs, CSFS (and later DFPC) provided virtually all of the support for their operation, including SEAT bases and SEAT Managers. Furthermore, because of the extraordinary wildland fire season and aggressive representation by CSFS/DFPC to the Rocky Mountain Coordinating Group (RMCG), SEAT availability was maintained in the State of Colorado throughout the fire season.

2012 SEAT Operational Statistics

Requesting Agency	# Total Incidents	# Total Loads	# Total Flight Time (hrs)	# Total Gallons Delivered	%
County/State	15	121	145.48	89,034	24.30
BLM	45	290	241.76	209,127	40.38
USFS	19	260	168.14	192,111	28.08
Other States	3	13	10.08	9,834	1.68
BIA	13	58	28.33	42,057	4.73
NPS	1	5	4.95	3,547	0.83
Total	**96**	**747**	**598.74**	**545,710**	**100.00**

Off-Season Operations

When the CSFS had an Exclusive Use contract, during the off-season, one SEAT was available as a "Call-When-Needed" (CWN) resource, which in reality meant that a SEAT was housed in a hangar in the State, but the pilot was on-call at their home base in Idaho. If the CWN contract were activated for a fire, the pilot would need to travel to Colorado before the SEAT was ready for a mission, and the minimum contract period was 10 days.

This year, in the absence of an Exclusive Use contract, once the SEATs were released from their federal contracts on September 30, they were free to return to their home base in Idaho. However, due to the ongoing potential of a wildland fire that could threaten lives and/or property, the DFPC maintained one SEAT available in the State on a weekly contract rate.

On November 13, after consultation with stakeholders, the DFPC released the remaining SEAT to return to its home base.

Fire Billing and Cooperator Reimbursements

With the transfer of wildland fire management functions from the Colorado State Forest Service to the Division of Fire Prevention and Control, the DFPC has assumed responsibility for fire billing and cooperator reimbursements. All fire billing between federal and local/county agencies are submitted through DFPC's Support Services Branch.

The DFPC responsibilities related to fire billing and cooperator reimbursements include:

- Develop, distribute, process, and approve Cooperative Resource Rate Form (CRRFs) for Cooperator agencies.
- Assist Cooperator agencies with training and CRRF completion as requested.
- Provide Cooperator agencies with IQSweb training and access.
- Facilitate entry of Cooperator engine and personnel resources into ROSS.
- Process Cooperator agency reimbursement requests per current DFPC Reimbursement Guidelines.

The workload related to fire billing and cooperator reimbursements has increased significantly over the past three years, as evidenced in the below table.

Fire Billing and Cooperator Reimbursement
Workload Indicators

	2007	2008	2009	2010	2011	2012
CRRFs		15	214	74	252	268
Cooperator Reimbursements	788	862	445	726	1,391	2,521
Increase Over Previous Year		9.4%	-48.4%	63.2%	91.6%	81.2%
Participating Cooperators		90	101	123	134	157
Increase Over Previous Year			12.2%	21.8%	8.9%	17.2%
Number of Incidents In-State	172	152	111	82	118	156
Number of Incidents Out-of-State	301	167	106	62	203	263
Total Incidents	473	319	217	144	321	419
Number of States	19	20	18	15	23	16
Average Days to Process	21	26	43	46	60	90

It is the goal of the DFPC to reduce the average time to process Cooperator reimbursements to 30 days. This will require examination and reengineering of fire billing procedures, as well as an evaluation of resource needs.

Colorado Department of Corrections: State Wildland Inmate Fire Team

Following the 2000 fire season, Colorado Corrections Industries (CCi) began forming a wildland fire team to provide hand crew support and assistance on wildland fires within Colorado. CCi operates the four State Wildland Inmate Fire Team (SWIFT) crews, housed at various correctional facilities in Colorado. Currently, one SWIFT crew operates out of the Four Mile Correctional Center in Canon City, one out of the Buena Vista Correctional Center, and two SWIFT crews operate out of the Rifle Correctional Center, one of which was added in 2012.

The Buena Vista SWIFT Crew on the Hewlett Fire (May 17, 2012)

During the 2012 fire season, SWIFT crews responded to 41 separate wildfire incidents, working a total of 246 days on 54 fire assignments. The crew that was added mid-season did 19 days on assignment and the other 3 crews averaged 75 days on assignment.

Immediate Actions Taken to Improve the State's Response to Wildfires

To accomplish the orderly transfer of responsibilities from CSU/CSFS and to ensure the continuity of services and support to counties, sheriffs and local fire chiefs, the following immediate actions were taken:

- CDPS established the State Emergency Operations Line as the new point of contact for counties to report wildland fires and/or request assistance (303-279-8855).
    - Upon request, communications personnel will notify the appropriate Regional FMO or Area FMO if the Regional FMO is not available.
    - The closest available resource capable of providing technical assistance and support to local agencies and facilitate the EFF assessment and application process will be dispatched. In some cases, this was a CSFS Line Officer operating under an MOU between CSFS and DFPC.
- DFPC requested and Governor Hickenlooper approved plan to double WERF in order to provide for 2 hours of firefighting helicopter time; first 2 SEAT flights; or 4 hand crew days. DFPC believes that without use of WERF and specifically "enhanced WERF", several more fires would have qualified as Emergency Fire Fund fires, which would have negatively impacted the Disaster Emergency Fund.

- DFPC prepositioned State Engines and crews in Northwest Colorado on "severity assignments" during a period of high wildfire incidence.

- DFPC financially supported the addition of a 4th SWIFT crew, housed at Rifle Correctional Center.

- In a partnership with DFPC, the Colorado National Guard, and the Governor's Office, the Colorado Wildland Fire and Incident Management Academy provided basic wildland firefighter training to 112 members of the CONG.

The Colorado National Guard graduates of S-130/190 basic wildland firefighter training.

Appendices

A Wildland Fires by County
B Colorado's Largest Wildfires

Appendix A

Wildland Fires by County

[January 1 – December 31, 2012]

Wildland Fires by County

January 1 – December 31, 2012

The following table depicts the wildland fires reported by Colorado fire departments through the National Fire Incident Reporting System (NFIRS) for 2012. This report includes all incidents compiled through April 25, 2013.

Lower North Fork Fire

Sunrise Mine Fire

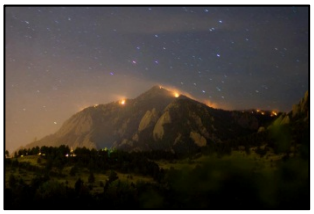
Hewlett Fire

High Park Fire

Waldo Canyon

County	Total Wildland Firess	Total Acres Burned	Total Dollar Loss
Adams	477	746	$118,615
Alamosa	22	133	$170,000
Arapahoe	445	8,241	$32,500
Archuleta	68	35	$1,500
Baca	2	0	$0
Bent	2	2	$0
Boulder	359	595	$8,231
Broomfield	0	0	$0
Chaffee	18	25	$0
Cheyenne	10	222	$0
Clear Creek	0	0	$0
Conejos	12	10	$0
Costilla	0	0	$0
Crowley	9	2	$0
Custer	21	5	$0
Delta	23	35	$2,500
Denver	0	0	$0
Dolores	2	2	$0
Douglas	92	7	$10
Eagle	65	688	$2,220
El Paso	748	35,616	$352,600,000
Elbert	45	51	$3,100
Fremont	201	42	$1,150
Garfield	154	1,054	$1
Gilpin	15	2	$0
Grand	25	13	$0
Gunnison	32	980	$0
Hinsdale	0	0	$0
Huerfano	34	334	$0
Jackson	11	57	$0
Jefferson	535	5,961	$12,300
Kiowa	0	0	$0
Kit Carson	51	3069	$0

Wildfire in Colorado 2012 – Appendix A


Flagstaff Fire

Heartstrong Fire

Springer Fire

Little Sand Fire

Last Chance Fire

Weber Fire

County	Total Wildland Firess	Total Acres Burned	Total Dollar Loss
La Plata	262	570	$4,300
Lake	9	2	$0
Larimer	540	87,560	$30,006,926
Las Animas	127	161	$1
Lincoln	10	215	$0
Logan	97	14,358	$215,550
Mesa	407	1,218	$655,900
Mineral	0	0	$0
Moffat	29	2,038	$0
Montezuma	177	2,921	$2,400,000
Montrose	66	123	$1,300
Morgan	56	3,659	$0
Otero	28	87	$1,820
Ouray	0	0	$0
Park	55	331	$0
Phillips	12	838	$0
Pitkin	0	0	$0
Prowers	47	3,124	$2,500
Pueblo	394	136	$53,100
Rio Blanco	63	538	$0
Rio Grande	1	0	$0
Routt	23	819	$3,600
Saguache	6	2	$0
San Juan	0	0	$0
San Miguel	30	18	$0
Sedgwick	14	3,171	$3,150
Summit	52	7	$0
Teller	36	4,194	$0
Washington	46	46,813	$3,000
Weld	367	1,932	$165,277
Yuma	27	26,688	$20,401
TOTAL	6,459	259,451	$386,488,952

Appendix B

Colorado's Largest Wildfires

[Largest Wildfires by Acres Burned]

Colorado's Largest Wildfires

Following is a summary of the largest wildfires in Colorado history, in terms of how many acres were burned.

1 - Hayman Fire

Lake George (Park County), CO
June 8 – July 18, 2002

Acres burned: 138,114
Homes destroyed: 133
Deaths: 6 (1 civilian, 5 firefighters)
Firefighting cost: $39.1 million
Cause: Human (arson)

Photograph taken from the headquarters of the Manitou Experimental Forest located on the eastern perimeter of the Hayman Fire, as the fire approached on June 18, 2002.

The Hayman fire started on June 8, 2002, and became the largest wildfire in Colorado's recorded history. The fire started just south of Tarryall Creek and County Highway 77 near Tappan Mountain (Park County) on the Front Range of the Rocky Mountains between Denver and Colorado Springs, CO.

When the fire was finally brought under control on July 18, 2002, it had burned 138,114 acres, resulted directly in the death of one civilian, $39.1 million in suppression costs, the destruction of 133 homes with total private property losses valued at $40.4 million, and indirectly led to the death of five firefighters.

Hayman Fire Case Study: http://www.fs.fed.us/rm/pubs/rmrs_gtr114.pdf.

2 - High Park Fire

Larimer County (Fort Collins), CO
June 9 – 30, 2012

Acres burned: 87,250
Homes destroyed: 259
Firefighters: 1,923
Firefighting cost: $39.2 million
Cause: Lightning

Photo: Trees torching at the High Park Wildfire on the Arapaho and Roosevelt National Forests and Pawnee National Grassland on Thursday, June 17, 2012. USFS Photo

The High Park fire, located approximately 15 miles west of Fort Collins in Larimer County, was caused by a lightning strike and was first detected on the morning of June 9, 2012.

The fire burned over 87,250 acres making it the second-largest fire in recorded Colorado history by area burned, after the Hayman Fire of 2002. It destroyed at least 259 homes, surpassing the number consumed by the Fourmile Canyon fire of 2010. The High Park fire was the most destructive fire in Colorado history, in terms of the number of houses burned, until it was surpassed by the Waldo Canyon fire. A 62-year-old woman was killed in the fire.

The High Park fire was declared 100 percent contained on June 30, 2012. Total suppression costs are estimated at $39.2 million.

For more information, go to: http://inciweb.org/incident/2904/

3 - Missionary Ridge Fire

Durango (La Plata County), CO
June 9 – July 14, 2002

Acres burned: 71,739
Homes destroyed: 56
Deaths: 1 firefighter
Firefighting cost: $40 million
Cause: Spark from an unknown source

A single spark from an unknown source ignited a large, fast moving fire on Missionary Ridge northeast of Durango, CO on Sunday afternoon, June 9, 2002. The fire quickly roared out of control and would go on to become the second largest wildfire in Colorado history, burning 73,145 acres. It would be the end of June before the fire would be mostly under control. One firefighter was killed by a falling tree.

4 - Last Chance Fire

Last Chance (Washington County), CO
June 25-26, 2012

Acres burned: 52,232 (grassland)
Structures destroyed: 11 (4 homes)
Firefighters: 110
Firefighting cost: Unknown
Cause: Sparks from a tire blowout ignited surrounding brush.

The Last Chance fire burned more than 45,000 acres of grassland, farmland, ranchland and several residences, making it the second largest fire in Colorado so far this summer. It burned at least four homes and destroyed seven other structures. A fire truck was also burned when crews were forced to escape from the fast-moving flames. Flames burned power lines and cut power to parts of southern Washington County.

More than 110 firefighters were involved in fighting the fire. At least 40 pieces of equipment were in use during the firefighting, including several aircraft dumping water and fire retardant on the flames.

5 - Bridger Fire

Piñon Canyon Maneuver Site and Comanche National Grasslands (Las Animas County)
June 8 - July 9, 2008

Acres burned: 45,800
Structures destroyed: 3
Firefighters: 355
Firefighting cost: $2,700,000
Cause: Lightening

The Bridger Fire started at the U.S. Army's Piñon Canyon Maneuver Site on June 8th in the Red Rock Canyon area, about 35 miles inside the north rim of the training grounds in Las Animas County. The fire subsequently moved to private ranch land.

6 - Bear Springs/Callie Marie Fires

Piñon Canyon Maneuver Site (Las Animas County)
June 5 – 21, 2011

Acres burned: 44,662
Structures destroyed: 5
Firefighters: 205
Firefighting cost: $2.5 million
Cause: Lightning

The Bear Springs fire (35,583 acres) was 15 miles west of the Callie Marie fire (9,079 acres) on the Piñon Canyon Maneuver Site.

7 – Burn Canyon Fire

San Miguel County (5 Miles SW of Norwood)
July 9 – 22, 2002

Acres burned: 31,300
Firefighters: 735
Firefighting cost: $5,745,500
Cause: Lightning

8 - Mount Zirkel Complex

Steamboat Springs (Routt County), CO
August 12 – September 25, 2002

Acres burned: 31,016
Firefighting cost: $13.3 million.
Cause: Lightning

This complex, comprised of the Hinman (9,326 acres) and Burn Ridge (8,260 acres) Fires, was 25 miles north of Steamboat Springs in the Mt. Zirkel Wilderness Area (Routt National Forest).

9 - Trinidad Complex (Spring, Fisher/James John Fires)

Stonewall/Trinidad (Las Animas County), CO
June 2 – 14, 2002

Acres burned: 33,000*
Firefighters: 284
Firefighting cost: $2.6 million.
Cause: Lightning

*25,919 acres in Colorado

The Trinidad Complex consisted of the Spring Fire which was 8 miles south of Stonewall and burned in both Colorado (20,223 acres) and New Mexico (7,081 acres), and the James John (or Fisher) Fire which was 9 miles southeast of Trinidad (5,696 acres).

10 – Mayberry Fire

Moffat County (32 Miles NW of Craig, CO)
August 24 – 28, 2002

Acres burned: 25,385
Firefighting cost: Not Reported
Cause: Lightning

11 – Little Sand Fire

Archuletta County (13 miles NW of Pagosa Springs)
May 13 – July 9, 2012

Acres burned: 24,900
Firefighters: 181
Firefighting cost: $7.54
Cause: Lightning

See: http://inciweb.org/incident/2878/

12 – Heartstrong Fire

Yuma County (20 miles SE of Yuma), CO
March 18 - 19, 2012

Acres burned: 24,000 (grassland)
Homes destroyed: 2
Firefighting cost: Unknown
Cause: Downed power line from high winds

Note: 3 firefighters were injured in a burnover incident

13 – Bircher Fire

Montezuma County (near Mesa Verde NP)
July 20 - 29, 2000

Acres burned: 23,607
Firefighters: 1,000+
Firefighting cost: $5.3 million
Cause: Lightning

For more information: http://tinyurl.com/b4bpf4d

14 – Waldo Canyon Fire

Colorado Springs (El Paso County), CO
June 23 - July 10, 2012

Acres burned: 18,247
Deaths: 2
Homes destroyed: 346
Firefighters: 1,000+
Firefighting cost: $15.3 million
Cause: Human (under investigation)

As of this printing, the Waldo Canyon Fire is the most expensive fire in state history with insurance claims totaling more than $352.6 million dollars. It is also the most destructive fire in state history as measured by the number of homes destroyed, eclipsing the previous record-holding fire, the High Park Fire of 2012. For more information see: http://inciweb.org/incident/2929/

15 – Big Fish Fire

Garfield/Rio Blanco Counties
July 8 - November 1, 2002

Acres burned: 17,056
Structures destroyed: 8
Firefighting cost: $1.9 million
Cause: Lightning

The Big Fish fire was sparked by lightning on July 8, 2002 but was being allowed to burn because it was in the remote Flat Tops Wilderness Area, 34 miles southwest of Steamboat Springs. It flared up on August15, 2002, forcing evacuations, and destroyed Trappers Lake Lodge, seven cabins and burned through Trappers Lake Campground.

16 – Cheyenne County Fire

Cheyenne County, CO
May 31 - June 1, 2002

Acres burned: 15,000 (brush and grass)
Firefighting cost: Unknown
Cause: Lightning

17 – Ft. Lyons Fire

Las Animas (Bent County), CO
April 7 - 15, 2011

Acres burned: 14,000 (brush and grass)
Firefighting cost: $302,000
Cause: Lightning

18 – Pine Ridge Fire

Garfield/Rio Blanco Counties
June 27 - July 4, 2012

Acres burned: 13,920
Firefighters: 213
Firefighting cost: Unknown
Cause: Lightning

See: http://inciweb.org/incident/2951/

19 – Mato Vega Fire

Costilla County (12 miles NE of Fort Garland), CO
June 18 - 30, 2006

Acres burned: 13,820
Firefighters: 566
Firefighting cost: $3.1 million
Cause: Lightning

The Mato Vega Fire burned on the Trinchera Ranch and surrounding area and closed U.S. 160 over La Veta Pass for four days.

20 – Spring Creek Complex

Garfield County (6 miles north of New Castle), CO
June 22 – July 21, 2002

Acres burned: 13,490
Firefighters: 293
Firefighting cost: $6.98 million
Cause: Lightning

This complex was created on July 17, 2002 and consists of Spring Creek Fire (CO-WRF-339) and East Meadow Creek Fire (CO-WRF-475).

21 – Shell Complex

Las Animas County (15 Miles N of Kim), CO
June 7 - 17, 2011

Acres burned: 13,312
Structures destroyed: 7
Firefighters: 258
Firefighting cost: $1.1 million
Cause: Lightning

The Shell Complex consisted of the Shell Fire (12,827 acres), Brice Fire (329 acres) and Mesa de Maya Fire (156 acres).

22 – Coal Seam Fire

Garfield County (W of Glenwood Springs), CO
June 7 – July 9, 2002

Acres burned: 12,209
Structures destroyed: 43 (29 homes)
Firefighting cost: $7.3 million
Cause: Other

The South Cañon Number 1 Coal Mine fire, a subsurface fire burning since 1910, ignited the Coal Seam Fire.

23 – Karval Fire

Lincoln County (Karval), CO
March 24, 2011

Acres burned: 12,000 (grass)
Structures destroyed: 3
Firefighting cost: Unknown
Cause: Human

The fast moving, wind driven grass fire west of Karval caused the evacuation of the town and destroyed a barn and two county bridges.

24 – Buffalo Creek Fire

Jefferson County, CO
May 18 - 25, 1996

Acres burned: 11,875
Structures destroyed: 18 (9 homes)
Firefighting cost: $2.8 million
Cause: Human

An unattended, smoldering campfire close to Wellington Lake in Pike National Forest near Buffalo Creek, escaped when winds picked up.

25 – Mason Fire

Fremont/Pueblo Counties
(2 Miles S of Wetmore), CO
July 7 - 16, 2005

Acres burned: 11,357
Structures destroyed: 1
Firefighting cost: $3.8 million
Cause: Lightning

26 – Hi Meadow Fire

Bailey (Park County), CO
June 12-20, 2000

Acres burned: 10,800
Homes destroyed: 51
Firefighters: 791
Firefighting cost: $4.5 million
Cause: Human (cigarette)

Note: The Hi Meadow wildfire was subsequently studied for the effect of fuel treatments on wildfire severity. See: "Effect of Fuels Treatment on Wildfire Severity" at: http://tinyurl.com/ad2xc68.

27 – Bobcat Gulch Fire

Larimer County, CO
June 12-19, 2000

Acres burned: 10,559
Structures destroyed: 22
Firefighters: 1,075
Firefighting cost: $3.3 million
Cause: Human (illegal campfire)

For more information: http://tinyurl.com/b5qxufs.

28 - Weber Fire

Mancos (Montezuma County), CO
June 22 – July 6, 2012

Acres burned: 10,133
Homes destroyed: 0
Firefighting cost: $2,135,000
Cause: Human

See: http://inciweb.org/incident/2937/

A juvenile was charged with two counts of juvenile delinquency for starting the fire.

29 – Lincoln County Complex

Lincoln County, CO
May 31 - June 1, 2002

Acres burned: 10,000 (grass and brush)
Structures destroyed: 4 (2 homes)
Firefighting cost: Unknown
Cause: Lightning

30 – Million Fire

Rio Grande County (2 miles S of South Fork), CO
June 19 - 29, 2002

Acres burned: 9,346
Structures destroyed: 13 (11 homes)
Firefighting cost: $9.8 million
Cause: Human

31 – Picnic Rock Fire

Larimer County (10 miles NW of Fort Collins), CO
March 30 - April 9, 2004

Acres burned: 8,908
Homes destroyed: 1
Firefighters: 444
Firefighting cost: $2.3 million
Cause: Human (escape of illegal burn of yard waste)

According to the IC, the lack of handcrews significantly hampered fire control operations. Normally, seasonal fire crews and equipment aren't in place in northern Colorado until May, so the necessary firefighters and air support were hard to come by.

32 – Ordway Fire

Ordway (Crowley County), CO
April 15 - 17, 2008

Acres burned: 8,900
Structures destroyed: 44 (24 homes)
Deaths: 2 firefighters
Firefighting cost: $150,000
Cause: Human (escape of an agricultural controlled burn)

For more information: http://tinyurl.com/d9dm8e4

33 – Furnish Fire

Las Animas County, CO
May 15 - 17, 2002

Acres burned: 8,000
Structures destroyed: 0
Firefighting cost: Unknown
Cause: Lightening

This fire was located approximately 80 miles east of Trinidad, CO (Las Animas County) in the Furnish and Black Canyon.

34 – Track Fire

Las Animas County, CO
June 12 - 28, 2011

Acres burned: 7,830*
Structures destroyed: 11 (8 homes)
Firefighting cost: $8,750,000
Cause: Human

This fire started on June 12th in New Mexico and crossed into Colorado on June 13th. The total acreage was 27,792 acres; of which 7,830 were in Colorado.

35 - Greasewood Fire (WFU)

Rio Blanco County (17 miles W of Meeker), CO
June 1 – June 24, 2004

Acres burned: 7,815
Homes destroyed: 0
Firefighting cost: $1,093,454
Cause: Lightening

This fire was managed by a Fire Use Team for resource benefit.

Colorado Division of Fire Prevention and Control

Wildfire Preparedness Plan 2013

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Introduction and Background

Colorado law; specifically Section 24-33.5-1226 (3) (a), C.R.S. requires the Director of the Division of Fire Prevention and Control to develop an annual Wildfire Preparedness Plan, in collaboration with a representative of the County Sheriffs of Colorado, a representative of the Colorado State Fire Chiefs' Association, the Director of the Office of Emergency Management and the Adjutant General.

The Wildfire Preparedness Plan shall be designed to address the following:

(1) The amount of aerial firefighting resources necessary for the state of Colorado at times of high and low wildfire risk;
(2) The availability of appropriate aerial firefighting equipment and personnel at times of high fire risk to respond to a wildfire;
(3) The availability of state wildfire engines and staffing of the engines at different levels of wildfire risk;
(4) The availability of state inmate wildfire hand crews at different levels of wildfire risk; and
(5) A process for ordering and dispatching aerial firefighting equipment and personnel that is consistent with, and supportive of, the statewide mobilization plan prepared pursuant to Section 24-33.5-705.4, C.R.S.

The Wildfire Preparedness Plan shall also provide recommendations on the use of the Wildfire Preparedness Fund created in §24-33.5-1226 (4) (a), C.R.S.

Wildfire Preparedness Fund

The Wildfire Preparedness Fund in Colorado was authorized by the 2006 Legislature through Senate Bill 06-096, which also appropriated funding for state fiscal years 2006 through 2010 to support implementation of the actions directed by the legislation.

Extension of the Wildfire Preparedness Fund – Governor Hickenlooper signed into law SB11-238 on June 8, 2011. The bill extends the annual transfer of $3.25 million by the Department of Local Affairs to the Division of Fire Prevention and Control for two years beginning July 1, 2012.

Statutory Change of Authorities

On July 1, 2012, the State responsibilities for wildland fire management and prescribed fire transferred from Colorado State University to the Colorado Department of Public Safety (CDPS) under its Division of Fire Prevention and Control (DFPC). This was a result of legislative action in the form of House Bill 12-1283. The purpose of HB12-1283 is to enhance Colorado's ability to prepare for and respond to fire and other emergencies by creating a single point of authority for fire and consolidating the State's homeland security and emergency management functions in the CDPS.

Situation

Wildfires occur as unscheduled emergency events in wildland fuels (prairie or forest vegetation) and in fuels that include a combination of wildland and human introduced fuels such as houses and improvements. Wildfires involve or threaten human life, residential housing, other improvements, and natural resources.

Wildfire knows no boundaries; it does not recognize jurisdictional responsibilities. A single wildfire often crosses private, county, state, tribal and federal lands and threatens communities, infrastructure, economies, and valuable natural resources that affect citizens, landowners and fire managers across all landscapes. In-as-much, wildland firefighting in Colorado is interagency in nature involving state, county, local, federal, and tribal partners.

Due to natural fuels build-up and increased population in wildland-urban interface areas, wildfires that exceed the control efforts of local and county resources are becoming more common and more complex. The Division of Fire Prevention and Control (DFPC) is the lead state agency for wildland fire as identified in ESF 4, Colorado State Emergency Operations Plan.

Preparedness Planning Assumptions

- Public, homeowner, and firefighter safety is the priority.
- Wildfires that exceed the capabilities of local and county resources will occur.
- Wildfires will threaten lives, property, and natural resources.
- No single entity or jurisdiction alone can suppress every wildfire.
- Successful suppression and extinguishment of catastrophic wildfires require organized interagency cooperation at all levels of government.
- Ensuring that state wildfire resources are identified, staffed, and positioned to respond will prevent some wildfires from becoming large catastrophic events and will assist in the containment and suppression of those wildfires that do escape initial attack.

Fire Season Outlook 2013

In late April and early May of every year, scientists and land managers produce coordinated outlooks for fire season across the western US to better prioritize resources. While it is too early to forecast with accuracy what the 2013 fire season will bring, experts are predicting "normal" significant wildland fire potential except for areas of above normal conditions across southern Colorado from May into July.[1]

- Long-range predictors for late April through May suggest conditions near to slightly below normal for precipitation and near normal for temperatures. June and July forecasts indicate drier and warmer than normal conditions, especially during June.

- Despite some recent moisture, the southern third of Colorado remains the driest part of the Rocky Mountain Area, with persistent dryness across that part of the region.

According to the Rocky Mountain Area Seasonal Outlook as of April 19, 2013, experts suggest a repeat of a 2012 or 2002 historical fire seasons is unlikely, with most indices trending towards a more average fire season this summer. However, large fires still occur during average and even below average fire seasons. Dry pockets, especially over southern Colorado will need to monitored closely for above average potential leading into the 2013 fire season.[2]

[1] National Significant Wildland Fire Potential Outlook, National Interagency Fire Center, Predictive Services, April 1, 2013
[2] Rocky Mountain Area Seasonal Outlook, April 19, 2013

Wildland Fire Management Program

Wildland fire management service, support, and programs are implemented and delivered to counties and fire districts primarily through the Wildfire Operations staff, consisting of the Deputy Chief of Wildfire Operations and the Area and Regional Fire Management Officers (FMOs). This workload consists of 2 key areas: 1) day to day assistance, coordination and administration; and 2) state assistance, response and management during incidents.

General Wildland Fire Management Duties Include:

- Coordination of Wildfire Emergency Response Fund (WERF) processes and facilitate reimbursement requests from local fire agencies.
- Annual Operating Plan (AOP): coordinate with affected county, state, and federal agencies to plan, develop, complete and distribute the Annual Operating Plan.
- Cooperative Resource Rate Form (CRRF): information distribution, training, compilation, and review of documents provided by cooperators.
- Facilitate and complete County and State Wildfire agreements, including County EFF as well as numerous other agreements.
- Provide technical prescribed fire assistance to other agencies through project design, plan development, and plan implementation.
- Grant Programs: distribution of information and applications, review of applications, project tracking, and project completion processes for the Volunteer Fire Assistance Program grant.
- Provide technical assistance, advice on qualification standards and training programs. Coordinate and develop course schedules, course sponsorship by providing instructors, and tracking of completed courses.
- Serve on various committees, councils, working groups, task forces, and local working groups for wildfire coordination and planning efforts with locals.

When a wildland fire occurs anywhere in the State, Colorado law requires the DFPC provide technical assistance to local governments, and assume the management of wildfires that exceed the capacity of Counties, upon the request of the sheriff or when wildfires threaten to become state emergencies or disasters. The immediate field response to these requests for assistance is the Fire Management Officer.

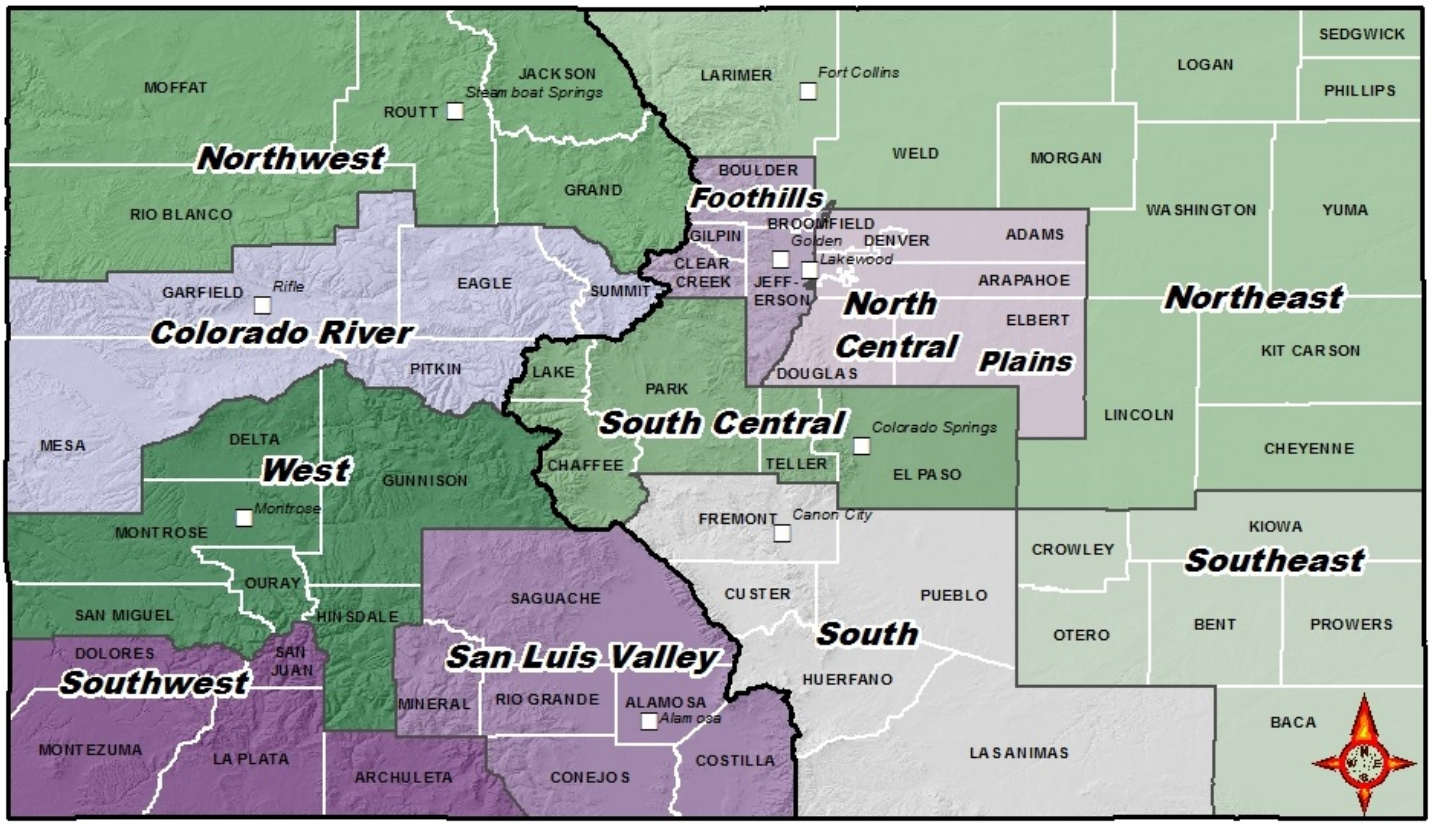
An assessment was performed to determine the number of Fire Management Officer (FMO) positions that would be needed to maintain necessary roles and functions without disruption. Additional criteria that were considered included: geographic size, accessibility, and travel; wildland urban interface (WUI) areas and potential incident complexity; typical wildfire fuels, fire behavior, fire occurrence, and incident duration; and the need to be located and integrated within the local communities.

The assessment concluded that the necessary field staff to maintain continuity of operations would be 2 Area FMO positions serving in supervisory and backfill roles, and 10 Regional FMO positions assigned within the Colorado All-Hazard Regions.

The DFPC Fire Management Zones

The DFPC Fire Management Zones are based on the State All-Hazard Regions, with certain exceptions. An analysis was conducted to determine the best distribution of FMO's to effectively provide rapid response to incidents in support of counties, sheriffs and local fire chiefs; and perform day to day duties, coordination and administration. This analysis resulted in development of the following Fire Management Zones.

Division of Fire Prevention and Control
Fire Management Zones



2013 Wildland Fire Management Plan

The Division currently has 9 Regional FMO's to cover the State's 9 All-Hazard Regions, with 2 Area FMO positions serving in supervisory and backfill role. DFPC is currently in the process of adding an FMO to the Southwest Region and is evaluating how to best address the workload and the complexity of fires in the North Central Region.

It is anticipated that during active fire seasons, additional experienced and trained state personnel will be needed for Fire Duty Officer and initial response roles. This need was addressed during the 2nd half of the 2012 fire season by maintaining an MOU with CSFS that provided for the response of a qualified "Line Officer" to fires when needed. The DFPC expects this MOU to be extended through June 30, 2013.

Fire Aviation Program

For the past several years, the Colorado State Forest Service (CSFS) annually procured Single Engine Air Tanker (SEAT) aircraft on an "Invitation for Bid to Provide Single Engine Air Tanker" contract. Per this contract, SEATs were available to the State of Colorado on an "Exclusive-Use" basis during the wildland fire season. Under the Exclusive Use contract the SEATs could not leave the State for Interagency use without permission of the contracting authority (CSFS).

For the 2012 fire season, due to contracting issues, the CSFS opted not to go with an Exclusive Use contract, but rather was part of a regional interagency joint use agreement for SEAT's, which were based out of the State of Colorado. To ensure that Colorado had more say in the operational control of the SEAT's, CSFS (and later, DFPC) provided virtually all of the support for their operation, including SEAT bases and SEAT Managers. Furthermore, because of the extraordinary wildland fire season and aggressive representation by CSFS (prior to July 1st) and DFPC personnel after July 1st to the Rocky Mountain Coordinating Group (RMCG), we were able to maintain SEAT availability in the State of Colorado throughout the fire season.

2012 SEAT Operational Statistics

Requesting Agency	# Total Incidents	# Total Loads	# Total Flight Time (hrs)	# Total Gallons Delivered	%
County/State	15	121	145.48	89,034	24.30
BLM	45	290	241.76	209,127	40.38
USFS	19	260	168.14	192,111	28.08
Other States	3	13	10.08	9,834	1.68
BIA	13	58	28.33	42,057	4.73
NPS	1	5	4.95	3,547	0.83
Total	**96**	**747**	**598.74**	**545,710**	**100.00**

Off-Season Operations

When the CSFS had an Exclusive Use contract, during the off-season, one SEAT was available as a "Call-When-Needed" (CWN) resource, which in reality meant that a SEAT was housed in a hanger in the State, but the pilot was on-call at their home base in Idaho. If the CWN contract was activated for a fire, the pilot would need to travel to Colorado before the SEAT was ready for a mission, and the minimum contract period was 10 days.

In the absence of an Exclusive Use contract in 2012, once the SEATs were released from their federal contracts on September 30th, they were free to return to their home base in Idaho. However, due to the ongoing

potential of a wildland fire that could threaten lives and/or property, the DFPC maintained one SEAT available in the State on a weekly contract rate. On November 13th, after consultation with stakeholders, the DFPC released the remaining SEAT to return to its home base.

2013 Fire Aviation Plan

For the 2013 fire season, DFPC has entered into an exclusive use contract for 2 SEATs for 120 days each. This contract is estimated at $1.2 million; however, the actual number of contract days and flight hours will affect the final amount.

DFPC continues to evaluate options towards the goal of making the State's fire aviation program more diverse, effective and efficient include:

- Support additional training to ensure further integration and consistent competency of CONG helicopters and streamline the process of mobilizing this resource.
- Utilizing CSP fixed wing and other available aircraft for detection activities.
- Increased training of local fire departments and sheriffs in the use of aircraft for initial attack on fires.
- Consider call-when-needed (CWN) contract for large air tankers (LATs).
- Consider call-when-needed (CWN) contract for SEATs for initial attack on fires in the eastern plains.

DFPC may enter into agreements to provide firefighting services, including personnel or firefighting aircraft, engines, or other vehicles to federal, state, or local agencies.

State Engine Program

The State Engine Program includes personnel, upgrades, and the operating expense of the permanent, seasonal, and cooperator staffed engines. DFPC currently maintains 12 Type 6 Engines and 4 Type 4 Engines, which have been traditionally deployed as follows:

- 4 state permanent staffed engines
- 3 state seasonal staffed engines
- 6 state engines with cooperator (call-when-needed) staffing
- 3 loaner engines

2013 State Engine Plan

For 2013, the amount of money available for the State Engine Program is not sufficient to maintain it at the same level that it could be in previous years.

In recognition that this program is important to filling gaps that exist in local wildland fire resources, DFPC is looking for innovative and cost-effective means to continue it. DFPC is currently soliciting interest from local fire departments and county sheriffs that in jointly staffing state engines and negotiating agreements with those that have expressed interest.

Example of DFPC Type 6 Engine

Example of DFPC Type 4 Engine

The 2013 plan for state engines will be based on wildfire risk and need as well as available funding, and may include any number of potential arrangements, including:

- Strategically Located State Engines (with Permanent, Seasonal, and/or Interagency staffing)
- Strategically Located Super Modules (Type 4 and Type 6)

To the degree practicable and possible, State engines will:

- be incorporated into local and regional response plans and will honor mutual aid periods; and
- be relocated around the state based on need, to fill gaps in coverage or to address wildfire potential and wildfire activity (severity assignments).

The following is also included in the 2013 State Engine Plan:

- Fire Equipment Shop support for equipment maintenance and repair
- 2 lowboy transport trailers for maintenance

DFPC may enter into agreements to provide firefighting services, including personnel or firefighting aircraft, engines, or other vehicles to federal, state, or local agencies.

Colorado Department of Corrections: State Wildland Inmate Fire Team

Following the 2000 Fire Season, Colorado Corrections Industries (CCi) began forming a wildland fire team to provide hand crew support and assistance on wildland fires within Colorado. CCi operates the four State Wildland Inmate Fire Team (SWIFT) crews, housed at various correctional facilities in Colorado. Currently, the base locations are at the Four Mile Correctional Center in Canon City, the Rifle Correctional Center in Rifle and the Buena Vista Correctional Center in Buena Vista, Colorado. In 2012, CCi added a fourth crew to the program, based out of Rifle Correctional.

In 2012, SWIFT crews have responded to 31 separate wildfire incidents in Colorado, working a total of 184 days on fire assignments.

2013 SWIFT Plan

In 2013, DFPC will continue to support the four State Wildland Inmate Fire Team (SWIFT) crews operated by CCi; providing training, logistical and/or overhead support that may be needed to ensure operational readiness and hazardous fuel reduction projects.

Federal Excess Personal Property (FEPP) Engine Program

While not a required component of the Wildfire Preparedness Plan, this program is responsible for building and maintaining a fleet of Federal Excess Personal Property (FEPP) engines that are placed with local jurisdictions across the State of Colorado.

Currently, there are 118 FEPP engines under agreements across the state and the Fire Equipment Shop builds an average of 10 such engines each year to maintain and expand the fleet.

Summary of 2013 Wildfire Preparedness Plan

Following is a summary of the activities that will be implemented to address the required components of the annual Wildfire Preparedness Plan

(1) The amount of aerial firefighting resources necessary for the state of Colorado at times of high and low wildfire risk.

- DFPC will develop and manage a fire aviation program which will include an Exclusive Use Single Engine Air Tanker (SEAT) Contract while evaluating options to diversify the State's Fire Aviation Program in the interest of increased effectiveness and efficiency.
- DFPC will coordinate Colorado fire aviation resources with interagency partners while considering current wildfire risk.

(2) The availability of appropriate aerial firefighting equipment and personnel at times of high fire risk to respond to a wildfire.

- DFPC will coordinate and execute cooperative wildfire management agreements with appropriate local, state, county and federal jurisdictions.
- DFPC will facilitate the development of Annual Operating Plans with each County and jurisdictions within the counties.

(3) The availability of state wildfire engines and staffing of the engines at different levels of wildfire risk.

- DFPC will maintain a staffed wildland engines program year round based on wildfire risk and need, and may include any number of potential staffing arrangements.
- DFPC will manage up to 140 wildland engines on loan to local fire departments.

(4) The availability of state inmate wildfire hand crews at different levels of wildfire risk.

- DFPC will continue to support the four State Wildland Inmate Fire Team (SWIFT) crews operated by CCi; providing training, logistical and/or overhead support that may be needed to ensure operational readiness and hazardous fuel reduction projects.

(5) A process for ordering and dispatching aerial firefighting equipment and personnel that is consistent with, and supportive of, the statewide mobilization plan prepared pursuant to Section 24-33.5-705.4, C.R.S.

DFPC will provide the technical assistance and program management that identifies local, county, and state resources; their qualification to national standards; and their listing in interagency zone dispatch centers and in the Colorado Statewide Resource Mobilization System.

Preparedness means having the appropriate resources available to respond when needed. For that to successfully occur, a framework of agreements, plans, processes, lists, standards, and relationships must exist, be clearly understood, and be supported. Since 2006, the Colorado Wildfire Preparedness Fund has provided that support.

2013 Preparedness Fund Budget

The 2013 Preparedness Fund Budget estimate reflects funding specifically authorized and appropriated from §24-33.5-1226 (4) (a), C.R.S. It is based on the second half of state Fiscal Year 2012/13 that runs through June 30, 2013 and the first half of FY 2013/14 which runs through December 31, 2013. The 2013 Calendar Year Budget is presented since work planning within the wildfire community typically follows a calendar year. Other funding sources available to support wildfire protection may align with the State Fiscal Year (July 1 through June 31), Local Government Fiscal Year (Calendar Year) or the Federal Fiscal Year (October 1 through September 30).

Division of Fire Prevention & Control
2013 Wildfire Preparedness Budget Estimate

Expense Category	Resource	Cost (Expense)	Running Total
Beginning Fund Balance			**$4,267,088**
Fire Aviation Program	Salaries and Operating	$594,329	
	2 SEATS (Exclusive Use)	$1,200,000	
	CONG Contingency	$150,000	
	Detection Flights	$6,500	
	Subtotal	$1,950,829	$2,316,259
Fire Management	FMO Salaries, Benefits & Operating	$1,005,634	
2 Area, 9 Regional	Wildland Fire Section Management	$688,993	
FMOs	Subtotal	$1,694,627	$621,632
State Engine Program	Salaries, Benefits & Operating	$200,963	
2 Staffed Engines, 6	Severity Assignments	$0	
Firefighters (1)	Subtotal	$200,963	$420,669
Vehicle Maintenance	Salaries, Benefits & Operating	$82,260	
Shop	Vehicle Maintenance & Repairs	$296,409	
	Subtotal	$378,669	$42,000
SWIFT Crew Support	Hand Crew Contingency	$42,000	0
	TOTALS	**$4,267,088**	**0**

Notes:

(1) Other funding sources may be used to increase the number of state staffed engines.

DFPC may use the moneys in the Wildfire Preparedness Fund to implement the Wildfire Preparedness Plan, including:

(a) purchasing, acquiring, leasing, or contracting for the provision of firefighting aircraft, engines and other vehicles, facilities, equipment and supplies for firefighting and other emergencies; and
(b) the retrofitting, staffing, maintenance, operation, and support of firefighting aircraft, engines and other vehicles.

DFPC may enter into agreements to provide firefighting services, including personnel or firefighting aircraft, engines, or other vehicles to federal, state, or local agencies.

Concurrence

The following organizations and individuals were consulted in the development of the Wildfire Preparedness Plan and concur with the recommendations contained therein:

For the County Sheriffs of Colorado

JOSEPH K. PELLE
Printed Name

Signature

For the Colorado State Fire Chiefs'

Jerrod VanLandingham
Printed Name

Signature

For the Director of the Office of Emergency Management

David K. Hard
Printed Name

David K Hard
Signature

For the Adjutant General

Peter Byrne, BrigGen, DTS
Printed Name

Signature

Colorado Wildfire Risk Assessment Project

Final Report

Prepared for:

Colorado State Forest Service

Last Updated: February 21, 2013

Prepared by:

Data Transfer Solutions

409 Mason Court, #127

Fort Collins CO 80524

Colorado Wildfire Risk Assessment Project

Final Report

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1.0 Introduction

This project involved developing an updated Colorado statewide wildfire risk assessment. The project was based on leveraging the data and achievements of the West Wide Wildfire Risk Assessment (WWA) project, and tailoring these to reflect Colorado conditions, requirements and priorities. Once the Colorado Wildfire Risk Assessment (WRA) project was completed, the data would be released to Colorado State Forest Service (CSFS) staff, CSFS partners and collaborators, and the public. The data would be made available by the development of an interactive web mapping application called the Colorado Wildfire Risk Assessment Portal (CO-WRAP).

This report documents the Colorado WRA methods, data and results, as the final report of this project. The Colorado WRA was completed by DTS (Fort Collins, CO) in collaboration with the CSFS.

1.1 Background

Wildfire risk in the western U.S. is increasing and becoming a more complex problem that warrants coordinated assessment, planning and response. The Council of Western State Foresters (CWSF) and the Western Forestry Leadership Coalition (WFLC) embarked on a wildfire risk assessment of all lands for the 17 western states and selected Pacific islands. This assessment is known as the "West Wide Wildfire Risk Assessment, or "WWA". The multi-year project was completed in December 2012.

The WWA documented the risk from wildfire by quantifying the magnitude of the current wildland fire problem in the West. The WWA is unique because it will assess all lands across the west using consistent data and methods, therefore providing information to support planning and decision making at national, regional, and state scales. The WWA results provide a foundation for coordinating policy and baseline data for state level planning, especially for those states with limited resources. The WWA is a separate, regional effort with potential to complement the State Forest Resource Assessments and Forest Action Plans currently maintained by individual states as required by the 2008 Farm Bill and part of USFS State and Private Forestry Redesign.

The WWA resulted in a series of GIS datasets that reflect the inputs and outputs of the assessment. All output data was calibrated for regional use reflecting data distribution across all 17 Western states. Each individual state received the regionally calibrated datasets.

As a leader across the West, the CSFS embarked on using the rich WWA datasets to develop a state calibrated data set. This process of calibrating and adjusting WWA data to reflect Colorado conditions, requirements and priorities is referred to as the Colorado WRA project. This resulted in a set of wildfire risk assessment outputs that focus on specific conditions and requirements within Colorado. The outputs have been calibrated based only on Colorado data and do not incorporate data or parameters from other states. However, the Colorado WRA project does heavily leverage the technical methods and standards developed in the WWA project, ensuring that the outputs are based on a scientifically sound, defendable and robust approach.

1.2 Project Deliverables

With the completion and release of WWA data in November 2012, DTS and the CSFS embarked on the review and enhancement of this data to meet CSFS and Colorado planning requirements. This report describes those processes and enhancements. In addition, CSFS also required capabilities to distribute the assessment results to meet agency obligations. Building on the technical foundation and achievements of the State of Texas Wildfire Risk Assessment Portal, CSFS embarked on implementing a suite of interactive web mapping applications to facilitate dissemination of assessment outputs to the public and local planners.[1] This website is referred to as the Colorado Wildfire Risk Assessment Portal, or CO-WRAP. A brief overview of CO-WRAP is provided in this report, however we encourage readers to visit the CO-WRAP web site at www.ColoradoWildfireRisk.com for more information.

1.3 Project Technical Team

The Colorado WRA project was undertaken by Data Transfer Solutions (DTS, Fort Collins,CO) in collaboration with the Colorado State Forest Service. The team consisted of:

- David Buckley (DTS, Fort Collins, CO), Senior Consultant & Project Manager
- Darian Krieter (DTS, Portland, OR), Lead GIS Analyst
- Jeff Germain (DTS, Fort Collins, CO), Lead Web Developer
- Rich Homann, Colorado State Forest Service, Project Lead & Project Manager
- Boyd Lebeda, CSFS, Fuels and Fire Behavior Technical Lead
- Matt Tansey, CSFS, GIS Manager
- Judy Serby, CSFS, Public Outreach
- Katherine Schaubert, CSFS, Public Outreach
- Lisa Mason, CSFS, Public Outreach
- GayLene Rossiter, CSFS, Web Services
- Dr. Joseph Berry (Berry & Associates, Fort Collins, CO) – GIS Modeling

This final report was developed by David Buckley (DTS) in collaboration with Rich Homann (CSFS) and Darian Krieter (DTS).

1.4 Contact Information

For more information about the Colorado WRA or the CO-WRAP web application please contact Rich Homann at the Colorado State Forest Service at Richard.Homann@Colostate.edu, or the support@ColoradoWildfireRisk.com.

[1] Please refer to the TxWRAP web site at www.TexasWildfireRisk.com for more information.

1.5 Supplemental Documents

Additional documents have been developed to support the Colorado WRA project. These include:

- **WWA Final Report** - the final report for the West Wide Wildfire Risk Assessment project (WWA) that describes all data used and the methods employed to derive data in the assessment. This data and these methods provide the basis of the Colorado WRA. Please refer to the WWA web site at www.WestWideRiskAssessment.com for more information.

- **Colorado Wildfire Risk Assessment: Summary Statistics Report** - a series of tables and charts that summarize the total acres, percent acres and total population for the primary risk outputs. Please refer to Section 3.3 of this report for more information.

- **CO-WRAP User Manual** - documentation that describes how to use the Colorado Wildfire Risk Assessment Portal (CO-WRAP) web application that encapsulates the Colorado WRA outputs. See www.ColoradoWildfireRisk.com for access to this document and other related resource information.

- **CO-WRAP Administrator Manual** - documentation that describes how to use the CO-WRAP Admin application to manage the site, including adding new users for the Professional Viewer application. This document is only provided to the CSFS CO-WRAP System Administrator.

2.0 Assessment Methods

This section describes the methods used to develop the Colorado WRA. The Colorado WRA is based on the deliverables of the West Wide Risk Assessment (WWA) project. WWA was a multi-year project, completed in December 2012, that developed a detailed wildfire risk GIS database and risk outputs for the entire West. Data was delivered per state.

2.1 West Wide Risk Assessment Methods

The WWA project was a regional wildfire risk assessment project conducted by the Western Forestry Leadership Coalition on behalf of the 17 western states and Pacific Islands.[2] While data was developed and delivered on a per state basis, the methods and deliverables were focused on satisfying regional priorities, and accordingly, utilized region wide data classification methods. The full WWA methods and deliverables are documented in the WWA Final Report.[3] Readers are referred to this document for detailed information about the compilation methods for source datasets, descriptions for each dataset, analysis and modeling methods used to derive risk outputs, and project findings and results.

To better satisfy specific Colorado requirements, enhancements were applied to the WWA methods and datasets to derive outputs and results tailored to *Colorado only* data and needs. These methods are described in the next section.

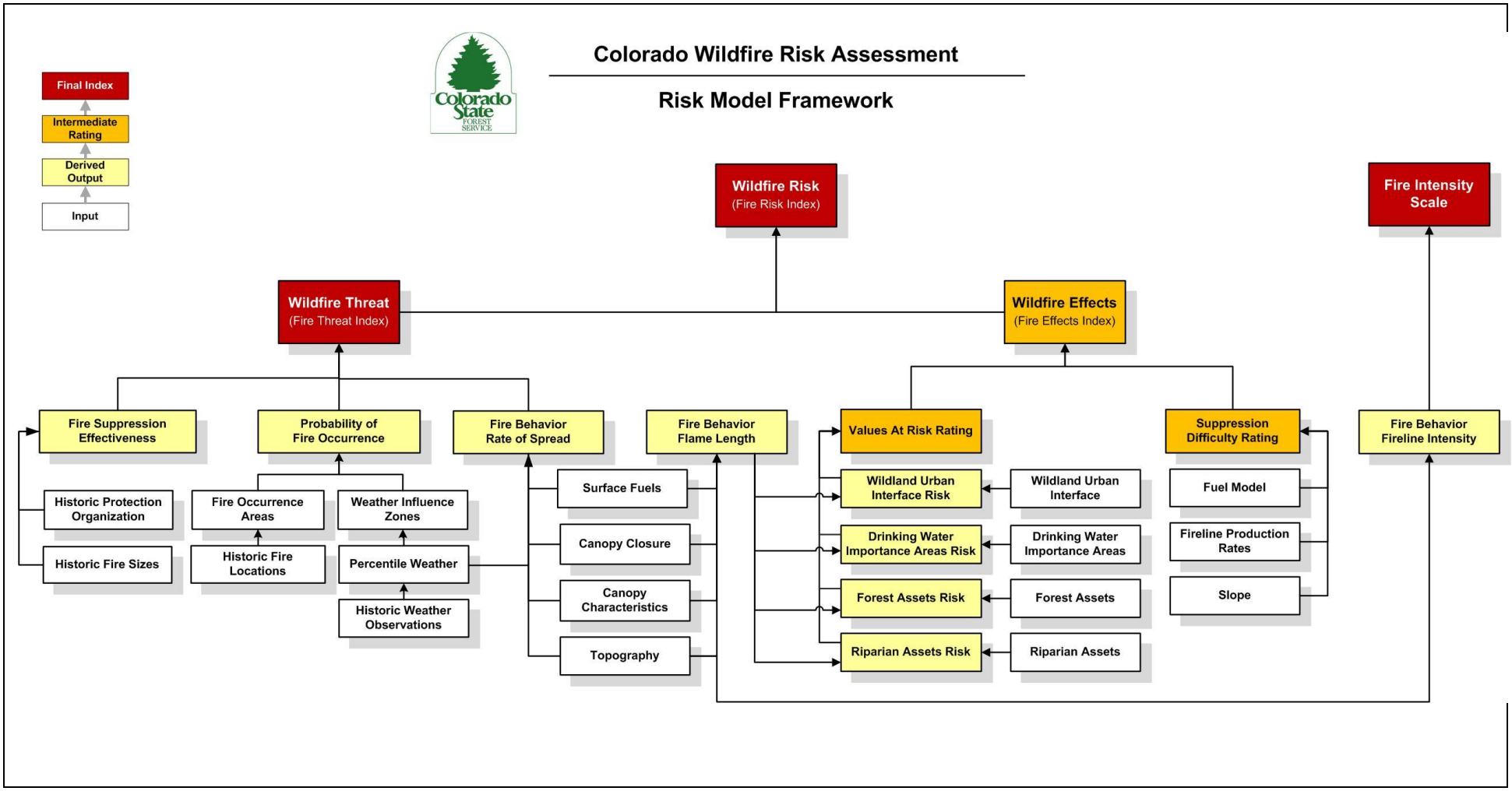
2.2 Overview of Colorado Assessment Methods and Outputs

The following diagram reflects the model flowchart used to derive the Colorado WRA outputs using the WWA deliverables as source data. These methods highly leverage the technical approach developed in the WWA project. Technical changes were undertaken to enhance the outputs to reflect Colorado conditions, requirements and priorities.

[2] See http://www.wflccenter.org/ for more information about WLFC.

[3] West Wide Risk Assessment, Western Forestry Leadership Coalition (2012). West Wide Risk Assessment Final Report. Salem, OR. A final report developed by the WWA Technical Team documenting the methods and specifications of the WWA project.

Figure 1. Colorado WRA flowchart



The following table provides a brief description of the primary datasets in the Colorado WRA. Please refer to Appendix A for a description of each output dataset identified in the process flowchart.

Table 1. Description of Colorado WRA primary datasets

Colorado WRA Output	Description
PRIMARY RISK INDICES	
Wildfire Risk	Possibility of loss or harm occurring from a wildfire, obtained by combining Wildfire Threat and Wildfire Effects
Wildfire Threat	Likelihood of a wildfire occurring or burning into an area
Fire Intensity Scale	Quantifies the potential fire intensity for an area by orders of magnitude
INTERMEDIATE RISK RATINGS	
Wildfire Effects	Represents an overall index of potential effects from wildfire by combining the Values At Risk Rating and the Suppression Difficulty Rating
Values At Risk Rating	Represents an overall rating of the potential impact of a wildfire on all values and assets
Suppression Difficulty Rating	Represents those areas where terrain and vegetation characteristics impede dozer operability based on fireline production rates
DERIVED RISK INDICES	
WUI Risk Index	Represents a rating of the potential impact of a wildfire on people and their homes in the WUI
Drinking Water Risk Index	Measure of wildfire risk to drinking water importance areas
Fire Occurrence	Likelihood of a wildfire starting based on historical ignition patterns
Forest Assets Risk Index	Measure of wildfire risk to forested lands characterized by height, cover and susceptibility/response to fire
Riparian Assets Risk Index	Measure of wildfire risk to forested riparian areas
FIRE BEHAVIOR OUTPUTS	
Characteristic Flame Length	Represents the distance between the tip and base of the flame based on historical percentile weather
Characteristic Rate of Spread	Represents the speed with which a fire moves in a horizontal direction across the landscape based on historical percentile weather
Fire Type (extreme weather)	Potential for canopy fire type for extreme weather conditions (canopy fire potential)
KEY INPUTS	
Drinking Water Importance Areas	Measure of quality and quantity of public surface drinking water categorized by watershed
Fire Ignitions	Fire ignition locations for both local (by zip code) and federal agency fires (lat/long points)
Forest Assets	Forested lands characterized by height, cover and susceptibility / response to fire
Riparian Assets	Forested riparian areas characterized by functions of water quantity, quality and ecology
Surface Fuels	Description of surface vegetation conditions described by fuel conditions that reflect fire behavior characteristics
Vegetation	General vegetation and land cover types

Colorado WRA Output	Description
Wildland Urban Interface (WUI)	Depicts where humans and their structures meet or intermix with wildland fuels. Presented as housing density (houses per acre).

2.3 Description of Methods

A number of tasks were undertaken to modify the WWA data to derive outputs that are considered calibrated for Colorado conditions and requirements. These tasks are primarily based on the adjustment of *Response Function* values used to generate the Wildfire Effects outputs. However, several other adjustments were also undertaken to enhance the WWA data for the Colorado WRA. These included:

1. **Renaming Layers to Match Colorado Terminology**
2. **Developing Additional Risk Outputs**
3. **Adjusting Response Function Assignments to Derive Wildfire Effects Outputs**
4. **Adjusting Class Breaks for Wildfire Effects Outputs**
5. **Adjusting Class Breaks for Primary Risk Outputs**

A detailed description on the use of Response Functions is provided in Adjusting Response Functions section. Please refer to the WWA Final Report for detailed descriptions of the methods used to create the WWA data, and also applied in this project to create the Colorado WRA outputs.

A description of the enhancements is provided below.

1. Renaming Layers to Match Colorado Terminology

The terminology and naming convention for risk assessment outputs used in the WWA project reflects appropriate descriptions for the methods employed that are understood regionally across the West. However, for the Colorado WRA some of the outputs were renamed to better reflect nomenclature and terminology used within the Colorado State Forest Service and its partners and collaborators. Accordingly, the following table presents the list of datasets where names are changed. This is provided so readers can easily associate the Colorado WRA data and outputs with WWA products.

Table 2. Colorado WRA output data name changes (alphabetical order)

Colorado WRA Dataset	WWA Dataset
PRIMARY RISK OUTPUTS	
Fire Intensity Scale	*Not available in WWA*
Values At Risk Rating	Values Impacted Rating
Wildfire Effects	Fire Effects Index
Wildfire Risk	Fire Risk Index
Wildfire Threat	Fire Threat Index

Colorado WRA Dataset	WWA Dataset
INTERMEDIATE RISK OUTPUTS	
Drinking Water Risk Index	DWIA Response Function Score
Forest Assets Risk Index	Forest Assets Response Function Score
Riparian Assets Risk Index	Riparian Assets Response Function Score
WUI Risk Index	WDA Response Function Score
KEY INPUTS	
Wildland Urban Interface (WUI)	Wildland Development Areas (WDA)

2. Developing Additional Risk Outputs

After review of the WWA outputs CSFS decided some additional processing could be applied to generate enhanced outputs that would better meet Colorado conditions, requirements and priorities. These enhancements included:

- Smoothing the fire behavior Flame Length output (used for Response Function processing in Wildfire Effects) to better reflect conditions *around* individual locations, instead of just the condition *at* a specific location.
- Adjusting key risk outputs to reflect the potential movement of wildland fire into urban and municipal areas (referred to as *urban penetration*). This involves extending key fire behavior outputs into urban areas so that these *fringe areas* are considered during the generation of risk outputs. A penetration distance of 0.25 mile was used.
- Development of a Fire Intensity Scale (FIS) output.

A description of each enhancement is provided.

Using Calculated versus Smoothed Fire Behavior Inputs

The Response Function (RF) modeling process requires the integration of the resource value datasets (i.e. WUI, Drinking Water, Forest Assets, Riparian Assets) with Flame Length. A detailed description of the Response Function is provided in the Adjusting Response Functions section of this document. Readers are also encouraged to review the WWA Final Report for an in depth description of the Response Function modeling approach.

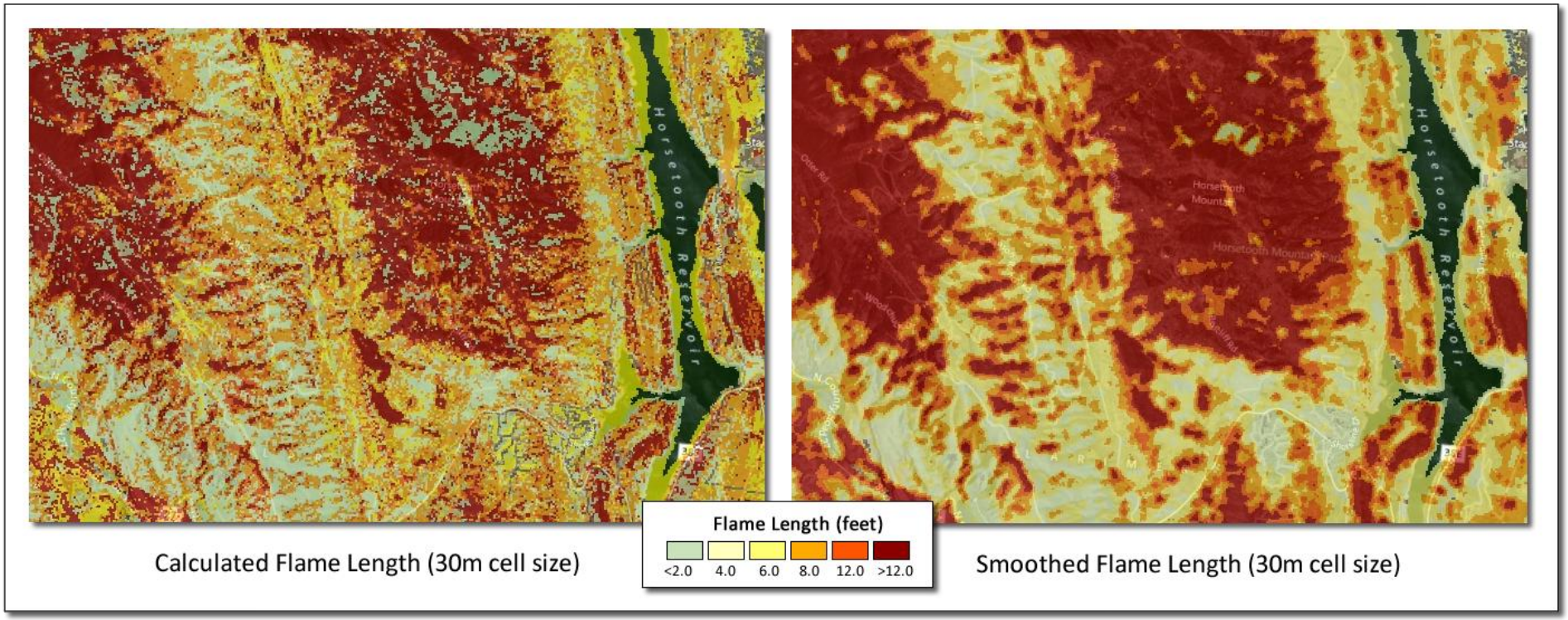
Flame Length (by percentile weather category) was calculated in the WWA project on a per cell basis without any consideration of surrounding cell values. This results in a dataset of *calculated* cell values. The term *cell* refers to a 30m x 30m pixel in the fuels dataset. This is the resolution of the data for the assessment, matching the standard LANDFIRE source fuels data resolution.

Response Function values can be derived using either the *calculated* Flame Length data or *smoothed* Flame Length data. Calculated Flame Lengths were used in the WWA project. Smoothing involves using

a neighborhood GIS function to average cell values based on the values of surrounding cells. Different distance reaches and averaging techniques can be applied. Since CSFS wants to consider not only the conditions at each 30m by 30m cell being processed, but also in surrounding cells (proximity of wildlands), some neighborhood smoothing is required.

Since Flame Length is a *localized* fire behavior output, representing the maximum length of the fire flame in feet, it was decided that smoothing with a small distance reach was more appropriate. Best results were found using a 4 cell circular reach with an inverse distance squared decay function. This ensured that localized cell values were usually retained, yet allowed for consideration of surrounding cell values. This resulted in a more easily understandable and aesthetically pleasing Flame Length map outputs. The following figure presents the calculated Flame Length and smoothed Flame Length data. Both datasets are categorized by the Flame Length categories used for the RFV calculations.

Figure 2. Example of calculated and smoothed Flame Length



Where People Live 2012

Census block data has traditionally been used to define Wildland Urban Interface (WUI) areas. As such, the USFS Silvis dataset has been a de facto standard used for wildland fire planning in the past.[4] SILVIS defines WUI areas based on a combination of housing density and forest cover percent. Recent improvements on defining the WUI have been achieved by Theobald and Romme (2007) to define WUI areas based on combining better sources of land cover with the definition of Community Protection Zones using variable width buffers.[5] Many Western states used analysis approaches based on Theobald and Romme to develop WUI for their State Forest Resource Assessments. For the Colorado State Forest Resource Assessment, Theobald generated new WUI data based on the LANDFIRE vegetation types used in the state assessment. The new data provides information on the 0.5, 1 and 2-mile community protection zones for both 2000 and 2030. The SFRA WUI dataset reflects the intersection of WUI and high severity vegetation types. Housing density, derived from Census data, was used.

In the WWA project considerable investigation was undertaken to evaluate existing WUI data and methods. Based on this investigation, a new housing density dataset was developed (called Where People Live), based on methods developed by DTS (Fort Collins, CO) in the Texas Wildfire Risk Assessment project. For the Texas and WWA projects, DTS built upon methods initially developed in the USFS First Approximation to Wildfire Risk project that utilized LandScan population count data to model housing density.[6] Accordingly, the Where People Live (WPL) dataset was derived by modeling the Oak Ridge National Laboratory LandScan data.[7]

LandScan depicts an estimate of population count on a 90m cell basis. The model used to create LandScan data uses spatial data and imagery analysis technologies and a multi-variable dasymetric modeling approach to disaggregate census counts within an administrative boundary. Since no single population distribution model can account for the differences in spatial data availability, quality, scale, and accuracy as well as the differences in cultural settlement practices, LandScan population distribution models are tailored to match the data conditions and geographical nature of each individual country and region. A key component of the LandScan model is the integration of night time imagery to determine where people are living. LandScan is the preferred choice for population data and given its spatial resolution is ideal for defining *where people live*.

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[4] Please see http://silvis.forest.wisc.edu/maps/WUI for more information about the SILVIS WUI data.

[5] Theobald, D.H. Romme, W.H. 2007. Expansion of the US wildland-urban interface. Landscape and Urban Planning Journal.

[6] Calkin, David E.; Ager, Alan A.; Gilbertson-Day, Julie, eds. 2010. Wildfire Risk And Hazard: Procedures For The First Approximation. Gen. Tech. Rep. RMRS-GTR-235. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 62 p.

[7] Please refer to the ORNL Landscan web site at http://www.ornl.gov/sci/landscan/ for more information about LandScan.

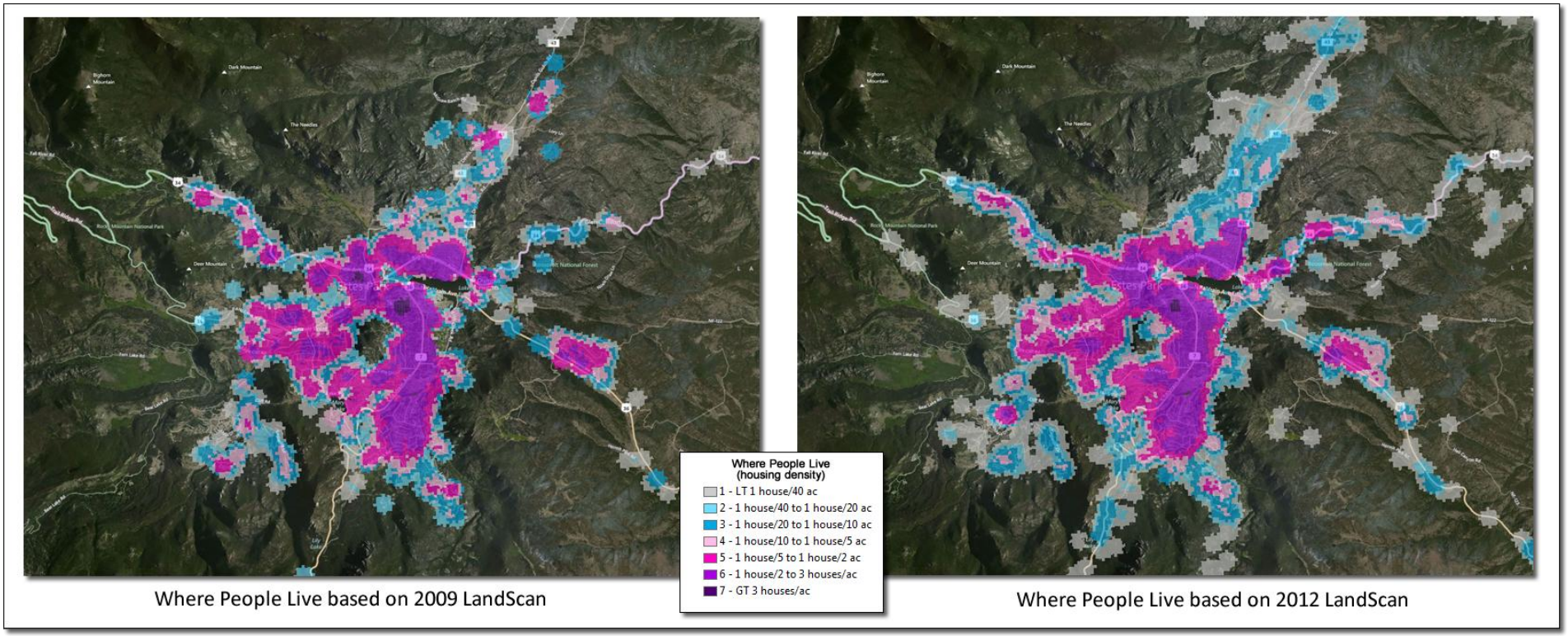
In particular, the resolution and accuracy of the LandScan data provides a better definition of the location of rural and wildland communities and residential population compared to traditional WUI datasets (i.e. USFS Silvis or Theobald) that were developed using Census Block data that has a coarser spatial resolution. For the WWA project LandScan data for 2009 was used to create the WPL dataset. Urban areas were then extracted from the WPL data to create the WWA version of WUI, called Wildland Development Areas (WDA). The WWA project chose not to use the term WUI for this dataset to reflect preferences of the project steering committee.

With delays in the completion of the WWA, and delivery of the Colorado source data to be used in the Colorado WRA, opportunities existed to enhance the Colorado WPL (and WUI) data to reflect more up-to-date LandScan data. Accordingly, LandScan data for 2012 was obtained and modeled to create Colorado WPL and WUI 2012 datasets. These datasets were then used to model WUI Risk for Colorado.

The following figure compares WPL for 2009 and WPL for 2012 for the Estes Park, CO area. The primary difference in 2012 outputs are that they incorporate changes in urban growth patterns that have occurred between 2009 and 2012. In the example shown there are changes in density noticeable in the southwest area of Estes Park where a new subdivision has been developed, and along transportation routes. When combined with Flame Length to calculate the potential risk for WUI, this will provide a more accurate reflection of risk for current conditions.

Note that the WPL data incorporates both urban and wildland/rural areas. Using urban penetration methods described in the next section a WUI dataset is derived by simply extracting the urban core areas from the WPL. Examples are shown in the next section.

Figure 3. Comparison of WPL for 2009 and 2012.

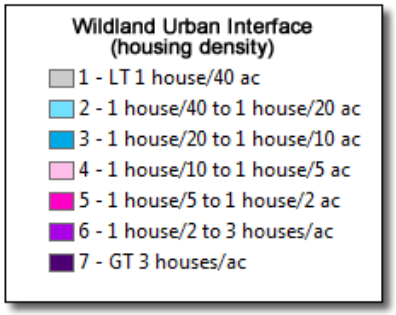


Where People Live based on 2009 LandScan

Where People Live based on 2012 LandScan

WPL & WUI Class Breaks

The WPL and WUI datasets have been calculated to represent the "number of houses per square kilometer", consistent with Federal Register and USFS Silvus procedures and standards. However, to aid in the interpretation and use of this data, the datasets are presented with a legend as "houses per acre". This was done to adhere to common use and understanding of WUI by planners and fire professionals. The same approach is used by the Federal Register and USFS Silvis. The following figure depicts the standard WPL/WUI legends classes used in the Colorado WRA.



Accordingly, in the Colorado WRA and in the CO-WRAP applications, both datasets are depicted as housing density classes in houses per acre. However, if users choose to work directly with the GIS data on their local computer they need to be aware that the actual units of the data are in "houses per square kilometer". A standard conversion is required to obtain "houses per acre". The following table shows the "houses per sq. km" class breaks that reflect the chosen "houses per acre" legend classes. Note that DTS has provided CSFS a simple Excel file that will help the technical GIS user in translating between the two units to determine other class breaks.

Table 3. WPL and WUI class breaks

WPL/WUI Class	Houses/Sq.KM (min. value)	Houses/Sq.KM (max. value)	Houses per acre (min. value)	Houses per acre (max. value)
1	0.000001	6.177635		LT 1 house / 40 acres
2	6.177635	12.355269	1 house / 40 acres	1 house / 20 acres
3*	12.355269	24.710538	1 house / 20 acres	1 house / 10 acres
4*	24.710538	49.42	1 house / 10 acres	1 house / 5 acres
5	49.42	123.55269	1 house / 5 acres	1 house / 2 acres
6*	123.55269	741.31614	1 house / 2 acres	3 houses / acre
7	741.31614	100,000	More than 3 house / acre	

The WPL and WUI "houses per acre" class breaks also adhere to the standard Federal Register and USFS Silvus classes. However, to provide a smoother gradient in housing density a few additional classes have been added. This was undertaken based on feedback from several states where planning standards vary and accordingly, greater delineation of density classes was preferred. WPL/WUI classes 3, 4, and 6 represent new classes that have been inserted into the standard Federal Register classes. These are denoted with the * in the table above.

Urban Penetration

Although non-burnable areas, such as urban, do not directly have a Flame Length assigned due to the lack of surface fuels, it is understood that small urban areas in the wildlands and urban *fringe* areas are both highly susceptible to wildfire from adjacent fuels. The term *urban fringe* is used to refer to those areas on the periphery of highly urban areas that are in close proximity to wildland areas.

Accordingly, so that the Response Function modeling will incorporate these urban areas into the Wildfire Effects outputs, the model must accommodate penetration into urban, non-burnable areas. The agreed upon approach used in the Colorado WRA was to *extend* the Flame Length data into urban areas using GIS neighborhood smoothing techniques.

A maximum penetration distance is defined (i.e. 0.25 mile), and GIS modeling techniques are applied to extend the Flame Length into urban areas. The best outputs were obtained by using an incremental neighborhood smoothing technique where the fire behavior value from the *wildland edge* was smoothed with incremental rings. This *incremental ring* approach ensured that the fire behavior values decayed as they penetrated the urban areas, understandably since the distance from the wildland edge increased, similar to a decay type function. Custom techniques were developed to implement this since the standard Esri neighborhood decay function resulted in interior artifacts of high fire behavior values due to the existence of isolated edge cells. This occasionally produced artificially high values in the urban core that would not be realistic to represent the impact of wildland edges.

Urban penetration of fire behavior mimics the approach where interior urban cells *look out* to consider surrounding wildland cells to determine their susceptibility to wildfire. Consideration and weighting of wildland edge values depends on the distance of the particular urban cell from the wildland edge. The fundamental steps involved in the urban penetration algorithm used are presented in the three following figures.

The first figure presents how urban cells have no fire behavior values to consider for RFV calculations. This relates specifically to the Where People Live housing density (WPL) input data.

The next figure shows how an incremental ring approach can extend fire behavior values into the urban areas, and decay these based on distance from the surrounding wildland edges.

The final figure presents the enhanced fire behavior output where values have been extended into the urban area providing for consideration of susceptibility to wildfire for urban fringe areas. This is especially relevant for the WPL calculations, although the same logic can be applied to calculating potential loss to structures and people for economic impact analysis in the future. Note the following figures use a simple color ramp to portray gradient values of Flame Length (i.e. green is low, yellow is moderate, and red is high).

Figure 4. Urban cells have no fire behavior values to use for RFV calculations

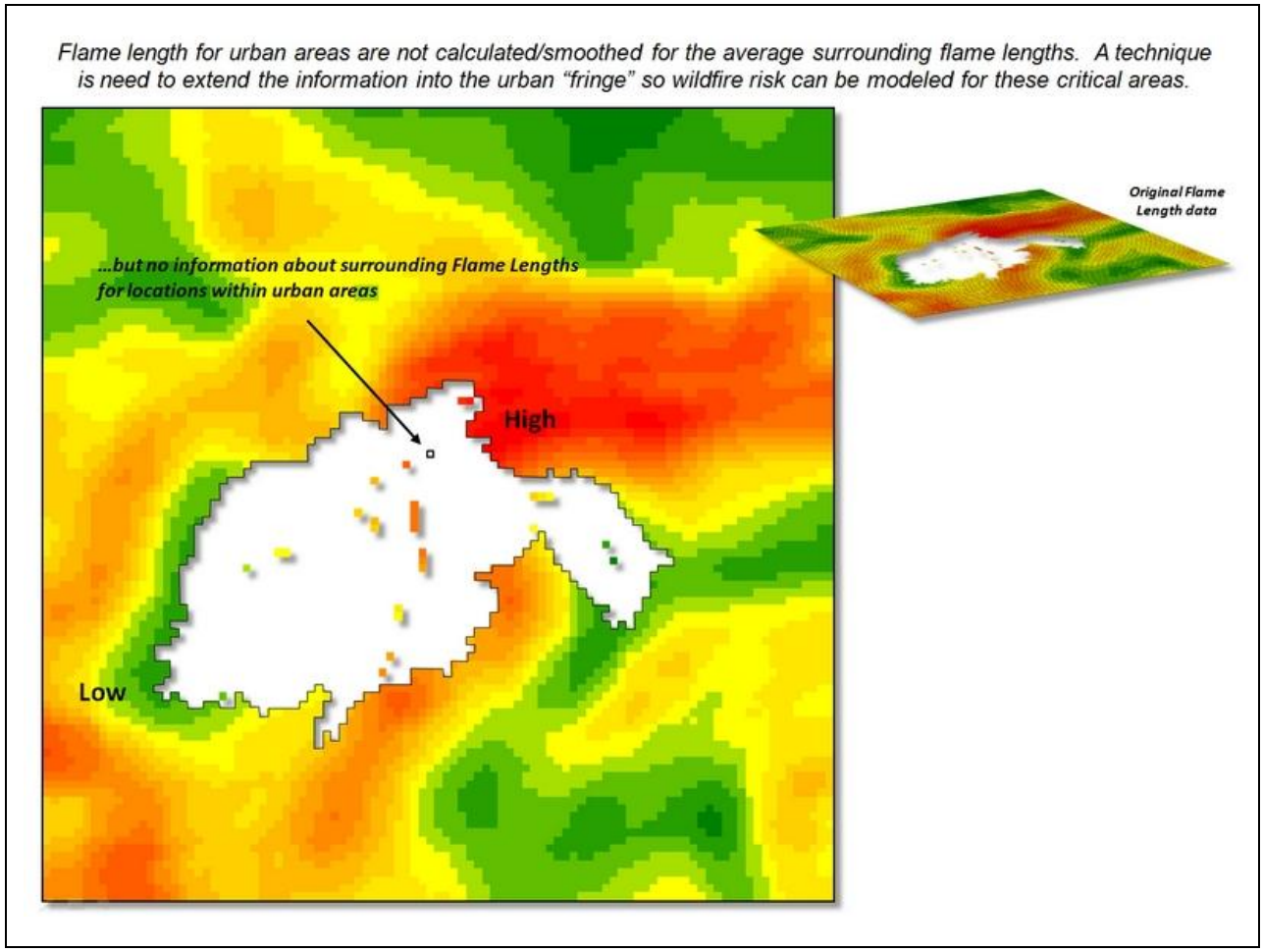


Figure 5. An incremental ring approach can be used to extend fire behavior values into the urban fringe areas

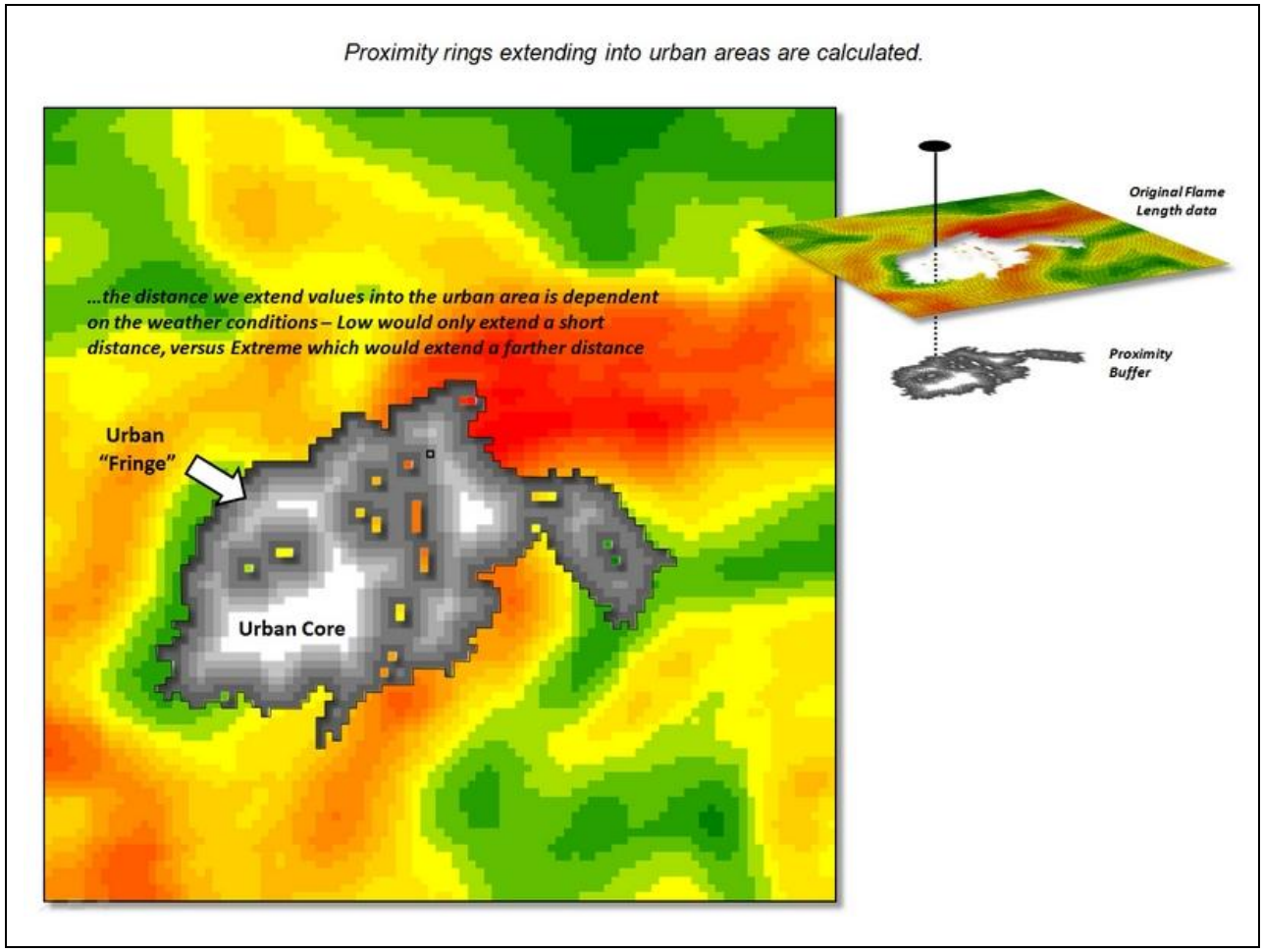
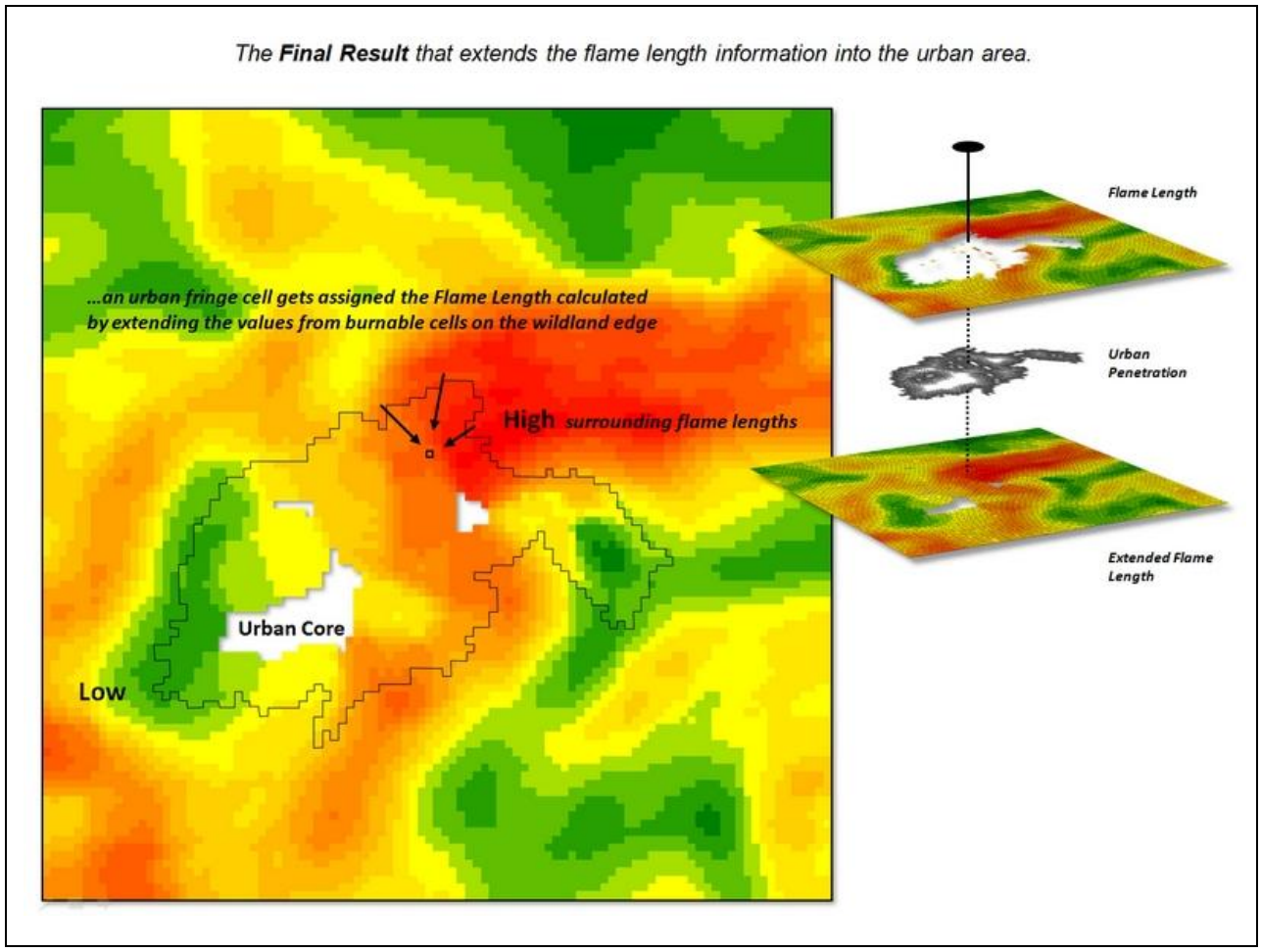


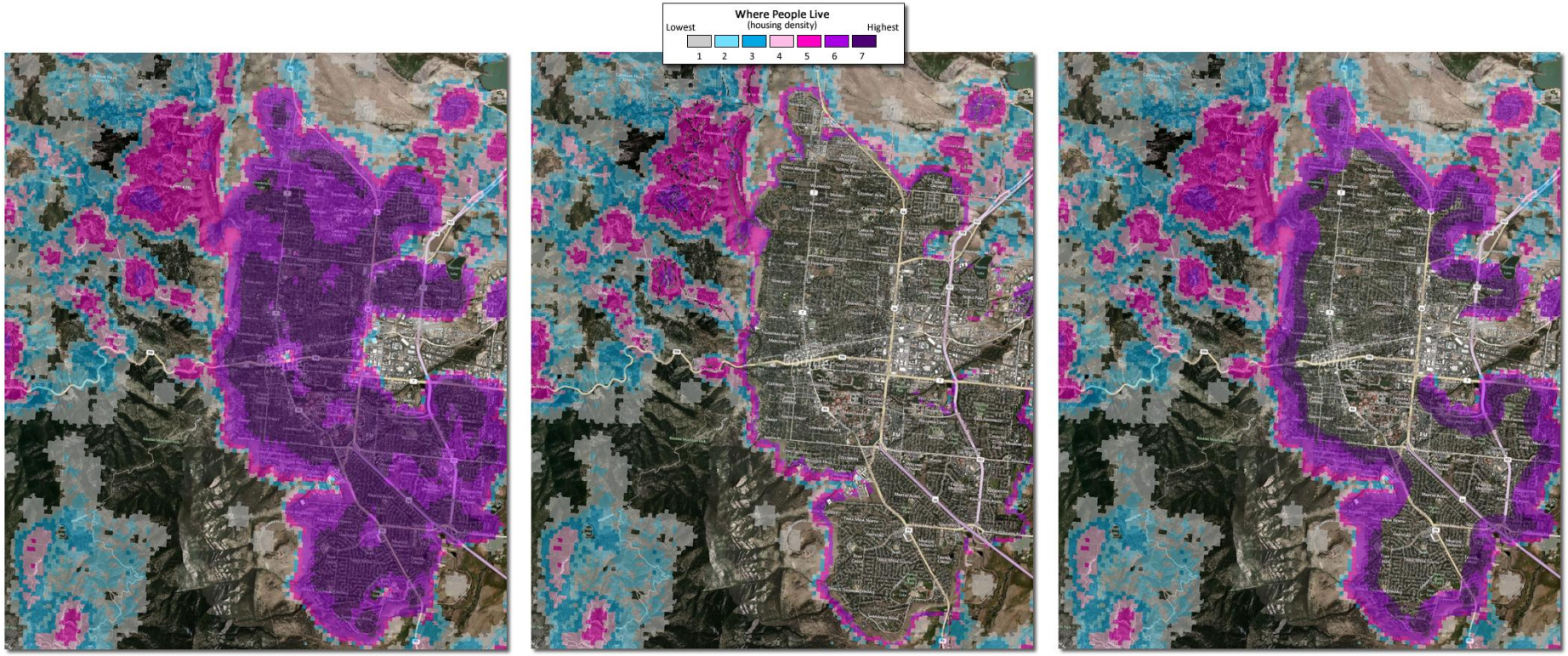
Figure 6. With an extended fire behavior dataset the RFV values can provide a better approximation of susceptibility to wildfire for urban fringe areas



The urban penetration approach was used to enhance the delineation of Wildland Urban Interface. Accordingly, this ensured that urban fringe areas and wildland urban areas were assigned a Response Function value and are reflected in the WUI Risk Index output. As well, this ripples into other outputs that utilize the WUI Risk Index, such as Values at Risk, Wildfire Effects, and Wildfire Risk.

The following figure shows an example of the WUI enhancements achieved with using urban penetration. The map on the left shows the Where People Live housing density data. This dataset is the source for the WUI as it depicts *where people live*. The map in the center shows the WWA Wildland Development Areas (WDA) dataset that does not accommodate urban penetration. Note the strict boundary around the urban core. The map on the right show the WUI with urban penetration included. Areas on the fringe of the urban area are included in the WUI as they are potentially impacted should a wildfire occur, due to their close proximity to wildland fuels areas.

Figure 7. Comparison of WPL vs WDA vs WUI

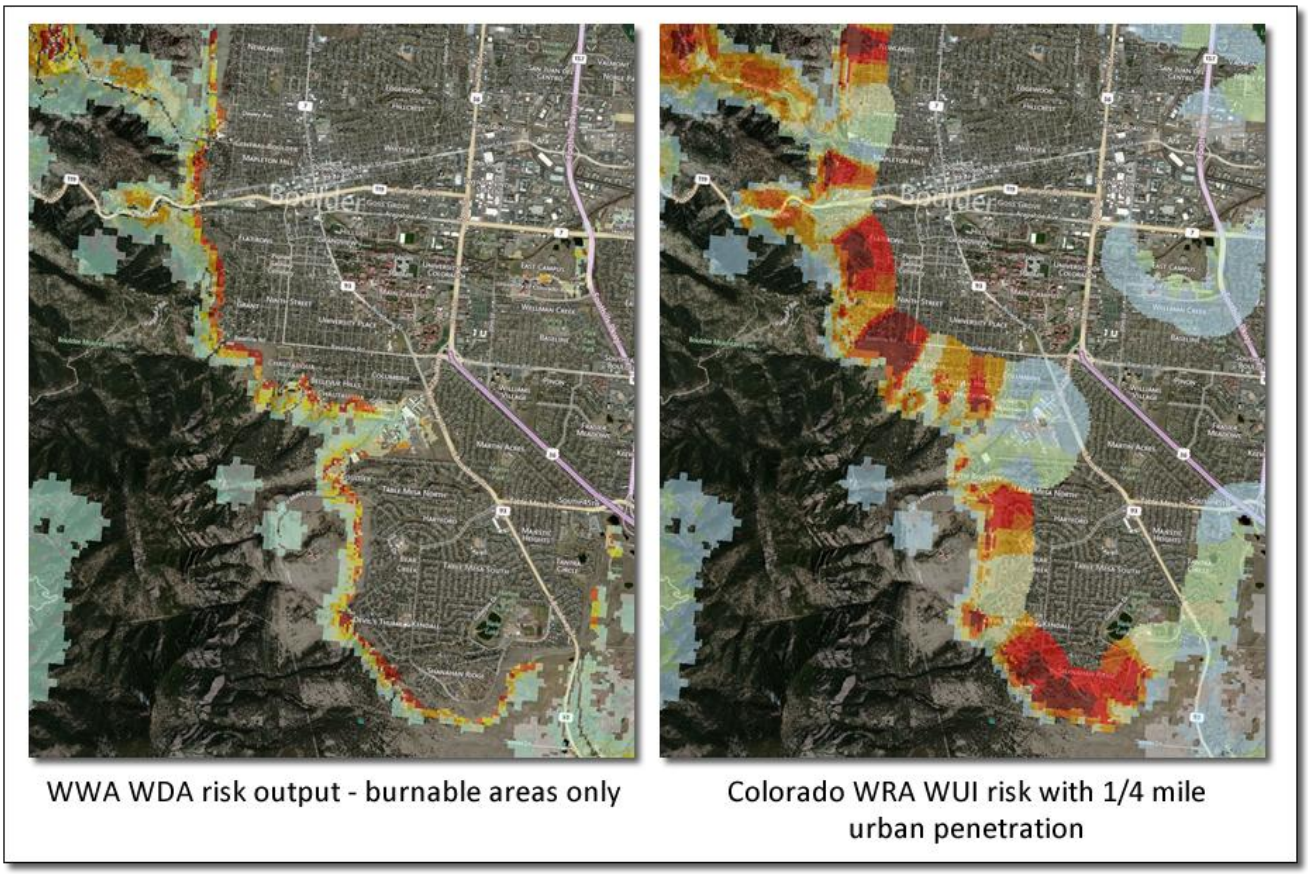


Where People Live | WWA Wildland Development Areas (WDA) | Colorado Wildland Urban Interface (WUI)

Note that in the WWA project the WUI dataset is called Wildland Development Areas. For the Colorado WRA it was decided that the term Wildland Urban Interface was better understood by fire planners and the public. Both datasets represent housing density derived using the methods developed in the WWA project to create the source Where People Live (WPL) dataset. WPL is the source for both WWA WDA and Colorado WRA WUI. The Colorado WRA WUI dataset has been enhanced to incorporate urban penetration.

The urban penetration enhancement is focused on the development of the WUI dataset and accordingly results in an enhanced WUI Risk Index output. The following figure presents examples of the WWA WDA risk output (referred to as WDA Response Function Score), and the Colorado WRA WUI Risk Index output. Note that the Colorado WRA WUI Risk Index output incorporates urban penetration and includes urban fringe areas in the delineation of "at risk" areas.

Figure 8. Comparison of WWA WDA risk output and Colorado WRA WUI risk output with urban penetration



Fire Intensity Scale (FIS)

An additional risk index was developed to support public awareness and education. Building upon achievements from the State of Texas risk assessment, it was decided that the Fire Intensity Scale output would be developed in the Colorado WRA.

The Fire Intensity Scale (FIS) quantifies potential fire intensity based on high to extreme weather conditions, fuels, and topography. It is similar to the Richter scale for earthquakes, providing a standard scale to measure potential wildfire intensity by magnitude.

As an alternative way to deal with Byram's wide-ranging fireline intensity values, Joe Scott (2006) suggested using the common logarithm of fireline intensity (kW/m) as a standard scale of wildfire

intensity (called the Fire Intensity Scale, or FIS).[8] The common logarithm is also used in the Richter scale of earthquake magnitude; each unit increase on the Richter scale represents a ten-fold increase in the amplitude of ground shaking.

The same is true of the FIS. Each unit increase in FIS is a meaningful ten-fold increase in fireline intensity. FIS values range from just less than 1 (10 kW/m) to just over 5 (100,000 kW/m), suggesting a classification by orders of magnitude that lends itself to a multi-class dataset.

DTS (Fort Collins, CO) worked with Joe Scott (Pyrologix, Missoula, MT) to develop the FIS model and implement it for use in state risk assessments.[9] The FIS data is ideal for helping non-fire specialists easily understanding the potential risk around a specific location. Accordingly, FIS was developed for Colorado and encapsulated in the CO-WRAP Public Viewer web application to support the identification of risk for specific locations. A custom tool, called What's Your Risk?, was develop to help public users determine the risk for their homes (or businesses) based on FIS values.

To ensure that FIS provides a risk rating that not only considers the specific location defined by the user, but also incorporates risk for the surrounding area (0.5 mile), further modeling was undertaken to enhance the FIS output. A modified FIS output was generated that utilizes a *decay function* to calculate risk for any given location. A 0.5 mile buffer is used, with values closer to the user location weighted higher than those farther away. This results in a FIS value that considers the risk *around* any location, not just the value at the specific location.

The benefit of using FIS for the CO-WRAP Public Viewer *What's Your Risk?* tool is that it provides a description of the potential fire conditions that the user can understand, in units the user can understand. In addition, given the fire conditions associated with each FIS class, CSFS was able to accommodate a general description of prevention recommendations as guidance for the user. This provides the two basic bits of information the public needs: 1) a description of potential fire conditions, and 2) a description of prevention recommendations. We consider this a significant achievement (not included in the WWA) that provides much greater utility to the risk assessment outputs to support public awareness and education. Please review to Section 4 for a detailed description of how the Colorado WRA results have been made available through the CSFS CO-WRAP web application.

FIS consist of 5 classes where the order of magnitude between classes is ten-fold. The minimum class, Class 1, represents very low wildfire intensities and the maximum class, Class 6, represents extreme wildfire intensities. In Colorado, only classes 1 through 5 exist.

[8] Scott, Joe. November 2006. Off the Richter: Magnitude and Intensity Scales for Wildland Fire. A non-published white paper prepared for the AFE Fire Congress, November 2006, San Diego, CA

[9] Joe Scott is a leading wildland fire research scientist best known for his establishment of the 2005 FBPS Fuel Models (Scott & Burgan) and his research into fire behavior analysis for surface and canopy fuels, and related fuels modeling. Mr. Scott actively works with western forestry agencies to provide custom fuels analysis and fire behavior analysis to support values-at-risk assessment.

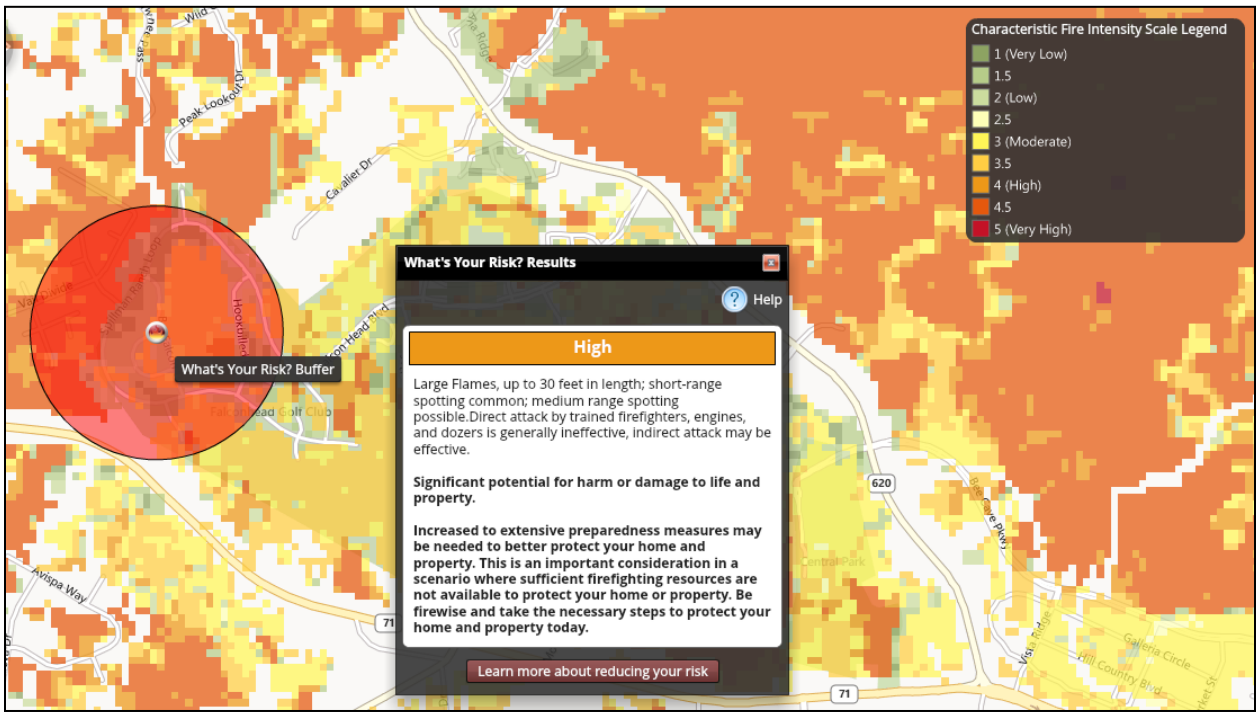
Figure 9. Fire Intensity Scale legend

Class 1 Lowest Intensity	Class 2 (Low)	Class 3 (Moderate)	Class 4 (High)	Class 5 (Very High)	Class 6 Extreme Intensity

FIS data is modeled at 30-meter resolution consistent with all other Colorado WRA outputs. Accordingly, while this is accurate enough to provide general ratings, it is not appropriate for site specific recommendations. For site specific advice, the user would press on the link in the Public Viewer *What's Your Risk?* tool to be directed to the CSFS web site where they can obtain information for contacting a local mitigation planner for help as they can incorporate local conditions not available in the risk assessment scale of data.

The following figure shows an example of FIS output, with the description of fire conditions and general preparedness recommendations, that are provided in the CO-WRAP Public Viewer application WYR tool.

Figure 10. CO-WRAP Example of FIS Data (What's Your Risk? tool)



A detailed description of the FIS classes is provided in the following table.

Table 4. Description of Fire Intensity Scale Classes

Fire Intensity Class	Fire Intensity Scale	I_B, kW/m	Description of fire behavior and potential effects	General Preparedness Recommendations
I	$FIS < 1$	$0 \leq I_B < 10$	Very small, discontinuous flames, usually less than 1 foot in length; very slow spread rate; no spotting. Fires suppressible by lay-firefighters without specialized tools. Very little potential for harm or damage. Fires of this intensity occur on the flanks and rear of large fires, and near the beginning and end of burning periods. These fires are relatively rare due to their slow spread rate and easy control.	**Basic preparedness measures will better protect your home and property.** Be firewise and take the necessary steps to protect your home and property today.
II	$1 \leq FIS < 2$	$10 \leq I_B < 10^2$	Small flames, usually less than two feet long; small amount of very short range spotting possible. Fires easily suppressed by trained hand crews with protective equipment and firefighting tools. Little potential for harm or damage. This intensity class can occur at the head of a fire in a mild fire environment or on the flanks and rear of fires in more severe fire environments. This intensity class is very common, especially on fires not being actively suppressed.	**Increasing potential to cause harm or damage to life and property.** Increased preparedness measures may be needed to better protect your home and property. This is an important consideration in a scenario where sufficient firefighting resources are not available to protect your home or property. Be firewise and take the necessary steps to protect your home and property today.
III	$2 \leq FIS < 3$	$10^2 \leq I_B < 10^3$	Flames up to 8 feet in length; short-range spotting is possible. Hand crews will find these fires difficult to suppress without support from aircraft or engines, but dozers and plows are generally effective. Increasing potential to cause harm or damage. This intensity class occurs at	**Increasing potential to cause harm or damage to life and property.** Increased preparedness measures may be needed to better protect your home and property. This is an important consideration in

Fire Intensity Class	Fire Intensity Scale	I_B, kW/m	Description of fire behavior and potential effects	General Preparedness Recommendations
			the head and flanks of fires in moderate fire environments, or near the rear of fires in heavy fuel. This intensity class is common.	a scenario where sufficient firefighting resources are not available to protect your home or property. Be firewise and take the necessary steps to protect your home and property today.
IV	$3 \leq FIS < 4$	$10^3 \leq I_B < 10^4$	Large flames, up to 30 feet in length; short-range spotting common; medium-range spotting possible. Direct attack by hand crews and equipment is generally ineffective, indirect attack may be effective. Moderate potential for harm or damage. This intensity class is generally observed at the head of fires in moderate fire environments or near the head and flank of fires in moderate to severe fire environments. This intensity class is relatively common.	**Significant potential for harm or damage to life and property.** Increased to extensive preparedness measures may be needed to better protect your home and property. This is an important consideration in a scenario where sufficient firefighting resources are not available to protect your home or property. Be firewise and take the necessary steps to protect your home and property today.
V	$4 \leq FIS < 5$	$10^4 \leq I_B < 10^5$	Very large flames up to 150 feet in length; copious short-range spotting, frequent long-range spotting; strong fire-induced winds. Indirect attack marginally effective at the head. Great potential for harm or damage. This intensity class is usually observed near the head of fires in severe fire environments. Despite the high spread rate, this intensity class is relative infrequent due to the rarity of the fire environment and spread direction.	**Significant potential for harm or damage to life and property.** Increased to extensive preparedness measures may be needed to better protect your home and property. This is an important consideration in a scenario where sufficient firefighting resources are not available to protect your home or property. Be firewise and take the necessary steps to protect your home and property today.

Fire Intensity Class	Fire Intensity Scale	I_B, kW/m	Description of fire behavior and potential effects	General Preparedness Recommendations
VI	$FIS \geq 5$	$I_B \geq 10^5$	Extraordinary flame size, greater than 150 feet in length; copious spotting; very strong fire-induced winds. Conditions supporting this behavior are rare and short-lived. All suppression efforts are ineffective. Great potential for harm or damage. This intensity class is usually observed near the head of fires in severe fire environments. Despite the high spread rate, this intensity class is relative infrequent due to the rarity of the fire environment and spread direction.	**Great potential for harm or damage to life and property.** Extensive preparedness measures may be needed to better protect your home and property.

3. Adjusting Response Function Assignments to Derive Wildfire Effects Outputs

A description of the use of Response Functions is provided below, followed by a description of the detailed calibration tasks that were undertaken in the Colorado WRA. Readers are encouraged to review the WWA Final Report for more detailed information on the risk assessment methods employed in the WWA and subsequently used in the Colorado WRA enhancements.

Overview of Response Function Approach

The primary underpinning of the Wildfire Effects model is based on the use of "response functions". Response Functions are a method of assigning a rating of net change to a resource value or asset based on susceptibility to fire intensity. These impacts can be negative or positive. For the WWA and Colorado Wildfire Effects model only adverse effects are being considered at this time, although the model has been designed to accommodate positive effects in the future if desired.[10]

Calculating risk at a given location requires spatially defined estimates of the likelihood and intensity of fire integrated with the identified *resource/asset value*. This interaction is quantified through the use of response functions that estimate expected benefits and losses to values/assets at the specified fire intensities. The measure of fire intensity used in the model is Flame Length. Specific classes of Flame Length have been defined that reflect key thresholds for damage from wildfire to the resource values.

For the CSFS model, response functions are defined for each category of the resource value inputs, for each given flame length category. Flame length categories were defined by the fire experts that reflect key thresholds for rating impacts. Positive response functions indicate a benefit or increase in value to the resource; negative response function values indicate a loss in resource value.

The CSFS model response function uses a value range of +9 to -9. This 1 to 9 range is typical for suitability modeling and provides a consistency with previous risk modeling methods. With this scale, a value of 0 represents no measureable impact; -1 the least negative impact, ramping to a -9 where the worst possible impact or loss occurs. An example *response function value matrix* for the WUI resource value is presented in the following figure.

This WUI example assumes that the higher the flame length the worse the impact on people and their homes. This could also be interpreted as the higher the value the more susceptible to wildfire. Areas with high population/structure density would result in more people/homes impacted while areas with low density would result in less people/homes impacted. The user defined response function value (-1 to -9) would only be applied to areas where the WUI and Flame Length overlap and both occur in the same area. Areas that do not have a Flame Length of WUI value are not assigned a RF value.

[10] More detailed descriptions of response functions and how they can be applied are described in USFS General Technical Report RMRS-GTR-235, Wildfire Risk and Hazard: Procedures for the First Approximation (March 2010), and more recently, Wildfire Threat to Key Resources on the Beaverhead-Deerlodge National Forest,, Joe Scott, Don Helmbrecht, USFS (December 24, 2010).

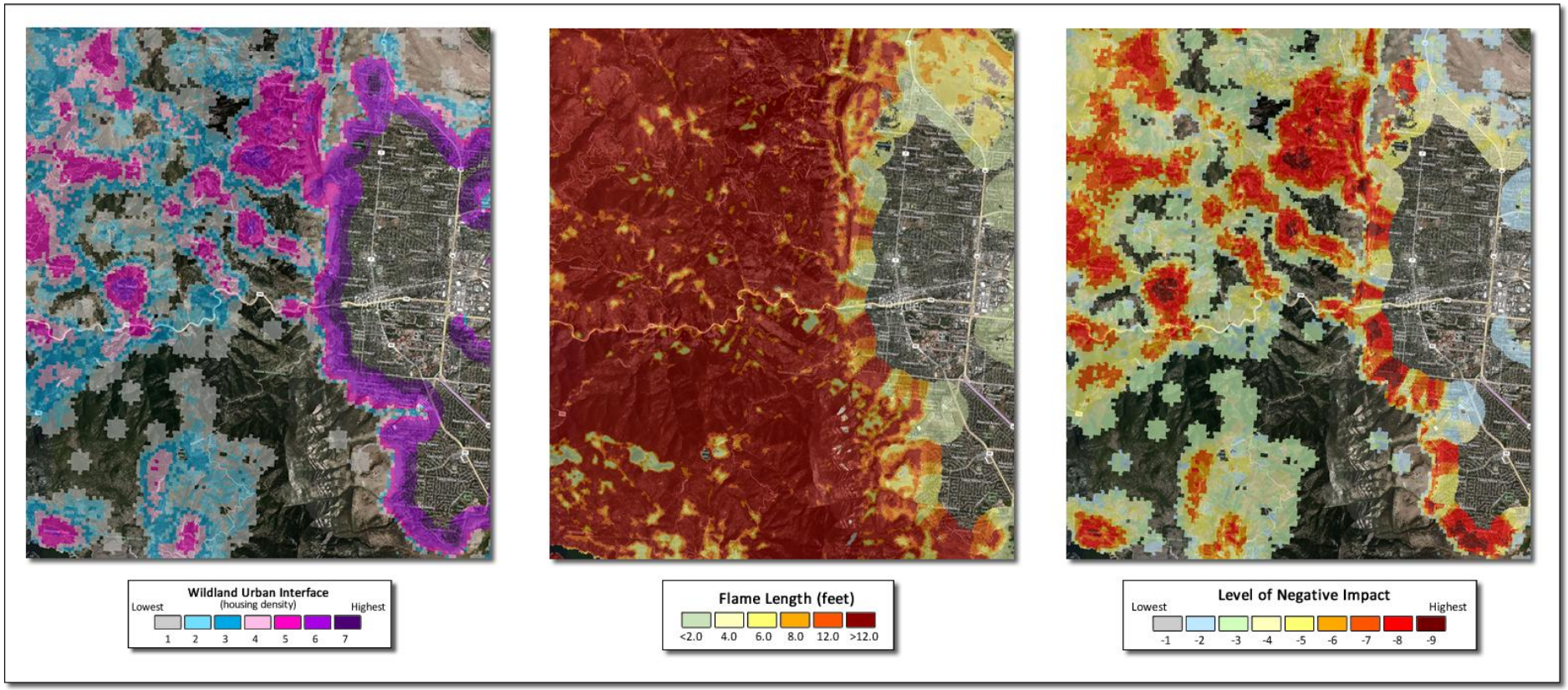
Table 5. Example RF Value Assignments - WUI

Flame Length	Wildland Urban Interface (housing density)						
	LT 1 house /40 ac	**1 house/ 40 - 20 ac**	**1 house/ 20 - 10 ac**	**1 house/ 10 - 5 ac**	**1 house/ 5 - 2 ac**	**1 - 3 houses/ac**	**GT 3 houses/ac**
0-2 ft	-0.5	-0.8	-1.0	-1.4	-1.7	-2.0	-2.0
2-4 ft	-1.0	-1.6	-2.0	-2.8	-3.4	-4.0	-4.0
4-6 ft	-1.25	-2.0	-2.5	-3.5	-4.25	-5.0	-5.0
6-8 ft	-1.75	-2.8	-3.5	-4.9	-5.95	-7.0	-7.0
8-12 ft	-2.0	-3.2	-4.0	-5.6	-6.8	-8.0	-9.0
12+ ft	-2.25	-3.6	-4.5	-6.3	-7.65	-9.0	-9.0

Using the response function matrices, GIS data of flame length and the resource value (WUI in the example above) can be combined to derive an output that reflects those areas where the least or most impact/susceptibility exists. The following figure presents an example response function value (RFV) output using the matrix shown above for WUI.

The map on the left shows the WUI areas presented as housing density. The map in the center is the Flame Length. The map on the right is the RF output that represents and overlay of the two inputs with the RF values in the table above applied to each cell.

Figure 11. Response Function example showing Wildland Urban Interface, Flame Length and WUI Risk Index output.



Response functions represent mathematical relationships between fire characteristics (intensity) and fire outcome. Although fire outcomes could be related to any fire characteristic, response is typically related to some measure of fire intensity, e.g., flame length (Ager and others 2007; Finney 2005). Accordingly, the Colorado Wildfire Effects model uses response functions that correspond to the following flame length classes:

- Low = 0 to 2 ft,
- Low to Moderate = greater than 2 to 4 ft,
- Moderate = greater than 4 to 6 ft,
- Moderate to High = greater than 6 to 8 ft,
- High = greater than 8 to 12 ft, and
- Very High = greater than 12 ft.

In detailed risk analyses conducted at smaller scales it is possible for outcomes to be expressed as absolute benefits and losses, such as people, structures or even dollars. However, such detail is not practical in this scale of statewide assessment. Rather than developing response functions that directly address absolute change in resource or asset value, the Colorado Wildfire Effects model relies on generalized, relative response functions that can be applied to any number of resources values or assets.

Percentile Weather Weights

Response function values are applied to each layer independently to create a RFV output for that layer (resource value). Calculations are first applied on a per weather percentile category (low, moderate, high and extreme) using the Flame Length for each weather category. These interim *weather bin* outputs are then combined to create the final *conditional RFV* output. This output reflects the response of the resource to wildfire assuming that a fire occurs and the Flame Length conditions are met.

A constant weighting that reflects the *percent acres burned in each weather category* is applied to derive a weighted RFV output across the four percentile weather classes for each resource/asset. Using constant weights provides flexibility for production and future modification if desired. The following table shows the default constant weightings used for the RFV calculations.

Table 6. Constant weightings used for RFV calculations

Percentile Weather Category	Weighting
Low	**.01**
Moderate	**.09**
High	**.20**
Extreme	**.70**

Colorado Response Function Assignments

In the WWA project each state provided Response Function value assignments for each Wildfire Effects layer. This included:

- RF values for the five input layers for the WWA Values Impacted Rating
- RF values for the Suppression Difficulty Rating
- weights for combining the five input layers and calculating the WWA Values Impacted Rating output
- weights for combining the WWA Values Impacted Rating and Suppression Difficulty Rating to create the WWA Fire Effects Index

Response functions are a method of assigning a net change in the value to a *resource* or *asset* based on susceptibility to fire at different intensity levels, such as flame length. This modeling approach was used in the WWA project to calculate the potential impacts (or risk) for each Wildfire Effects layer. This approach was also retained for the Colorado WRA.

For the Colorado WRA, Response Function outputs were derived for each input data set and then combined to derive the Values At Risk Rating. This output is referred to as the Values Impacted Rating in the WWA project. In the WWA project five (5) input layers were used. For the Colorado WRA, it was decided that only four (4) input layers would be used. The Infrastructure layer was not included. This was eliminated based on a review of WWA outputs where the Infrastructure layer provided undesirable results for Colorado. It was felt that these assets are better addressed by using other methods to evaluate the wildfire risk.

Additionally, in the WWA, RF outputs were not calculated for each state using the state supplied RF values. Instead, average RF values were derived for the entire West by combining all the RF values provided by the individual states. Outputs were then generated using the *west wide average RF values*. The specific method used to create the west wide average are described in the WWA Final Report.

Accordingly, the individual states, like Colorado, weren't able to visualize the output of their RF value assignments, and no review or refinement of these RF values occurred. For the Colorado WRA, it was decided that CO RF value assignments should be used (instead of the WWA regional averages) to create the RF outputs. In addition, some sensitivity analysis should be conducted with the RF values to refine the values until a final acceptable set of RF value assignments were defined.

With this approach, new RF value assignments were defined for the following Wildfire Effects input layers:

- Wildland Urban Interface
- Drinking Water Importance Areas
- Forest Assets
- Riparian Assets

Appendix B presents the revised RF value assignments used in the Colorado WRA project.

Values At Risk Rating Weights

Once all RF outputs are generated for the four Colorado layers, they were combined using a weighted average to derive the Values At Risk Rating. Since the Infrastructure layer was not utilized these weights were adjusted. The following tables presents the adjusted weights used for the Values At Risk Rating (VAR). The following description applies to the table:

- The "WWA CO Weights" column are the weights provided by CO for the WWA project
- The "WWA Average" are the weights used in the WWA project to calculate the VIR output. This represents a west wide average of weights provided by the individual states.
- The "Adjusted CO Weights" are the new weights used in the development of the Colorado WRA VAR output.

Table 7. Colorado adjusted Values At Risk Rating weights

Values Impacted Rating Weights			
VAR/VIR Input Layer	**WWA CO Weights**	**WWA Average**	**Adjusted CO Weights**
WUI	22.1%	44.7%	**36.4%**
Drinking Water	29.4%	1.0%	**36.4%**
Forest Assets	14.7%	3.6%	**18.2%**
Riparian Assets	7.4%	4.5%	**9.1%**
Infrastructure	26.5%	46.2%	**NA**

Wildfire Effects Weights

Once the VAR output is derived it was combined with the Suppression Difficulty Rating using a weighted average to derive the Fire Effects Index. The following table presents the adjusted weights used for the Fire Effects Index (FEI). The following descriptions apply to the table:

- The "WWA CO Weights" column are the weights provided by CO for the WWA project
- The "WWA Average" are the weights used in the WWA project to calculate the FEI output. This represents a west wide average of weights provided by the individual states.
- The "Adjusted CO Weights" are the new weights used in the development of the Colorado WRA FEI output.

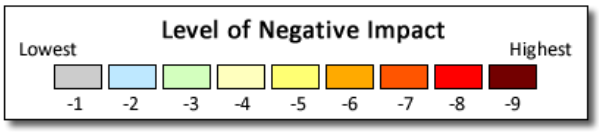
Table 8. Colorado adjusted FEI weights

Wildfire Effects Index Weights			
VIR Input Layer	**WWA CO Weights**	**WWA Average**	**Adjusted CO Weights**
Values Impacted Rating	60.0%	90.0%	**80.0%**
Suppression Difficulty Rating	40.0%	10.0%	**20.0%**

4. Adjusting Class Breaks for Wildfire Effects Outputs

The WWA project utilized *cumulative percentile area* class breaks for all Wildfire Effects outputs. While this provided a consistency with the other WWA risk outputs (i.e. Fire Threat Index, Fire Risk Index), it does make it difficult for the user to *relate* the Wildfire Effects outputs back to the input datasets - namely the input VAR classes and Flame Length class. It was decided that for the Colorado WRA, class breaks would use the standard RF output classes from -1 to -9. With this approach the output classes would adhere to the RF value assignments defined by the Colorado State Forest Service and provide for easier interpretation by the users of the Colorado WRA. Accordingly, the following class breaks and symbology was used for all Wildfire Effects outputs.

Figure 12. Colorado WRA Wildfire Effects legend



These class breaks and color symbology is used for the following outputs:

- WUI Risk Index
- Drinking Water Risk Index
- Forest Assets Risk Index
- Riparian Assets Risk Index
- Values-At-Risk Rating
- Suppression Difficulty Rating
- Fire Effects Index

5. Adjusting Class Breaks for Primary Risk Outputs

The WWA was a regional assessment that utilized the outputs for the entire west to determine class breaks for maps and statistics. Several output data layers, specifically the Fire Risk Index, Fire Threat Index, and Fire Occurrence Area, are comprised of continuous floating point data values. To properly view the data it must be classified into categories to be shown thematically (i.e. from low to high). Multiple different approaches exist to determine class breaks.

The WWA project utilized a standard approach that determined class breaks based on the cumulative percentile values of total area for each class. Nine categories were chosen. Data values for the entire west (all 17 western states) were used as inputs to determine the class breaks. This approach was used for all outputs in the WWA. The following table presents the percentile class breaks defined for the WWA.

Table 9. Cumulative percentiles used for class breaks in the WWA

Category	% Range	Cumulative % of Area	Categorical % of Area
1	0 – 32.9%	32.9%	**32.9%**
2	33.0 - 63.5%	63.5%	**30.5%**
3	63.5 -70.0%	70.0%	**6.5%**
4	70.0 - 77.5%	77.5%	**7.5%**
5	77.5 - 85.5%	85.5%	**8.0%**
6	85.5 - 92.5%	92.5%	**7.0%**
7	92.5 - 96.5%	96.5%	**4.0%**
8	96.5 - 98.5%	98.5%	**2.0%**
9	98.5 - 100.0%	100.0%	**1.5%**

The percent values are based on totaling the area of the raster data. The data is represented as 30m x 30m cells. Accordingly, the cumulative percentiles reflect total area, and as such can be interpreted as acres (i.e. Category 9 reflects the 1.5% of acres with the highest values).

By design, the categories were developed to display the highest rated 14.5% of the cells (area) in categories 6 through 9. The highest rated 22.5% of the cells are in categories 5-9. Notice this places the highest rated cells (areas) into just about half of the categories (5-9) which allows the user to truly locate and distinguish the differences within these highly rated cells (areas).

The class breaks have been defined based on the distribution of data for the 17 western states for each layer. In this regard, the categorical % represents the percentage of area across the entire west, i.e. Category 9 reflects the top 1.5% of area in the entire West.

This approach provides for map classes that are ordinated across the entire west, and it inherently allows for comparison of areas across the entire West. This is ideal for regional planning. However, it does <u>not</u> best reflect the conditions within an individual state, nor facilitate true comparisons only within a state. In Colorado, it was decided that the risk assessment results would have greater utility for Colorado planners if the data was ordinated using only Colorado data. In this regard outputs would reflect conditions only within Colorado (i.e. Category 9 would reflect the top 1.5% of area within Colorado, not the entire West).

It was decided that the percentile class breaks would be retained as defined in the WWA. Nine categories were used and calculated using the same percentiles breaks. This was undertaken for the following outputs datasets:

- Fire Occurrence Areas (FOA)
- Fire Threat Index (Wildfire Threat)
- Fire Risk Index (Wildfire Risk)

While the WWA project also used the cumulative percentile approach for other layers, such as the Wildfire Effects outputs, it was decided that Colorado preferred to use discrete Response Function

categories instead for those outputs. Please refer to the section Adjusting Class Breaks for Wildfire Effects Outputs for a description of the Colorado approach.

The following tables presents the final cumulative percentile class breaks derived for the Colorado outputs for Fire Occurrence, Wildfire Threat and Wildfire Risk.

Table 10. Fire Occurrence class breaks (using Colorado data)

Fire Occurrence Classes					
Category	**Cumulative%**	**CO Min Value**	**CO Max Value**	**WWA Min**	**WWA Max**
1	32.9%	0	0.022486	0	0.018736
2	63.5%	0.022486	0.065905	0.018737	0.022485
3	70.0%	0.065905	0.081638	0.022486	0.029771
4	77.5%	0.081638	0.098884	0.029772	0.047850
5	85.5%	0.098884	0.130968	0.047851	0.086730
6	92.5%	0.130968	0.191981	0.086731	0.158430
7	96.5%	0.191981	0.309597	0.158431	0.290943
8	98.5%	0.309597	0.422359	0.290943	0.505909
9	100.0%		>0.422359	> 0.505909	

Table 11. Wildfire Threat class breaks (using Colorado data)

Wildfire Threat Classes					
Category	**Cumulative%**	**CO Min Value**	**CO Max Value**	**WWA Min**	**WWA Max**
1	32.9%	0	0.000857	0.000001	0.000593
2	63.5%	0.000857	0.002058	0.000594	0.002120
3	70.0%	0.002058	0.002135	0.002121	0.002827
4	77.5%	0.002135	0.002237	0.002828	0.004577
5	85.5%	0.002237	0.002797	0.004578	0.008443
6	92.5%	0.002797	0.005247	0.008444	0.017200
7	96.5%	0.005247	0.009901	0.017201	0.034760
8	98.5%	0.009901	0.01885	0.034761	0.065895
9	100.0%		>0.01885	0.065895	1.000000

Table 12. Wildfire Risk class breaks (using Colorado data)

Wildfire Risk Classes					
Category	Cumulative%	CO Min Value	CO Max Value	WWA Min	WWA Max
1	32.9%		> -8.38		> -1.56
2	63.5%	-8.38	-15.97	-1.57	6.08
3	70.0%	-15.97	-20.75	-6.09	9.15
4	77.5%	-20.75	-29.42	-9.16	16.91
5	85.5%	-29.42	-47.74	-16.92	36.44
6	92.5%	-47.74	-91.83	-36.45	81.66
7	96.5%	-91.83	-177.85	-81.67	173.05
8	98.5%	-177.85	-332.68	-173.06	350.10
9	100.0%		< -332.68		< -350.11

3.0 Assessment Results and Findings

This section provides a description of the assessment results and findings.

3.1 Project Deliverables

The Colorado WRA project involved the following key deliverables:

1. Statewide Colorado wildfire risk assessment GIS datasets
2. Calibration of WWA data to reflect Colorado conditions, requirements and priorities
3. Final report that documents the data, methods and outputs for the assessment (this document)
4. Development, implementation and hosting of the Colorado Wildfire Risk Assessment Portal (CO-WRAP) web application. This includes loading of the Colorado WRA datasets and customization to support Colorado risk reporting requirements.
5. CSFS user training and documentation for CO-WRAP
6. On-site presentation of project report and results
7. Hosting of CO-WRAP for a predefined period.

3.2 Risk Outputs

Maps are presented for the following key Colorado WRA outputs:

- **Wildfire Risk**
- **Wildfire Threat**
- **Values At Risk Rating**
- **Wildland Urban Interface**

- **WUI Risk Index**
- **Drinking Water Risk Index**

Urban areas are represented in dark grey areas on the maps. County boundaries are also shown.

Figure 13. Colorado Wildfire Risk

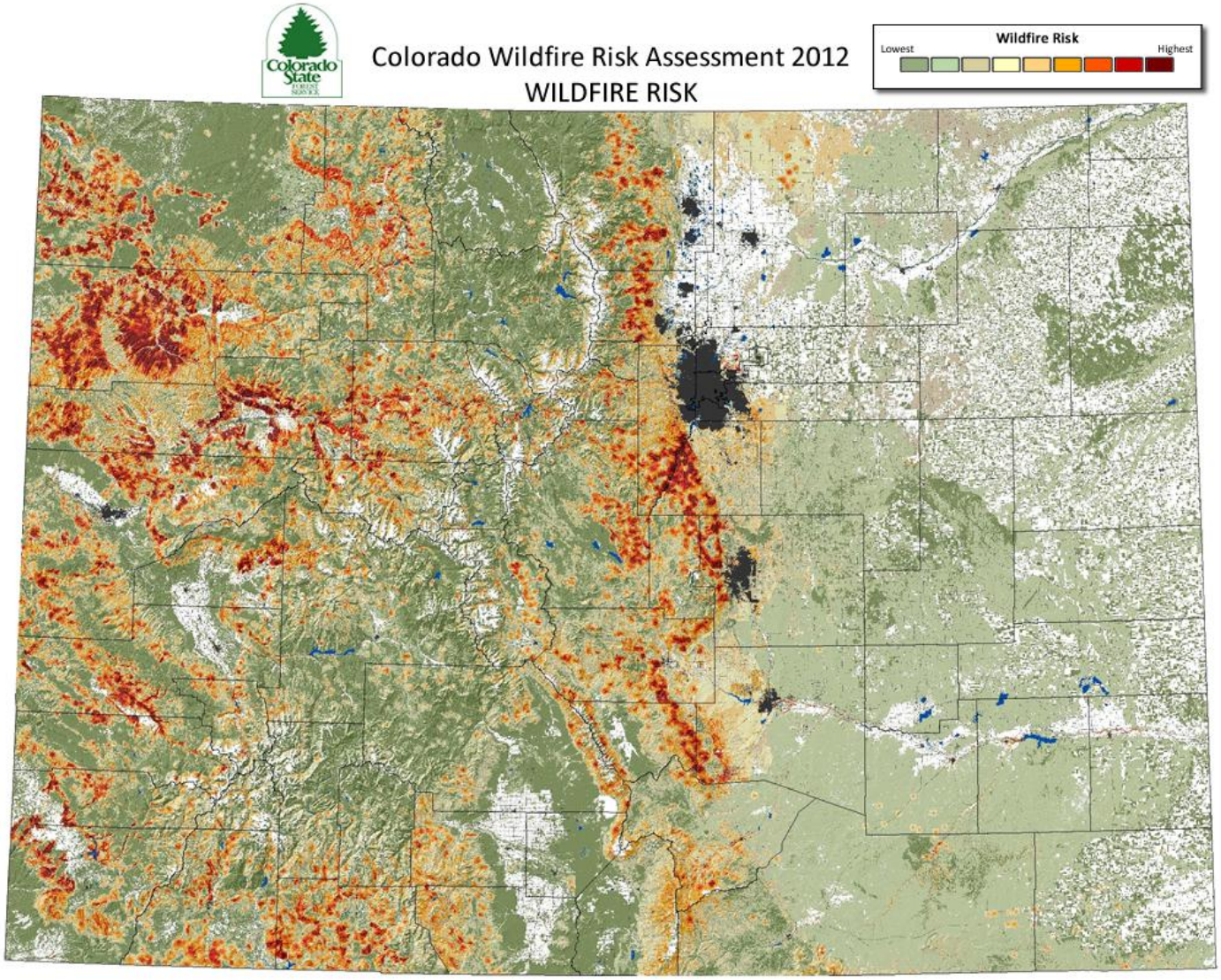


Figure 14. Colorado Wildfire Threat

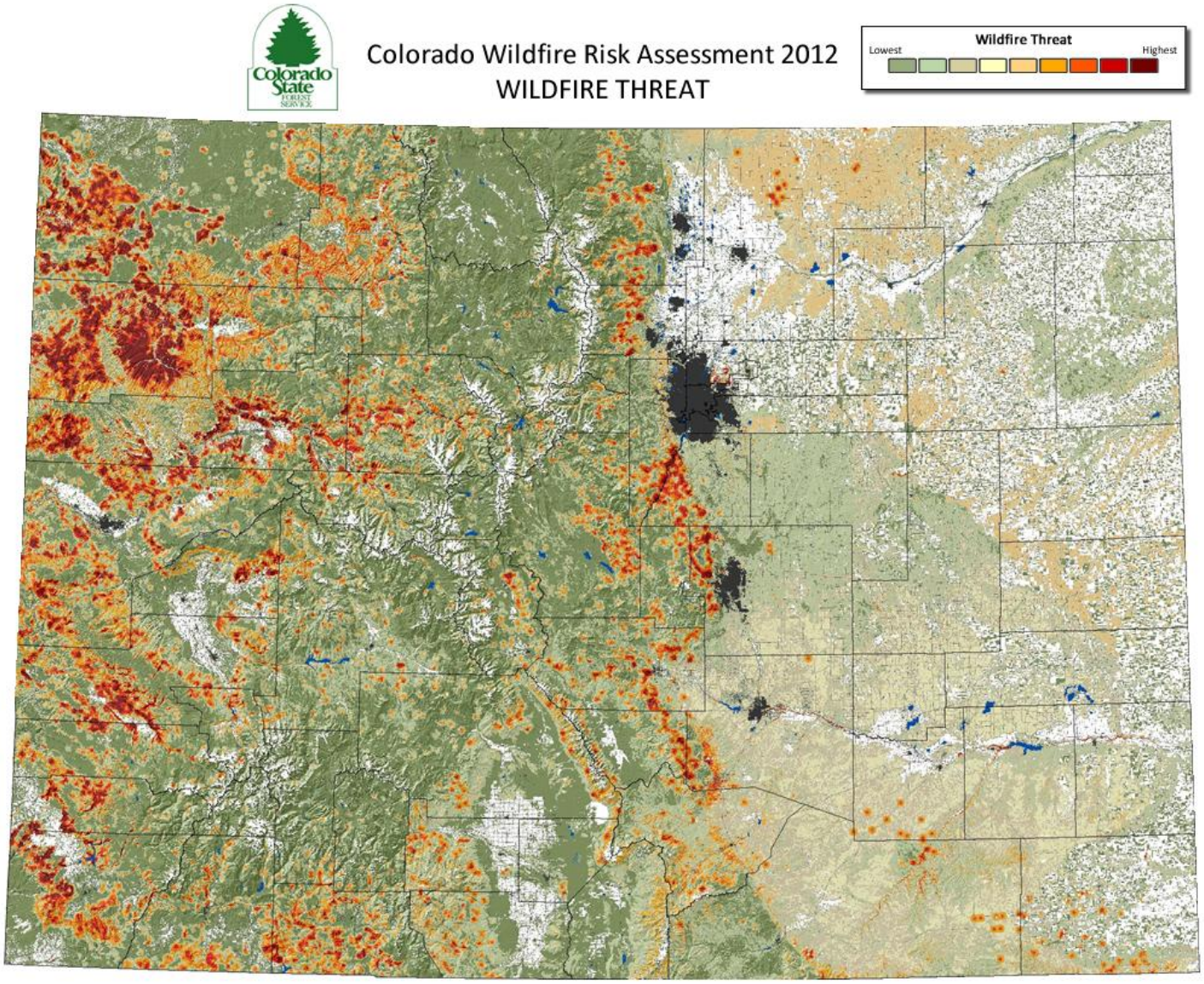


Figure 15. Colorado Values-at-Risk Ratings

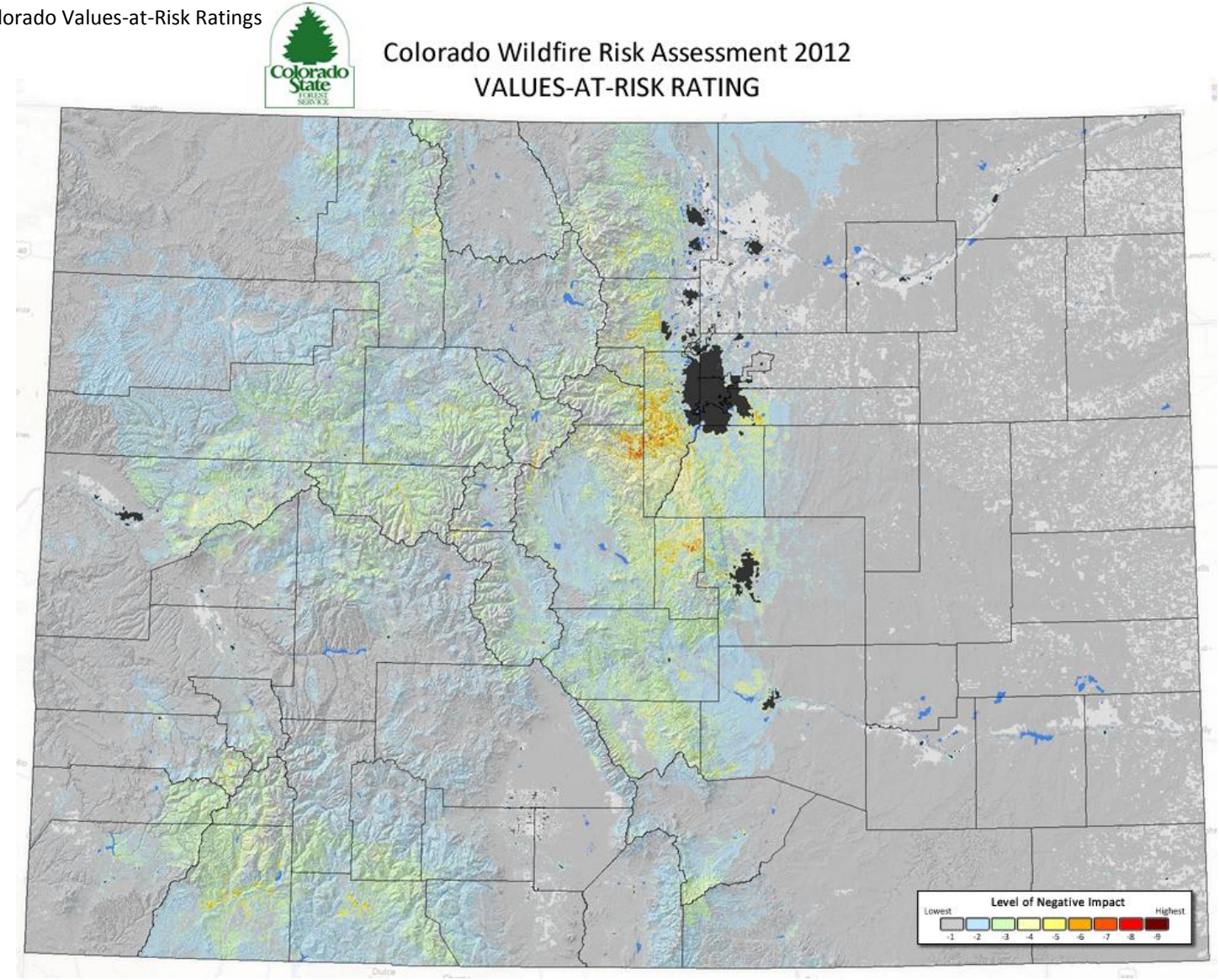


Figure 16. Colorado Wildland Urban Interface

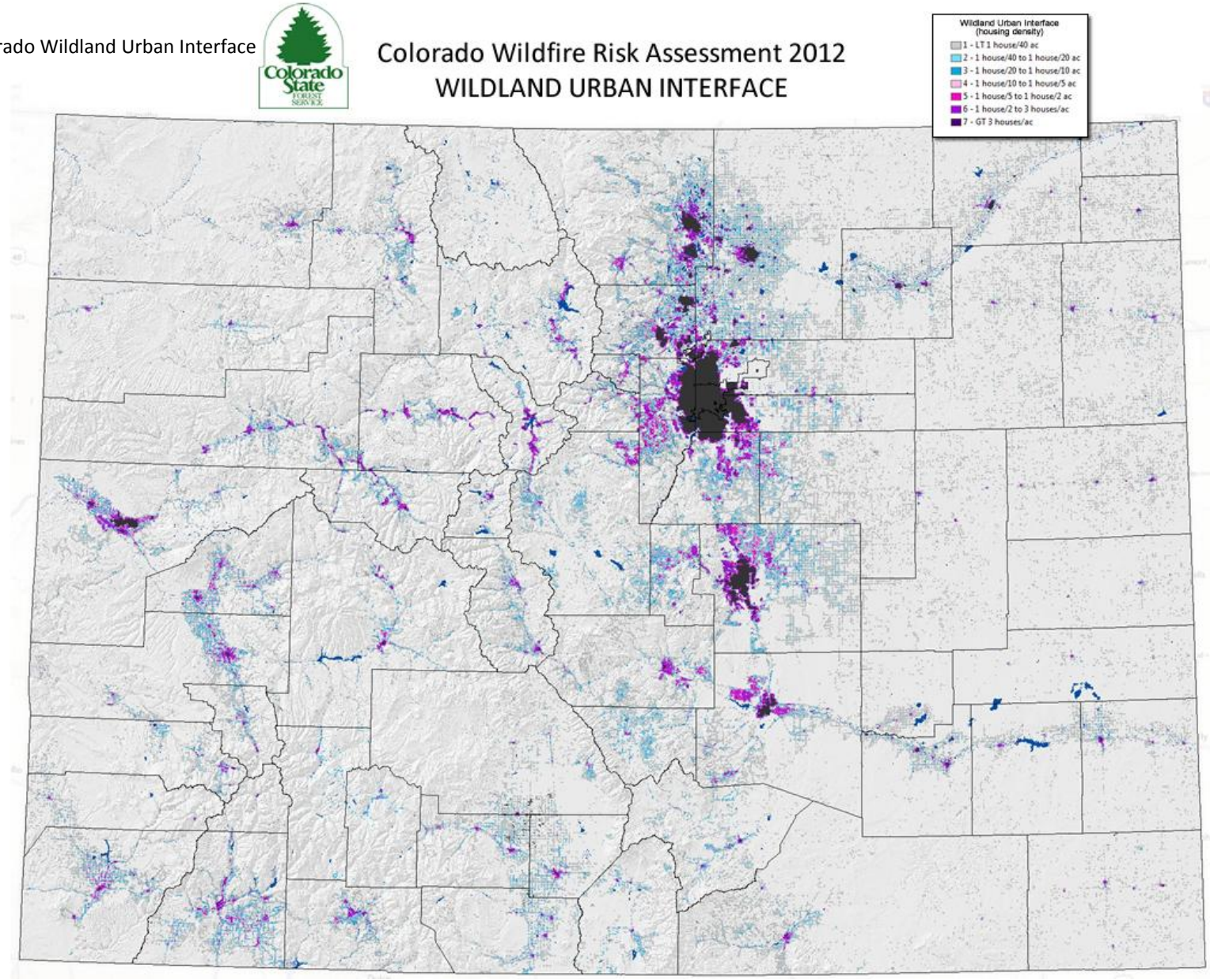


Figure 17. Colorado WUI Risk Index

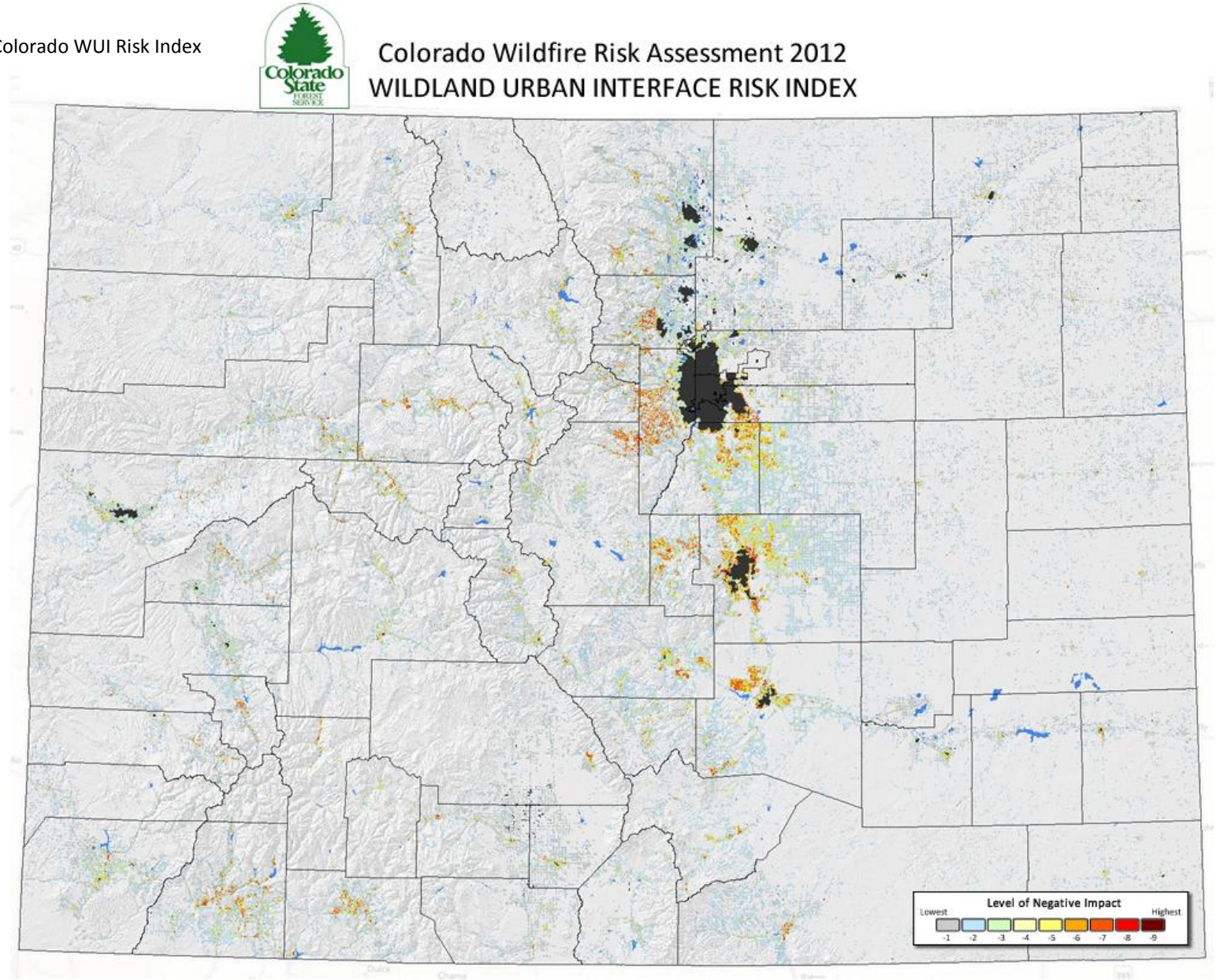
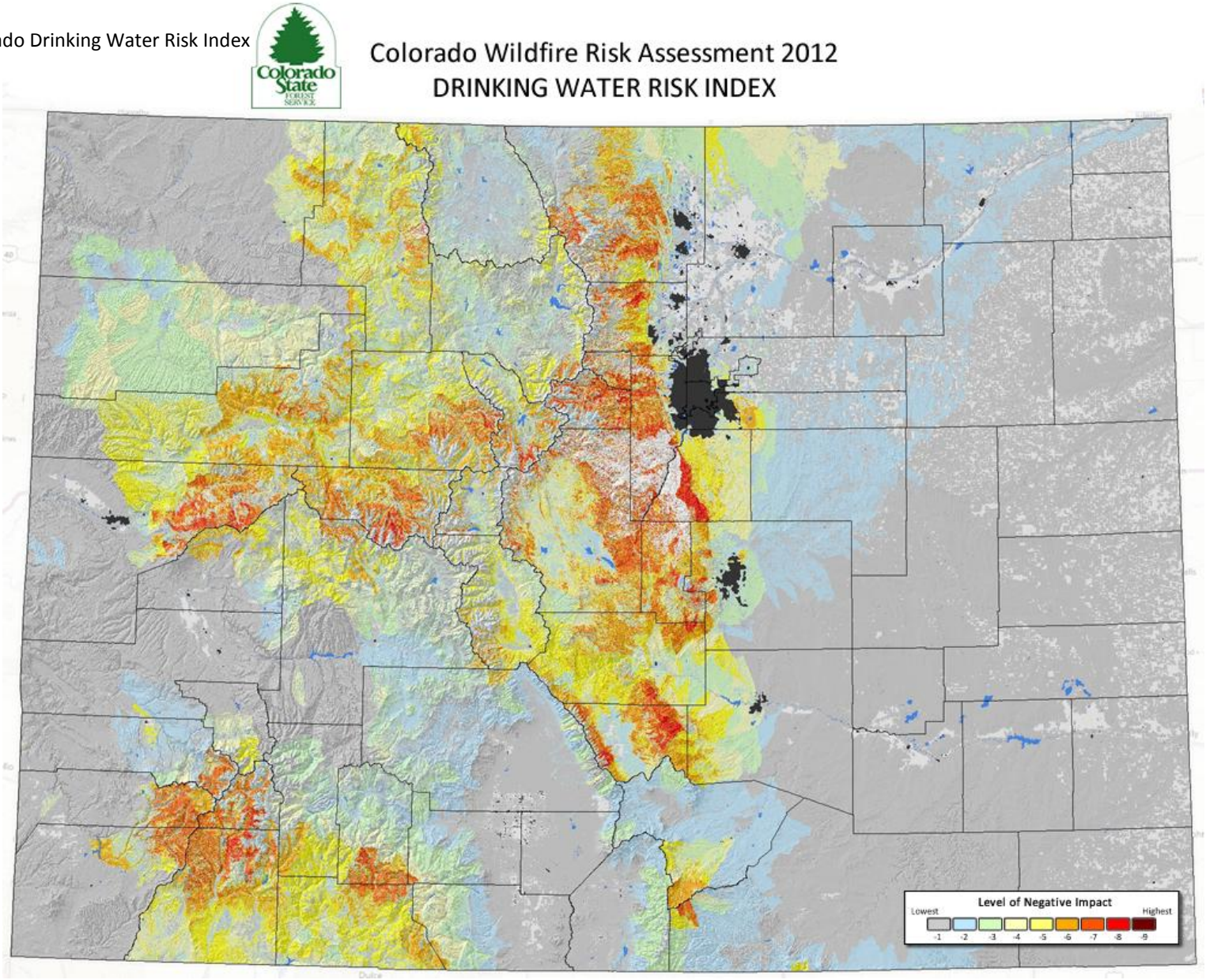


Figure 18. Colorado Drinking Water Risk Index



3.3 Summary Statistics

Summary statistics were derived for the Colorado WRA. These statistics provide a summary of the current wildfire risk situation in Colorado. A separate summary statistics report is available that shows the following statistics:

- **Wildfire Risk**: Total Acres, Percent Acres, and Population by Risk Class
- **Wildfire Threat**: Total Acres & Percent Acres
- **Wildfire Effects**: Total Acres & Percent Acres
- **Values At Risk Rating**: Total Acres & Percent Acres
- **Wildland Urban Interface**: Total Acres & Population by WUI Class
- **WUI Risk Index**: Population by WUI Risk Class
- **Surface Fuels**: Total Acres
- **Number of Fires**: State & Federal Reported VS NFIRS
- **Acres Burned**: State & Federal Reported Fires

In addition to statewide outputs, a summary of key risk outputs per county were also calculated. This includes:

- **Wildfire Risk:** Acres by County
- **Wildfire Threat:** Acres by County
- **Values At Risk:** Acres by County
- **WUI:** Acres by County
- **WUI Risk Index:** Acres by County

A few key summary statistics outputs are provided in this report as reference. However, we encourage readers to review the Colorado Wildfire Risk Assessment Summary Statistics Report for more detailed information.

Figure 19. Colorado Wildfire Risk - Total Acres by Risk Class (5 classes)

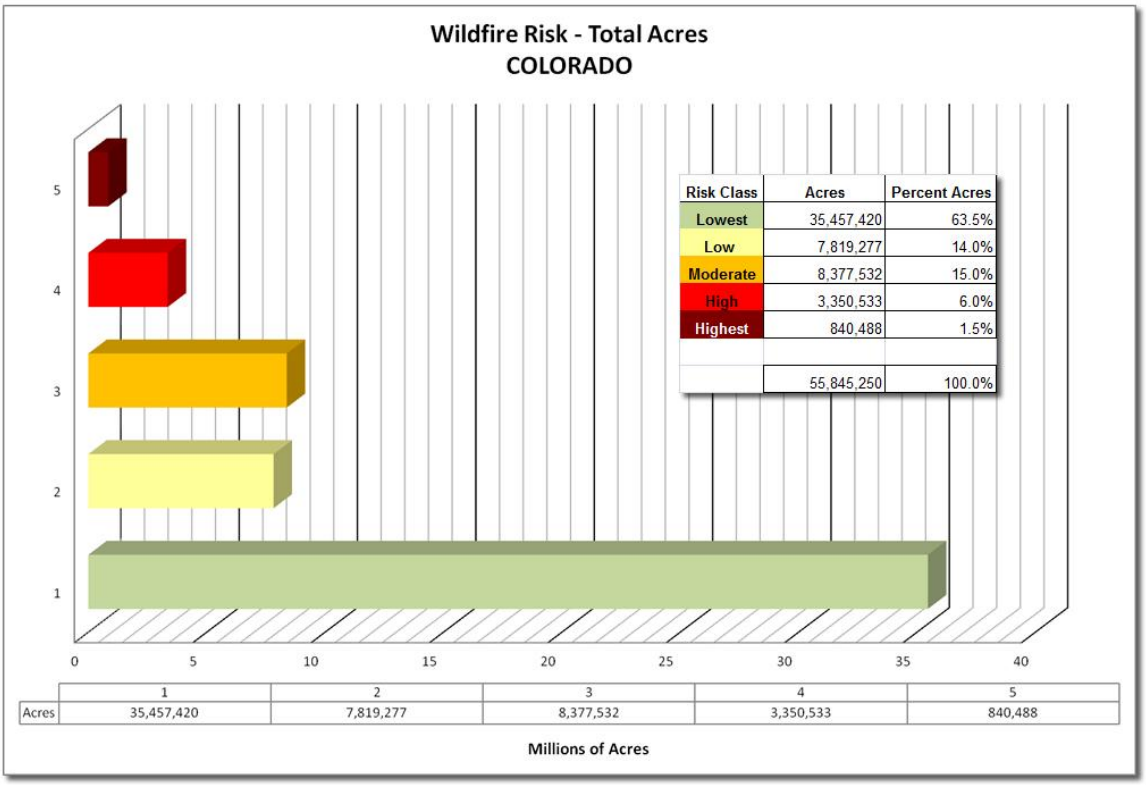


Figure 20. Colorado Wildfire Risk - Total Population by Risk Class (5 classes)

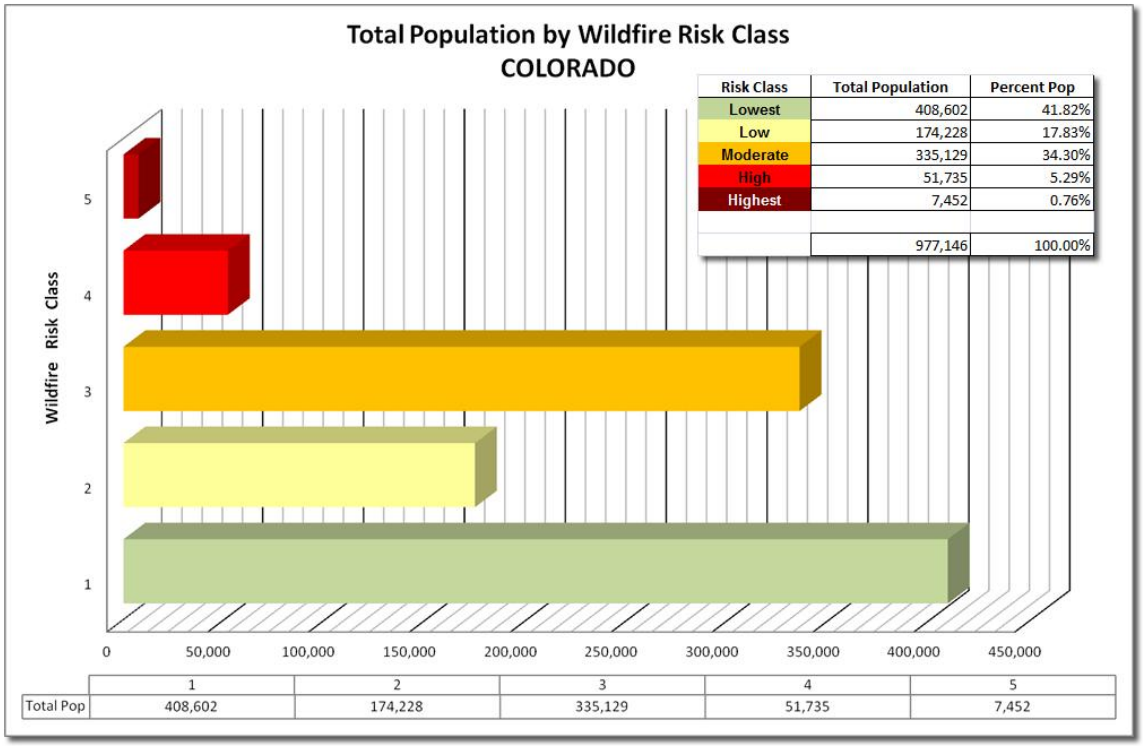
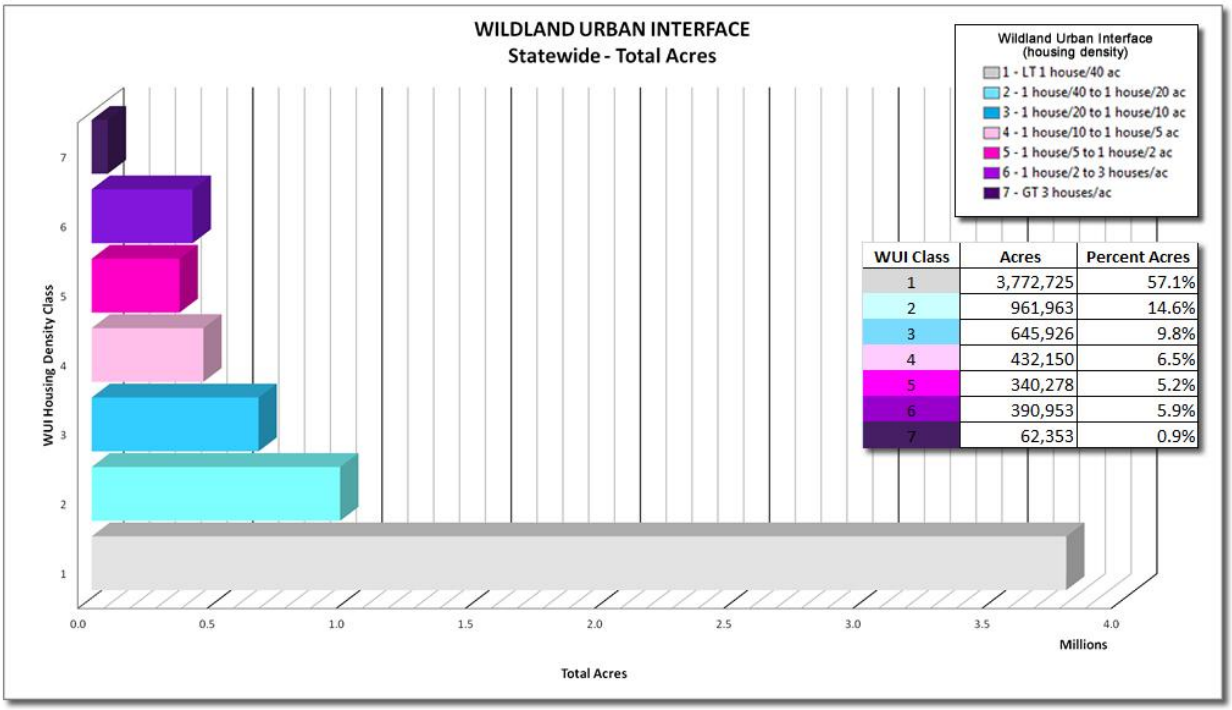
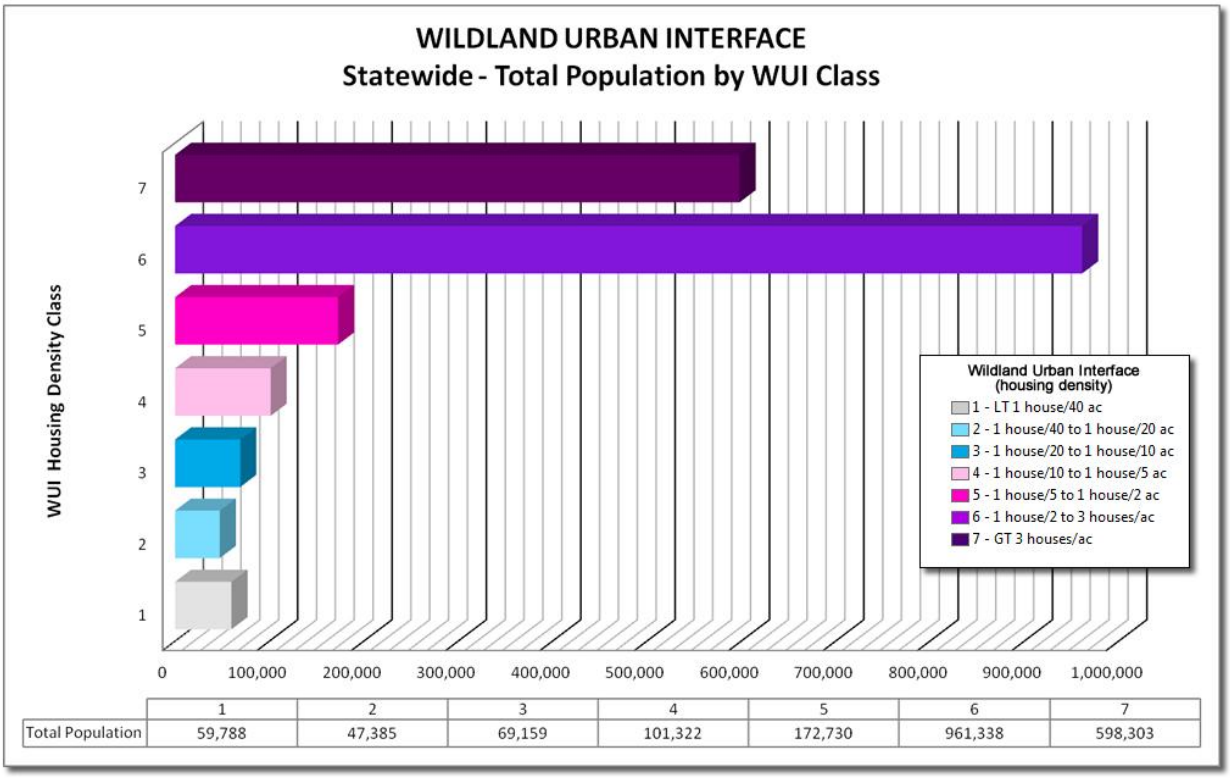


Figure 21. Colorado WUI - Total Acres



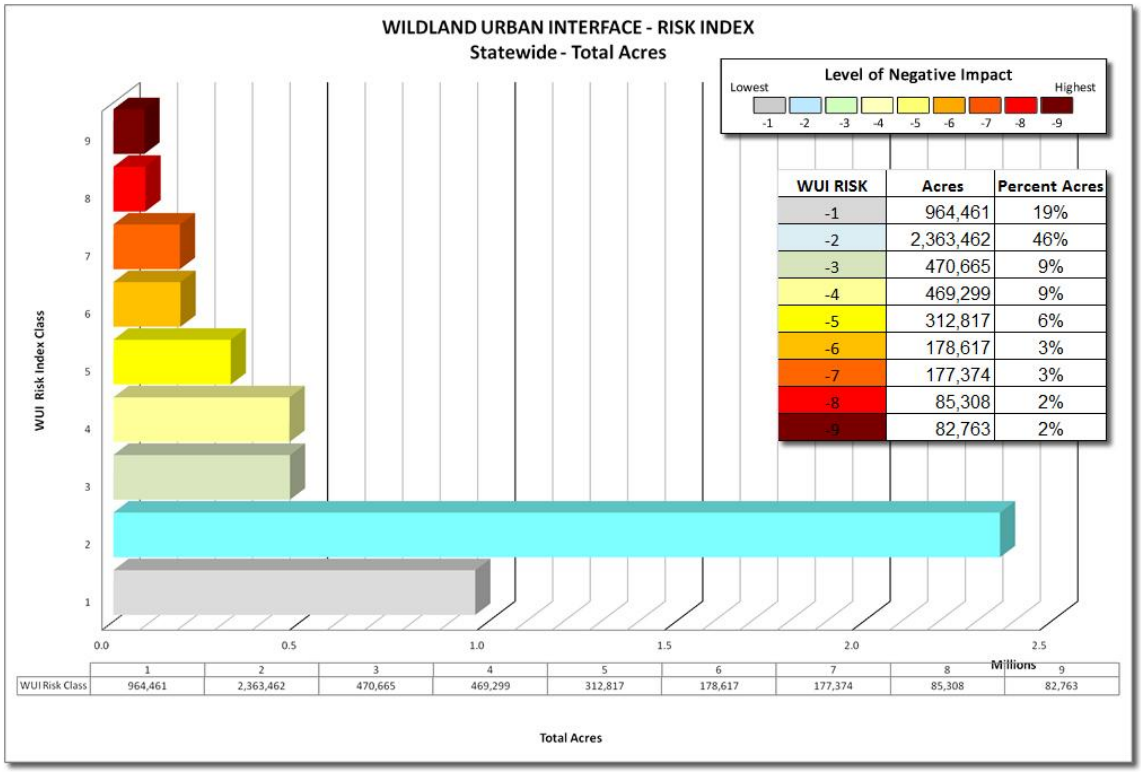
WUI Class	Acres	Percent Acres
1	3,772,725	57.1%
2	961,963	14.6%
3	645,926	9.8%
4	432,150	6.5%
5	340,278	5.2%
6	390,953	5.9%
7	62,353	0.9%

Figure 22. Colorado WUI - Total Population by WUI Class



	1	2	3	4	5	6	7
Total Population	59,788	47,385	69,159	101,322	172,730	961,338	598,303

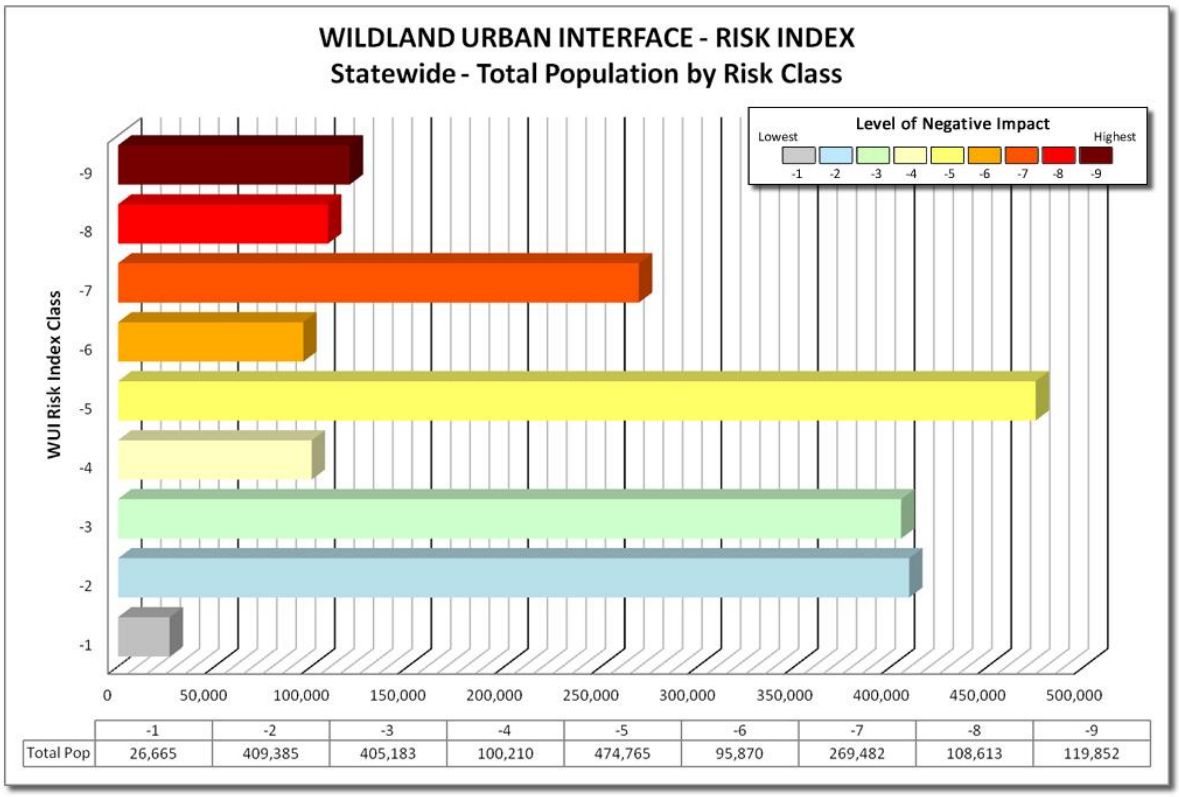
Figure 23. Colorado WUI Risk Index - Total Acres



WUI RISK	Acres	Percent Acres
-1	964,461	19%
-2	2,363,462	46%
-3	470,665	9%
-4	469,299	9%
-5	312,817	6%
-6	178,617	3%
-7	177,374	3%
-8	85,308	2%
-9	82,763	2%

	1	2	3	4	5	6	7	8	9
WUI Risk Class	964,461	2,363,462	470,665	469,299	312,817	178,617	177,374	85,308	82,763

Figure 24. Colorado WUI Risk Index - Total Population by Risk Class



	-1	-2	-3	-4	-5	-6	-7	-8	-9
Total Pop	26,665	409,385	405,183	100,210	474,765	95,870	269,482	108,613	119,852

3.4 Future Enhancements

The processing of the WWA results to create the Colorado WRA results identified opportunities for future enhancement in addition to the improvements completed. These opportunities for further enhancement relate to the development of some additional output datasets that may further aid mitigation and prevention specialists with wildland fire planning. They include:

- Community Protection Zones
- Communities-at-Risk
- Fire Adapted Communities
- Values-At-Risk Modeling Tool
- Mobile CO-WRAP Version

Community Protection Zones

Community Protection Zones (CPZ) represent those areas considered highest priority for mitigation planning activities. CPZs are a planning dataset utilized by CSFS in the recent State Forest Resource Assessment to reflect WUI and Wildfire Risk to Communities[11]. CPZs were created by buffering the WUI with distances of 0.5, 1.0 and 2.0 miles to reflect different types of mitigation activities typically conducted. A cost-weighted method was used to allow the shape and distance of the CPZs to confirm to local conditions (vegetation types). This approach was based on methods and data developed by Theobald and Romme.[12]

Building upon these methods, DTS has developed an approach to define CPZs that leverage the more accurate and detailed WUI layer developed from LandScan data, in addition to using the Rate of Spread fire behavior output to determine CPZ distance and extent from WUI areas. Rate of Spread is used instead of vegetation types to incorporate potential fire spread and travel time in the CPZ delineation.[13]

CPZs are based on an analysis of the Where People Live housing density data and the surrounding fire behavior potential. Rate of Spread data is used to determine the areas of concern around populated areas that are within a 2-hour fire spread distance. However, any distance could be used to reflect fire travel time.

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[11] Colorado State Forest Service. 2010. State Forest Resource Assessment: A foundation for strategic discussion and implementation of forest management in Colorado.

[12] Theobald, D.M. and W. Romme. 2007. Expansion of the U.S. Wildland-Urban Interface, *Landscape and Urban Planning* 83: 340-354.

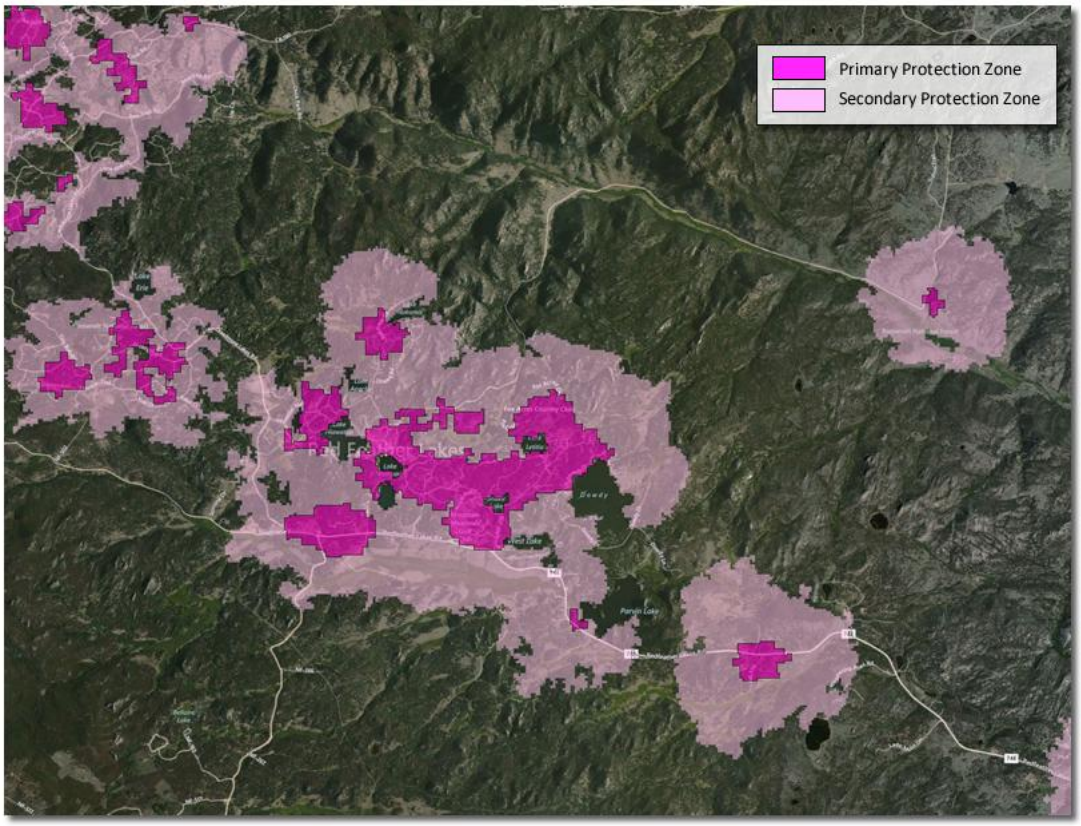
[13] DTS developed these methods for the State of Texas in their recent 2010 risk assessment update, working closely with Joe Scott (Pyrologix, Missoula, MT) and Texas Forest Service mitigation staff.

General consensus among fire planners is that for fuel mitigation treatments to be effective in reducing wildfire hazard, they must be conducted within a close distance of a community. With this approach, the WUI housing density is used to reflect populated areas in place of community boundaries, a dataset often lacking in most states. This ensures that CPZs reflect where people are living, not jurisdictional boundaries.

Accordingly, CPZs represent a variable width buffer around populated areas that are within a 2-hour fire spread distance. CPZs will extend farther in areas where rates of spread are greater and less in areas where minimal rate of spread potential exists. CPZ boundaries inherently incorporate fire behavior conditions.

All areas in Colorado would have the CPZs calculated consistently, which allows for comparison and ordination of areas across the entire state. Data would be modeled at a 30-meter cell resolution, which is consistent with other Colorado WRA layers. The following figure presents an example of CPZs for an area in Larimer County. The Primary Community Protection zone in this example is defined by the WUI housing density of "One house per 20 acres" or greater. The Secondary Community Protection Zone is based on a 2 hour travel time for fire spread using the Rate of Spread data. Both criteria can be modified to meet specific requirements, either density threshold for the primary zone, or fire spread time for the secondary zone. Note that the secondary zone distance varies around primary zone areas. This is based on the travel time of a potential fire using historical percentile weather.

Figure 25. Community Protection Zones map example



Defining Communities-at-Risk

In addition to the development of CPZs, the WUI dataset can be used to define draft community boundaries based on housing density threshold values. This is ideal for wildland and rural areas where population places / communities are typically not incorporated and hence formal boundaries do not exist. Rather, communities are defined by a grouping of homes, often given local names.

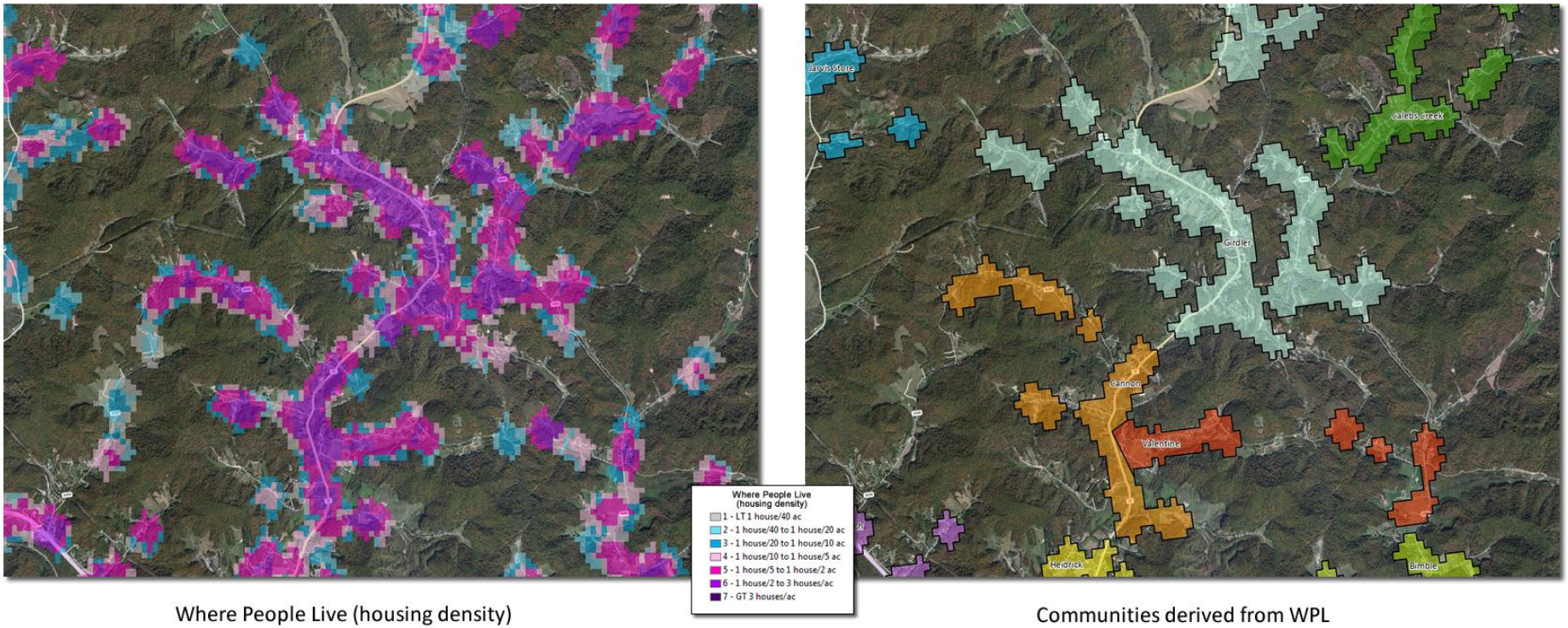
A challenge with many state fire protection agencies, in adherence to the Federal Register and NASF requirements, has been the accurate definition of communities at risk to wildfire,. This includes defining wildland community boundaries and locations, the number of communities, and the risk level of each community.

Building upon methods developed by DTS for the Southern Group of State Foresters, and recently applied to enhance the Southern Wildfire Risk Assessment (SWRA), the opportunity exists to leverage the Colorado WRA WUI dataset to define draft community boundaries. This approach has been successfully tested in Southern states, providing a draft dataset that local agency foresters can then use to name and finalize communities.

The following figure presents an example of WPL data and resultant community boundaries for an area in Kentucky. A threshold of "one house per 7 acres" was used to define the draft community boundaries. This threshold was decided upon by state agency staff based on population patterns in the state. This can be adjusted for any area based on testing to best reflect the housing density appropriate for the state. The map on the left shows the Where People Live reflecting housing density in standard classes. Based on the review of the WPL data, a threshold density value was selected to best represent "community boundaries". Local forestry staff then reviewed the draft boundaries on a per county basis and adjusted them, grouped polygons together to represent a "community", and then applied local names to the communities. The map on the right shows the final communities using arbitrary colors to reflect different communities. Names are shown. Once defined, these communities can then be combined with the wildfire risk data to derive risk ratings for the individual communities.

In addition, with the recent implementation of the Southern Wildfire Risk Assessment Portal (SouthWRAP) web site, a custom web mapping application is being developed by DTS to derive the draft community boundaries and provide the editing tools necessary for local foresters and planners to finalize the boundaries based on the draft boundaries derived from the WUI housing density data. This web application is referred to as the Community At Risk Editor (CARE).These tools, when added to CO-WRAP, would provide capabilities for editing the shape of community polygons, grouping of polygons to represent a single community, naming of the community to adhere to local use, and calculating risk ratings for each community based on the underlying Colorado WRA risk layers.

Figure 26. Example Community boundaries delineated from Where People Live (housing density) data



Where People Live (housing density)

Communities derived from WPL

Fire Adapted Communities - Cohesive Strategy

Creating Fire Adapted Communities is one of three primary goals of the National Cohesive Wildland Fire Management Strategy (Cohesive Strategy). The purpose of the Cohesive Strategy is to address the growing wildland fire challenges in the U.S. across all lands and jurisdictions. The basic premise underlying the creation of Fire Adapted Communities is**:**

> *Preventing or minimizing the loss of life and property due to wildfire requires a combination of thorough pre-fire planning and action, followed by prudent and immediate response during an event. Post-fire activities can also speed community recovery efforts and help limit the long-term effects and costs of wildfire. CWPPs or their equivalents should identify high-risk areas and community-specific requirements. Collaboration, self-sufficiency, individuals' and/or communities' acceptance of the risks and consequences of their actions (or non-action), treating homes and property equally regardless of appraised value (social justice), and facilitating culture and behavior changes are important concepts.*

The Colorado WRA and the CO-WRAP mapping applications provide both planners and individuals the ability to identify the threat and risk to communities and to display that threat and risk visually to inform decision makers. In addition, CO-WRAP provides the capability to generate detailed risk summary reports for user defined project areas. This information specifically addresses the CWPP "risk assessment" requirements.

As the Colorado WRA data becomes better understood by local planners, enhancements to the analysis data and CO-WRAP software tools are possible to incorporate local data and analysis to specifically meet Fire Adapted Communities planning requirements. These enhancements could build upon previously identified enhancements of Defining Communities-at-Risk Boundaries and Community Protection Zones. Opportunities include:

- the ability to incorporate fuel treatment planning and tracking
- tools to analyze the change in risk to communities as fuel treatments are applied (before and after analysis - "what is the change in risk if we apply these planned fuel treatments?")
- incorporate home assessment surveys and defensible space planning information
- incorporate FireWise and other prevention program status information
- track grant program projects
- integrate ingress, egress and evacuation route data, and
- integrate critical infrastructure and facility data.

Values-At-Risk Modeling Tool

The Colorado WRA Values-at-Risk (VAR) outputs were generated using the Response Function approach described in the WWA Final Report and in Section 2.3 (Assessment Methods) of this report. The specific Response Function values (RFV) used to calculate the VAR were developed by a team of technical specialists at the CSFS. These RFVs are documented in Appendix B.

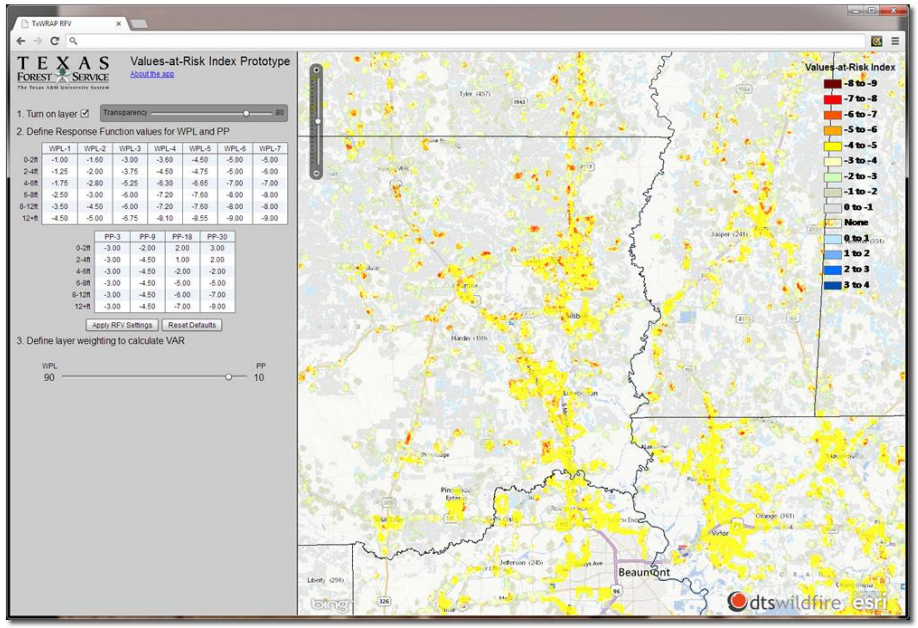
The VAR is comprised of four key input layers that reflect important assets that are considered at risk to wildfire. These are Wildland Urban Interface (people & homes), Drinking Water Importance Areas (primary sources of drinking water), Forest Assets (susceptibility and resilience of the forests), and Riparian Assets (riparian areas susceptibility to fire). The RFVs reflect the potential level of negative impact that wildfire can have on these resources. These values for each input layer were defined by the CSFS technical team based on their knowledge and understanding of statewide concerns and priorities. Weights were defined to combine the four outputs into a single measure of Values-At-Risk.

While the RFVs defined for the statewide assessment provide a consistent and comparable measure of concerns and priorities across the state, they do not incorporate local conditions or priorities. To incorporate consideration of local knowledge, conditions and priorities, the RFVs may need modification by local fire specialists and planners to reflect their needs. This may be required in future for development of detailed local plans, specifically for areas where local priorities and conditions differ from the average statewide situation. To accommodate this need, the Values-At-Risk model utilized in the Colorado WRA could be provided as an additional CO-WRAP application. This VAR application would facilitate local specialists re-running the VAR model to derive new outputs that represent the local situation. This inherently empowers local planning specialists with the ability to develop enhanced outputs, using the standardized Colorado WRA methods, easily and quickly with no additional costs or risk assessment updates required.

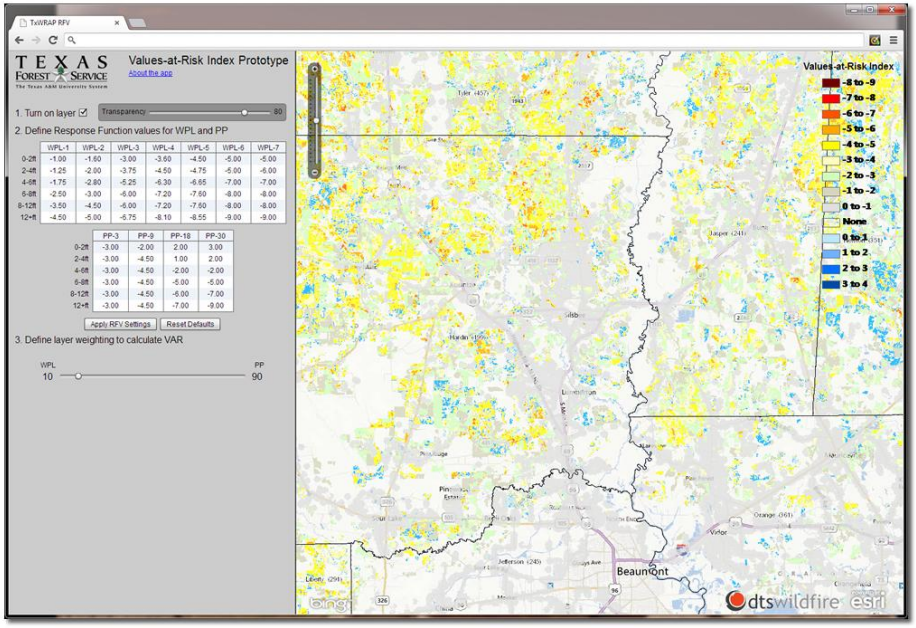
The following figure presents an example of a VAR web application prototype developed by DTS for the Texas A&M Forest Service. This prototype was developed as a proof-of-concept to prove that these VAR modeling capabilities could be deployed using a WRAP approach. The maps show VAR outputs generated by combining WUI and Pine Plantations input layers. The protection of pine plantations from fire is a concern in East Texas as this is a major economic driver in the area. This concern for pine plantations varies depending on location with consideration of WUI (people living in the wildland and rural areas). The maps shown reflect outputs based on different priorities.

The map on the left shows the VAR output with a 90/10 weighting for WUI as the priority. The map on the right shows the VAR output with a 90/10 weighting for Pine Plantations as the priority. The web application allows the user to change RFVs, and adjust weights, to reflect their knowledge and understanding of local conditions and priorities. By simply adjusting the inputs the user can immediately see the result of these changes. This model processing is completed in less than 2 seconds. This provides the ability for the user to consider many different priorities (RFVs and weights), until they determine the output that best reflects their situation.

Figure 27. Example Values-At-Risk model as a web application



Values-At-Risk with a 90/10 weighting for WUI over Pine Plantations



Values-At-Risk with a 90/10 weighting for Pine Plantations over WUI

Mobile CO-WRAP Version

Options are also available to develop a mobile application that will allow users to view the Colorado WRA data using a Smartphone or Tablet mobile device (i.e. iPhone, iPad, Android, etc). With recent advancements in mobile technology DTS has developed several applications that display web mapping applications into mobile mapping interfaces. This capability will allow users to review risk information while in the field during survey, reconnaissance or even fire incident activities. The following figure presents a recent example of the Texas WRAP application that has been deployed with a custom mobile version. Both Public and Professional Viewer interfaces can be supported to work on any mobile device.

Figure 28. The image on the left shows the Texas WRAP Mobile Browser application operating on an iPhone (main screen), while the image on the right shows the Landscape Characteristics Map Page (surface fuels) of the same mobile application operating on an iPad.

Note that other more advanced applications and deployment options exist for future integration for the Colorado WRA and CO-WRAP. We propose to discuss these items in more detail with CSFS in future as demand and budget warrant. New enhancements and applications are constantly being developed by DTS and our clients to meet other similar requirements and we propose to leverage these efforts in future for the benefit of the State of Colorado and its citizens.

4.0 Colorado Wildfire Risk Assessment Portal - CO-WRAP

This section provides a brief description of the CO-WRAP web application Readers are encouraged to visit the site directly at www.ColoradoWildfireRisk.com for more information.

4.1 Overview

In response to increasing demand for more accurate and up-to-date wildfire risk information across the state, the Colorado State Forest Service (CSFS) established the 2012 Colorado Wildfire Risk Assessment Project (Colorado WRA 2012). The goal of the project is to provide a consistent, comparable set of scientific results to be used as a foundation for wildfire mitigation and prevention planning in Colorado. The results were completed in December 2012. The CSFS developed the Colorado Wildfire Risk Assessment Portal (CO-WRAP) in order to deliver the information quickly and seamlessly to stakeholders. Through CO-WRAP, the CSFS is creating awareness among the public and providing state and local government planners with information to support mitigation and prevention efforts.

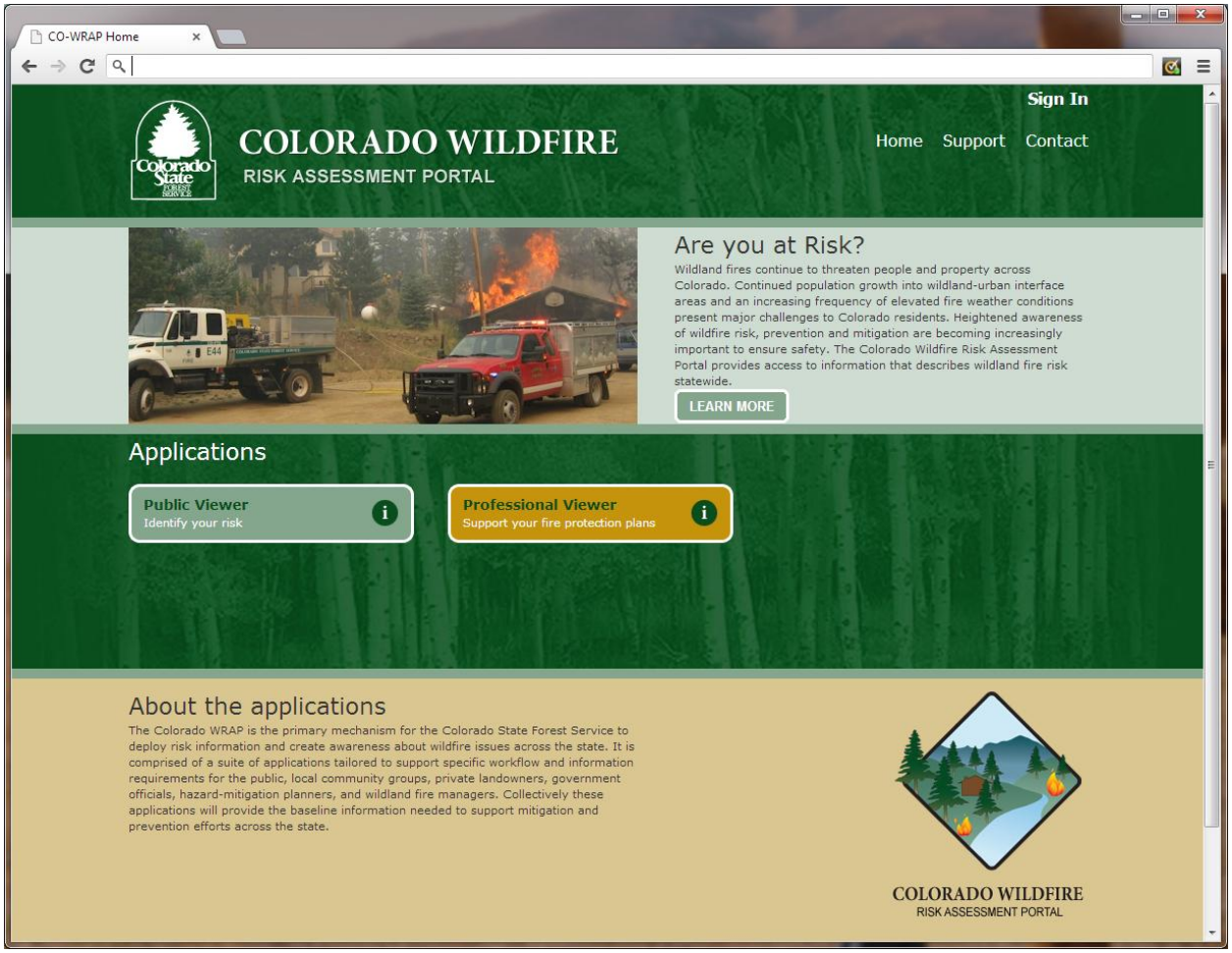
Results of the assessment can be used to help prioritize areas in the state where tactical analyses, community interaction and education, or mitigation treatments might be necessary to reduce wildfire risk. In addition, the information provided in the assessment can be used to support the following priorities:

- Identify areas that may require additional tactical planning, specifically related to mitigation projects and Community Wildfire Protection Planning
- Provide the information necessary to justify resource, budget and funding requests
- Allow agencies to work together to better define priorities and improve emergency response, particularly across jurisdictional boundaries
- Increase communication with local residents and the public to address community priorities and needs
- Plan for response and suppression resource needs
- Plan and prioritize hazardous fuel treatment programs

With the successful completion of the 2012 Colorado Wildfire Risk Assessment project, the CSFS continues to be a national leader in wildland fire management. This latest assessment builds upon and calibrates the West Wide Wildfire (WWA) Risk Assessment results. The WWA risk assessment was completed in spring 2012 and provides baseline risk assessment results for the 17 western states and Pacific Islands. Colorado has enhanced the results to reflect priorities and data distributions only within Colorado to better meet Colorado planning requirements.

CO-WRAP is the primary mechanism for the Colorado State Forest Service to deploy risk information and create awareness about wildfire issues across the state. It is comprised of a suite of applications tailored to support specific workflow and information requirements for the public, local community groups, government officials, professional hazard mitigation planners, and wildland fire managers. Collectively

these applications will provide the baseline information needed to support mitigation and prevention efforts across the state. The following figure shows the main web portal for CO-WRAP.

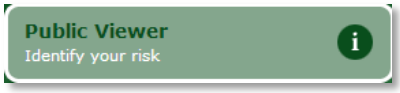


Access to the interactive web mapping applications is available from the main portal page. Currently, CO-WRAP has two applications.

Professional Viewer

The Professional Viewer is a web-mapping application designed to support the community wildfire protection planning needs of government officials, hazard mitigation planners and wildland fire professionals. This application contains advanced functionality and additional map themes as compared to the Public Viewer. The key features of this application include the capability to define a project area, generate a detailed risk summary report, and export and download wildfire risk GIS data. Access to the Professional Viewer requires a valid user account from the Colorado State Forest Service. You must register for the site using the link on the Sign In page.

Public Viewer



The Public Viewer is a web-mapping application designed to let users zoom to a place of interest, explore map themes and identify wildfire risk for a specific location on the map. The featured tool in this application is called **"What's Your Risk?"** It allows users to identify potential wildfire intensity near their home, or any other point of interest on the map, and provides a link to additional resources for users wanting to know how to reduce their risk. The application is accessible to any web browser and does not require registration or a login.

4.2 CO-WRAP Support Information

A variety of resources are available to help make the most use of the Colorado Wildfire Risk Assessment (Colorado WRA) results and the Colorado Wildfire Risk Assessment Portal (CO-WRAP) web application. Support, documentation and reference information is available from several sources. Key resources for the Colorado WRA and CO-WRAP applications are provided below.

User Manual

A simple step-by-step guide on how to use CO-WRAP is provided. The manual provides all the information necessary to learn how to use both the Public and Professional Viewer applications.

Training

Custom training on how to use the Colorado WRA results and the CO-WRAP application is available from the Colorado State Forest Service (CSFS). If you are interested in receiving training for your organization, you can reach us by using the Contact page.

Help Desk

Support for use of the Colorado WRA data and the Professional Viewer application within CO-WRAP is available by sending an email to the CSFS at support@coloradowildfirerisk.com. The Professional Viewer application is intended for use by fire planners and land managers. For general inquiries, especially regarding the Public Viewer or the Colorado WRA data, please use the Contact page. This will allow you to pose questions, make suggestions and provide feedback. We welcome and encourage your comments so we can continue to improve CO-WRAP to better meet your needs.

More Information

To aid users in developing a fire protection plan, a few additional resources are provided. This includes guidelines for protecting your home and property from wildfire through mitigation, minimum standards for developing a Community Wildfire Protection Plan (CWPP), requirements for a community to receive the Firewise Communities USA™ designation and templates for developing a CWPP and a Forest Stewardship Plan. Use the links below to access these resources. We also encourage you to check out the information available on the Colorado State Forest Service website at www.csfs.colostate.edu. Key links are provided below.

- Quick Guide - Protecting Your Home from Wildfire: Creating Wildfire Defensible Zones (PDF)

- FireWise Constrouction: Site Design & Building Materials (PDF)
- Home and Property Wildfire Protection
- Community Wildfire Protection Planning

Example Plan Templates/Guidelines

Planning is essential for the long-term success of wildfire mitigation efforts. CWPPs have become the planning standard, as defined in the Healthy Forests Restoration Act of 2003. The risk summary report capability within the CO-WRAP Professional Viewer application has been specifically designed to support Step 5 in CWPP development, the Community Risk Assessment component. The risk report is generated in a Microsoft WORD format to facilitate easy copy-paste of content directly into a plan. Examples are provided below to get you get started. Links to existing CWPPs developed across Colorado also are provided; please note, however, that these plans were developed before Colorado WRA and CO-WRAP were available.

- Review Current Colorado CWPPs
- CWPP Template
- CWPP Minimum Standards
- Colorado Landowner Forest Stewardship Plan Template

Revision History

This document has undergone the following revisions .

Date	Revised By:	Description of Revision
December 07, 2012	David Buckley	Initial draft for CSFS review.
December 14, 2012	David Buckley	Revisions to incorporate CSFS feedback and changes. Added Mobile CO-WRAP enhancement description.
December 21, 2012	David Buckley Rich Homann	Incorporate comments and feedback from CSFS review.
January 8, 2012	David Buckley	Incorporate final summary statistics charts and maps.

Appendix A: Description of Outputs

This appendix provides a description of the Colorado WRA key output datasets (in alphabetical order). Please refer to the WWA Final Report for a description of all WWA datasets.

Wildfire Risk

Represents the possibility of loss or harm occurring from a wildfire

Wildfire Risk represents the possibility of loss or harm occurring from a wildfire**.** It is the primary output of the Colorado Wildfire Risk Assessment. Risk is derived by combining the Wildfire Threat and the Fire Effects assessment outputs. It identifies areas with the greatest potential impacts from a wildfire – i.e. those areas most at risk.

Wildfire Risk combines the likelihood of a fire occurring (threat), with those areas of most concern that are adversely impacted by fire (fire effects), to derive a single measure of wildfire risk. Since all areas in Colorado have risk calculated consistently, it allows for comparison and ordination of areas across the entire state. For example, a high risk area in Southern Colorado is equivalent to a high risk area in Northern Colorado.

Fire Effects is a key component of Wildfire Risk. Fire Effects is comprised of several inputs focusing on values impacted. The purpose of Fire Effects is to identify those areas that have important values or assets that would be adversely impacted by a wildfire. Fire Effects inputs include Where People Live (derived from 2012 LandScan data for Colorado),Colorado Forest Assets, Riparian Assets and Drinking Water value layers. The Colorado component is a key element of Fire Effects since it represents where people live in the wildland and urban fringe areas.

The risk map is derived at a 30-meter resolution. This scale of data was chosen to be consistent with the accuracy of the primary LANDFIRE surface fuels dataset used in the assessment. While not appropriate for site specific analysis, it is appropriate for regional, county or local planning efforts.

Wildfire Threat

Represents the likelihood of an acre burning.

Threat is derived by combining a number of landscape characteristics including surface fuels and canopy fuels, resultant fire behavior, historical fire occurrence, percentile weather derived from historical weather observations, and terrain conditions. These inputs are combined using analysis techniques based on established fire science.

The measure of wildfire threat used in the Colorado WRA is called Fire Threat Index (FTI). FTI combines the probability of an acre igniting (Fire Occurrence) and the expected final fire size based on rate of spread in four weather percentile categories. Since all areas in Colorado have FTI calculated consistently, it allows for comparison and ordination of areas across the entire state. For example, a high threat area in East Colorado is equivalent to a high threat area in West Colorado.

To aid in the use of Wildfire Threat for planning activities, the output values are categorized into five (5) classes. These are given general descriptions from Lowest to Highest Threat.

The threat map is derived at a 30 meter resolution. This scale of data was chosen to be consistent with the accuracy of the primary surface fuels dataset used in the assessment. While not

appropriate for site specific analysis, it is appropriate for regional, county or local protection mitigation or prevention planning.

Fire Intensity Scale

Quantifies the potential fire intensity by orders of magnitude.

Fire Intensity Scale (FIS) specifically identifies areas where significant fuel hazards and associated dangerous fire behavior potential exist. Similar to the Richter scale for earthquakes, FIS provides a standard scale to measure potential wildfire intensity. FIS consists of five (5) classes where the order of magnitude between classes is ten-fold. The minimum class, Class 1, represents very low wildfire intensities and the maximum class, Class 5, represents very high wildfire intensities.

1. Class 1, Lowest Intensity:
   Very small, discontinuous flames, usually less than 1 foot in length; very low rate of spread; no spotting. Fires are typically easy to suppress by firefighters with basic training and non-specialized equipment.
2. Class2, Low:
   Small flames, usually less than two feet long; small amount of very short range spotting possible. Fires are easy to suppress by trained firefighters with protective equipment and specialized tools.
3. Class 3, Moderate:
   Flames up to 8 feet in length; short-range spotting is possible. Trained firefighters will find these fires difficult to suppress without support from aircraft or engines, but dozer and plows are generally effective. Increasing potential for harm or damage to life and property.
4. Class 4, High:
   Large Flames, up to 30 feet in length; short-range spotting common; medium range spotting possible. Direct attack by trained firefighters, engines, and dozers is generally ineffective, indirect attack may be effective. Significant potential for harm or damage to life and property.
5. Class 5, Highest Intensity:
   Very large flames up to 150 feet in length; profuse short-range spotting, frequent long-range spotting; strong fire-induced winds. Indirect attack marginally effective at the head of the fire. Great potential for harm or damage to life and property.

Wildfire Threat and Fire Intensity Scale are designed to complement each other. Unlike Wildfire Threat, the Fire Intensity Scale does not incorporate historical occurrence information. It only evaluates the potential fire behavior for an area, regardless if any fires have occurred there in the past. This additional information allows mitigation planners to quickly identify areas where dangerous fire behavior potential exists in relationship to nearby homes or other valued assets.

Since all areas in Colorado have fire intensity scale calculated consistently, it allows for comparison and ordination of areas across the entire state. For example, a high fire intensity area in Eastern Colorado is equivalent to a high fire intensity area in Western Colorado.

Fire intensity scale is a fire behavior output, which is influenced by three environmental factors - fuels, weather, and topography. Weather is by far the most dynamic variable as it changes frequently. To account for this variability, four percentile weather categories were created from historical weather observations to represent low, moderate, high, and extreme weather days for each weather influence zone in Colorado. A weather influence zone is an area where, for analysis purposes, the weather on any given day is considered uniform. There are 11weather influence zones in Colorado. The FIS represents the weighted average for all four weather percentiles.

The fire intensity scale map is derived at a 30-meter resolution. This scale of data was chosen to be consistent with the accuracy of the primary surface fuels dataset used in the assessment. While not appropriate for site specific analysis, it is appropriate for regional, county or local planning efforts.

Wildfire Effects Themes

Values At Risk Rating

Represents those values or assets that would be adversely impacted by a wildfire

The Values At Risk Rating (VAR) is an overall Fire Effects rating that combines the risk ratings for Wildland Urban Interface (WUI), Forest Assets, Riparian Assets, and Drinking Water Importance Areas into a single measure of values-at-risk. The individual ratings for each value layer were derived using a Response Function approach.

Response functions are a method of assigning a net change in the value to a resource or asset based on susceptibility to fire at different intensity levels. A resource or asset is any of the Fire Effects input layers, such as WUI, Forest Assets, etc. These net changes can be adverse (negative) or positive (beneficial).

Calculating the VAR at a given location requires spatially defined estimates of the intensity of fire integrated with the identified resource value. This interaction is quantified through the use of response functions that estimate expected impacts to resources or assets at the specified fire intensity levels. The measure of fire intensity level used in the Colorado assessment is flame length for a location. Response Function outputs were derived for each input data set and then combined to derive the Values Impacted Rating.

Different weightings are used for each of the input layers with the highest priority placed on protection of people and structures (i.e. WUI). The weightings represent the value associated with those assets. Weightings were developed by a team of experts during the assessment to reflect priorities for fire protection planning in Colorado. Refer to the Colorado WRA Final Report for more information about the layer weightings.

Since all areas in Colorado have the VAR calculated consistently, it allows for comparison and ordination of areas across the entire state. The VAR data was derived at a 30-meter resolution.

Suppression Difficulty Index

Reflects the difficulty or relative cost to suppress a fire given the terrain and vegetation conditions that may impact machine operability.

This layer is an overall index that combines the slope steepness and the fuel type characterization to identify areas where it would be difficult or costly to suppress a fire due to the underlying terrain and vegetation conditions that would impact machine operability (in particular Type II dozer).

The rating was calculated based on the fireline production rates for hand crews and engines with modifications for slope, as documented in the NWCG Fireline Handbook 3, PMS 401-1.

The burnable fuel models in the Colorado WRA were grouped into three categories: slow (0-66 feet), medium (67-165 feet) and fast (greater than 165 feet).

Fireline production capability on five slope classes was used as the basic reference to obtain the suppression difficulty score. To remain constant with the Value Impacted Rating output values, a response function (-1 to –9) is assigned to each combination of fuel model group (slow, medium and fast) and slope category.

Wildland Urban Interface Risk Index

A measure of the potential impact on people and their homes from wildfire.

The Wildland-Urban Interface (WUI) Risk Index layer is a rating of the potential impact of a wildfire on people and their homes. The key input, WUI, reflects housing density (houses per acre) consistent with Federal Register National standards. The location of people living in the wildland-urban interface and rural areas is essential for defining potential wildfire impacts to people and homes.

The WUI Risk Index is derived using a response function modeling approach. Response functions are a method of assigning a net change in the value to a *resource* or *asset* based on susceptibility to fire at different intensity levels, such as flame length.

To calculate the WUI Risk Index, the WUI housing density data was combined with flame length data and response functions were defined to represent potential impacts. The response functions were defined by a team of experts led by Colorado State Forest Service mitigation planning staff. By combining flame length with the WUI housing density data, it is possible to determine where the greatest potential impact to homes and people is likely to occur.

The range of values is from -1 to -9, with -1 representing the least negative impact and -9 representing the most negative impact. For example, areas with high housing density and high flame lengths are rated -9, while areas with low housing density and low flame lengths are rated -1.

The WUI Risk Index has been calculated consistently for all areas in Colorado, which allows for comparison and ordination of areas across the entire state. Data is modeled at a 30-meter cell resolution, which is consistent with other Colorado WRA layers.

Drinking Water Risk Index

A measure of the risk to Drinking Water Importance Areas based on the potential negative impacts from wildfire

In areas that experience low-severity burns, fire events can serve to eliminate competition, rejuvenate growth and improve watershed conditions. But in landscapes subjected to high, or even moderate-burn severity, the post-fire threats to public safety and natural resources can be extreme.

High-severity wildfires remove virtually all forest vegetation – from trees, shrubs and grasses down to discarded needles, decomposed roots and other elements of ground cover or duff that protect forest soils. A severe wildfire also can cause certain types of soil to become hydrophobic by forming a waxy, water-repellent layer that keeps water from penetrating the soil, dramatically amplifying the rate of runoff.

The loss of critical surface vegetation leaves forested slopes extremely vulnerable to large-scale soil erosion and flooding during subsequent storm events. In turn, these threats can impact the health, safety and integrity of communities and natural resources downstream. The likelihood that such a post-fire event will occur in Colorado is increased by the prevalence of highly erodible soils in several parts of the state, and weather patterns that frequently bring heavy rains on the heels of fire season.

In the aftermath of the 2002 fire season, the Colorado Department of Health estimated that 26 municipal water storage facilities were shut down due to fire and post-fire impacts. The potential for severe soil erosion is a consequence of wildfire because as a fire burns, it destroys plant material

and the litter layer. Shrubs, forbs, grasses, trees and the litter layer disperse water during severe rainstorms. Plant roots stabilize the soil, and stems and leaves slow the water to give it time to percolate into the soil profile. Fire can destroy this soil protection.

The range of values is from -1 to -9, with -1 representing the least negative impact and -9 representing the most negative impact.

Riparian Assets Risk Index

A measure of the risk to riparian areas based on the potential negative impacts from wildfire.

This layer identifies those riparian areas with the greatest potential for adverse effects from wildfire.

The range of values is from -1 to -9, with -1 representing the least negative impact and -9 representing the most negative impact.

The risk index has been calculated by combining the Riparian Assets data with a measure of fire intensity using a Response Function approach. Those areas with the highest negative impact (-9) represent areas with high potential fire intensity and high importance for ecosystem services. Those areas with the lowest negative impact (-1) represent those areas with low potential fire intensity and a low importance for ecosystem services.

This risk output is intended to supplement the Drinking Water Risk Index by identifying wildfire risk within the more detailed riparian areas.

Forest Assets Risk Index

A measure of the risk to forested areas based on the potential negative impacts from wildfire.

This layer identifies those forested areas with the greatest potential for adverse effects from wildfire. The range of values is from -1 to -9, with -1 representing the least negative impact and -9 representing the most negative impact.

The risk index has been calculated by combining the Forest Assets data with a measure of fire intensity using a Response Function approach. Those areas with the highest negative impact (-9) represent areas with high potential fire intensity and low resilience or adaptability to fire. Those areas with the lowest negative impact (-1) represent those areas with low potential fire intensity and high resilience or adaptability to fire.

This risk output is intended to provide an overall forest index for potential impact from wildfire. This can be applied to consider aesthetic values, ecosystem services, or economic values of forested lands.

Primary Input Layers

Surface Fuels

Fire behavior fuel models that contain the parameters needed to calculate fire behavior outputs

Surface fuels, or fire behavior fuel models as they are technically referred to, contain the parameters required by the Rothermel (1972) surface fire spread model to compute surface fire behavior characteristics, including rate of spread, flame length, fireline intensity and other fire behavior metrics. As the name might suggest, surface fuels account only for surface fire potential. Canopy fire potential is computed through a separate but linked process. The Colorado WRA accounts for both surface and canopy fire potential in the fire behavior outputs. However, only surface fuels are shown in this report.

Surface fuels typically are categorized into one of four primary fuel types based on the primary carrier of the surface fire: 1) grass, 2) shrub/brush, 3) timber litter, and 4) slash. Two standard fire behavior fuel model sets have been published. The Fire Behavior Prediction System 1982 Fuel Model Set (Anderson, 1982) contains 13 fuel models, and the Fire Behavior Prediction System 2005 Fuel Model Set (Scott & Burgan, 2005) contains 40 fuel models. The Colorado WRA uses fuel models from the 2005 Fuel Model Set.

The LANDFIRE Program Refresh 2008 version of data products was used to compile the Surface Fuels data for the West Wide Risk Assessment and the Colorado Wildfire Risk Assessment. This reflects data through 2008. Some modifications were completed to reflect recent disturbances, such as large wildfires and pine beetle infestations, prevalent in central Colorado over recent years. These updates reflect changes in the landscape that represent conditions through 2010. Information on the process used to compile the Colorado fuels dataset can be found in the West Wide Assessment Final Report cited on the Reference Page.

Table 13 provides a description of the FBPS 2005 fuel model set (Scott & Burgan, 2005)

Table 13. FBPS 2005 Fuel Model Set used in the Colorado WRA.

Value	Fuel Model Name	Description
101	GR01	Short, sparse dry climate grass
102	GR02	Low load dry climate grass
103	GR03	Low load, very coarse, humid climate grass
104	GR04	Moderate load dry climate grass
105	GR05	Low load humid climate grass
106	GR06	Moderate load humid climate grass
107	GR07	High load dry climate grass
108	GR08	High load very coarse humid climate grass
109	GR09	Very high load humid climate grass
121	GS01	Low load dry climate grass-shrub
122	GS02	Moderate load dry climate grass-shrub
123	GS03	Moderate load humid climate grass-shrub
124	GS04	High load humid climate grass-shrub
141	SH01	Low load dry climate shrub
142	SH02	Moderate load dry climate shrub
143	SH03	Moderate load humid climate shrub
144	SH04	Low load humid climate timber-shrub
145	SH05	High load humid climate grass-shrub
146	SH06	Low load humid climate shrub
147	SH07	Very high load dry climate shrub
148	SH08	High load humid climate shrub
149	SH09	Very high load humid climate shrub
161	TU01	Light load dry climate timber-grass-shrub
162	TU02	Moderate load humid climate timber-shrub
163	TU03	Moderate load humid climate timber-grass-shrub
164	TU04	Dwarf Conifer with Understory
165	TU05	Very High Load, Dry Climate Timber-Shrub
181	TL01	Low load compact conifer litter
182	TL02	Low load broadleaf litter
183	TL03	Moderate load conifer litter
184	TL04	Small downed logs
185	TL05	High load conifer litter
186	TL06	Moderate load broadleaf litter
187	TL07	Large downed logs
188	TL08	Long-needle litter
189	TL09	Very high load broadleaf litter
201	SB01	Low load activity fuel
202	SB02	Moderate load activity or low load blowdown
203	SB03	High load activity fuel or moderate load blowdown
204	SB04	High load blowdown
91	NB01	Urban
92	NB02	Snow and Ice
93	NB03	Agriculture
98	NB08	Water
99	NB09	Bare Ground

Vegetation

General vegetation and land cover types

The Vegetation map describes the general vegetation and landcover types across the state of Colorado. In the Colorado WRA, the Vegetation dataset is used to support the development of the Surface Fuels, Canopy Cover, Canopy Stand Height, Canopy Base Height, and Canopy Bulk Density datasets.

The LANDFIRE program Refresh version of data products (Existing Vegetation Type) was used to compile the Vegetation data for the West Wide Risk Assessment and the Colorado WRA. This reflects data current to 2008. Some modifications were completed to reflect recent disturbances such as large wildfires and pine beetle infestations prevalent in central Colorado over recent years. The LANDFIRE EVT data was classified to reflect general vegetation cover types for representation with CO-WRAP.

Wildland Urban Interface

Reflects housing density depicting where humans and their structures meet or intermix with wildland fuels.

Colorado is one of the fastest growing states in the Nation, with much of this growth occurring outside urban boundaries. This increase in population across the state will impact counties and communities that are located within the Wildland Urban Interface (WUI). The WUI is described as the area where structures and other human improvements meet and intermingle with undeveloped wildland or vegetative fuels. Population growth within the WUI substantially increases the risk from wildfire.

The Wildland Urban Interface (WUI) layer reflects housing density depicting where humans and their structures meet or intermix with wildland fuels. In the past, conventional wildland-urban interface data sets, such as USFS SILVIS, have been used to reflect these concerns. However, USFS SILVIS and other existing data sources did not provide the level of detail needed by the Colorado State Forest Service and local fire protection agencies.

The new WUI data set is derived using advanced modeling techniques based on the Where People Live data set and LandScan USA population count data available from the Department of Homeland Security, HSIP Freedom data set. WUI is simply a subset of the Where People Live data set. The primary difference is populated areas surrounded by sufficient non-burnable areas (i.e. interior urban areas) are removed from the Where People Live data set, as these areas are not expected to be directly impacted by a wildfire.

Data is modeled at a 30-meter cell resolution, which is consistent with other Colorado WRA layers. . The WUI classes are based on the number of houses per acre. Class breaks are based on densities well understood and commonly used for fire protection planning.

Drinking Water Importance Areas

A measure of quality and quantity of public surface drinking water categorized by watershed

This layer identifies an index of surface drinking water importance, reflecting a measure of water quality and quantity, characterized by Hydrologic Unit Code 12 (HUC 12) watersheds. The Hydrologic

Unit system is a standardized watershed classification system developed by the USGS. Areas that are a source of drinking water are of critical importance and adverse effects from fire are a key concern.

The U.S. Forest Service Forests to Faucets (F2F) project is the primary source of the drinking water data set. This project used GIS modeling to develop an index of importance for supplying drinking water using HUC 12 watersheds as the spatial resolution. Watersheds are ranked from 1 to 100 reflecting relative level of importance, with 100 being the most important and 1 the least important.

Several criteria were used in the F2F project to derive the importance rating including water supply, flow analysis, and downstream drinking water demand. The final model of surface drinking water importance used in the F2F project combines the drinking water protection model, capturing the flow of water and water demand, with a model of mean annual water supply. The values generated by the drinking water protection model are simply multiplied by the results of the model of mean annual water supply to create the final surface drinking water importance index.

Water is critical to sustain life. Human water usage has further complicated nature's already complex aquatic system. Plants, including trees, are essential to the proper functioning of water movement within the environment. Forests receive precipitation, utilize it for their sustenance and growth, and influence its storage and/or passage to other parts of the environment.

Four major river systems – the Platte, Colorado, Arkansas and Rio Grande – originate in the Colorado mountains and fully drain into one-third of the landmass of the lower 48 states. Mountain snows supply 75 percent of the water to these river systems.

Approximately 40 percent of the water comes from the highest 20 percent of the land, most of which lies in national forests. National forests yield large portions of the total water in these river systems. The potential is great for forests to positively and negatively influence the transport of water over such immense distances.

Riparian Assets

Forested riparian areas characterized by functions of water quantity and quality, and ecology

This layer identifies riparian areas that are important as a suite of ecosystem services, including both terrestrial and aquatic habitat, water quality, water quantity, and other ecological functions. Riparian areas are considered an especially important element of the landscape in the west. Accordingly, riparian assets are distinguished from other forest assets so they can be evaluated separately.

The process for defining these riparian areas involved identifying the riparian footprint and then assigning a rating based upon two important riparian functions – water quantity and quality, and ecological significance. A scientific model was developed by the West Wide Risk Assessment technical team with in-kind support from CAL FIRE state representatives. Several input datasets were used in the model including the National Hydrography Dataset and the National Wetland Inventory.

The National Hydrography Data Set (NHD) was used to represent hydrology. A subset of streams and water bodies, which represents perennial, intermittent, and wetlands, was created. The NHD water bodies' data set was used to determine the location of lakes, ponds, swamps, and marshes (wetlands).

To model water quality and quantity, erosion potential (K-factor) and annual average precipitation was used as key variables. The Riparian Assets data is an index of class values that range from 1 to 3 representing increasing importance of the riparian area as well as sensitivity to fire-related impacts on the suite of ecosystem services.

Forest Assets

Forested areas categorized by height, cover, and susceptibility/response to fire

This layer identifies forested land categorized by height, cover and susceptibility or response to fire. Using these characteristics allows for the prioritization of landscapes reflecting forest assets that would be most adversely affected by fire. The rating of importance or value of the forest assets is relative to each state's interpretation of those characteristics considered most important for their landscapes.

Canopy cover from LANDFIRE was re-classified into two categories, open or sparse and closed. Areas classified as open or sparse have a canopy cover less than 60%. Areas classified as closed have a canopy cover greater than 60%.

Canopy height from LANDFIRE was re-classified into two categories, 0-10 meters and greater than 10 meters.

Response to fire was developed from the LANDFIRE existing vegetation type (EVT) dataset. There are over 1,000 existing vegetation types in the project area. Using a crosswalk defined by project ecologists, a classification of susceptibility and response to fire was defined and documented by fire ecologists into the three fire response classes.

These three classes are sensitive, resilient and adaptive.

- **Sensitive** = These are tree species that are intolerant or sensitive to damage from fire with low intensity.
- **Resilient** = These are tree species that have characteristics that help the tree resist damage from fire and whose adult stages can survive low intensity fires.
- **Adaptive** = These are tree species adapted with the ability to regenerate following fire by sprouting or serotinous cones

Federal Wildfire Ignitions

Point locations for all federally reported wildfires from 1999 to 2008

Fire history statistics provide insight as to the number of fires, acres burned and cause of fires in Colorado. These statistics are useful for prevention and mitigation planning. They can be used to quantify the level of fire business, determine the time of year most fires typically occur and develop a fire prevention campaign aimed at reducing a specific fire cause.

Ten years of historic fire report data was used to create the fire occurrence summary charts. Wildfire Ignition data was compiled from federal and local sources for the years 1999 through 2008. Federal wildfire ignitions were spatially referenced by latitude and longitude coordinates. All ignitions references were updated to remove duplicate records and correct inaccurate locations.

Federal wildfire ignitions are symbolized in CO-WRAP by the cause of fire. Fire reports were gathered from the following federal data sources:

- US Forest Service
- US Fish and Wildlife Service
- Bureau of Land Management
- Bureau of Indian Affairs
- National Park Service

Non-Federal Wildfire Ignitions

Total non-federal fires reported by zipcode from 1999 to 2008

Fire history statistics provide insight as to the number of fires, acres burned and cause of fires in Colorado. These statistics are useful for prevention and mitigation planning. They can be used to quantify the level of fire business, determine the time of year most fires typically occur and develop a fire prevention campaign aimed at reducing a specific fire cause.

Ten years of historic fire report data was used to create the fire occurrence map layer and the summary history charts provided in the Professional Viewer risk summary report. Wildfire ignition data was compiled from federal and local sources for the years 1999 through 2008. State and local data was spatially referenced by zipcode. All ignitions data sources were updated to remove duplicate records and correct inaccurate locations. Since non-federal ignition data is referenced by zip code, the map layer in CO-WRAP show the total number of fires occurring over the 10 year period for each zip code.

State wildfire ignitions were gathered from fire department reports submitted by:

- Volunteer Fire Departments
- Combination Fire Departments (paid and volunteer)
- Paid Fire Departments
- Fire Protection Districts
- Counties

Fire Occurrence

Likelihood of a wildfire starting based on historical ignition patterns.

Fire Occurrence is an ignition density that represents the likelihood of a wildfire starting based on historical ignition patterns. Occurrence is derived by modeling historic wildfire ignition locations to create an average ignition rate map. The ignition rate is measured in the number of fires per year per 1000 acres.

Historic fire report data was used to create the ignition points for all Colorado fires. Data was obtained from the West Wide Risk Assessment project. The compiled fire occurrence database was cleaned to remove duplicate records and to correct inaccurate locations. The database was then modeled to create a density map reflecting historical fire ignition rates.

The measure of fire occurrence used in the Colorado WRA is called Fire Occurrence. Since all areas in Colorado have ignition density calculated consistently, it allows for comparison and ordination of areas across the entire state. For example, a high occurrence area in East Colorado is equivalent to a high occurrence area in West Colorado.

Fire Occurrence is a key input into the calculation of the Wildfire Threat output. In particular, with most Colorado fires being human caused, there is a repeatable spatial pattern of fire ignitions over time. This pattern identifies areas where wildfires are most likely to ignite and prevention efforts can be planned accordingly.

To aid in the use of wildfire ignition density for planning activities, the output values are categorized into seven (7) classes reflecting average annual ignition rates. These are given general descriptions from Low to Very High. Seven classes are used to present finer detail for mapping purposes so that transitional areas can be easily identified.

The class breaks are determined by analyzing the Fire Occurrence output values for the entire state and determining cumulative percent of acres (i.e. Class 7 has the top 3.5% of acres with the highest occurrence rate). Refer to the Colorado WRA Final Report for a more detailed description of the mapping classes and the methods used to derive these.

The Fire Occurrence map is derived at a 30-meter resolution. This scale of data was chosen to be consistent with the accuracy of the primary surface fuels dataset used in the assessment. While not sufficient for site specific analysis, it is appropriate for regional, county or local protection mitigation or prevention planning.

Appendix B: Revised CO Response Function Value Assignments

This appendix presents the final RF value assignments used to derive Wildfire Effects outputs for the Colorado WRA.

Colorado

Flame Length (classes in feet)					Class	Flame Length Class (1 to 6) 1	2	3	4	5	6	RI
					Feet	0-2	2-4	4-6	6-8	8-12	12+	
Wildland Urban Interface (houses per acre)					1 - LT 1hs/40 ac	-0.40	-0.60	-1.00	-1.40	-1.80	-1.80	25
					2 - 1 hs/40-20 ac	-0.80	-1.20	-2.00	-2.80	-3.60	-3.60	40
					3 - 1 hs/20-10 ac	-1.20	-1.80	-3.00	-4.20	-5.40	-5.40	60
					4 - 1 hs/10-5 ac	-1.50	-2.25	-3.75	-5.25	-7.10	-7.10	90
					5 - 1 hs/5-2 ac	-1.90	-2.85	-4.75	-6.65	-7.90	-8.55	95
					6 - 1-3 hs/ac	-2.00	-3.00	-5.00	-7.10	-9.00	-9.00	100
					7 - GT 3hs/ac	-2.00	-5.00	-7.00	-8.00	-9.00	-9.00	100
Drinking Water (level of importance)					1 - Lowest	-0.10	-0.20	-0.50	-0.60	-0.80	-0.90	10
					2	-0.10	-0.20	-0.50	-0.60	-0.80	-0.90	10
					3	-0.20	-0.40	-1.00	-1.20	-1.60	-1.80	20
					4	-0.30	-0.60	-1.50	-1.80	-2.40	-2.70	30
					5	-0.40	-0.80	-2.00	-2.40	-3.20	-3.60	40
					6	-0.50	-1.00	-2.50	-3.00	-4.00	-4.50	50
					7	-0.60	-1.20	-3.00	-3.60	-4.80	-5.40	60
					8	-0.70	-1.40	-3.50	-4.20	-5.60	-6.30	70
					9	-0.80	-1.60	-4.00	-4.80	-6.40	-7.20	80
					10 - Highest	-1.00	-2.00	-5.00	-6.00	-8.00	-9.00	100
Forest Assets	Sensitive	Closed	0-10 m	77	1	-2.00	-3.00	-4.00	-5.00	-9.00	-9.00	100
	Sensitive	Closed	10+m	77	2	-1.60	-2.40	-3.20	-4.00	-7.20	-7.20	80
	Sensitive	Open/Sp	0-10 m	34	3	-0.88	-1.32	-1.77	-2.21	-3.97	-3.97	X
	Sensitive	Open/Sp	10+m	34	4	-0.71	-1.06	-1.41	-1.77	-3.18	-3.18	X
	Resilient	Closed	0-10 m	78	5	0.00	0.00	-2.00	-3.00	-5.00	-5.00	100
	Resilient	Closed	10+m	78	6	0.00	0.00	-0.60	-0.90	-1.50	-1.50	30
	Resilient	Open/Sp	0-10 m	35	7	0.00	0.00	-0.90	-1.35	-2.24	-2.24	X
	Resilient	Open/Sp	10+m	35	8	0.00	0.00	-0.27	-0.40	-0.67	-0.67	X
	Adaptive	Closed	0-10 m	78	9	0.00	-1.00	-3.00	-4.00	-7.00	-7.00	100
	Adaptive	Closed	10+m	78	10	0.00	-0.50	-1.50	-2.00	-3.50	-3.50	50
	Adaptive	Open/Sp	0-10 m	36	11	0.00	-0.46	-1.38	-1.85	-3.23	-3.23	X
	Adaptive	Open/Sp	10+m	36	12	0.00	-0.23	-0.69	-0.92	-1.62	-1.62	X
Riparian Assets (importance & sensitivity to fire)					1 - Lowest Impt	0.00	0.00	-0.50	-1.00	-1.75	-1.75	25
					2 -Moderate Imp	0.00	0.00	-1.00	-2.00	-3.50	-3.50	50
					3 - Highest Imp	0.00	0.00	-2.00	-4.00	-7.00	-7.00	100

	Value Impacted/ Values At Risk	WWA CO	WWA CO %	WWA Avg	CO WRA Wts	
Value Impacted/Values At Risk Relative Importance	Infrastructure	90	26.5%	46.2%	NA	NA
	Wildland Development Areas	75	22.1%	44.7%	100	**36.4%**
	Drinking Water	100	29.4%	1.0%	100	**36.4%**
	Forest Assets	50	14.7%	3.6%	50	**18.2%**
	Riparian Assets	25	7.4%	4.5%	25	**9.1%**
		340	100.0%		275	100.0%

	Fuel Type	Code	slope steepness				
			0-25	26-40	41-55	56-74	75+
			1	2	3	4	5
Suppression Difficulty	Grass	1	-1.0	-3.7	-6.9	-8.7	-9.0
	ush/Sla	2	-3.0	-5.2	-7.9	-8.9	-9.0
	TL	3	-4.2	-5.9	-8.0	-8.9	-9.0

	Category	WWA CO	WWA Avg	CO WRA Wts
Fire Effects Weights	Values Impacted Rating	60.0	90.0	**80.0**
	Suppression Difficulty Rating	40.0	10.0	**20.0**
	Total	100.0	100.0	100.0

WWA Values Impacted Weights	
Infrastructure	**46.2%**
Wildland Development Areas	**44.7%**
Drinking Water	**1.0%**
Forest Assets	**3.6%**
Riparian Assets	**4.5%**

CO-WRA Values At Risk Weights	
Wildland Urban Interface	36.4%
Drinking Water	36.4%
Forest Assets	18.2%
Riparian Assets	9.1%

FRONT RANGE ROUNDTABLE

2011 ANNUAL REPORT

April 20, 2012

In 2011, the Front Range Roundtable continued its mission to "serve as a focal point for diverse stakeholder input into efforts to reduce wildland fire risks and improve forest health through sustained fuels treatment along the Colorado Front Range."

The Roundtable is a coalition of about 200 individuals from state and federal agencies, local governments, environmental and conservation organizations, the academic and scientific communities, and industry and user groups, all with a commitment to forest health and fire risk mitigation along Colorado's Front Range. The Roundtable's focus area encompasses 10 Front Range counties: Boulder, Clear Creek, Douglas, El Paso, Gilpin, Grand, Jefferson, Larimer, Park and Teller.

In 2011, the Roundtable made progress on its mission in a number of ways:

1. After extensive literature review, research, and discussions led by the Colorado Forest Restoration Institute, the Roundtable's Collaborative Forest Landscape Restoration Program (CFLRP) Monitoring Team published the first CFLRP Monitoring Guide for the Front Range in June 2011.[1]
2. The CFLRP Monitoring Team attended field trips to discuss CFLRP treatments on the Arapaho-Roosevelt and Pike-San Isabel National Forests.
3. The Outreach and Policy Team organized a Colorado CFLRP delegation to Washington, D.C., to advocate for CFLRP in partnership with Uncompahgre Partnership.[2] (CFLRP received full funding from Congress for the 2012 fiscal year.)
4. The Implementation and Mapping Team selected the Western Boulder County Healthy Forest Initiative as a partner in demonstrating forest restoration and wildfire mitigation through a competitive review of candidate partner communities in priority landscapes. The team worked with the HFI to define its organization and partnership with the Roundtable.
5. The Roundtable Biomass Utilization and Slash Sites (BUSS) Team held its second annual talking point workshop during which it renewed agreement on many points and added new points of agreement on trucking weight limits on federal highways and explaining Colorado's biomass climate.[3]
6. Roundtable representatives participated in forest stakeholder meeting at state Capitol in January to discuss policy proposals.
7. The Roundtable hosted approximately 20 elected officials and their staff on field trips of Fourmile Canyon Fire area in August.[4]
8. In November, the Roundtable reconvened its Science and Monitoring team after a year-long hiatus to allow members to serve on CFLRP Monitoring Team. (The SM Team will continue to serve as the CFLRP collaborative monitoring group, and has made that effort its top goal.)

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[1] http://frontrangeroundtable.org/uploads/Roundtable_CFLRP_Monitoring_Plan_062511.pdf
[2] http://frontrangeroundtable.org/uploads/Roundtable_UP_DC_trip_briefing_091311_v6.pdf
[3] http://frontrangeroundtable.org/uploads/New_2011_BUSS_Talking_Points-Draft.pdf
[4] http://frontrangeroundtable.org/uploads/Roundtable_Fourmile_Tour_082411.pdf

9. The Roundtable Executive Team and Outreach and Policy Team launched a WUI policy effort to explore ways to move forward on the 2006 Roundtable recommendation to "change local policy to limit the growth of fire risk in the Wildland-Urban Interface."

To implement the accomplishments above, the Roundtable convened four quarterly meetings in 2011 in March, May, August and October. During the year, 99 different people participated in at least one quarterly meeting.

In addition to the quarterly Roundtable meetings, the executive team and the four working teams held another 77 meetings and conference calls involving 89 team members focused on the team goals noted below. Since 2006, the Roundtable has worked or communicated with (via its email distribution list) 386 people from more than 91 organizations.

The Roundtable thanks alls its members, guests, funders, and teams for helping the Roundtable achieve most of its 2011 goals.

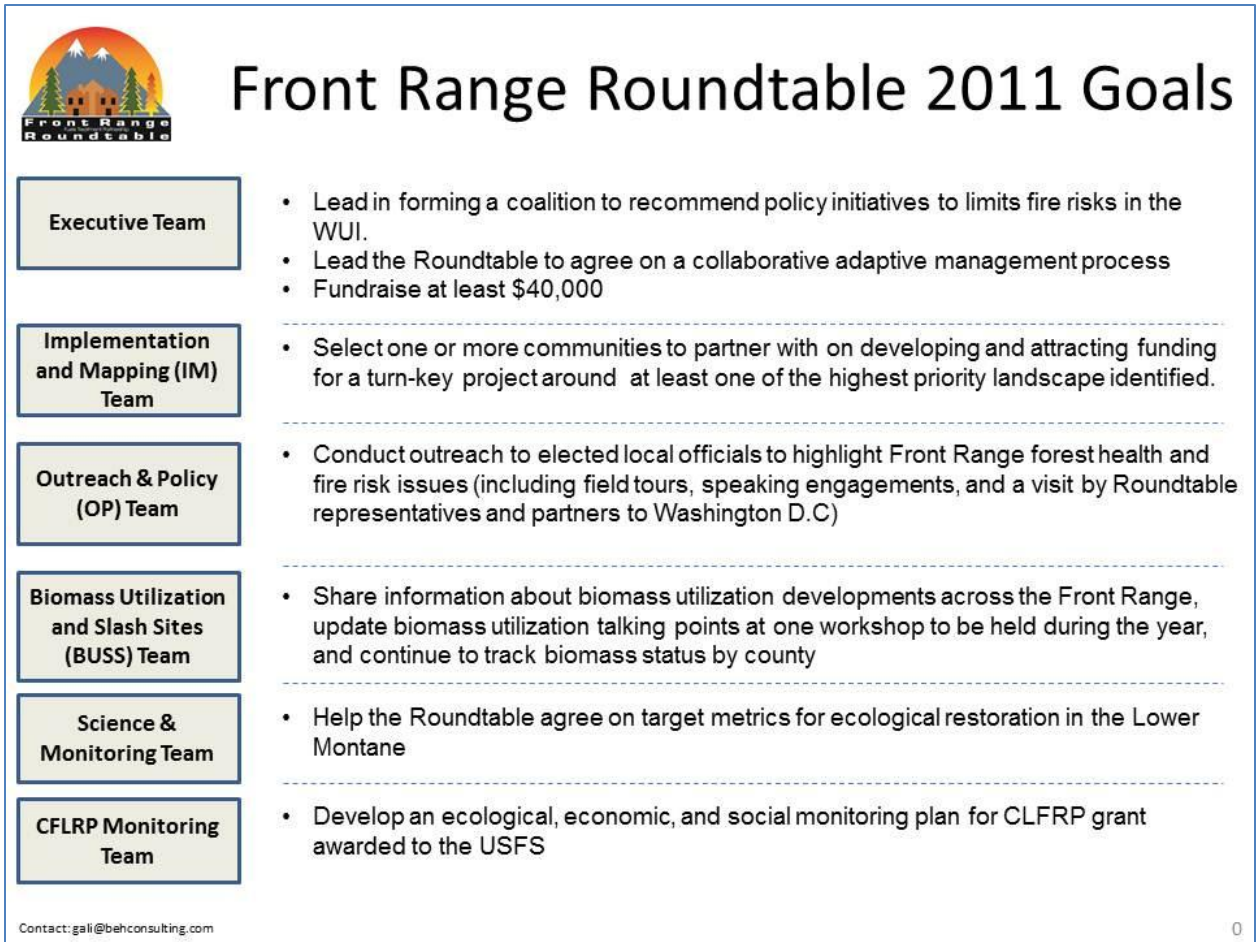


Figure 1. 2011 Front Range Roundtable Team Goals

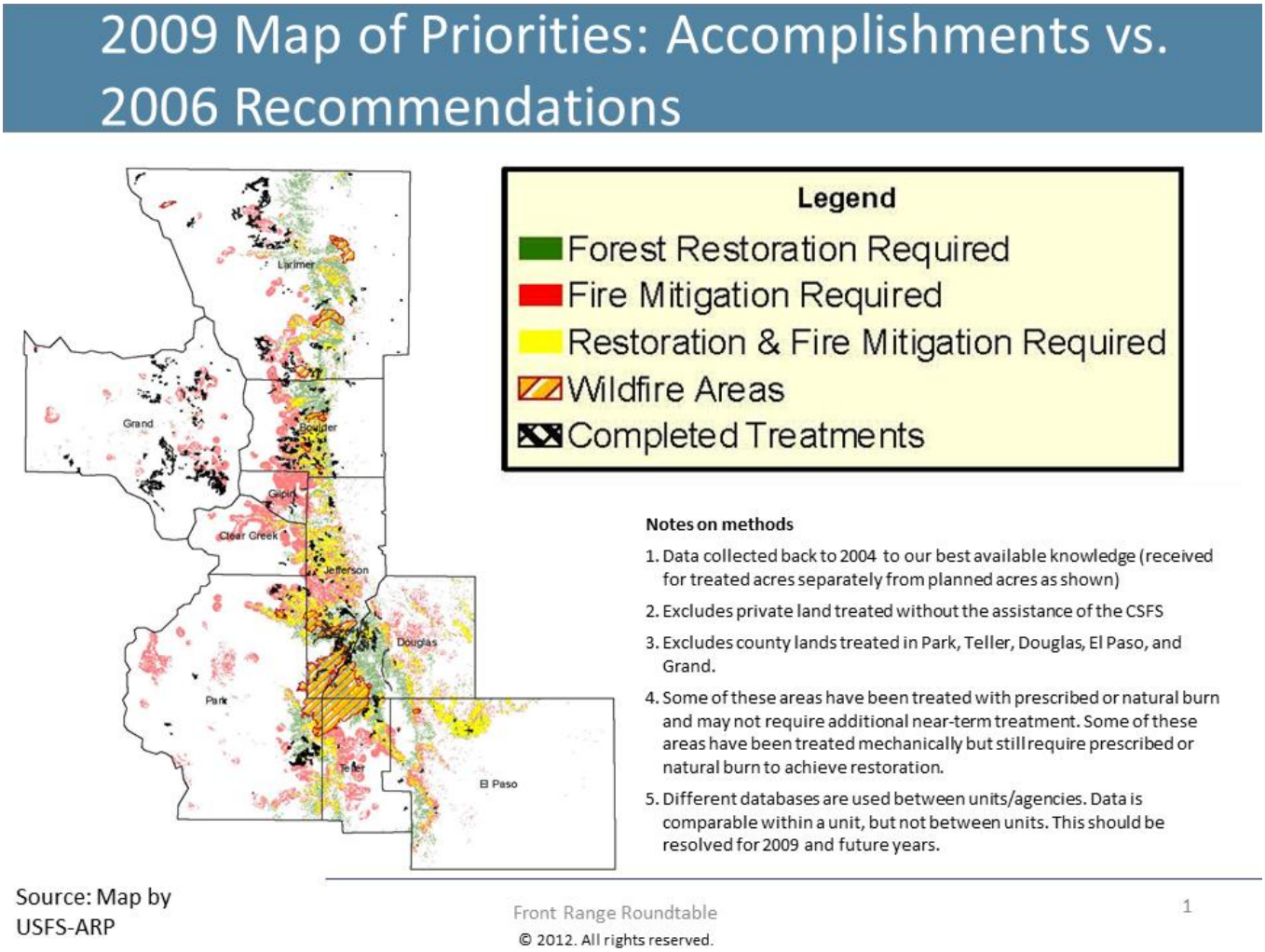


Figure 2. The Front Range Roundtable has identified 1.5 million acres of lower montane forest in need of restoration and/or fuels reduction.

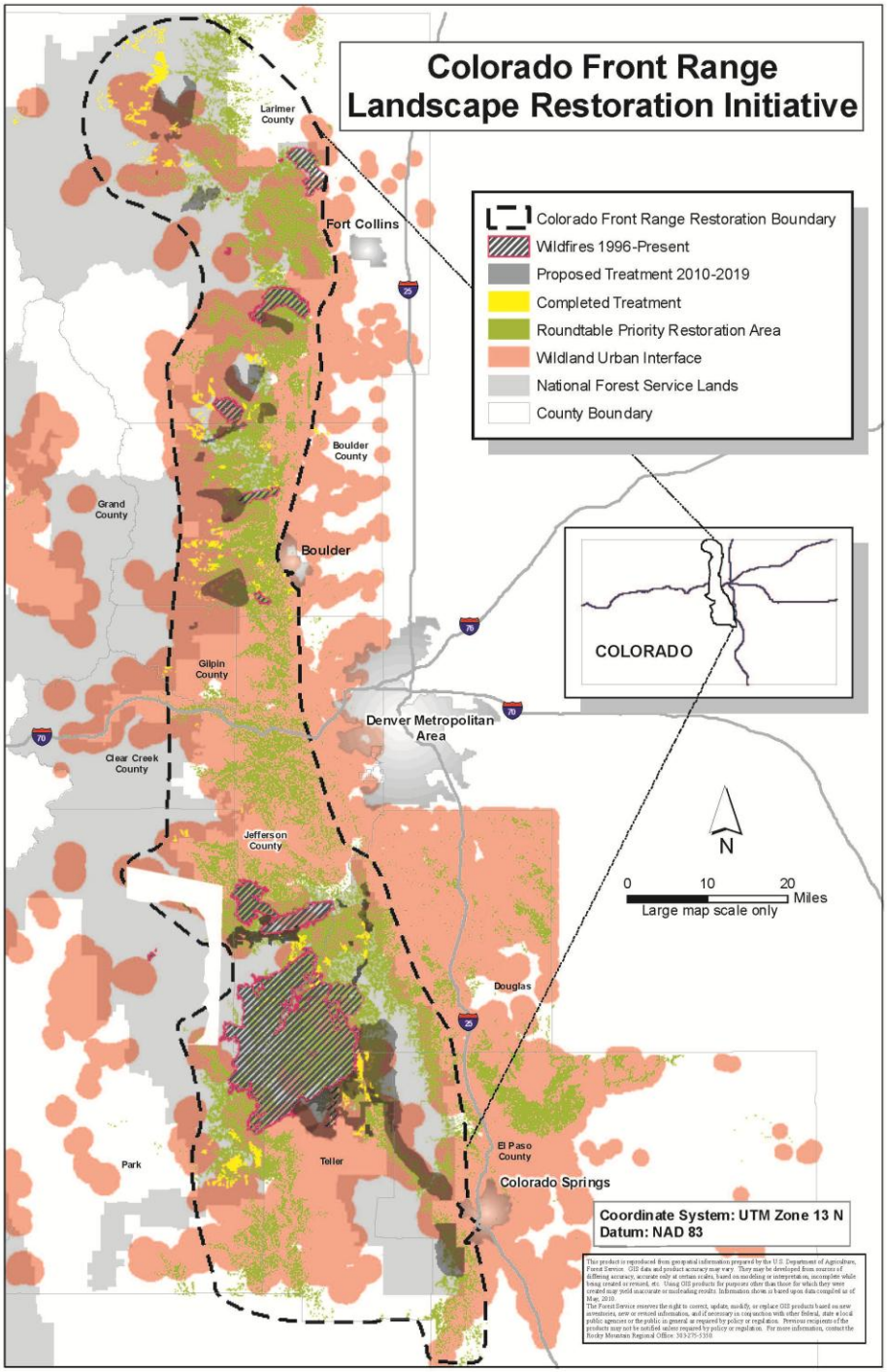


Figure 3. The Collaborative Forest Landscape Restoration Program map

SECTIONS:

- **Wildfire in Colorado**
- **Wildland Fire**
- **Wildfire Facts**
- **Wildfire History in Colorado**
- **Wildfire Season Summaries by Year 2009 – 2000**
- **Wildfire Risk and Hazard**
- **Assessments**
- **MITIGATING THREAT, SUSCEPTABILITY, AND IMPACTS OF WILDLAND FIRE**
- **Legislation**
- **Mitigation Action Examples**
- **Post Fire Mitigation**

Wildfire in Colorado

Warm winters, hot, dry summers, severe drought, insect and disease infestations, years of fire suppression, and growth in the wildland-urban interface continue to increase wildfire risk and the potential for catastrophic wildland fires in Colorado.

Over the past two decades, Colorado has experienced an increase in insect infestations that have left vast areas of forest vulnerable to wildfire. These infestations, coupled with the increasing number of people who live in the wildland-urban interface, where humans and human-made structures abut vegetation, make Colorado increasingly susceptible to large-scale fires that threaten human lives, communities, power lines, roads, domestic water supplies, wildlife habitat, and other important resources.

From 1990-2009, 43,283 wildfires were reported in Colorado, burning 1,069,994 acres. In 2002, the Hayman Fire alone burned 137,760 acres and destroyed 600 structures. Tragically, that fire also resulted in five deaths and 16 injuries. In 2007, the Ordway Fire burned 8,900 acres, and destroyed 14 homes and 10 structures. The Ordway Fire also claimed three lives.

Although wildfires in recent years have not been as dramatic, the challenge of addressing fire-related impacts remains. Large fire incidents, such as the Hayman Fire, can leave critical watersheds in need of emergency and long-term rehabilitation. Since 2002, Denver Water has spent millions to restore Strontia Springs Reservoir, which was severely impacted by runoff caused by the Hayman Fire.

Since the 2002 wildfire season, the worst in Colorado's recorded history, state and federal land-management agencies have increased their efforts to work with communities and private landowners to help inform them about the risks associated with living in the wildland-urban interface and to identify opportunities to implement cross-boundary wildfire mitigation projects. In addition, numerous place-based forestry collaboratives are working at the local level to help inform and educate communities about the importance of mitigating wildfire risk and restoring forests so that they are more resilient to insect and disease epidemics and wildland fire.

To support these efforts, the Colorado General Assembly and Colorado Congressional Delegation have passed legislation in recent years to address wildfire prevention, mitigation, and suppression challenges.

One of the most significant challenges Colorado faces is the cost to implement fire mitigation projects on a landscape scale. For example, a 2006 report by the Front Range Roundtable indicates that it would cost approximately $6 million, excluding overhead and planning costs, to treat roughly 800,000 acres in lower montane ponderosa pine forests on the Front Range where human lives, communities, natural resources, and other values are most at risk from wildfire.

Another significant challenge is the cost to suppress wildland fires. Consider, for example, that the total estimated cost (direct and indirect) to fight the Hayman Fire was approximately $237.8 million.

Protecting the wildland-urban interface is the nation's fastest-growing firefighting expense. In 2007, suppressing wildfires in the WUI accounted for 85 percent of firefighting costs in the United States. Protecting life and property in these areas is costly because fire managers must take an aggressive stand on the ground and from the air.

Wildland Fire is defined as an unplanned, unwanted wildland fire including unauthorized human-caused fires, escaped wildland fire use events, escaped prescribed fire projects, and all other wildland fires where the objective is to put the fire out.

Wildfire Facts

Three main factors influence wildfire behavior – topography, fuel, and weather.

Wildfires are divided into four categories:

- Wildland fire – fuel consists mainly of natural vegetation
- Interface or intermix fire – urban/wildland fires that consist of vegetation and manmade fuel
- Catastrophic Fire – a very intense event that makes suppression very difficult and negatively impacts human values.
- Prescribed fire – Any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist, and NEPA requirements (where applicable) must be met, prior to ignition.

Other hazards can contribute to the potential for wildfires or can influence wildfire behavior. High winds can down power lines; earthquakes can crack gas lines; lightning can spark fires. Drought conditions increase wildfire potential by decreasing fuel moisture.

Forest insect epidemics and forest parasites contribute to wildfire potential by increasing fuel loading.

Wildfires have post fire impacts that may contribute to the susceptibility of mudslides, landslides, and floods in areas where fire has burned off vegetation In recent years, roads, residential structures and outbuildings have suffered prolonged damaging impacts from flood, mudslides, and siltation of municipal water sources in areas scarred by wildfires.

Lightning is a major cause of structural fires and wildfires. In 1997, a lightning-caused warehouse fire in Denver resulted in a $70 million loss.

The 2002 Colorado wildfire season was the most expensive in the state's recorded history. The overall estimated cost of insured losses related to the Iron Mountain, Coal Seam, Missionary Ridge and Hayman Fires is $70.3 million ($78.8 million in 2006 dollars). Insurance companies

paid an estimated $56.4 million for 1,236 claims related to the Hayman and Missionary Ridge fires alone.

Catastrophic fires account for 2.3 percent of insurance losses.

WILDFIRE HISTORY IN COLORADO

Wildfires play a significant role in the development of Colorado's diverse ecosystems. Through time, wildfires have been both beneficial and destructive. That relationship is measured, in part, by the number and frequency of wildfires, how they were ignited, the cost of suppression, the dollar value of what was burned, the negative impact on the environment and the related costs to infrastructure, air and water quality, and human values/benefits.

NOTABLE FIRE EVENTS IN COLORADO		
YEAR	LOCATION/NAME	COSTS/LOSSES
1937	Roosevelt NF	1 death
1976	Battlement Mesa, Grand Junction	3 deaths, 880 acres
1985	Columbia	1 death
1986	Montrose	4 deaths
1988	Lefthand Canyon, BoulderCo.	2,500 acres
1989	Black Tiger, Boulder Co.	$10,000,000, 44 structures, 1,778 acres
1989	Panorama, Garfield & Eagle Counties	Unknown
1990	Olde Stage, Boulder Co.	10 structures, 3,000 acres
1991	Routt NF	1 death
1992	Glenwood Springs	1 death
1994	Hourglass (Pingree Park)	13 structures, $2,200,000
1994	Wake, Delta Co.	$2,675,000, 3 structures, 4,000 acres
1994	South Canyon, Garfield Co.	14 deaths, 2,115 acres
1994	Roxborough, Jefferson Co.	100 acres
1996	Buffalo Creek, Jefferson Co.	$3,835,000, 10 structures, 12,000 acres
1999	Battlement Mesa	9 structures
2000	Eldorado, Boulder Co.	$2,000,000
2000	Bobcat, Larimer Co.	18 structures, 10,600 acres
2000	Hi Meadow, Jefferson Co.	51 structures, 10,800 acres
2000	Pony Fire	4 structures, 5,240 acres
2000	Eldorado Fire-Walker Ranch	1,061 acres
2000	Bircher (Mesa Verde)	19,709 acres
2001	Larkspur	1 death
2001	Armageddon-Carter Lake	1,216 acres
2002	Snaking Fire	2,590 acres, 2 structures
2002	Cuerno Verde Fire	388 acres, 2 structures, 2 deaths
2002	Black Mountain Fire	200 acres, 1 injury

2002	Schoonover Fire	3,862 acres, 12 structures, 1 bridge, 2 injuries
2002	Iron Mountain Fire	4,440 acres, 200+ structures, 3 injuries
2002	Spring & James John/Fisher (Trinidad Complex)	17,295 acres, 6 injuries
2002	Ute Pass Fire	
2002	Coal Seam Fire	12,209 acres, 99 structures & 14 outbuildings
2002	Hayman Fire	137,760 acres, 5 deaths, 16 injuries, 600 structures
2002	Dierich Creek/Long Canyon (Miracle Complex)	3,951 acres, 1 injury
2002	Missionary Ridge Fire	70,485 acres, 56 structures, 52 injuries, 1 death
2002	Million Fire	9,346 acres, 11 structures
2002	Mt. Zirkel Complex	31,016 acres
2002	Wiley Ridge Fire	1,084.5 acres
2002	Valley Fire	400 acres, a few homes
2002	Burn Canyon Fire	31,300 acres, 9 injuries
2002	Big Elk Fire	4,413 acres, 1 airtanker, 3 deaths
2002	Big Fish	17,056 acres, 1 logde, 7 cabins
2002	Long Mesa	2,601 acres, 3 homes
2002	Panorama Fire	1,700 acres, 4 homes
2003	Brush Mountain	5,292 acres
2003	Overland	3,439 acres, 12 homes
2003	Cherokee Fire	1,200 acres, 2 homes
2004	Picnic Rock	8,908 acres, 1 home
2005	Mason	11,357 acres
2006	Mauricio Canyon	3,825 acres
2006	Yuma County	23,000 acres
2006	Thomas	3,347 acres
2006	Mato Vega	13,820 acres
2007	Newcastle	1420 acres
2007	Bear	1526 acres, 1 home, 2 structures
2007	Wolf Park	150 acres
2007	Holms Mesa	180 acres
2008	Ordway	8900 acres, 14 homes, 10 structures, 3 Fatalities
2008	Incline	30 acres
2008	Bridger	45,800 acres
2008	Nash Ranch	1115 acres, 2 structures
2008	Ferguson	190 acres
2008	Housetop	143 acres
2009	Olde Stage	1300 acres, 3 homes, 2 structures
2009	Newlin Creek	142 acres
2009	Grammar	801 acres
2009	Spring Creek	1,340 acres
2010	Parkdale	628 acres, 1 home, 1 structure
2010	Fourmile Canyon	628 0 acres, 169 homes, 5+ structure
2010	Parkdale	710 acres, 2 homes, 3 structure3

Sources: Teie & Weatherford 2000, Wildfire Hazard Mitigation Plan 2007, CSFS 2009 Fire Report

The table below shows statistics provided by the Colorado State Forest Service. In the period from 1990 through 2009, more than 43,000 fires were reported on state and private lands resulting in over one million acres burned.

FIRES IN COLORADO ON STATE AND PRIVATE LANDS BY YEAR FROM 1990 TO 2009		
YEAR	NUMBER	ACRES
2009	2,973	41,430
2008	2,142	75,571
2007	2,084	151,184
2006	3,294	201,809
2005	2,014	14,446
2004	1,826	15,239
2003	2,471	23,308
2002	3,409	244,252
2001	2,966	45,816
2000	2,043	76,288
1999	1,987	33,256
1998	1,349	10,282
1997	1,605	16,703
1996	2,499	49,498
1995	2,224	32,011
1994	3,158	52,125
1993	1,267	3,526
1992	1,048	4,158
1991	1,449	6,576
1990	1,475	9,825
Totals	43,283	1,107,303
Colorado State Forest Service 2009		

The 2009 Wildfire Season Summary

Colorado experienced dry conditions in the first quarter of 2009. Fire activity reflected this with large fires occurring in Boulder County, commencing on January 7. Periodic precipitation in the form of rain and snowfall from March through June tempered fire activity during the spring months. Fire activity picked up on the western slope and southern front range in July with large fires in Montrose County, Fremont County and Rio Blanco County.

The 2008 Wildfire Season Summary

During the first part of 2008, Colorado experienced dry conditions in the southeast quarter of the state, resulting in large fires in Crowley, Fremont, El Paso, and Park counties during April, May, and June. Fire activity increased on the Western Slope in July.

The early season fires brought tragedy to the Colorado firefighting community with the deaths of 2 volunteer firefighters on the Ordway Fire in Crowley County and the death of a Single Engine Air Tanker pilot on the TA-25 Fire in El Paso County.

The 2007 Wildfire Season Summary

Contrary to conditions in most other Western States including California, Utah, Nevada, Wyoming and Montana, Colorado's 2007 fire season was relatively mild – exhibiting significantly less activity than the 10 year average in both numbers of firs and total acres burned. State responsibility fires included 5 separate incidents, one of which qualified for a FEMA Fire Management Assistance Grant. Most Colorado fire activity occurred prior to mid-July, after which time, Colorado experienced favorably moist weather (monsoonal) conditions that significantly reduced the ignition and spread of wildfires within the state.

The resulting benefit for preparedness actions included reductions in need, as resources were placed into the lower-cost "on-call" status rather than the more costly "ready stand-by" . Also, fewer resources were retained (by using flexible contracting) and some, including Single Engine Air Tankers (SEAT's) were released from obligation to Colorado (and subsequently re-directed to aid other states). Additional secondary support and National Guard Air aircraft were not needed at all this season, nor were Call When Needed (CWN) air resources. In more active wildfire seasons these resources will be activated and pre-positioned.

The 2006 Wildfire Season Summary

Three Fire Management Assistance declarations were received during the 2006 Colorado wildfire season: Red Apple, Mato Vega, and Mauricio Canyon. Red Apple, south of Rifle, started on August 31 and was declared September 1. It burned approximately 800 acres. It was human-caused. Local landowners, Natural Resources Conservation Service, Bookcliffs Conservation District and Williams Production had grass seed sown in the burn area from an airplane in the fall. In the Spring of 2007, juniper and pinon trees were planted. The Mato Vega Fire, in the Sangre de Cristo Mountains in southern Colorado burned in June 2006. The fire burned 13,820 acres in grass, timber, and logging debris. The Mauricio Canyon fire, human caused, burned 3,825 acres near Aguilar in Las Animas and Huerfano Counties.

The 2005 Wildfire Season Summary

One Fire Management Assistance declaration was received during 2005 for the Mason Fire, that burned south of Wetmore, in Custer and Pueblo Counties.

The 2004 Wildfire Season Summary

Two Fire Management Assistance declarations were made during 2004: McGruder Fire and Picnic Rock Fire. Picnic Rock was declared April 1, 2004 and McGruder was declared July 3, 2004. McGruder was near Cedaredge in Delta County.

The 2003 Wildfire Season Summary

According to the "National Report of Wildland Fires and Acres Burned by State," in 2003 Colorado had a total of 2,180 fires reported and 53,412 acres burned. One hundred twenty-two fires were prescription burns for a total of 22,238 acres. Five Fire Management Assistance declarations were received during 2003: Buckhorn Creek, Cherokee Ranch, Overland, Lincoln Fire Complex, and Cloudy Pass.

The 2002 Wildfire Season Summary

The 2002 Colorado wildfire season was the worst in the state's recorded history. The season began in April and continued until early fall. At times, multiple large fires were burning simultaneously. Following are highlights of the 2002 wildfire season:

- 4,612 fires burned 619,030 acres (the 10-year average is 3,119 fires and 70,000 acres)

- 22 large fires (17 qualified for FEMA assistance) became state- responsibility fires with an estimated cost to the state of over $24 million
- The USDA released $14 million to the Natural Resources Conservation Service to restore burned watersheds in Colorado at a 75/25 match
- 13Type I and II Incident Management Teams were utilized
- 142 subdivisions were evacuated, displacing 81,435 people
- 384 homes and 624 other structures were destroyed
- 16,500 firefighters fought wildfires in Colorado (tragically, nine firefighters were killed, and one airtanker and one helicopter were lost, killing three people)
- One Presidential disaster declaration and 20 Fire Management Assistance declarations were received: Panorama, Big Elk, Burn Canyon, Again, Grizzly Gulch, Valley, Wiley Ridge, Million, Missionary Ridge, Dierich, Hayman, Coal Seam, Ute Pass, Janes John/Fisher, Spring, Iron Mountain, Schoonover, Black Mountain, Cuerna Verde, and Snaking

2002 Colorado Wildfire Insurance Costs

Hayman Fire: $38.7 million insured losses
Missionary Ridge Fires: $17.7 million in insured losses
Coal Seam Fire: $6.4 million in insured losses
Iron Mountain Fire: $7.5 million in insured losses

Suppression costs for 2002 exceeded $152 million.

While these numbers are dramatic, they are not surprising. A century of aggressive fire suppression, combined with cycles of drought and changing land management practices, has left many of Colorado's forests unnaturally dense and ready to burn. At the same time, the state's record setting growth has driven nearly a million people into the forested foothills of the Front Range and along the West Slope and central mountains – the same landscapes that are at highest risk for large-scale fire. This movement of urban and suburban residents into the wildland-urban interface (WUI) significantly increases the values-at-risk from wildland fire – the most critical of these being human life.

The 2001 Wildfire Season Summary

In October, 2001, a fire management assistance grant was awarded to the State of Colorado to support fire-fighting activities associated with containing the Armageddon Fire. The fire began on October 31, 2001. The fire was in the foothills along the Front Range.

Although the 2001 fire season in Colorado was not as severe as the 2000 fire season, at 4,022, the number of fires was higher than the total of 3,698 fires that occurred in 2000, but the acreage burned (72,210) was significantly less than the 249,976 acres burned in 2000. The Armageddon Fire was the only fire that met the criteria for a Fire Management Assistance Grant.

The human-caused Armageddon Fire was located in Larimer County and threatened approximately 100 homes in the Carter Lake area. The fire originated on private land and expanded quickly, fanned by high winds. Initial response to the fire focused on evacuation and structure protection. The complexity of the fire led to the order for an Interagency Type 2 Incident Management Team. The fire was returned to local management on November 3, 2001. The final size of the fire was calculated at 1,216 acres, all in private ownership. Like most large fires, the fire was weather driven. . The biggest concerns were high winds, light flashy fuels, narrow roads with congested urban traffic, and a private dump that contained unknown material. No dwellings were destroyed, no lives were lost, and no serious injuries were reported.

The 2000 Wildfire Season Summary

In June 2000, two fire management assistance grants were awarded to the State of Colorado to support firefighting activities associated with containing the Bobcat Gulch and Hi Meadow fires.

Both fires began on June 12, 2000. A third fire management assistance grant was awarded to Colorado for the Eldorado/Walker Ranch (Eldorado) Fire that began on September 15, 2000. All fires occurred in the foothills along the Front Range. . The Bobcat Gulch Fire was caused by human error – an escaped campfire. The fire was located in Larimer County approximately one mile north of the Town of Drake; the affected acreage was in Township 6 North and Ranges 70 and 71 West. The Bobcat Gulch Fire burned in the Arapahoe-Roosevelt National Forest. Fuels included brush, ponderosa pine, spruce-fir, and lodgepole pine at higher elevations. The fire impacted the Cedar Park subdivision where a total of 60 homes were evacuated. It also threatened structures in an area from Eden Valley to Buckhorn Creek. The fire consumed 10,599 acres of grass, brush, and timber, and destroyed 18 homes within the wildland interface out of a total of 25 sites that were reported as destroyed or damaged. An estimated 1,500 to 2,000 residences were within easy reach of the fire.

The Hi Meadow Fire, which began in Jefferson and Park counties, also started on June 12, 2000. The human-caused fire was located approximately 35 miles southwest of Denver. The Hi Meadow Fire affected federal, state, and private lands, resulting in the evacuation of approximately 600 residents from Pine and Buffalo Creek, as well as 19 subdivisions in the area. Three thousand structures located in the interface could have been affected by the Hi Meadow Fire. The fire was controlled on June 25, after burning 5,623 acres on federal land and 5,177 acres on state or private land. A total of 10,592 acres were in Jefferson County and 208 acres were in Park County. A total of 51 residences, six outbuildings, and one commercial building were destroyed.

The Eldorado Fire began on September 15, 2000, and was located approximately seven miles southwest of the City of Boulder. The fire was suspected to have been human-caused, and was started in Walker Ranch Park, which is county-administered open space. The fire affected county land, Denver Water Board land, and private land. The fire burned in mixed Douglas-fir and ponderosa pine, with interspersed open grasslands and shrubs. The blaze consumed 1,061 acres, posing a threat to residents in the Pine Notch, Lake Shores, and Juniper Heights subdivisions and forcing the evacuation of more than 200 residents from 125 homes. No residences or other structures were lost. In addition to the homes, utilities, park facilities, and historic structures, Denver Water Board lands with significant watersheds, and riparian and fisheries resources also were at risk.

Like most large fires, the three fires in 2000 were weather driven. A major problem was a high fuel load. The area's steep terrain and high altitude made firefighting difficult, and the state had only a limited number of resources.

WILDFIRE RISK AND HAZARD IN COLORADO

Assessments : IDENTIFYING AND DEFINING THE CHALLENGE

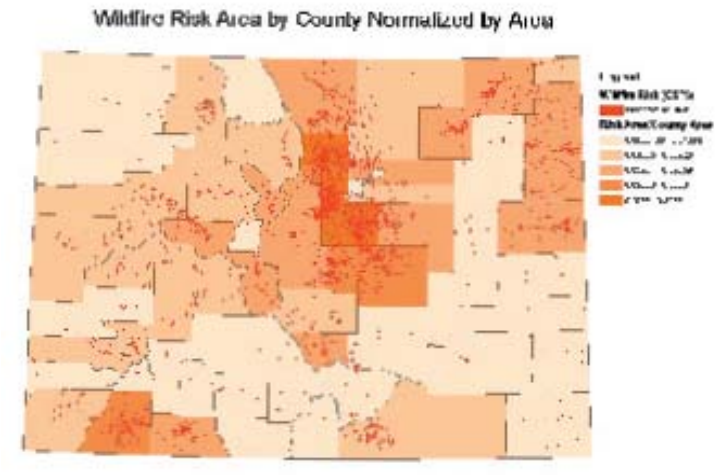
The Colorado State Forest Services has conducted several assessments that address wildfire hazard and risk. The assessments took place in 1999, 2002, and 2008. While slightly different methodologies were used in each assessment, the outcomes show very similar areas are susceptible to wildland fire in the terms of risk and hazard.

The resultant maps produced from data collected during the assessments have been made available to counties and fire departments as a tool in prioritizing fuel treatment areas and fire response planning.

The maps are available to review at: http://csfs.colostate.edu/pages/wf-wildland-map.html

The first assessment was completed by the Colorado State Forest Service and the Colorado Office of Emergency Management in March of 1999 known as the Midlevel Assessment. The table below represents data from that model. The wildfire risk is shown in acres and as the percent of the

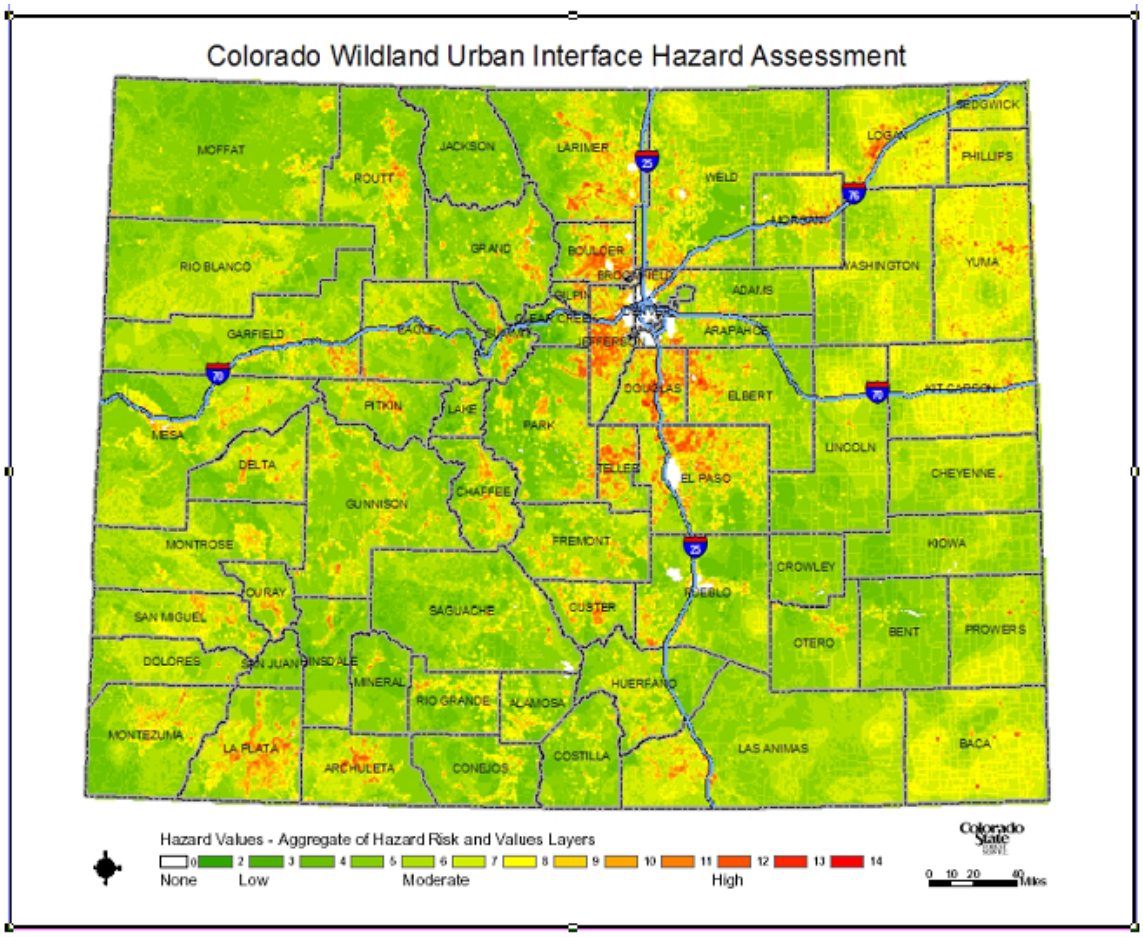
county with a moderate to high hazard. The layer was combined with the moderate to high hazard risk layer to create the map to the right.



Colorado Counties by Percent of Acres at Risk for Wildfire: 1999*							
% Area at Risk	County	Moderate to High Hazard (acres)	Total Acres	% Area at Risk	County	Moderate to High Hazard (acres)	Total Acres
0.06	Adams	497.78	768,098.50		Kit Carson		
2.65	Alamosa	12,233.72	462,496.20	9.33	Lake	22,870.38	245,001.80
1.12	Arapahoe	5,748.71	514,107.30	26.46	La Plata	287,983.31	1,088,385.00
26.36	Archuleta	228,558.66	867,207.00	21.91	Larimer	368,957.77	1,684,129.00
	Baca			7.09	Las Animas	216,392.35	3,053,720.00
	Bent				Lincoln		
19.80	Boulder	95,168.25	480,686.40		Logan		
	Broomfield			25.81	Mesa	552,686.56	2,141,740.00
19.80	Chaffee	128,559.50	649,452.80	5.49	Mineral	30,831.46	561,889.90
	Cheyenne			3.80	Moffat	115,639.59	3,042,580.00
29.21	Clear Creek	73,998.63	253,372.60	17.68	Montezuma	230,435.72	1,303,012.00
2.95	Conejos	24,337.81	826,095.90	24.45	Montrose	351,531.89	1,437,765.00
5.99	Costilla	47,137.33	787,009.30		Morgan		
	Crowley				Otero		
19.93	Custer	94,314.40	473,309.80	23.38	Ouray	81,149.07	347,072.30
21.15	Delta	155,555.62	735,609.50	14.47	Park	204,649.50	1,414,525.00
0.01	Denver	8.64	99,617.14		Phillips		
6.60	Dolores	45,495.34	689,285.80	21.01	Pitkin	130,464.21	621,026.90
35.97	Douglas	193,724.18	538,527.30		Prowers		
29.32	Eagle	319,184.56	1,088,545.00	3.07	Pueblo	47,180.53	1,534,410.00
0.80	Elbert	9,411.22	1,182,788.00	9.04	Rio Blanco	186,769.06	2,065,924.00
18.36	El Paso	250,229.55	1,362,591.00	6.03	Rio Grande	35,238.91	584,600.10
33.78	Fremont	331,266.29	980,558.00	17.55	Routt	265,245.90	1,511,680.00
39.93	Garfield	755,612.73	1,892,209.00	14.31	Saguache	290,135.10	2,027,853.00
20.50	Gilpin	19,728.13	96,212.98	0.34	San Juan	841.74	248,753.50
11.47	Grand	137,260.33	1,196,335.00	20.99	San Miguel	173,351.36	826,057.50
22.32	Gunnison	465,280.69	2,084,727.00		Sedgwick		
5.59	Hinsdale	40,199.48	719,278.60	13.10	Summit	51,892.21	396,124.60
15.09	Huerfano	153,756.32	1,019,181.00	32.06	Teller	114,669.95	357,724.60
2.29	Jackson	23,784.72	1,036,872.00		Washington		
56.84	Jefferson	282,540.56	497,076.60	0.05	Weld	1,403.47	2,570,639.00
	Kiowa				Yuma		

Based on the Mid-level wildfire assessment, March 1999 by the Colorado State Forest Service and Office of Emergency Management

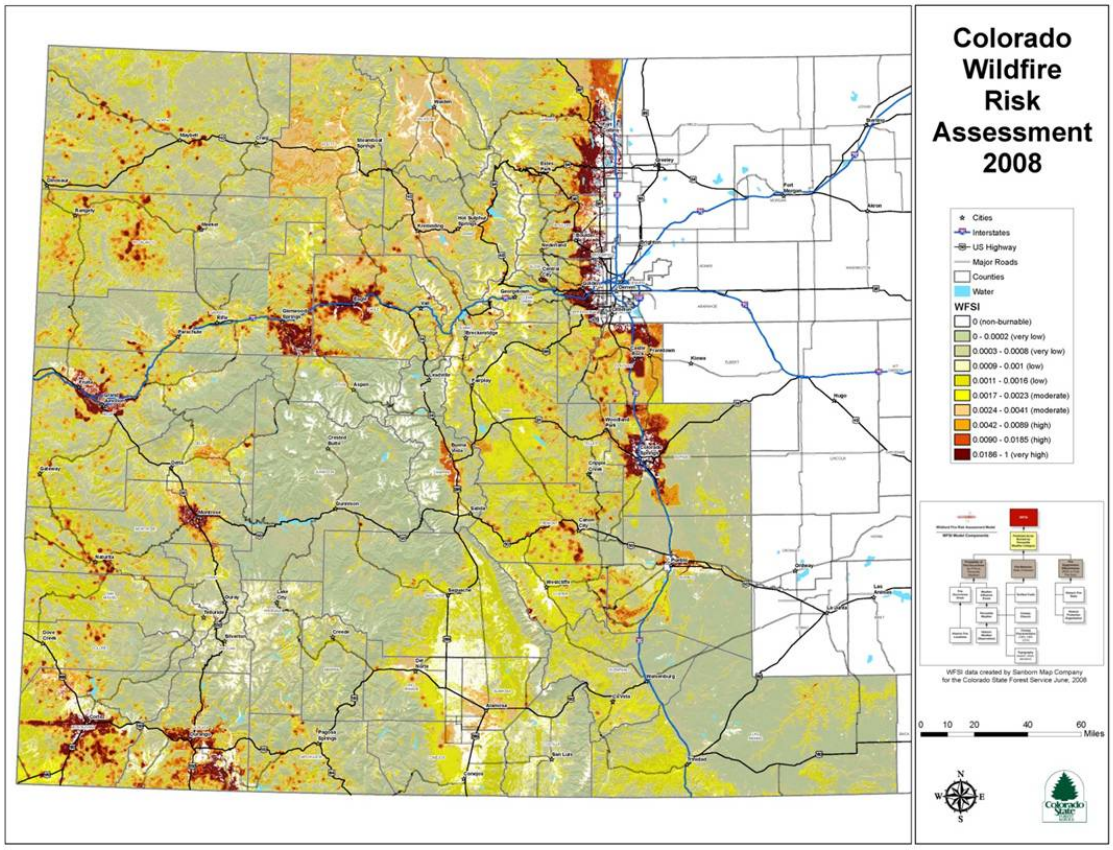
The second risk assessment was completed in 2002 by the Colorado State Forest Service. Full details of the risk assessment, including the methodology and digital layers used, are included in the appendices. The map below was generated as a product of the assessment and indicates the wildland urban interface hazard assessment for the state. In reviewing the map, it becomes obvious that every county has some area with at least a moderate interface wildfire hazard.



Potential Losses – Potential losses to wildfire were estimated by intersecting the high risk zones (values 10-15) from the 2002 hazard assessment with the building and contents values provided in the HAZUS-MH loss estimation software. The analysis was completed at the census block level then summarized by county. If a high risk zone intersected only part of any given census block, the area ratio was used to calculate the building and contents values assuming an equal distribution. While every county in the state has the potential for loss, Jefferson ($8.9 billion), Boulder ($6 billion), Douglas ($5.4 billion), El Paso ($5.4 billion), and Larimer ($4.1 billion) have the greatest potential for dollar losses in high risk zones. The results are summarized in the table to the left.

The Colorado Wildland Urban Interface Hazard Assessment built on the work of earlier hazard methodologies and provides new and updated data to further enhance accuracy and scale. A better, more accurate housing density surface was created to assist in ranking the Wildland Urban Interface hazard. This assessment also included all of the counties in Colorado, including the easter plains counties, which were previously omitted. The final outputs are a Risk, Hazard, and Value (RHV) map displaying areas of concern that are at risk of catastrophic wildland fire.

The third assessment was completed in the fall of 2008. This assessment focused on the susceptibility of wildfire risk in the western two thirds of Colorado. The eastern plains was not included in the assessment because national fuel typing had not been completed at the time of the assessment. CSFS with the assistance of the Division of Emergency Management cost share grant plans to complete an eastern plains assessment in early 2011.



The 2008 Wildfire Risk Assessment brought together the elements of fire occurrence, weather influence zones, and national standardized fuel models adjusted and ground truthed for Colorado. CSFS purchased license to the software developed for the assessment and will be able to update the assessment as new data is received. CSFS printed and distributed county susceptibility maps to each county in the assessment area.

BUILDING & CONTENTS VALUES IN HIGH RISK WILDFIRE ZONES			
COUNTY	EXPOSURE ($000s)	COUNTY	EXPOSURE ($000s)
Adams	$1,472,568	La Plata	$1,464,219
Alamosa	$113,532	Lake	$51,543
Arapahoe	$1,794,503	Larimer	$4,136,945
Archuleta	$628,988	Las Animas	$248,457

Baca	$128,792	Lincoln	$125,561
Bent	$2,539	Logan	$506,894
Boulder	$6,032,590	Mesa	$652,620
Chaffee	$346,101	Mineral	$82,619
Cheyenne	$87,084	Moffat	$81,019
Clear Creek	$852,894	Montezuma	$209,672
Conejos	$73,938	Montrose	$355,534
Costilla	$30,023	Morgan	$3,243,694
Crowley	$150,490	Otero	$238,909
Custer	$174,350	Ouray	$96,028
Delta	$544,192	Park	$891,563
Denver	$102,710	Phillips	$108,235
Dolores	$47,517	Pitkin	$748,445
Douglas	$5,445,250	Prowers	$192,966
Eagle	$1,742,943	Pueblo	$289,553
El Paso	$5,424,875	Rio Blanco	$60,842
Elbert	$1,067,531	Rio Grande	$156,854
Fremont	$261,257	Routt	$764,981
Garfield	$935,392	Saguache	$40,381
Gilpin	$319,242	San Juan	$28,952
Grand	$790,525	San Miguel	$318,370
Gunnison	$424,010	Sedgwick	$46,399
Hinsdale	$92,915	Summit	$1,223,161

Huerfano	$50,090	Teller	$1,145,128
Jackson	$8,855	Washington	$60,949
Jefferson	$8,937,700	Weld	$2,351,598
Kiowa	$9,782	Yuma	$208,443
Kit Carson	$213,296	**TOTAL**	**$58,437,008**

*Sources: CSFS 2002 WUI Hazard Assessment, HAZUS-MR2

MITIGATING THREAT, SUSCEPTABILITY, AND IMPACTS OF WILDLAND FIRE.

There are common themes to consider in wildfire mitigation:

- Wildfires will continue to happen.
- Wildfire does not respect political boundaries.
- No single jurisdiction or agency can suppress all wildfires in their jurisdiction by themselves.
- Mitigation actions are required before a wildfire starts to maximize response to keep fires small and minimize damage; and Mitigation actions are required after a wildfire to minimize impacts resulting from wildfire.

The purpose of wildfire mitigation is to:

- Lessen the risk of wildfire through prevention and outreach;
- Lessen the hazard of wildfire through preparedness;
- Lessen the size and potential damage through cooperative and coordinated response;
- Lessen the post fire damage through coordinated and cooperative recovery and restoration.

Many forestry collaboratives around the state have started conducting localized risk assessments. For example, the Front Range Roundtable has conducted a regional wildfire risk assessment across jurisdictional boundaries. Roundtable members formed four working groups to complete specific tasks within the process. The above chart depicts acres at highest risk for wildfire as defined by the Roundtable. In an effort to reduce the potentially devastating impacts of wildfire, wildfire mitigation councils, committees, and forums are being formed throughout the state.

The mountain pine beetle epidemic that has encompassed 1.02 million acres of the state's 1.5 million areas of lodgepole pine forests in Colorado has led to increasing concerns about wildfire risk. Fire suppression policies spanning several decades have affected natural processes and made large areas of forests unhealthy and vulnerable to catastrophic wildfire. In response to these concerns, the Colorado General Assembly has passed several pieces of state legislation over the past five years that focuses on wildfire mitigation and suppression.

Small- and large-scale wildfire mitigation projects are being completed throughout Colorado. The City of Colorado Springs' wildfire mitigation team has used many funding sources, including a FEMA Pre-Disaster Mitigation grant, to fund fuels mitigation projects. El Paso County bought a chipper with Hazard Mitigation Grant program funds and completed fuels mitigation in several neighborhoods within the Monument-Woodmoor area. Clear Creek County also bought a chipper with Project Impact funds and implemented mitigation projects throughout the county. Recently,

the Colorado State Forest Service, Colorado State Parks, and Colorado Division of Emergency Management pursued funds to continue fuels mitigation in the state park system.

A number of key reviews, reports, and assessments form the basis for wildfire mitigation in Colorado.

The 1995 Colorado Wildfire Mitigation Plan provided a comprehensive foundation by identifying roles, responsibilities, issues, challenges, and recommendations for wildfire mitigation. Recommendations were captured in a table and used by state, county, and local government to prioritize actions.

The 2001 Report to the Governor on Colorado Wildland Urban Interface anchored to the 1995 Plan, reported on success and reinforced recommendations across political boundaries that needed to be addressed.
A 2007 Update on the recommendations was included in the last State Hazard Mitigation Plan.

These reports can be reviewed at: http://csfs.colostate.edu/pages/wf-wildland-map.html

A Summary of Recommendations and their status is presented in table format below followed by a list of reference documents and a few examples of accomplishments.

Recommendation, Goal and Objective	Action	Potential Benefits	Status Update
Strengthen Local Capacity in Wildland Fire Preparedness, Suppression, and Mitigation	Provide state-supported technical and cost-sharing assistance to counties for the development and implementation of expanded Annual Operating Plans (AOP)**.**	Clear understanding of wildfire response in counties. Identification of values at risk within communities and of mitigation measures.	**CSFS facilitates Annual Operating Plans between 47 counties and the interagency wildland fire community. Community Wildfire Protection Plans are being developed.**
	Increase State Disaster Emergency Fund to provide for wildland-urban interface contingency needs and for a fuels mitigation cost-sharing program. Continue funding support for Wildfire Preparedness Plan	Resources will be available for wildlfire response, and mitigation.	**Contingency needs for preparedness resources were addressed by the 2006 Colorado General Assembly which passed SB 096 that provides for an Annual Wildfire Preparedness Plan, the formation of a state to state Wildfire Compact, and for hazard fuel mitigation work.**

	Develop state-level wildland-urban interface training program for local fire service personnel.	Increased public protection and safety. Increased effectiveness and interagency cooperation.	**The 2008 Colorado General Assembly passed SB 39 to provide WUI training to Fire Protection District Boards of Directors.**
	Institute state contribution to Emergency Fire Fund (EFF). Continued support for Healthy Forest Vibrant Communities Act.(HB 1199).	Less dependence on Disaster Emergency Executive Order funding. WERF increases initial attack success, keeping fires small and less costly.	**There has been no direct state contribution to the Emergency Fire Fund. Counties collectively contribute $1 million annually. The Colorado General Assembly has made available the Wildfire Emergency Response Fund.**
Enhance State Leadership and Coordination in Interagency Wildland Fire Response.	Coordinate and fund the development and implementation of a statewide, county-by-county wildfire risk assessment	Statewide assessment to aid decision making at the state and county level for mitigation and preparedness needs.	**CSFS supports Community Wildfire Protection Planning through technical and cost share assistance. Western Colorado Risk Assessment completed in 2008, Eastern Plains need to be done.**
	Provide statutory clarification of wildland fire roles and responsibilities held by County Sheriffs, Fire Protection Districts, and related local response personnel.	Local responsibilities defined, implementation driven by local determination.	Senate Bill 09-020 was passed. Implementation is in progress. SB 09-001 provides for county fire planning. CSFS provides technical assistance.
	Clarify in state Master Agreement interagency roles and responsibilities for wildfire protection in the wildland urban interface.	Clear understanding of Federal and State responsibilities in the WUI	**Master Agreement is scheduled for review and renewal in 2011.**

	Provide state-level support for expanded state participation in zone dispatch centers and in the extended attack phase of wildfire suppression.	Resources will be available for wildlfire response, and mitigation.	**CSFS has established Area Fire Management Officer positions that communicate with interagency zone dispatch centers. CSFS also provides all the dispatch centers operational support.**
	Investigate and identify statewide protocols for radio communication across local, state, and federal jurisdictions.	Interagency communications on wildland fire.	**State telecommunications is reviewing. Interoperability is being reviewed.**
	Coordinate interagency implementation and allocation of funds related to the National Fire Plan, the Ten Year Comprehensive Strategy, and related efforts	Efficiencies in prioritizing mitigation projects across boundaries. Leveraging of federal funds.	**Forest Health Advisory Council is active. CSFS Statewide Forest Resource Assessment has been completed.**
Improve Statewide Public Awareness Regarding the Role of Fire in Colorado Landscapes and Tools for Wildland Fire Prevention.	Provide state leadership in delivering coordinated interagency messages to homeowners, landowners, land management agencies.	Awareness leads to informed decision making and action to mitigate wildfire threats.	**Collaboratives have been formed around the state: ex: Front Range Fuel Treatment Partnership; Colorado Bark Beetle Coalition.**
	Encourage the development of a professional outreach and information campaign to targeted audiences within the state.	Informed decision making at the individual landowner and local level results in action towards hazard mitigation in wildland areas.	**CSFS technical support through District Offices; Rockymountianfire.info was established as a clearing house and reference source for fire information.**

LEGISLATION

2010 Forestry-related Legislation:

- **Boundaries of Forest Improvement Districts (SB10-046):** Allows for the creation of a forest improvement district whose boundaries do not necessarily coincide with a county or municipality. Further, the district boundary may consist of noncontiguous tracts or parcels of property.

- **State Forester Prescribed Fire Certification Standard (SB10-102):** Requires the Colorado State Forest Service to establish standards for training and for certification of prescribed fire users.

- **Promote Biomass Energy Development (SB10-177):** Requires biomass energy facilities to be valued for the purpose of property taxation in the same manner in which wind or solar energy facilities are valued. Exempts forestry equipment that is used in the production of woody biomass from property taxes. Agriculture includes silviculture.

- **Colorado Forest Products (SJR10-037):** Recognizes the economic and environmental importance of Colorado's forests.

- **Elimination of the Forestry Experience Requirement (HB10-1071):** Eliminates the requirement that persons employed in a technical forestry capacity by the board of governors of the Colorado State University system have at least 2 years experience in forest practice.

- **Colorado Kids Outdoors Grant Program (HB10-1131):** Provides grants for programs that allow Colorado youth to participate in outdoor activities in the state, including but not limited to programs that emphasize the environment and experiential, field-based learning.

- **Sunset Repeal Forestry Advisory Board (HB10-1223):** Allows for the repeal of the 7-member Forestry Advisory Board. In 2008, Governor Ritter created the 24-member Colorado Forest Health Advisory Council to provide input and guidance on Colorado forest policy, making the board redundant.

- **Bark Beetle Wood Industry Incentives (HJR10-1024):** Supports bark beetle mitigation efforts, developing marketing and incentive programs; encourages development of properly sized, sustainable wood industries.

2009 Forestry-related Legislation:

- **Intergovernmental Cooperation for the Purpose of Mitigating Wildfires:** Required each local government to enter into an intergovernmental agreement (IGA) if that local government owns any land area located inside the territorial boundaries of a county, and contains at least 50-percent forestland or land that constitutes a wildland area. The bill is effective on or before July 1, 2011. The purpose of the agreement is to mitigate forest land/wildland fires that affect the contiguous land areas of the local government and county (**HB09-1162).**

- **Colorado Healthy Forests and Vibrant Communities Act of 2009:** Increased efforts to address wildfire risk, provided resources to the Colorado State Forest

Service to augment its technical outreach capabilities, and provided loans and grants for market-based and forest treatment solutions to reduce wildfire risk (**HB09-1199).**

- **Community Wildfire Protection Plans:** Required the Colorado State Forest Service to establish guidelines and criteria for counties to consider in preparing Community Wildfire Protection Plans to address wildfires in fire hazard areas within the unincorporated portion of a county (**SB09-001).**

- **Civil Immunity to Persons Engaged in Emergency Response Activities:** Enacted the "Marc Mullenix Volunteer Firefighter Protection Act," which provides limited civil immunity for fire departments and other entities that donate surplus firefighting equipment for later use; immunity for volunteer firefighters, their commanders, and the organizations that employ them; and immunity for incident management teams, in connection with fires and other emergencies (**SB09-013).**

- **Responsibility for Responding to Wild Land Fires:** Created a systematic, proactive approach to the management of wildland fire incidents in Colorado, regardless of cause, size, location, or complexity **(SB09-020).**

- **Incentives for Volunteer Firefighters:** Created a fund in the Division of Fire Safety to provide tuition vouchers to qualified volunteer firefighters who are enrolled in full-time or part-time study, and who agree to serve as volunteer firefighters for four years after completing their education (**SB09-021).**

- **Removal of Statutory Limit on the Amount that may be Raised for the Purpose of Fighting Fires:** Removed the statutory limit on the amount that can be raised in a year by a special property tax levied by a Board of County Commissioners for the purpose of fighting specified types of fires in a county (**SB09-105).**

2008 Forestry-related Legislation

- **Income Tax Deduction:** Five-year program that allowed a landowner to deduct the actual costs of wildfire mitigation up to $2,500 **(HB08-1110).**

- **Mitigating the Effects of the Pine Beetle Infestation:** Established a beetle mitigation fund that allows the public to make voluntary donations that can be used to treat beetle-infested state-owned lands **(HB08-1318).**

- **Extend the Forest Restoration Pilot Program:** Extended for 5 years the Community Forest Restoration Grant Program that was established in 2007 through the passage of the 2007 Community-Based Forest Restoration Act (HB07-1130; see below). Grants are available to communities for fuels mitigation and restoration **(SB08-71).**

- **Watershed Bonding for Forest Health:** With proper authority and agreement, bonds can be issued for forest health and watershed protection projects **(SB08-221).**

- **CSU Agency Line Item Authorization:** Authorized the General Assembly to appropriate funds directly to the Colorado State Forest Service, Agricultural Experiment Station and CSU Extension **(SB08-232).**

- **Training Directors of Fire Protection Districts in the WUI:** Directed the Division of Fire Safety to develop a pilot education program for board members of Fire Protection Districts in the wildland-urban interface **(SB08-39).**

- **Colorado Forest Health:** Promoted active management in National Forests impacted by bark beetles **(HJR08-1033).**

- **Concerning Stewardship Contracting:** Requested that the U.S, Forest Service, Bureau of Land Management and Colorado State Forest Service work together to identify and implement up to three long-term stewardship contracts **(SJR08-10).**

- **WUI Interim Committee:** Created an eight-member interim committee to hold hearings on issues related to the WUI, fuels mitigation, firefighting, bark beetle mortality and incentives for forestry-related industry **(SJR08-25).**

2007 Forestry-related Legislation

- **Community-Based Forest Restoration:** Authorized a 5-year cost-share grant program for community-based forest restoration pilot projects across the state **(HB07-1130).**

- **Forest Improvement Districts:** Authorized a municipality or county to propose to its voters the formation of a Forest Improvement District through which the municipality or county could tax itself to raise money for priority forest improvement projects **(HB07-1168).**

Reducing Fire Risk in the Wildland-Urban Interface

The primary purpose of federally based State Fire Assistance (SFA) funding is to mitigate wildfire risk in areas where human development is adjacent to wildland fuels, often collectively referred to as the wildland-urban interface (WUI). SFA funding is available and awarded through a competitive process.

To be considered for SFA grant funding, a project must meet one or more of the following criteria:

- ***Reduce hazardous fuels/restore fire-adapted ecosystems:*** Fuel treatments in or adjacent to identified fire-prone communities to reduce the threat of catastrophic wildfire. Includes fuelbreaks, defensible space, thinning and prescribed fire.

- ***Improve prevention/education in the WUI:*** Leadership to coordinate, develop and distribute WUI education programs on wildfire risk mitigation. Includes “Living with Fire” newspaper inserts, the CSFS "Are You FireWise?" Program and pamphlets, and brochures or handouts on wildfire risk mitigation.
- ***Planning:*** Creation of Community Wildfire Protection Plans (CWPPs) or the implementation of priority projects identified in existing CWPPs.

In addition to meeting the above criteria, SFA grant applicants also must be willing to match the allocated grant amount using a non-federal source (a 50/50 match requirement, using actual dollars, donated equipment/labor, or a combination thereof). Applications go through a rigorous review process, and ultimately are ranked by the CSFS and members of the Western State Fire Managers based on the applicant’s ability to meet the required criteria, provide measurable results and collaborate with partners. Projects with the highest ranking receive grant funding, though not always the full amount requested.

The CSFS awarded a total of $2.3 million in SFA grant funds in 2008-2009. These funds are being used to treat nearly 6,500 acres, inform more than 140,000 Colorado citizens about the importance of fire risk mitigation and support communities in the development of CWPPs.

Grand County Wildfire Demonstrates Effectiveness of SFA-Funded Projects

In the early summer of June 2007, three teenagers playing with gasoline and matches on the YMCA Snow Mountain Ranch near Granby, Colo., started an intense forest fire. The fire quickly jumped into the tinder-dry crowns of the surrounding beetle-killed lodgepole pines and was poised to burn a huge footprint into history.

Yet the fast-moving Y Fire ultimately would consume only 50 acres, sparing the YMCA’s cabins and all other structures in the area – including 100 homes in an adjacent subdivision. The fire died down as quickly as it ignited because a 200-foot-wide fuelbreak was finished only weeks before.

“When the Y Fire reached the fuelbreak, it dropped to the ground and firefighters were able to get a handle on it,” said CSFS Granby District Forester Ron Cousineau. “The fire behaved exactly as we hoped it would.”

Santa Fe Trail Ranch

Santa Fe Trail Ranch (SFTR) is a 17,000-acre subdivision in southern Colorado near Trinidad. I-25 forms the eastern boundary of the subdivision, Trinidad Lakes subdivision lies to the north, Vermejo Park Ranch borders the south and west, and Wootton Ranch lies to the south. Piñon-juniper forests dominate the north end of the community and ponderosa/mixed conifer forests dominate the south. Significant amounts of Gambel oak and New Mexico locust also dot the landscape.

Following the development and adoption of a CWPP in 2006, the committee began working with the head forester of Vermejo Park Ranch (VPR) to create a shaded fuelbreak on the boundary between SFTR and VPR. A shaded fuelbreak is an easily accessible strip of land 300 feet or more in width where fuel density is reduced, which provides firefighters with improved access to help them control fires. Fuelbreaks force crown fires to the ground so that firefighters can safely attack the fire directly. Thinning also reduces tree-to-tree competition for sunlight, water and nutrients, which enhances vigor in individual trees and improves overall forest health.

Over the past five years, the coalition has coordinated defensible space treatments on more than 120 of the 454 privately owned lots, which are 35 acres or more.

The SFTR Property Owners Association works with many partners to update and maintain its CWPP, including VPR, CSFS, Wootton Ranch, Colorado Division of Wildlife, Natural Resources Conservation Service, Fishers Peak Fire Protection District and the Las Animas County Fire Marshal. The coalition also partners with the Culebra Range Community Coalition, New Mexico Forestry Division, Sugarite Canyon Watershed Protection Project, Cimarron and Canadian Watershed Alliance Groups, Colfax County Coalition of Firewise Communities (NM) and Firewise Communities/USA to expand their understanding of current issues and generate interest in developing and implementing CWPPs in southern Colorado and northern New Mexico.

An active group from the start, the coalition has been able to educate, inspire and motivate property owners to embrace forest health restoration resulting in significant participation in fuels reduction and habitat improvement projects on private lands.

Protecting Our Watersheds

Colorado's Forest Restoration Pilot Program allows the state to fund projects that demonstrate a community-based approach to forest restoration. Projects funded by this program focus on protecting water supplies and related infrastructure, as well as restoring ecosystem function in forested watersheds. Forest management efforts range from thinning and fuels reduction to replanting trees.

To be eligible for funding through this program, projects must include a diverse group of stakeholders in project design and implementation, and must be located in an area with an approved CWPP. Every Forest Restoration Pilot Program project must address one or more of the following objectives:

- Reduce the threat of high-intensity wildfires and/or the negative effects of excessive competition between trees;
- Preserve old and large trees of ecological or scientific value;
- Replant trees in deforested areas;

- Improve the use of, or add value to, smaller-diameter trees.

As a result of the Forest Restoration Pilot Program, more than 5,300 acres will be treated with this funding for a total of more than 8,400 treated acres in 2008-2009.

LOCAL STATE PARTNERSHIPS MITIGATE WILDFIRE POTENTIAL

Durango residents use Dalla Mountain Park for hiking, walking dogs, mountain biking and rock climbing. Sandwiched between Bureau of Land Management (BLM) acreage to the northeast and private land to the southwest, the 176-acre park sits in a classic wildland-urban interface (WUI) zone. Until recently, the park was cloaked in a thick understory of flammable Rocky Mountain juniper and Gambel oak – vegetation that could have set the stage for a catastrophic wildfire.

The city contracted the Southwest Youth Conservation Corps to complete the Dalla Mountain Park treatments, employing hand crews to minimize soil disturbance in the watershed. Although non-mechanized thinning is more expensive and time- consuming than operations using heavy equipment, CSFS Durango District Forester Kent Grant says that it has a much lighter impact on the ground, which is important when watershed protection is one of the ultimate project goals.

In 2008-2009, more than 37 acres were treated at Dalla Mountain Park using Forest Restoration Pilot Program funding. More acreage is slated for treatment in the next one to two years.

"If there is a significant wildfire in Dalla Mountain Park, it should now be less intense and less likely to become a devastating crown fire," said Grant. "Hence it would have a limited impact on the Junction Creek and Animas River watersheds."

THE CSFS ENGINE CREWS

In 2006, the General Assembly directed the creation of a Wildfire Preparedness Fund in the State Treasury to address the risk of wildfire in Colorado's wildland-urban interface. Senate Bill 06-96 recognized the daunting challenge wildfire poses to public safety, fiscal management and natural resource integrity in the state.

The significance of SB-96 is the consistency it provides to acquire long-term aviation contracts, staff wildland fire engines, support National Guard resources, and train and use Colorado Department of Corrections State Wildland Inmate Fire Teams. In wildland fire management, consistency in the availability of resources leads to increased efficiencies and effectiveness in response to wildland fires.

One of the many successful efforts following the passage of SB-96 was the formation of the CSFS engine crews in 2007. Located at the CSFS Cañon City, Boulder, Golden and Fort Collins districts, these crews staff Type 6 and Type 4 wildland fire engines.

The local district offices provide daily supervision and project work. When not fighting fires, crews participate in projects that pertain to the management of Colorado's forests. Project work includes mountain pine beetle mitigation, wildland fire hazard reduction, timber stand improvement, preparedness and fire prevention education programs. The

crews also are available for fire suppression assignments at the district, state, regional and national levels.

When the engine program began in 2007, the program was new and in uncharted waters. Since then, the responsibilities of the crews have evolved in several innovative directions. Depending on the needs of the local CSFS district and the strengths of individual crews, personnel concentrate on thinning forests on state lands adjacent to private property; using prescribed fire as a tool for fuels reduction and forest management; or providing training and education as a way to encourage the development of much-needed human resources to fight fires and to educate the public on wildland fire.

RESTORING FORESTS

In 2009, the CSFS received American Recovery and Reinvestment Act (ARRA) funding from the U.S. Forest Service through a competitive grant process. The CSFS received a $6.25 million grant to create or retain jobs that help implement high-priority forest restoration and fuels mitigation projects. A portion of the funds also are being used to create and retain jobs in Colorado's wood products industries. In addition, the CSFS received a second grant for $4.465 million to help fund jobs affiliated with developing and implementing Community Wildfire Protection Plans.

Interested organizations competed for sub-grants by writing project proposals, per guidelines and requirements set forth in the Requests for Proposals. Interdisciplinary review panels evaluated project proposals and selected the following to receive ARRA funding.

SUPPORTING RURAL FIRE DEPARTMENTS

Wildfires can occur almost any time in Colorado, so it’s important to have trained firefighters and equipment available throughout the year. In the United States, 75 percent of the 35,000 local fire agencies are volunteer. These volunteer organizations are the first responders on approximately 80 percent of wildfires.

In addition, volunteer fire departments provide wildfire protection and emergency response services to residents in rural areas with populations of 10,000 or less.

Each year, federal funds are available through Volunteer Fire Assistance (VFA) grants administered by the CSFS. The grants allow fire departments to buy fire equipment, pay for training or training materials, or cover the cost of department organization. VFA funds are granted on a 50/50 matching basis. In order to help volunteer fire departments, which often are strapped for funds, only departments in rural areas may apply for these funds.

In 2008, 150 fire departments in Colorado received grant funding; in 2009, 126 departments received grants. The average grant awarded is $3,000, however, they can range from $100 to $10,000.

FEDERAL EXCESS PROPERTY PROGRAM BENEFITS RURAL FIRE DEPARTMENTS

In 2008, the Town of Walsh received a new 2½-ton, 878-gallon, 6x6 fire engine. The CSFS Fire Equipment Shop builds approximately eight new Federal Excess Property Program (FEPP) engines each year, which are then assigned to local fire departments throughout the state.

When CSFS Fire Equipment Shop personnel delivered the engine, they gave Walsh Fire Department firefighters a briefing and instructions in the use and minor maintenance of the new Type 4 fire truck. Walsh Fire Department Chief Lance James said, "We're excited to receive the new equipment, and particularly excited by the water tank design, which allows for lower weight distribution of the vehicle. This newer design is safer than the older design for firefighters. There is also additional room on the flatbed for equipment."

An equipment agreement between the State of Colorado, Colorado State Forest Service and the Town of Walsh was effective on October 1, 1990. Signed by the mayor, county sheriff and county commissioners, the agreement allows placement of fire equipment for the benefit of emergency use within Baca County.

The Walsh engine is one of 140 engines maintained in Colorado and authorized by law under the Cooperative Forestry Assistance Act of 1978. This Act provides a mechanism for federally owned equipment to be used locally for emergency and fire-related protection.

This beneficial agreement provides for the loan of fire equipment to be used for fire duties within the town and county, an annual maintenance inspection and repairs from normal wear and tear. The town pays a $200 per year inspection fee. In return, Walsh officials agree to only use the equipment for fire protection or other emergency situations when life or property are threatened; maintain the equipment in good operating condition with a minimum of tools and hose on the engine; provide adequate year-round equipment housing; pay for all operating costs and minor maintenance; maintain liability insurance; and submit national fire reports. If available, the engine also may be dispatched for emergency mutual aid or initial attack responses outside its normal jurisdiction.

THE FRONT RANGE ROUNDTABLE

The Front Range Roundtable was formed to "*serve as a focal point for diverse stakeholder input into efforts to reduce wildland fire risks and improve forest health through sustained fuels treatment along the Colorado Front Range.*"

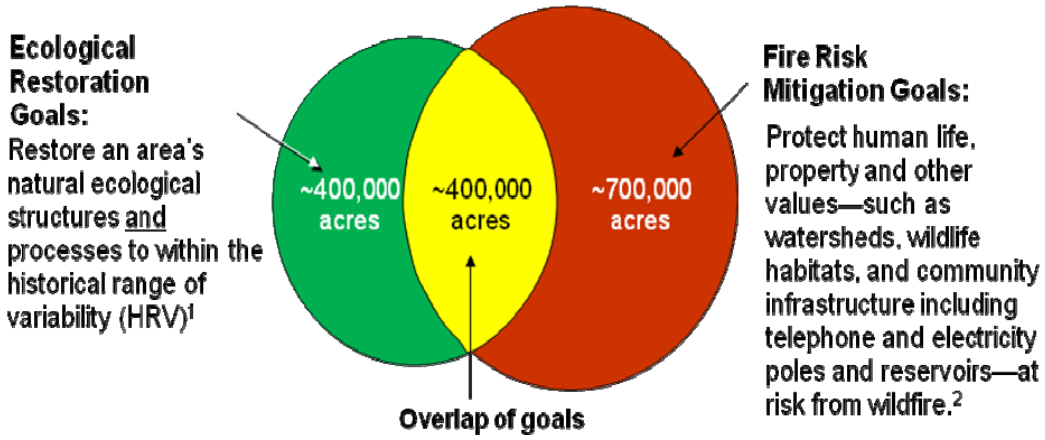
- The Front Range roundtable has reached consensus that 1.5 million acres of Front Range forests require treatments to reduce fire risk.

Ecological Restoration Goals:

Restore an area's natural ecological structures and processes to within the historical range of variability (HRV)[1]

Fire Risk Mitigation Goals

Protect human life, property and other values—such as watersheds, wildlife habitats, and community infrastructure including telephone and electricity poles and reservoirs—at risk from wildfire.[2]



County	Overlap Zone	Fire Risk Mitigation Zone	Ecological Restoration Zone	Total Roundtable Priorities
Boulder	51,021	77,212	35,978	164,211
Clear Creek	7,356	58,595	833	66,784
Douglas	40,529	61,143	90,807	192,479
El Paso	• 57,107	41,891	31,169	130,167
Gilpin	472	42,365	2,177	45,014
Grand	390	94,321	1,838	96,549
Jefferson	88,094	92,971	71,157	252,222
Larimer	42,350	130,956	98,856	272,162
Park	31,377	122,808	27,463	181,648
Teller	23,168	86,848	27,211	137,227
Total Front Range	341,864	809,110	387,489	1,538,463

FRONT RANGE FORESTS REQUIRING FOREST TREATMENT BY COUNTY (acres)					
County	Restoration only	Fire risk mitigation only	Both restoration and fire risk mitigation	Total restoration and/or fire risk mitigation	Private land (percent of total)
Boulder	35,978	77,212	51,021	164,211	58%
Clear Creek	833	58,595	7,356	66,784	59%
Douglas	90,807	61,143	40,529	192,479	42%
El Paso	31,169	41,891	57,107	130,167	62%
Gilpin	2,177	42,365	472	45,014	63%
Grand	1,838	94,321	390	96,549	65%
Jefferson	71,157	92,971	88,094	252,222	73%
Larimer	98,856	130,956	42,350	272,162	60%
Park	27,463	122,808	31,377	181,648	57%
Teller	27,211	86,848	23,168	137,227	61%
Total Front Range	387,489	809,110	341,864	1,538,463	60%
Source: Front Range Fuels Treatment Partnership: Living with Fire: Communities and Restoring Forests, May 2006					

COMMUNITY WILDFIRE PROTECTION PLANS (CWPPS)

Community Wildfire Protection Plans (CWPPs)

Community Wildfire Protection Plans are authorized and defined in Title I of the Healthy Forests Restoration Act (HFRA) passed by Congress on November 21, 2003, and signed into law by President Bush on December 3, 2003.

The Healthy Forests Restoration Act places renewed emphasis on community planning by extending a variety of benefits to communities with a wildfire protection plan in place. Critical among these benefits is the option of establishing a localized definition and boundary for the wildland-urban interface (WUI), and the opportunity to help shape fuels treatment priorities for surrounding federal and non-federal lands.

The CWPP, as described in the Act, brings together diverse local interests to discuss their mutual concerns for public safety, community sustainability and natural resources. It offers a positive, solution-oriented environment in which to address challenges such as local firefighting capability, the need for defensible space around homes and subdivisions, and where and how to prioritize land management on both federal and non-federal land.

The Colorado State Forest Service maintains a database of CWPPs that have been developed and/or are in the process of being implemented. To view the most recent list of CWPPs, visit www. http://csfs.colostate.edu/pages/CommunityWildfireProtectionPlans.html.

POST FIRE MITIGATION

NRCS Emergency Watershed Protection 2002

Year	Fire Name	County	Funding
2002	Coal Seam	Garfield Co.	446,199
	Missionary Ridge	La Plata Co.	2,183,904
	Hayman	Douglas/Park/Jefferson/Teller	5,627,369
	Million	Rio Grande Co.	214,046
	Snaking	Park Co.	72,883
	Schoonover	Douglas Co.	74,951
	Iron Mountain	Fremont Co.	96,298
	Dierich	Mesa Co.	38,013
	Burn Canyon	San Miguel Co.	232,393
	Panorama	Garfield Co.	108,298
	Cherry Creek	La Plata Co.	59,484
2003	Overland Fire	Boulder County	$56,114
2004	Picnic Rock	Larimer County	$137,680
	McGruder	Delta County	$18,000

2005	Mason	Pueblo County	$52,200
2006	Mauricio Canyon	Las Animas and Huerfano Counites	$85,586
2007	Newcastle	Garfield County	$89,281
2008	Ordway	Crowley County	$179,868

CONCLUSION

Declining forest health and increasing wildfire risk in Colorado has been brought about by a combination of factors over the years, including, but not limited to, fire suppression policies, insect and disease infestations, lack of fire-safe construction practices, and increased population in the wildland-urban interface. Fire prevention, mitigation, and suppression require a multi-agency, multi-organizational approach that involves interested stakeholders, communities, and decision-makers at all levels in order to be effective. In Colorado, numerous place-based forestry collaboratives have formed over the past decade to tackle the most pressing forest-health related issues, including wildland fire mitigation.

The costs of implementing large-scale, cross-boundary forest management projects to reduce fuels and mitigate fire risk is a continuing challenge. To help address this challenge, the Colorado General Assembly and Colorado Congressional Delegation have passed numerous bills related to forest management, and fire mitigation and suppression.

The current mountain pine beetle epidemic will pose additional challenges to firefighters, residents, and visitors in infested areas as large areas of dead lodgepole pine trees begin to fall and regeneration occurs. These areas will be susceptible to large fires that may burn hot, causing erosion and sedimentation, which will threaten important watersheds that supply domestic water.

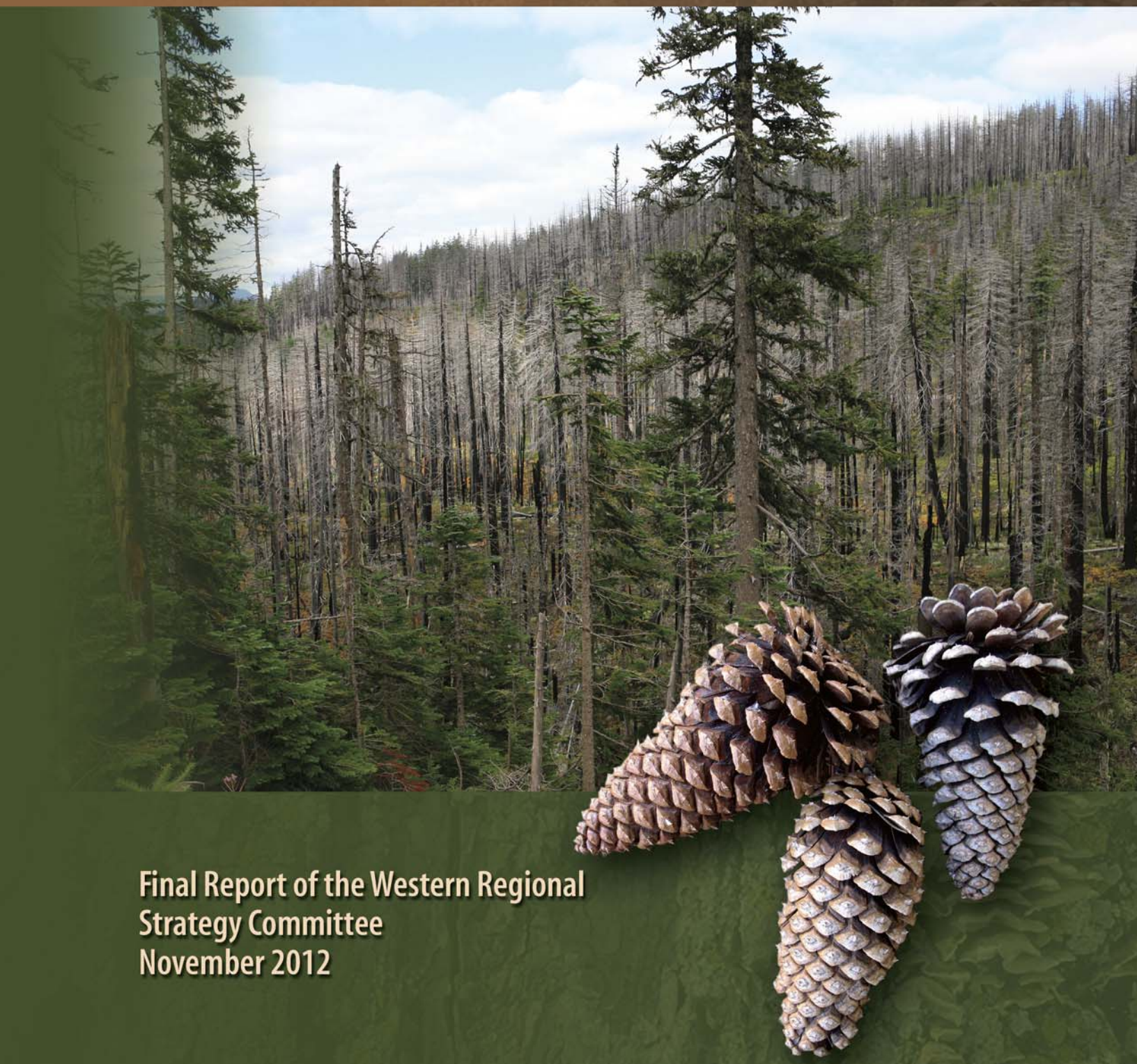
Public education and technical assistance are essential to help wildland-urban residents make appropriate decisions about wildfire mitigation, and to help keep the public safe whenever and wherever wildfires do occur.

REFERENCE DOCUMENTS

1995 Colorado Wildfire Mitigation Plan
1999 Western State Fire Managers Report, Wildland Urban Interface
2001 Report to the Governor on Wildland Urban Interface
2001/2002 Colorado Wildfire Mitigation Plan
2003 Hayman Fire Case Study
2006 – 2007 Front Range Fuel Treatment Partnership Annual Report
2006 Front Range Fuel Treatment Partnership, Living With Fire, Findings and Recommendations
2007 Colorado Wildfire Mitigation Plan Update
2008 Report, The Health of Colorado's Forests
2009 The Health of Colorado's Forests, Special Edition
2008 – 2009 Colorado State Forest Service Accomplishment Highlights
2010 Colorado Statewide Forest Resource Assessment

2010 Colorado Forest Resource Assessment Implementation Strategy
http://csfs.colostate.edu

The National Cohesive Wildland Fire Management Strategy: Phase III Western Regional Science-Based Risk Analysis Report



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November 2012

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Executive Summary

The National Cohesive Wildland Fire Management Strategy: Phase III Western Regional Science-Based Risk Analysis Report (Western Regional Risk Report) has been developed by representatives of federal, state, local, and tribal governments, interested governmental and non governmental organizations, businesses and industries to comprehensively address issues relating to wildland fire in the West. The Western Regional Strategy Committee (WRSC) was developed to provide inclusiveness and transparency to stakeholders in the process of addressing the wildland fire challenge, while focusing on the three goals of the Cohesive Strategy: Restoring and maintaining resilient landscapes, Creating fire adapted communities, and Responding to wildfires. Stakeholder input has been instrumental in forming the risk analysis and alternatives to address the wildland fire management issues in the 17 Western states.

The Western landscape is diverse and reaches from the plains states of Kansas and Nebraska to Hawaii, Alaska and the western pacific islands such as Guam and American Samoa. This diverse landscape creates strengths and weaknesses. One identified weakness concerns availability of data across all lands. A need for data from our island partners and Alaska has been identified, and the Western region will work to address this need in the future.

The Western Region contains a vast amount of land administered by federal agencies, which creates opportunities and challenges. The West has significant wildland fire risks from overstocked fuel conditions, insects and disease, invasive species, and urban development in wildland urban interface areas (WUI). Restoring landscapes to a healthy, resilient state would generate important environmental and social benefits, create much-needed jobs and revenue for rural economies, and lead to tremendous cost savings in wildfire suppression efforts.

The Western Regional Risk Report aims to explore and characterize strategies that stakeholders, communities, agencies and all partners can use to address the three goals. The maps and charts in this document give us a generalized picture across the entire region, while identifying existing biophysical and social conditions and relationships among factors. The analysis shows us where fires are occurring, where future fires are likely to occur, and where we might be able to intervene with mitigation efforts to reduce fuels to reduce the severity of future fires. The landscape needs active management to reduce fuels in order to reduce losses of homes, lives, and resources to wildfire. Experience with fuels treatment projects has demonstrated the value of fuels reduction to reduce suppression costs and protect land and resources, and the importance of collaborative groups, which bring a variety of stakeholders to the table to forge agreements on how to restore landscapes and reduce wildfire risk.

The risk analysis in this report summarizes three alternatives in relation to the three Cohesive Strategy goals and social, economic, and ecological conditions. This Phase III effort builds on the Phase II *Western Regional Assessment and Strategy Report*. The National Science Analysis Team has assembled a library of data and tools that can be used to inform decision-makers in making land management choices.

As part of the Cohesive Strategy planning process, the Western Regional Strategy Committee reviewed and analyzed the data to refine Alternatives 1, 2 and 3, which represent three different focus areas to address in the future development of specific Action Plans. Like the three goals, the three alternatives are not mutually exclusive. Resilient landscapes, fire adapted communities, and improved fire response work together to mitigate the risk of wildfire. There is no one preferred alternative to be applied across the West. Rather, the three alternatives present investment options that are believed to offer the greatest positive impact. The value of employing a blend of the goals and alternatives has applicability across the vast geographic landscape of the West.

- Alternative #1 emphasizes landscape resiliency and recommends activities that contribute to improvements in forest and rangeland health.
- Alternative #2 emphasizes fire-adapted communities in which all stakeholders and affected publics are collaboratively engaged in protecting communities and WUI residents from wildland fire and in fulfilling a stewardship role for their surrounding landscape.
- Alternative #3 emphasizes increased stakeholder effectiveness in risk-based wildland fire response that enhances the effectiveness of firefighter and public safety.

Recommendations

Following from the alternatives are recommendations to address each alternative, plus overarching recommendations that address all facets of the Cohesive Strategy. The following recommendations are broad based.

Overarching Recommendations

- Recognize the depth and importance of the communications framework and provide resources to implement communications recommendations, as it establishes the foundation of our collaborative process.
- Ensure the coordinated implementation of the Cohesive Strategy among all stakeholders.
- Enhance collaboration through incentives.
- Emphasize landscape treatments where existing collaborative groups have agreed in principle on management objectives and areas for treatment, and encourage and facilitate the establishment of collaborative groups.
- Expand collaborative land management, community and fire response opportunities across all jurisdictions, and invest in programmatic actions and activities that can be facilitated by Tribes and partners under the Indian Self-Determination and Education Act (as amended), the Tribal Forest Protection Act, and other existing authorities in coordination with the UN Declaration on the Rights of Indigenous Peoples.
- Address identified barriers and promote critical success factors across the region and at all levels.
- Provide resources to support local government officials, such as fire chiefs, in the integration of the Cohesive Strategy into their communities and operations – i.e., support the development of an International Association of Fire Chiefs (IAFC) Leaders' Guide for the Cohesive Strategy.
- Formalize a comparative risk model that includes federal, state, and local costs. Use the model to complete a trade off analysis and establish a risk base point.
- Establish the use of the model, including training and data descriptions for local decision makers, such as counties. Facilitate local updates to the models to enable updates to the national models.
- Identify data gaps and inconsistencies, including describing the purpose of the data in monitoring and evaluating progress to accomplishing the goals of the Cohesive Strategy. Prioritize action toward addressing gaps and inconsistencies.

Landscape Resiliency Recommendations

- Encourage US Forest Service and Department of the Interior/Bureau of Land Management to use existing authorities under Healthy Forest Restoration Act, Healthy Forest Initiative, and other contracting authorities to expedite fuels treatments. Assess what is currently being spent on these tools and increase that amount. Project criteria to be worked out during action planning may include: Project has to be 5,000 acres or larger, reduces risk to landscapes and/or communities by focusing on areas that have a high burn probability or departure; has to be initiated within 2 years; and is based on collaborative processes.
- Explore data to identify and prioritize landscapes for treatment. This information would be provided to sub-geographical stakeholders, decision makers, as well as state and federal officials for their consideration and use.
- Expedite coordinated identification, prioritization, and restoration of damaged landscapes as a result of natural disturbances including, insect/disease, hurricanes, wildfire, invasives, changing climatic conditions. Identify where investments are not likely to restore areas to assist in prioritization of resources.
- Work with Council on Environmental Quality (CEQ) in developing categorical exclusions for landscape restoration.
- Where appropriate, utilize CEQ alternative arrangements when restoring damaged landscapes as a result of natural disturbances.

- Examine legislative related barriers that are impeding implementation of collaboratively developed landscape health related projects and pursue reform of the existing process to increase our effectiveness in active forest and rangeland management. (e.g., Endangered Species Act, Equal Access to Justice Act, National Environmental Policy Act (NEPA)). Encourage and enlist local, state, tribal, and federal environmental regulatory agency representatives to participate actively in collaborative efforts to restore resilient landscapes.

Fire Adapted Communities Recommendations

- Accelerate achievement of fire adapted communities using existing tools; offer incentives, such as chipping/disposal and incentives for collaboration, etc.
- Enhance campaigns to educate the public about the urgent need for homeowners to take action, including having statewide, Western, and other coordinated campaigns. Use videos such as how to protect homes from fire, the importance of fire in nature, and the need to live with fire.
- Facilitate shared learning among communities for fire adaptation.
- Continue to create and update Community Wildfire Protection Plans (CWPPs) using Secure Rural Schools Community Self-Determination Act and identify new funding sources. Be sure to include offices of emergency management and local response entities, such as the sheriff's office in planning efforts. Update CWPPs in areas that have had a wildfire event.
- Review and modify requirements for technical and financial support of communities through Federal Emergency Management Agency (FEMA), i.e. NEPA administrative processes, and applications for funding.
- Develop and promote local collaborative capacities to implement fuels treatments and respond to fires.

Fire Response Recommendations

- Improve response effectiveness by convening state level groups to identify where fire protection exists for all areas within each state. Eliminate unprotected areas by establishing/extending jurisdictional responsibilities. Response cooperators in each state should identify those voids and negotiate to ensure that every acre within the state has designated protection. Promote realignment of protection responsibilities to the organization that is best suited to provide protection (e.g., block protection areas, offset protection agreements, protection contracts).
- Improve firefighter and public safety. Maintain and/or improve an aggressive human caused ignition prevention program. Involve all stakeholders in the prevention campaign.
- Integrate local, state, federal, and tribal response capacity. Identify where the greatest opportunities exist in communications, training, qualifications, mobilization, and instruments.
- Increase capacity where necessary in order to improve overall local response effectiveness and reduce the need for external (non-local) resources.

Next Steps

The Western Region will use the Phase III report in conjunction with the objectives outlined in the Phase II report, *A National Cohesive Wildland Fire Management Strategy: Western Regional Assessment and Strategy* to develop a Regional Action Plan that addresses the needs of landscapes, communities at risk, and fire response. The Action Plan will be developed with stakeholder input, in an inclusive and transparent process, and will be completed in early 2013.

Experience has shown us that collaboration does not spontaneously happen. It requires structure, process, focus, and resources. To that end, the next step for the Western Region is to establish a coordination structure that will exist under the umbrella of the Wildland Fire Executive Council (WFEC). This structure will facilitate the broad scale implementation of the recommendations identified in the Western Regional Risk Report.

It is envisioned that the structure will be a coordinating body, composed of representatives of the decision-making and jurisdictional authorities in the West. This regional coordinating body will need

resources, a full-time staff lead, and a communications component. It is recommended that these resources be acquired through new or existing agreements with the Western Governors' Association and/or Western Forestry Leadership Coalition. The objective of the coordinating body will be to facilitate the development of the action plan and its implementation, provide consistent communications with stakeholders, and foster true collaboration.

Introduction

The National Cohesive Wildland Fire Management Strategy (Cohesive Strategy) is a bold, new national approach to the increasingly complex reality of wildland fire and land management, and fire response. The Cohesive Strategy is being developed in response to a mandate under the Federal Land Assistance and Management and Enhancement Act (FLAME Act). The Cohesive Strategy was developed in response to growing concern over mounting annual costs of fighting wildfires, devastating wildland fire losses to communities, and concern about overall landscape health. The Cohesive Strategy recognizes that fire is a natural process, necessary for the survival of many ecosystems, and focuses on attempting to reduce the conflict between fireprone landscapes and people. The Cohesive Strategy takes a holistic approach by simultaneously looking at the role of fire in the landscape, the ability of humans to actively manage these landscapes, plan for and adapt to living with fire, and the need to be prepared to respond to fire when it occurs.

The Cohesive Strategy brings together representatives of the many stakeholders – federal and state land management agencies, local governments, landowners, environmental groups, tribal groups, fire professionals, and non-governmental organizations and other entities, to discuss goals and work collaboratively to develop shared objectives. The top-down, bottom-up approach of the Cohesive Strategy brings local knowledge about landscapes and fire to the highest levels of decision-making. And it brings together natural and social scientists to employ a scientific model to inform the deliberations with the best available science, designed to help determine the best path forward in addressing the complex issues relating to wildland fire. Working through regional strategy committees representing the three distinct regions of the country – the Northeast, the Southeast, and the West- these groups are devising a shared strategy that will inform decision-making to best use our ecological, social, and economic resources in preparing for, responding to, and recovering after inevitable wildland fires.

The Cohesive Strategy takes an "all lands" view of wildland fire management. Fire knows no political or social boundaries -- not ownership boundaries, not state boundaries. Policymakers must take a landscape-level approach and work across boundary lines to implement effective management techniques. And, it is important to include all the stakeholders to reach decisions that are supported by the community at large. The Cohesive Strategy solicited feedback from a wide variety of stakeholders and used their feedback to help develop alternatives. The Cohesive Strategy is unprecedented in its effort to initiate dialogue and effect collaboration on a national scale.

Annual fire suppression and preparedness costs are high. In 2003, the cost of suppression to the federal government was $1.7 billion. In 2008, state and local governments spent over $1.6 billion on suppression and wildland fire mitigation. However, according to the recent study, *The True Cost of Wildfire in the Western United States*, by the Western Forestry Leadership Coalition, fire suppression costs are only a small portion of the true costs of a wildfire event. There are many costs borne by individuals that extend far beyond the scope of fire suppression. Direct costs reflect the cost of suppression, but the following costs are generally not included in direct cost estimates: rehabilitation costs, post-fire flooding, and watershed degradation costs. Other costs that go unaccounted for are indirect costs, such as lost tax revenues, business revenues, and property losses. And additional costs including loss of human life, ongoing health problems for the young, old, those with weak respiratory and immune systems, and mental health issues are also not included in estimates. A synthesis of six case studies in the report reveals a range of total wildfire costs anywhere from 2 to 30 times greater than the reported suppression costs (WFLC, 2010).

The National Fire Plan of 2001 began a strong effort to reduce losses to communities from wildland fire. In the twelve years since the inception of the National Fire plan, state and federal agencies, local government, the private sector, communities, tribes, and non-governmental organizations (NGOs) have worked diligently to improve the conditions of the lands, make communities fire safe, and develop a strong fire response capability.

One of the strengths of work done under the National Fire Plan and the 10-Year Implementation Strategy was the development of Community Wildfire Protection Plans (CWPPs) for communities at risk throughout the country. CWPPs are planning documents developed at the local level by community members working together to assess the risk to their community or county, and develop mechanisms to reduce risk, including: education of residents, reducing fuels around structures, identifying methods to reduce structural ignitability, and prioritizing fuels treatments in and around the community or county. The map below shows the geographic areas that have CWPPs today, at either the county or community level.

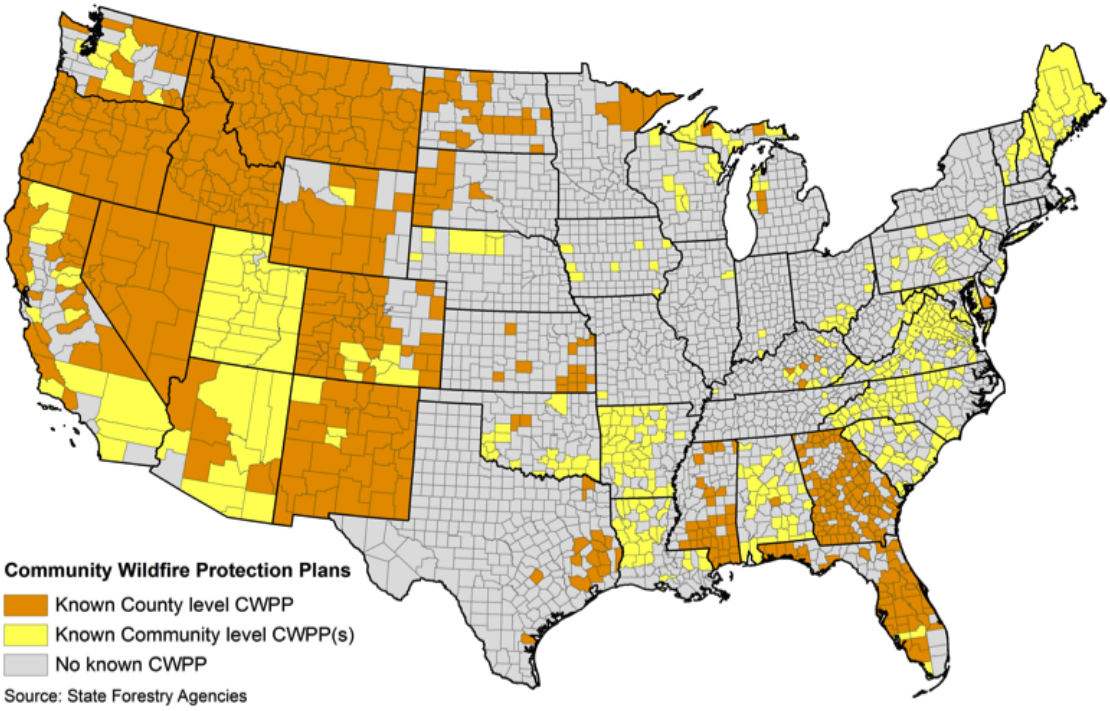


Figure 1. Counties that have CWPPs or community CWPPs within them.
Source: State Forestry Agencies

Large areas of the West have at least one CWPP within each county. This shows both the commitment of the Western states, counties and communities to take action to do what they can to reduce wildfire risk, and it also illustrates the need to further the extent of this work to all areas affected by wildfire risk.

Under the National Fire Plan, a lot of very good work was done, but some stakeholders say there is room for improvement. One concern expressed by stakeholders is that fuels treatments, community protection planning, and fire response efforts were led by separate agencies or groups, and not coordinated with the actions being done by other agencies or groups. This is sometimes referred to as "stove piping" within agencies.

The Cohesive Strategy brings the stakeholders together to form partnerships and to weave these separate pieces together. In doing so everyone benefits by gaining leverage, efficiencies, and reduced risk. Previous collaborative efforts highlight the need for shared responsibilities, effective partnerships, improved interagency coordination and response, and active land management. They create an imperative for a new direction in expectations for federal, state, tribal, and local wildland fire protection agencies

and organizations to address our nation's wildland fire problems in a more efficient way. An increased level of collaboration has developed among stakeholders that will carry into the implementation stage.

This report will summarize the work done in the Western region during Phase III of the Cohesive Strategy. Decisions from Phase I and Phase II will be briefly described in this report. More information on Phases II and I can be found on the website, www.forestsandrangelands.gov, including all the Phase I and Phase II reports and foundational national documents.

Three Phases of the Cohesive Strategy

The Cohesive Strategy has been developed in three phases. In Phase I, stakeholders met to develop national goals and performance measures, and agree upon the guiding principles of the Cohesive Strategy. Forums were held throughout the country to learn the values, objectives, perceived barriers and desired actions of the stakeholders. Phase I also created a framework under which the three regions would create individual assessments and strategies tailored to their unique, regional needs. In Phase II, diverse groups of stakeholders representing each of the three regions met independently, identifying regional challenges and opportunities as well as key priorities. They agreed upon regional goals, which for the most part are the same as the national goals. The regions focused on how the processes of wildland fire, or the absence of fire, affect their values-at-risk. In Phase II, the Western region articulated its broad objectives and actions required to achieve those objectives. The size, scope, amount of federal land, and diversity of the landscapes in the West were identified as key components that make the West unique. Immediate opportunities for success were identified. Phase III serves as the conclusion of the planning period of the Cohesive Strategy, during which the scientific analysis and risk assessment are added to the goals and objectives. In this phase, alternatives for emphasis and action plans will be developed as we approach the implementation phase.

Core Values and Vision for the Future

The Cohesive Strategy is built on several principles and values, including engaging stakeholders, managers, and scientists; using the best available science, knowledge, and experience; and emphasizing partnerships and collaboration. The Cohesive Strategy sets out a vision and actions for the future of wildland fire management.

The vision for the next century is to: "Safely and effectively extinguish fire when needed; use fire where allowable; manage our natural resources; and as a nation, live with wildland fire."

Guiding Principles

The following guiding principles were crafted through discussions with federal, state, tribal, and local governmental and non-governmental organizational representatives in Phase I. Stakeholder input received during Phase I forums was used in developing the guiding principles, which are an overarching set of principles that apply to all stakeholders in the wildland fire management community. The guiding principles apply to the different elements of the strategy: resilient landscapes, fire-adapted communities, and wildfire response. These guiding principles and core values were developed at the national level and were also adopted by the three regions as the regional guiding principles:

- Reducing risk to firefighters and the public is the first priority in every fire management activity.
- Sound risk management is the foundation for all management activities.
- Actively manage the land to make it more resilient to disturbance, in accordance with management objectives.
- Improve and sustain both community and individual responsibilities to prepare for, respond to and recover from wildfire through capacity-building activities.
- Rigorous wildfire prevention programs are supported across all jurisdictions.
- Wildland fire, as an essential ecological process and natural change agent, may be incorporated into the planning process and wildfire response.

- Fire management decisions are based on the best available science, knowledge, and experience, and used to evaluate risk versus gain.
- Federal, local, state, and tribal governments support one another with wildfire response. They engage in collaborative planning and the decision-making processes that take into account all lands and recognize the interdependence and statutory responsibilities among jurisdictions.
- Where land and resource management objectives differ, prudent and safe actions must be taken through collaborative fire planning and suppression response to keep unwanted wildfires from spreading to adjacent jurisdictions.
- Safe, aggressive initial attack is often the best suppression strategy to keep unwanted wildfires small and cost down.
- Wildland fire management programs and activities are economically viable and commensurate with values to be protected, land and resource management objectives, and social and environmental quality consideration.

The Three National Goals

Three factors were identified as the primary focus areas for the Cohesive Strategy. They are: restoring and maintaining resilient landscapes, creating fire adapted communities, and responding to wildfires. Flowing from the guiding principles and core values, and focusing on the three factors, three national goals were adopted in Phase I. The three national goals are:

- Restore and Maintain Landscapes: Landscapes across all jurisdictions are resilient to fire-related disturbances in accordance with management objectives.
- Fire-Adapted Communities: Human populations and infrastructure can withstand a wildfire without loss of life and property.
- Wildfire Response: All jurisdictions participate in making and implementing safe, effective, efficient risk-based wildfire management decisions.

In Phase II of the Cohesive Strategy, each of the regions adopted these goals and used them to define objectives, actions, and preliminary alternatives for implementation.

Stakeholder Engagement

Stakeholder involvement forms the foundation of the National Cohesive Wildland Fire Management Strategy. The Western Regional Strategy Committee has worked toward inclusiveness and transparency to further understanding and involvement among shared interests. Stakeholder input received during forums and comment periods has outlined the objectives, values, barriers and actions to address wildland fire management issues in the 17 Western states that form the Western Region. Additionally, stakeholder input was used to create the national and regional guiding principles and areas of concern for the development of the Phase II assessment. In the future, it is expected public comment will continue to shape the direction of the strategy in the West. A complete description of outreach and comments can be found in Appendices 5 and 6 of this report.

The public involvement process used to plan fuels management projects varies greatly among federal, state, tribal and local lands, affecting each agency's ability to implement on-the-ground treatments in a timely manner. State, local and tribal leadership is important in land use issues for most of the private land in the West as it affects the extent and growth of the WUI, adoption of fire-adapted communities and building codes, development and concurrence of Community Wildfire Protection Plans (CWPPs), local volunteer and professional response to fire and all-risk incidents, support of collaborative efforts, and the viability of fuel reduction and larger landscape restoration projects. Engaging elected officials at multiple levels in critical to success.

Collaboration Focus of the Cohesive Strategy

The foundation of the Cohesive Strategy is collaboration. The Western Governors' Association Forest Health Advisory Committee, found that landscape-scale forest restoration must be supported by meaningful, ongoing collaboration that serves to accelerate the restoration process in a socially, ecologically

and economically viable fashion. The more inclusive the group and the greater the diversity of interests involved, the more likely it is to be representative of the community as a whole and to find broadly acceptable, mutually agreeable solutions. Such collaboration can help identify areas of the greatest need, focus treatments for maximum benefit, increase participation in management decisions, and provide for more opportunities to reach agreement on management practices. Collaborators should define restoration of forest health for their area. This will help identify a "zone of agreement" that will avoid the gridlock challenging many public lands management initiatives. The Western Region's strategy is in agreement with the Western Governors' Association. Landscape treatments should be emphasized in areas where existing collaborative groups have agreed in principle on management objectives and areas for treatment. New collaborative groups should be encouraged and facilitated for future involvement in active management of the landscape.

Phase III is not the End but a Beginning

The publication of the Phase III report is not the end of the Cohesive Strategy process. Immediately following the release of this report, the WRSC will begin developing an action plan with stakeholder involvement to be completed in early 2013. Implementation of the strategy by the diverse partners that have been involved in its development will continue in the decisions that are made, informed by a scientific method, to effectively prepare for, utilize and respond to wildland fire.

Phase III of the Cohesive Strategy represents the first time that datasets from the various land and fire management agencies, NGO's, and the private sector have been brought together to create one tool that can be employed to identify key factors, issues and risks that affect wildland fire management across the nation. This robust new tool for landscape, social and fire analysis will continue to be used into the future.

The scientific model will continue to be refined and a trade-off analysis process will be developed at the national level. This will be contained in the National Risk Analysis Report to be finished in 2013, and a National Action Plan will describe actions for implementation of the Cohesive Strategy at the national level, and will be completed before the end of 2013.

These developments may have some impact on the regional analysis and the action plan in the future; updating will be a continuous process as new information is received by the WRSC.

Data and Methods for Exploring Opportunities to Reduce Risk

Introduction

Wildland fire is a complex issue that involves multiple interacting factors spanning the natural, human, and built environments. During Phase II of the Cohesive Strategy, the National Science Analysis Team (NSAT) examined various aspects of wildland fire and developed conceptual models specific to each component. The purpose of these models was to display the interactions and relationships among factors that may influence risk, such as the relationship between fuel treatments and the extent and intensity of wildfire. The NSAT also identified various data sets that might be used in Phase III to build analytical models consistent with the concepts articulated in Phase II. Building on these efforts, Phase III has involved an extensive effort to collect data necessary to quantify relationships and provide the ability to rigorously examine wildland fire and risk.

The types of data collected can be broadly categorized into five general types: biophysical, socioeconomic, land-use and ownership, wildfire frequency and extent, and incident response. Biophysical variables include physical measures such as precipitation, temperature, and terrain. They also include characteristics of vegetation that contribute to wildfire behavior. Socioeconomic variables describe the demographic and economic characteristics of populations and communities within each county, and also describe the distribution of homes within the wildland-urban interface. Land-use and ownership describes the mixture of public and private lands and also helps quantify the extent to which lands might be suitable for active management, e.g., by highlighting areas that historically supported timber harvest.

Variables describing wildfire frequency and extent have been gathered from various reporting systems that have been put in place by federal, state, and local fire departments (See Appendix 4). They also include data from independent monitoring systems that track wildfire using satellites and other remote devices. Finally, they include a series of modeled products from governmental and private entities. Similarly, incident response information has been gathered from many of the same reporting systems. These variables track that responded to wildfire, how long they took to arrive on site, and how long was required before the fire was contained. Information on injuries and casualties can also be found in these same reporting systems. All of the variables available for use in the Phase III analysis are listed in Appendix 4.

While the data sets included in this analysis represent the most comprehensive national wildland fire related information assembled at the county level to date, each individual data set has recognized shortcomings. Recommendations from the analysis include prioritizing data gaps and further analysis. Each layer of information comes from an organization that has collected and maintains the data. Improvements in the base data sets would involve action by the organization that is the custodian of the data.

Before data were used in analysis, three additional steps were accomplished. The first step was one of quality control to eliminate obvious errors. The second step involved compiling, reformatting, or summarizing data to fit within a common sampling frame—the county including processing higher resolution data into county level summaries and normalizing for comparative purposes. The third step in data preparation involved filtering and consolidation using statistical techniques – reducing the total number of variables considered by nearly two thirds.

Modeling

Various analytical models were constructed for the primary purpose of relating causal or contributing factors to variables, which collectively index levels of risk. Many of the analytical models used in our analysis were constructed using Bayesian networks. Bayesian networks are decision analysis tools that use conditional probabilities to link variables together and express the degree of relationship between them.

Five basic models or templates were created for use in the Western analysis to explore opportunities for reducing risk.

- Ignition Model - focused on understanding where human-caused wildfire ignitions occurred and where they might be reduced through targeted actions at preventing either accidental or intentional ignitions alone or in combination.
- Fire, Fuels, and Homes—explored the intersection of homes and wildfire and included variables that might suggest where either mechanical treatments and/or prescribed fire might be productively employed to alter the composition of surface fuels and affect wildfire behavior.
- Prescribed Fire and Ecological Resiliency—focused more on the potential application of prescribed fire in areas removed from human communities where the primary goal might be to restore a fire regime more consistent with historical conditions.
- Fire Adapted Communities – used information about current programs to suggest the extent to which evidence of local actions are tied to socioeconomic factors as well as to factors more directly indicative of risk to human communities from wildfire.
- Incident Response Capacity and Workload – used information about the relative contribution of federal, state, and local departments to incident response and factors contributing to variation in response metrics such as arrival and containment time and fire size.

These templates and associated data were customized for the Western analysis. Through a series of interaction with the Western RSC and technical team a series of summary tables, graphs, and maps were developed that highlighted findings relevant to objectives and goals articulated by each region. Many of these summary products and maps have been incorporated in the Western report. The data and models create a rich opportunity to further examine options for reducing risk beyond the work summarized in this report. The variables and data sets will be important in the development of the National Risk Analysis and the trade-off analysis.

Data Gaps

The extensive data assembled for the Cohesive Strategy process revealed relationships among factors that influence risk but also revealed data gaps. This section addresses incomplete, inaccurate, and missing information. The all lands approach revealed that some jurisdictions maintain data that is not available on other jurisdictions, that some data elements are inconsistently reported, and some data elements are not required for each reported incident.

No effort is made here to prioritize the data gaps by any specific criteria. In some instances there are efforts underway to remedy the recognized gaps while in other instances no current efforts are being made to address them. The recognized data gaps include:

- No consistent record of standing fuels from previously burned areas
- Limited spatial information on beetle kill areas across all ownerships
- Inconsistent and missing information on ignitions and fire across all ownerships – some jurisdictions have substantial records but when all jurisdictions are considered there are inconsistencies in reporting spatial, temporal, and fire characteristics
- Cost and spatial information on investments across all jurisdictions is inconsistently available – fuels treatments, mitigation actions, prevention efforts, response resources, and assets available for suppression
- Spatial information on unprotected lands and spatial information on protection assignments spatially
- Fuels treatment effectiveness monitoring data
- Litigation on treatment proposals
- Specifics on use of Categorical Exclusions and Environmental Assessments
- Specific communities that have adopted ordinances in response to fire risk and specific communities that have prepared and are implementing CWPPs
- The number, location, and size of fires that provide resource benefits
- Location and number of homes and structures burned in wildfire
- Spatial information on smoke extent, duration, and drift
- Specific watershed conditions with respect to resiliency
- Spatial information on high value areas and the extent fire influences values
- Across all ownerships – response capacity and resources – numbers and costs
- A lack of information on fuels, fire occurrence, values at risk, response, preparedness, community wildfire protection activities, and prevention activities in Alaska and the Pacific Islands.

Some information is important from a monitoring perspective to understand how risk changes through time and under varying management activities while other information is important to understand fundamental values at risk. The Cohesive Strategy process has been valuable in recognizing the importance of information across all ownerships and how inconsistencies complicate the ability to better inform decision-making at all levels.

The Risk Analysis

Wildland Fire is an Important Western Issue

Fire is a natural process and a mechanism for biological renewal across forest and rangeland ecosystems. In the Western United States, a century of widespread fire exclusion and the more recent severe reduction of active forest management, have resulted in a build-up of surface fuels (downed wood, litter and duff) and the overstocking of forests with trees and ladder fuels. Those conditions, exacerbated by other stressors such as drought; insects and disease; invasive species; and changing climate conditions have led to uncharacteristically large, severe, and costly wildfires that threaten homes, communities, and cultural and resource values, and can cause widespread property and environmental damage. These environmental conditions along with the effects of an expanding wildland urban interface underlie four broad areas of risk: risk to firefighters and civilian safety, ecological risks, social risks, and economic

risks. Air quality, water quality/quantity, sensitive species, natural and cultural resources, as well as human communities and associated values, are all at risk. Ignitions, fuels, insects, disease, terrain, climate change, responder availability, ecological departure, and other factors all contribute to such risk.

Managing wildfires in the West is becoming increasingly complex and consumes the majority of suppression dollars spent nationally. The influence of human community development and particularly, the more recent expansions of the WUI areas, contribute to challenges of wildland fire management and suppression. While significant interagency and interstate efforts have been made over the past decades to facilitate cross-boundary work, important issues regarding risk to communities, fire protection services, the ability to use wildland fire as a management tool, and smoke management and air quality continue to be raised, posing prevention and mitigation problems for the foreseeable future.

Wildland Fire Varies Across the Landscape

Fire behavior differs by region due to the type of vegetative fuels, topography, and climate. Trees, shrubs and grasses (both live and dead) all provide fuel for fires. Wildland fire management varies significantly based on jurisdictional mission, proximity to communities and values to be protected, and the potential for fire to spread onto jurisdictions with different ownerships, missions, and management responsibilities. The WUI includes all places where forests and human communities are next to or intermingled with each other. The WUI is not limited to forested areas. Land areas dominated by grasses and shrubs are also WUI, and may pose significant wildfire risk to neighboring communities. People who live in areas prone to fire need to be aware of the risk and prepare their homes and property for wildland fire events. While many areas have paid or voluntary fire departments, there are also areas of the country, particularly large areas of the West, which are unprotected or under protected from fire.

Landscape Management Can Reduce Wildfire Severity

Wildfire is natural and occurs at fairly regular return intervals that vary across the landscape. For example, historically, some areas have seven year fire return intervals, while others have 100-year return intervals, or longer. When these natural fires are suppressed, it allows more surface fuels to build up between fires, which makes it more difficult and more expensive to suppress the next fire. Suppressing all fires has the inevitable outcome of larger, more dangerous fires in the future. Through active management of our forests and rangelands, reducing fuels by either prescribed fire or mechanical means, the severity of future fires can be reduced. Active management of the landscape reduces the fuel for a wildfire, which reduces flame lengths and fire behavior, which in turn can reduce the potential impact of wildland fire on communities. Reducing the fuels near communities and preparing the area residents' homes to better withstand the inevitable fires through the creation of defensible space and use of fire resistant building materials can allow communities to reduce structural losses and reduce deaths or injuries.

There are vast expanses of federal lands and wilderness areas where access is extremely limited and distances to communities and community values to be protected are great. In these areas, where limited access, travel times, communication difficulties, and other factors simply place firefighters at too much risk, wildland fire management may focus on achieving ecological objectives rather than a suppression response. On these lands, fire may be included intentionally as a natural landscape component and change agent to achieve multiple objectives. There are also large expanses of land that are sparsely populated and have limited wildland fire response capability, frequently resulting in slower response times and escaped initial attack fires. Rugged topography can create natural access difficulties, further impacting response times and options, and in many cases contributing to larger and longer duration wildfires, threatening communities and community values to be protected. These challenges are compounded due to much of the West being arid and semi-arid, with long natural disturbance recovery times that, in some cases exceed one hundred years. The non-full-suppression objectives described above routinely pose challenges in mixed ownership areas and require pre-planning and collaboration to reduce objective and value-based conflicts, including recreation, timber, forage, tourism values and the potential of transferring risk and costs to neighboring landowners.

Addressing the Middle Ground

People of the West are concerned about more than just the physical structure of their communities. In the stakeholder input process, the tribes and local residents made it clear that the "middle ground" or "middle lands" also require protection and management. "Middle lands" are those nearby areas that contribute to the identity, structure, culture, organization, and wellbeing of a community, and are often considered essential to its economic, social, and ecological viability. The middle ground contains many values at risk such as watersheds, viewsheds, evacuation routes, private forests, wildlife habitat, utility corridors, cultural grounds and more. Middle ground areas can be included in CWPPs for prioritization in active management of WUI areas. Tribal members and partners often describe the community as the "home" and the surrounding middle lands as the "homeland". The landscape is an integral part of the community, and the community is part of the landscape. The tribes' knowledge that they have handed down about the country's landscapes and natural resources, along with their ethic of stewardship of the land, are invaluable assets that can be incorporated in the Cohesive Strategy.

The Management Alternatives

This report examines wildland fire-related challenges and identifies opportunities managers at any level can use within the Western region. Three discrete alternatives are delineated. Each of the three alternatives combines important elements to address all three goals. However, each alternative has a single goal, which it emphasizes: resilient landscapes, fire adapted communities, and response to wildfire. The alternatives were developed early in Phase III and considered stakeholder feedback and informed data to address risk in each goal area. The alternatives are not mutually exclusive, and there is no one preferred alternative to be applied across the West. Rather, the emphasized alternatives present investment options that are believed to offer the greatest positive impact. They will need to be balanced to achieve strategic goals and implement effective wildland fire management.

The strategy is designed to be responsive to the specific needs of each geographic area, based on consideration of relevant biophysical, social and economic information at the county level. When local decisions need to be made, a more detailed study of the specific area will necessarily be part of the decision making process.

The appropriate blend of goals and alternatives should be determined locally, depending on the local conditions being addressed. For instance, in some areas, an emphasis on restoring and actively managing landscapes might be the preferred alternative to create the wanted desired future condition, but fire response would still be a necessary element of the area's strategy, as would be work toward creating fire adapted communities. Conversely, other areas might need more emphasis placed on the creation of fire adapted communities. As one thinks and works through the possibilities of different alternatives, options, and actions, it is quickly recognized that greater emphasis needs to be placed on all three goals and the alternatives docked underneath them.

Alternatives neither identify specific implementation actions (i.e. who will do what, where, how, and when), nor specific process actions. However, it is expected that the analysis will inform specific actions the region may wish to pursue. Those specific actions will be developed in the Regional Action Plan to be accomplished in the near future.

Alternative #1: Landscape Resiliency

Alternative #1 emphasizes landscape resiliency and recommends activities that contribute to improvements in forest and rangeland health. This alternative uses active management to accomplish landscape resiliency through a variety of different management tools including mechanical, prescribed fire and other treatments. Much of the work to impact landscape resiliency will occur within the middle lands through active forest, rangeland and fuels management. Treatments in wilderness will occur through wildfires and prescribed fires, while other special land use designations may use a suite of

appropriate options. The outcome of more actively managing the landscapes in the West will have positive benefits for all three goals of the Cohesive Strategy. The middle lands are especially important, when considering the spatial extent of many large wildfires and rapid rates of spread that directly impact fire adapted communities, as well as the adverse impacts on private timber and grazing lands, natural resources, cultural and watershed resources that support these communities. A cohesive strategy must ensure that commitments to collaborative efforts and partnerships that have developed in treating areas outside of the WUI are maintained. Over time this alternative significantly reduces/modifies the impacts of wildfire, the level of required response, and helps to protect fire adapted communities.

Focus areas:

1. **Provides for collaborative fuels and prescribed fire strategies for the restoration and maintenance of resilient forest and rangelands through active management.**
   a. Employ a variety of vegetation management applications and treatments through mechanical treatments, grazing, prescribed fire and cultural fires, natural fires, and any other combination of tools that may be appropriate for a given geographic region or fuel type in the West. Management options and treatments are located to protect values at risk and implemented at a landscape scale, especially in areas with a history of large wildfire occurrence.
   b. Enable land owners/managers to develop and implement more appropriate actions to achieve healthy and resilient forest and rangeland landscapes.
   c. Emphasize vegetation treatment projects with a positive net revenue that will improve vegetative landscapes to the largest extent possible.
   d. Prioritize treatments geographically by existing forest and range conditions and by opportunities to stimulate local and regional economic activity.

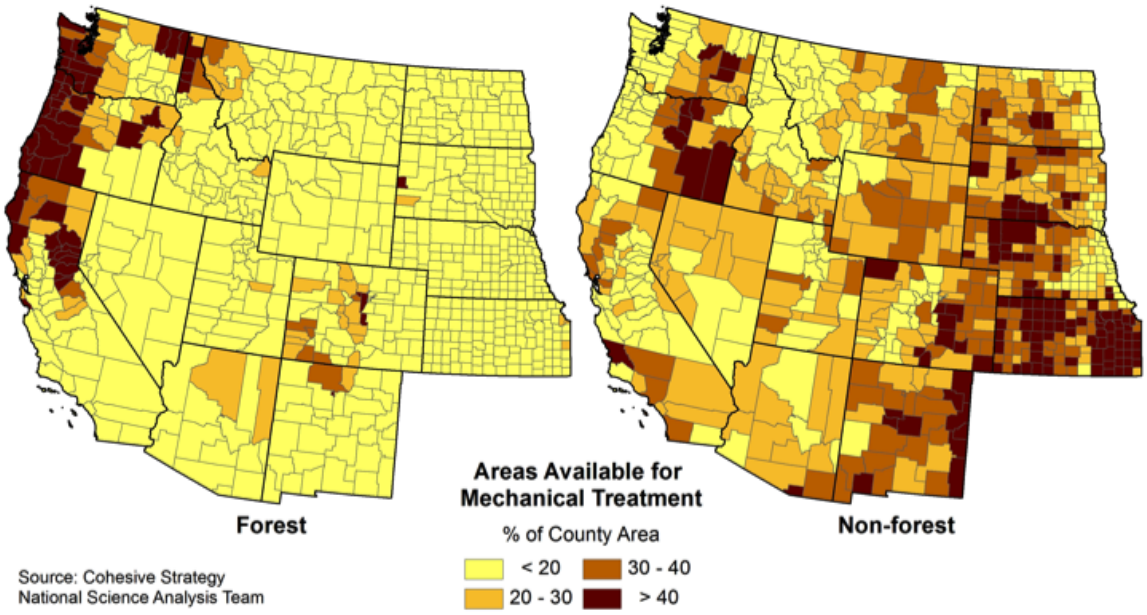


Figure 2. Areas Available for Mechanical Treatment
The percent of county area generally available for mechanical treatment - for forested (left) and non-forested (right) burnable fuels - based on legal or policy restrictions, slope, accessibility and land cover. The map does not reflect the availability of markets or capacity to plan and conduct treatments.

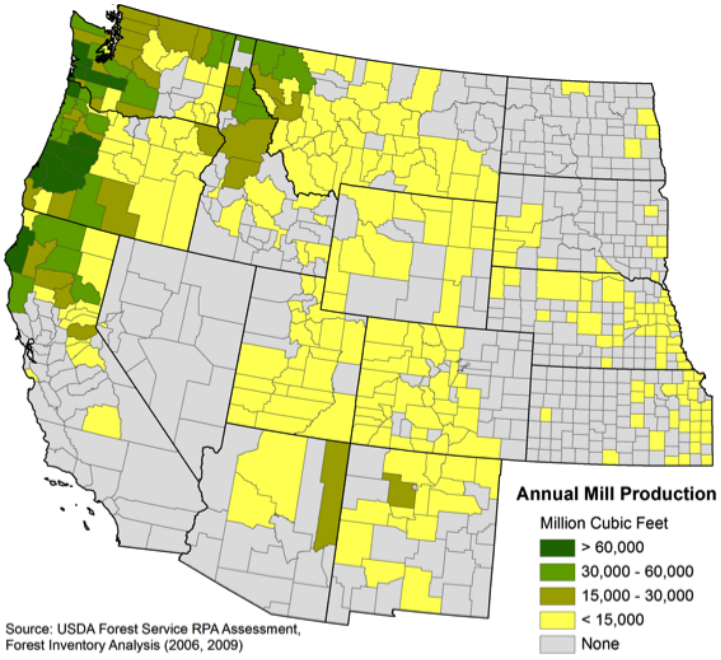


Figure 3. Annual Mill Production
Annual forest products produced by mills.

Mechanical fuels treatment can be used as one tool to protect, maintain, and restore landscapes. Mechanical fuels treatments can also provide side benefits of local employment, and revenues to offset the cost of treatments. Within the West, there are areas with the infrastructure in place and markets for biomass that will facilitate landscape scales treatments. Conversely, there are large portions of the West that lack the infrastructure and biomass markets, which reduces the capability of these areas to conduct mechanical treatments on a large scale. These maps provide a general description of where mechanized treatments could be an option to reduce risks.

e. Utilize prescribed fire where and when appropriate to enhancelandscape restoration and simulate natural disturbance or historic fire regimes.

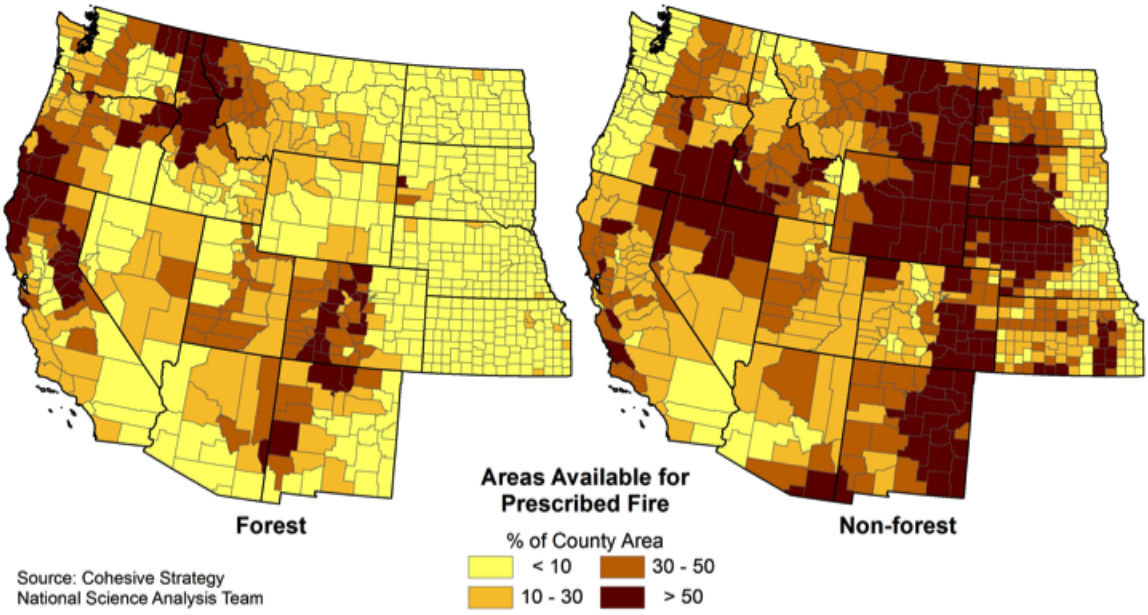


Figure 4. Areas Available for Prescribed Fire
Western counties categorized by the percent of the area within each county that is generally available for prescribed fire that are forested (left) and burnable non-forest (right) based on historic fire regime groups 1-4 and a filter removing urban, agricultural and mixed land use cover types. These do not reflect local restrictions or workforce capacity. There are significant forested areas in the west where prescribed fire potential exists to treat fuels, reduce fire risk, and improve landscape resilience. Prescribed fire opportunities are more likely to exist in the forest and non-forest environments in the highlighted counties.

Prescribed fire treatments can also be used as a tool to protect, maintain, and restore landscapes. Within this focus area, these maps provide a general description of where prescribed fire treatments could be an option to reduce risks.

f. Consider opportunities for wildland fire use for resource benefit and balanced with considerations of values at risk, transference of risk, and aggressive wildland fire suppression.

g. When conditions have experienced significant historical departure, hazardous fuels treatments will often be required within altered fire regimes before appropriate ecological responses can occur under wildfire response strategies to achieve resources objectives.

h. Appropriate landscape restoration and maintenance treatments can preserve or enhance important habitats and diminish threats to these habitats.

2. **Ecological Health- leverage collaborative efforts and actions to focus on lands damaged by severe wildfire, post fire rehabilitation, areas significantly departed from historical conditions, areas of insect and disease infestation and non-native species site invasion.**

a. Vegetation structure, age class, and species diversity is the focus for post-fire rehabilitation of forest and rangeland health and the restoration and maintenance of resilient landscapes.

b. Post fire rehabilitation should consider salvage and fuels management opportunities, road infrastructure opportunities across boundaries, and watershed protection and stabilization.

c. Site rehabilitation activities should focus on areas that are similar to those that have experienced large damaging fires in the past, pose the greatest risk of damaging environmental impacts, and have a track record of successful past rehabilitation efforts.

d. Consider ecological community interactions and strive to balance human needs with ecological function and resilience.

e. For permittees and users impacted by wildland fire, work to mitigate displaced use. Emphasis should be placed on the prioritization of new stewardship contract opportunities lost due to damage.

f. Mitigate cultural impacts through appropriate site, artifact and cultural use protection, restoration or enhancement.

g. Prioritize rehabilitation treatments on areas which have a high probability of success. In assessing rehabilitation efforts in areas of invasive species, caution should be used to prevent spread.

h. Prioritize land where there is a risk of transferring insect, disease and mortality issues to other ownerships.

i. Infestations pose risks to the forests and to the WUI, and require specific treatments; treatment objectives and priorities should be public safety, biological necessity and commerce. Public safety treatments reduce the risk to humans from the effects of the infestation. Biological functions involve vegetation or animal communities threatened by an infestation. Commerce protection includes treatment of an infestation that threatens a transportation system, energy production, water sources, or timber production. Treatments are prescribed, based on these classifications and in conjunction with science.

3. **Increase focus on stakeholder collaborations and the leverage partnerships across all ownerships.**

a. Landscape restoration and maintenance activities should protect, promote and enhance high value resources such as watersheds, forest and rangelands, wildlife habitat, cultural use areas and sites, recreation sites, and community infrastructure.

b. Treatments should be coordinated and planned across ownership boundaries.

c. Engage in collaborative management activities that blend traditional ecological knowledge (TEK) with western science, to restore and maintain historical fire regimes across landscapes.

d. Encourage public and private sector involvement in risk and mitigation activities.

e. Treatment opportunities need to consider smoke management impacts with collaboration amongst all stakeholders, balancing negative impacts from wildfire versus positive outcomes from fuels treatments and prescribed fire.

f. Collaboratively review and update air quality implementation plans where appropriate, to ensure prescribed fire objectives are given a high priority compared to the negative impacts of large

wildfires. Transference of risk from smoke impacts within the natural or historic fire return interval could be addressed through re-ignition capability in natural areas that experience suppressed natural fire.

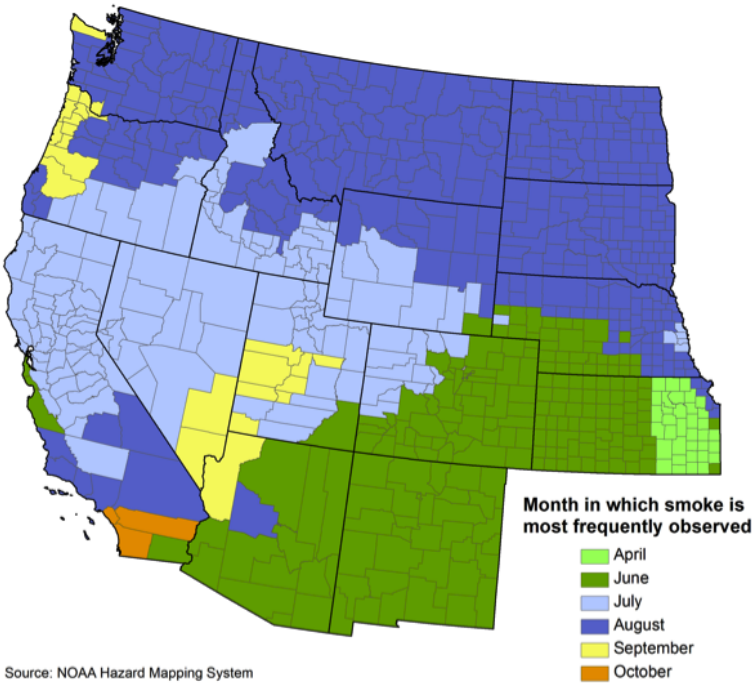


Figure 5. Smoke Plume Seasonality
Western counties categorized by the modal (most frequent) month when smoke originates within, or passes over each county. Summarized from satellite observations.

This map identifies the month in which smoke is most frequently observed, shown by county in the West. Outside of these months opportunities may exist for additional prescribed fire uses with limited smoke impacts. It is interesting to note that no area of the West sees its heaviest smoke concentrations during the month of May.

Resilient Landscapes

Resilient landscapes or ecosystems are forest or rangelands that resist damage and recover quickly from disturbances. Such resilience is related to the natural and historical fire regime in which the disturbance occurs, and the potential need to assist the ecosystem in restoring it to a resilient state. Ecological disturbance can have an impact on the social and economic systems of local communities. In resilient landscapes, the impacts of disturbances can be lessened at a local and regional level through active management. Ecological restoration efforts can have a positive impact on local economies and the social health of communities. Sustaining and restoring landscape resiliency and recognizing the role of wildland fire as a critical ecological process are important goals in the near- and long-term for reducing wildfire hazards and risks. Resilient landscapes, adapted to wildland fire, can protect and enhance important values through management or disturbance.

Factors were identified that contribute to healthy resilient landscapes as part of this analysis. These major factors are; fuels and climate, ecological health, topography and geographical vastness, natural fire starts, high percentage of acres burned and severity, and ownership patterns, uniqueness, smoke impacts, and cultural aspects. These identified key factors all contribute to local and regional risks to watersheds, including issues relating to water quality and quantity, air quality, vegetative health, natural habitats, and economic impacts.

Fuels and Climate

The Surface Fuel Type map shows a spatial representation of fuels, categorized in seven broad surface fuel types, and grouped by proportion of area in each county. Diverse forest and rangeland vegetation types, with mosaics of complex fuel structures, characterize Western fuels. These environments are increasingly departed from historical conditions, and are experiencing declining forest and rangeland health conditions, that are resulting in a cumulative buildup of fuel loadings.

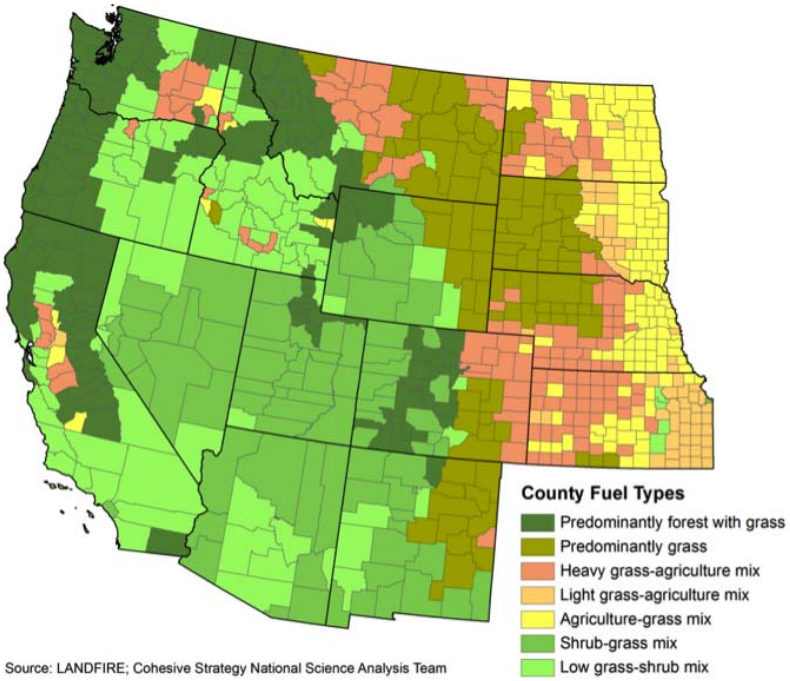


Figure 6. Surface Fuel Type
Source: LANDFIRE and Cohesive Strategy NSAT. Western counties categorized in seven broad surface fuel types, grouped by proportion of area in each county.

The Average Summer Precipitation Map, Figure 7, shows that much of the West tends to be dry and arid. Vegetative environments that occur in relatively warm and dry Western climates are highly conducive to fire ignitions and wildfires, with a high potential for intense fire behavior and spread. Wetter areas that experience high ignition frequencies and large fire occurrence may require additional focus, as growing conditions enable rapid growth with fuels accumulation, which may trigger the need for shorter management intervals.

A century of fire exclusion and lack of fuels management has resulted in many forest types seeing dramatic increases in tree density, with ladder fuels and increasing amounts of surface fuel loading and understory brush, that has led to an increased incidence and spread of uncharacteristically large and severe wildfires. This rapid escalation of severe wildfire behavior has resulted in increased wildfire suppression costs, greater fire severity, significant home and property losses, and increased threats to communities.

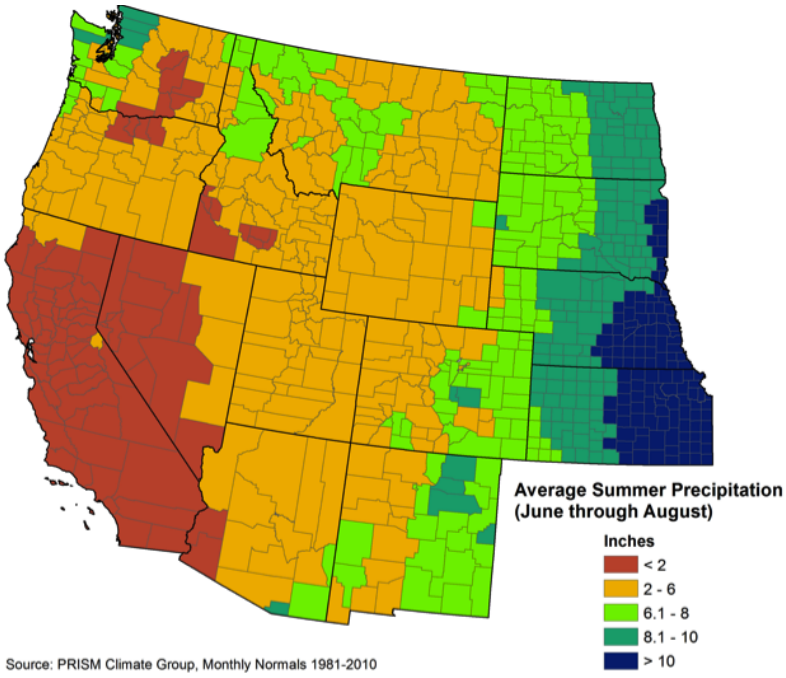


Figure 7. Average Summer Precipitation

Abnormally large and long-duration fires have been prevalent in the past two decades due to a variety of factors, such as fuels accumulations and changing climatic conditions. Stressed forest or

rangeland vegetated landscapes are increasingly susceptible to infestations of insects, pathogens, disease, and invasive exotic species, which in some areas, have left millions of acres of dead, standing trees that experience wildfire with increased frequency, intensity, and severity.

Western climate is generally warm and dry with seasonal and extended drought conditions. Coastal and mountainous areas, especially the Pacific Northwest and Northern Rockies, are identified in Figure 7 as wetter areas with fire regimes that experience lower fire frequency. Yet when fire does occur, it is characterized by large fires with high intensity.

Healthy, functioning ecosystems are vitally important to the ecological, social, and economic values in the West. The West needs landscape scale changes in vegetative structure and fuel loadings to significantly alter wildfire behavior, reduce wildfire losses, and ensure firefighter and public safety, while achieving longer term landscape resiliency. Some challenging aspects of fuels mitigation actions include steepness of terrain, access limitations, changing climate, and reduced budgets for fuels management, and increasing fuels treatment costs. Some of the physical characteristics, such as large inaccessible landscapes, provide challenges and opportunities for the unprecedented use of fire at the scales at which dominant disturbances are occurring.

Ecological Conditions

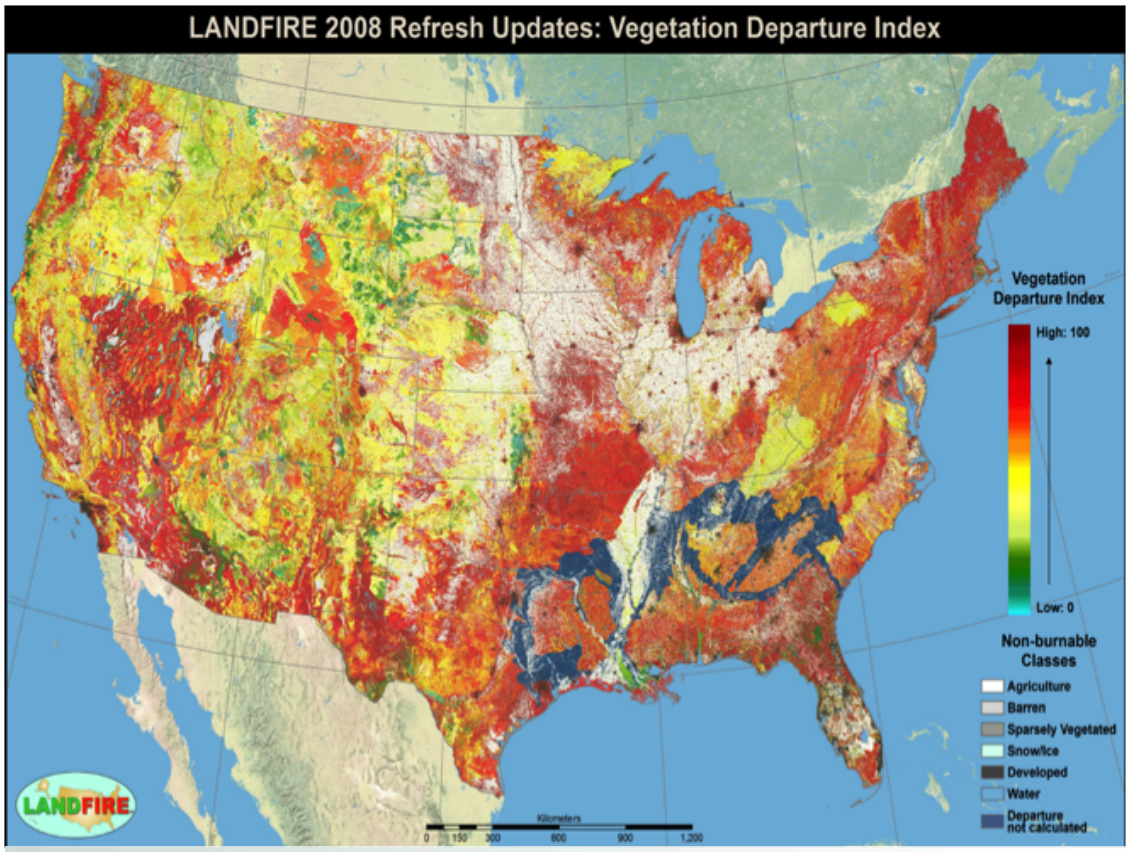


Figure 8. Vegetation Departure Index Map
Source: LANDFIRE Vegetation Departure layer

Western forest and rangeland ecological types are varied and expansive across Western landscapes. Western wildland environments are characterized by diverse forest and rangeland vegetation with mosaics of complex fuel structures with habitats that are increasingly departed from historical conditions. The Vegetation Departure Index Map, Figure 8, depicts the amount current vegetation has departed from simulated historic vegetation reference conditions. This departure results from changes to species composition, structural stage, and canopy closure. Many of these landscapes with high departure are experiencing declining forest and rangeland health conditions and a cumulative buildup of fuel loadings.

Stagnant, overgrown forests with increased insect and disease infestations, and rangeland sites being occupied by invasive species are but a few symptoms of widespread ecological health problems in the West Region. The forest and rangeland health problems in the West are widespread and increasing, affecting wildlife habitat, water quality and long-term soil productivity, while providing conditions for uncharacteristically large, severe, and costly wildfires with increasing threats to human life and property.

Healthy ecosystems include values associated with biodiversity, wildlife habitat, and healthy forest and rangeland landscape conditions. As an important value in the West, healthy ecosystems provide numerous ecological services, support a variety of land uses, offer a desirable backdrop and physical setting for homes and communities, and support a great number of historic, spiritual, and cultural resources. Healthy forests support clean water in the form of runoff to local streams and lakes. Surface water is an important drinking water source across the West. Watersheds important for drinking water are shown in Figure 9.

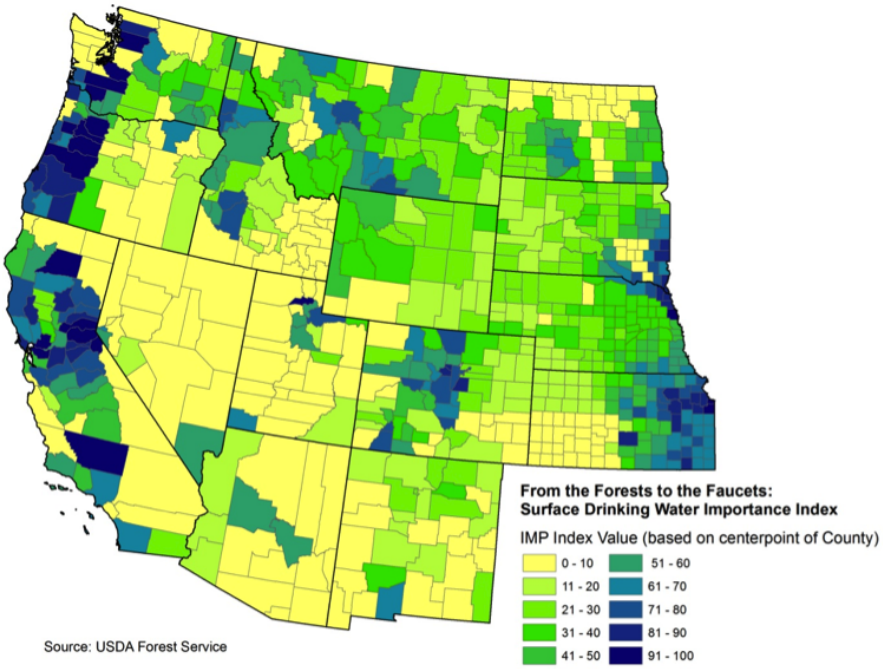


Figure 9. From the Forests to the Faucets: Surface Drinking Water Importance Index, IMP.
Areas with higher (blue) values represent areas most important for surface drinking water.
Source: (USDA Forest Service)

Insects and Diseases

The USDA Forest Service reports that insects and diseases play critical roles in both maintaining balance in healthy functioning forests and causing catastrophic outbreaks and forest loss. These critical roles affect the more that 750 million acres classified as forest land, and millions more acres with trees in urban areas, that provide a wide array of services and commodities, such as timber and other forest products, recreation, wildlife, clean water, energy and jobs. Determining the extent and intensity of insects and diseases through surveys is an important tool to help prioritize actions to be taken by federal agencies, states, and other stakeholders. As occurs with most biological systems, the overall mortality that insects and diseases cause varies from year to year and pest to pest. Figure 10 illustrates how mortality has varied over the past 14 years. In 2011, mountain pine beetle accounted for 59% of areas mapped with excessive forest mortality for the year. (USDA Forest Service, 2012).

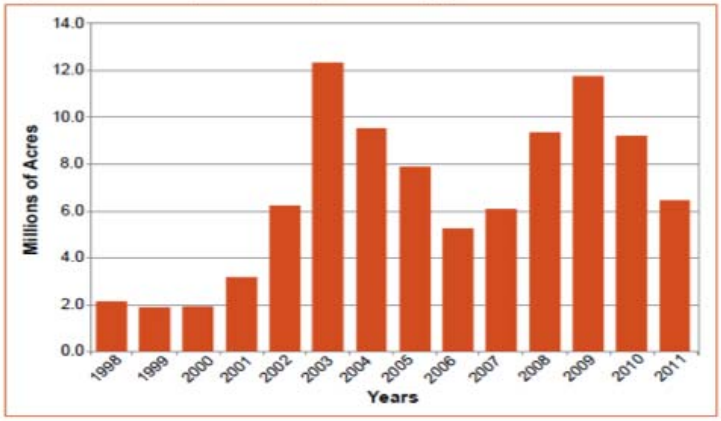


Figure 10. Annual extent of insect and disease forest mortality summarized from the annual survey 1998 to 2011.
Source: Major Forest Insect and Disease Conditions in the United States: 2011, USDA Forest Service.

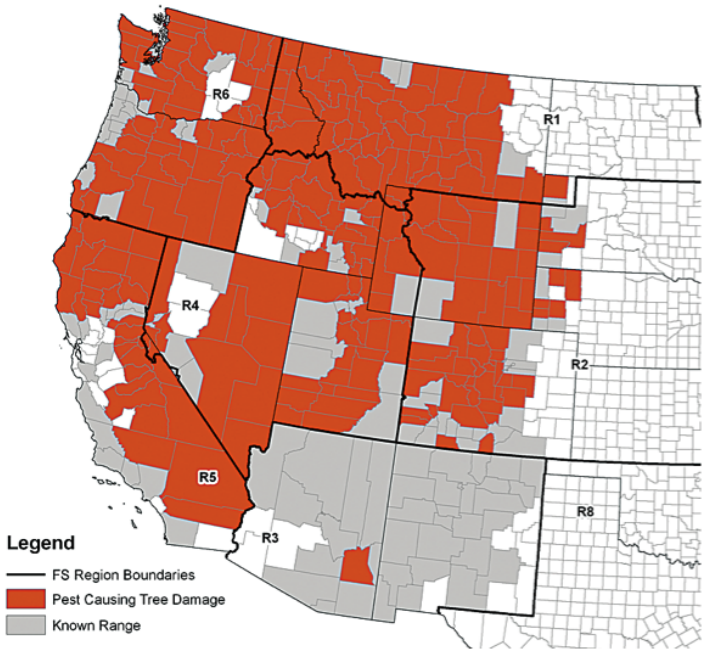


Figure 11. Counties reporting mountain pine beetle in 2011.
Source: USDA Forest Service, 2011.

The extent of the historical departure is compounded by the impact invasive species are having within the Western region. These invasive non-native species, such as cheat grass, red brome, and tamarisk, are having a major impact on Western fire regimes. These exotics are creating ecological deserts where the native species, not adapted to frequent fire in dry ecosystems, are being replaced. The invasive species are also creating fire suppression issues and impacting overall firefighter and public safety. These Western invasive species are having an overarching impact on all three elements of the Cohesive Strategy. This impact from invasive species is unlike the other two regions, especially when the vast spatial extent of the infestations is considered.

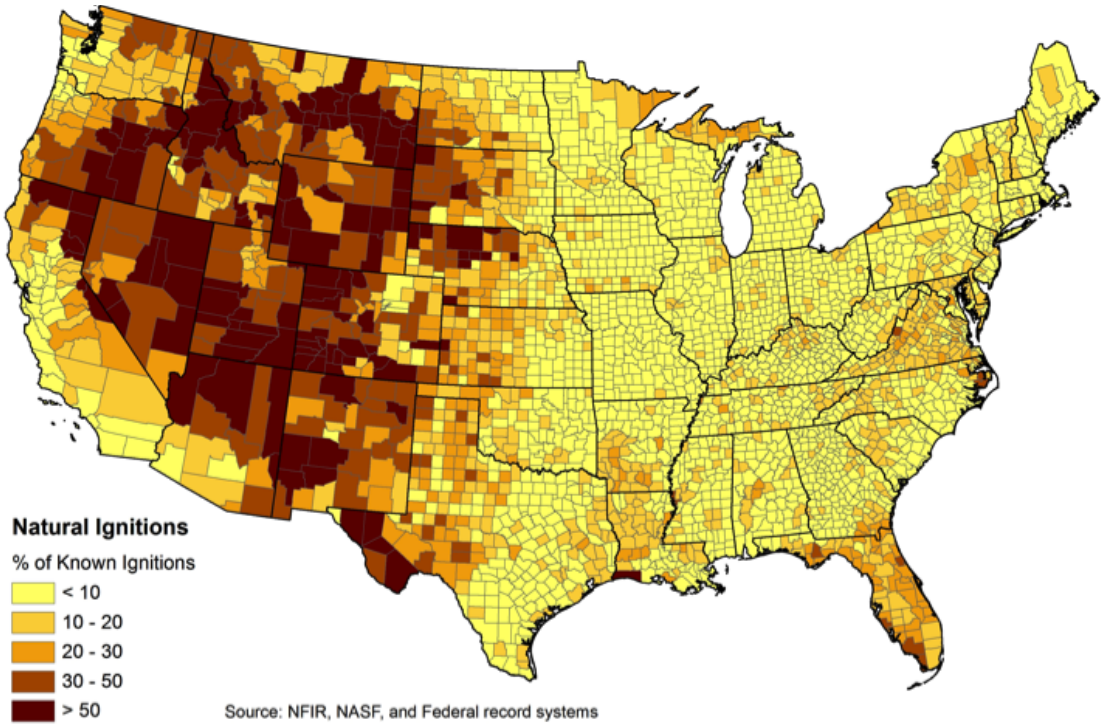


Figure 12. Percent of known fire causes from natural ignitions including lightning.
Source: Combined local reports (NFIRS, NSAF, Federal Record System).

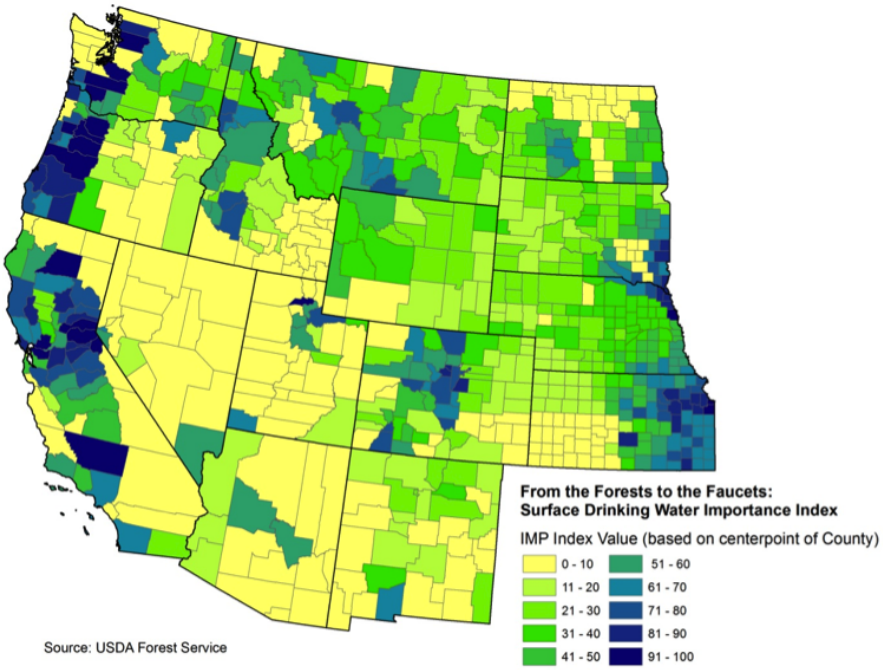


Figure 13. Western counties categorized by the percent of county area with slopes exceeding 15 percent.

Natural ignitions or lightning ignitions are a key contributor to fire issues. For the Western region, lightning ignitions pose additional barriers to suppression in that they often occur in events, causing multiple starts that can quickly exhaust the initial attack capability of a geographic area. In addition, lightning ignitions frequently occur in steep terrain with little to no access, which limits the ability of initial attack suppression resources to suppress the fire. The Natural Ignitions Map, figure 12, indicates that lightning ignitions are not confined to a specific geographic, but occur throughout most of the West.

Lightning ignitions are also a potential solution to the wildland fire issues in the West. The potential solution comes from creating opportunities for beneficial fires where conditions are right.

The following table displays sources of ignition and number of acres burned, nationally and within the Western region. It is interesting to note that in the Western Region, approximately two thirds of all ignitions are human caused, and lightning causes one third. Yet 71% of the acres burned are from lightning caused fires, and 28% are from human caused fires.

Table 1. A Decade of Fire Causes and Number of Acres Burned in the West

Total NIFC National 2001-2011	Number of Fires or Acres	Percentage burned per fire	Average Acres
Total Human-caused fires	717,527	85.5%	
Total lightning	121,849	14.5%	
Human-caused Acres	29,251,317	39.6%	41
Lightning AC	44,670,701	60.4%	367
Fires cause and acres in the Western Regional Strategy Committee area.			
Total Human caused fires	184946	63.7%	
Total lightning	105495	36.3%	
Human caused Acres	16,182,719	28.1%	87
Lightning Acres	41,319,501	71.9%	392

- http://www.nifc.gov/fireInfo/fireInfo_stats_lightng.html
- The NIFC lightning and human caused fires and acres data located at http://www.nifc.gov/fireInfo/fireInfo_stats_lightng.html is cumulative including the years 2001 to 2011.

Many areas of the West are subject to moderate to high burn probability in any given fire season. Burn probability is estimated using simulation and represents the likelihood of an area burning during large wildland fires. Burn probability can be relatively high in areas with large fires, even though ignition probability is low. In the Mean Burn Probability Map, figure 14, the counties are categorized as high, moderate, or low average burn probability. Fire was simulated with FSIM at 270 meter resolution with burn probability averaged across all the pixels within a county.

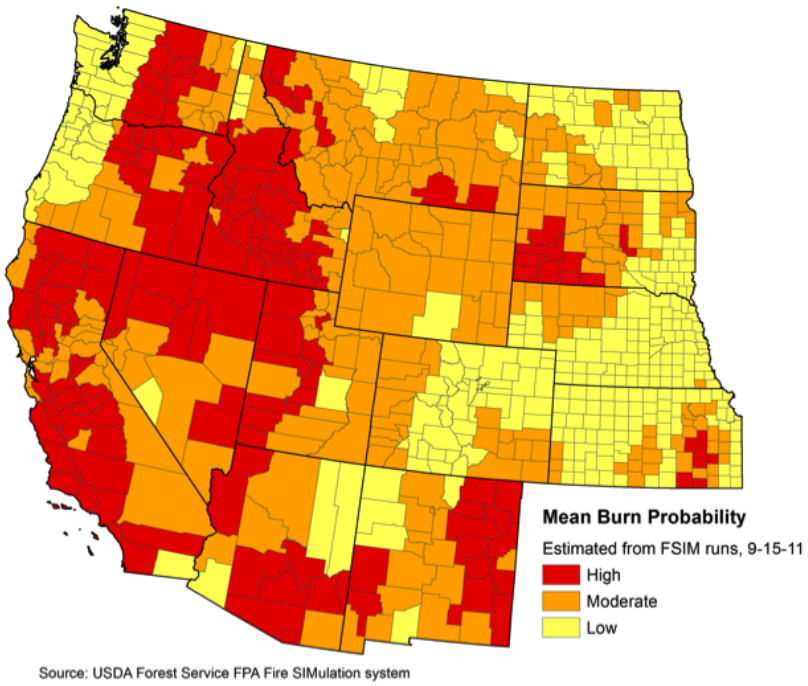


Figure 14. Mean Burn Probability

The magnitude of the large wildfire problem in the West is demonstrated with the Large Wildfire Acres Burned Map, figure 15. This map shows that excluding Florida, almost all the large fires nationally, per year, are in the Western states.

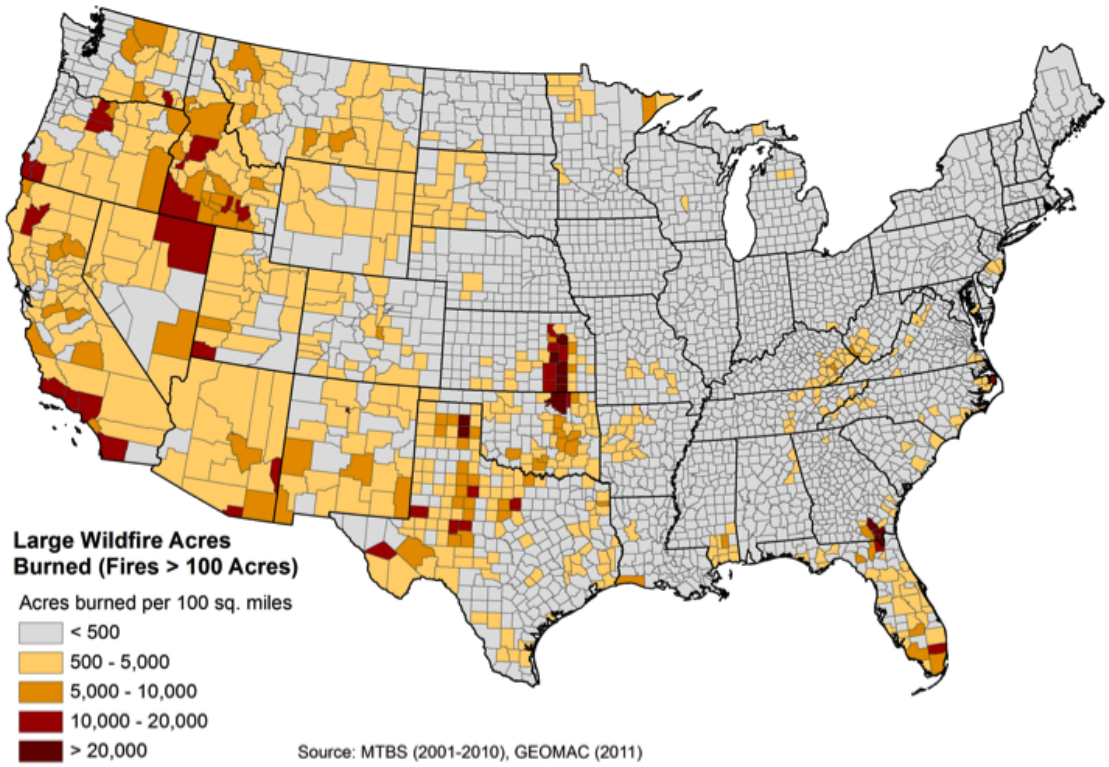


Figure 15. Acres burned per 100 square miles by large fires (300 acres or greater in size) between 2001 and 2011.

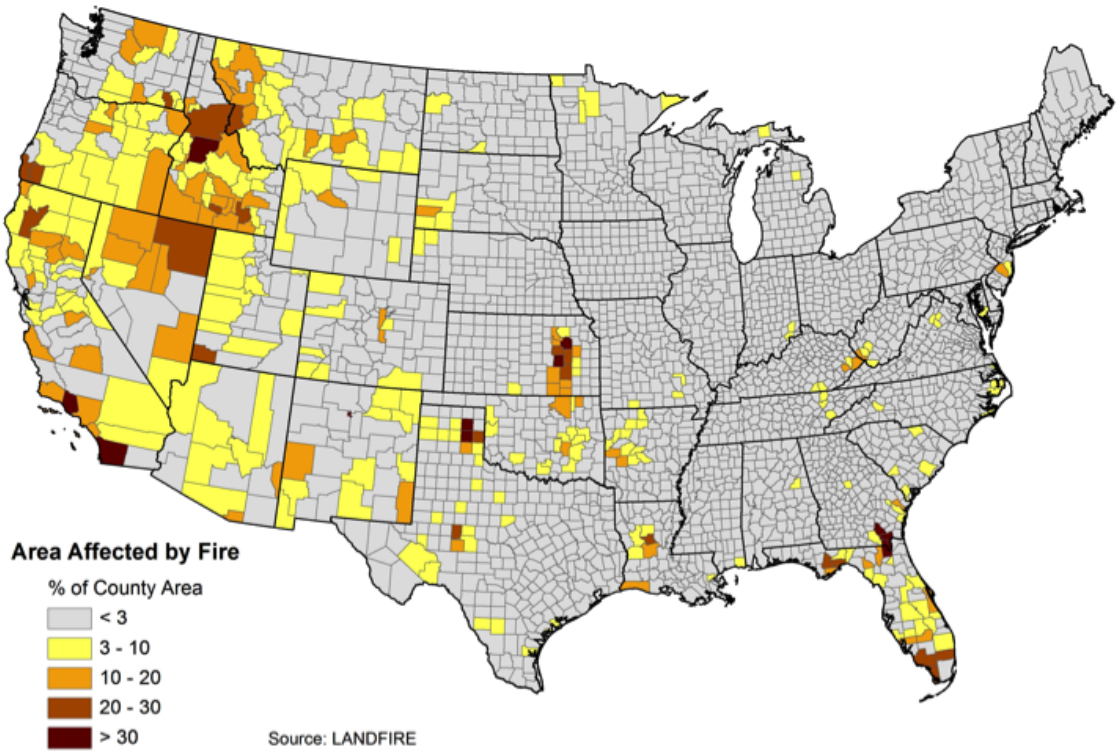


Figure 16. Percent area within each county disturbed by fire shown in eight broad categories.

Figure 16, Area Affected by Fire, is based on LANDFIRE data. The map shows the extent of areas within the West affected by wildland fire as compated the the rest of the United States. The spatial extent of these Western wildfires is much greater than other parts of the United States. This is exemplified with seven out of the nine wildfires studied as part of the Mega-Fire project occurring throughout the Western states (Valley Complex (212,030 acres, Montana 2000), Hayman Fire (137,760 acres, Colorado 2002), Rodeo-Chedeski Fire (468,638 acres, Arizona 2002), Biscuit Fire (499,965 acres, Oregon 2002), Ponil Complex (92,522 acres, New Mexico 2002), and the Boise National Forest portion of the Cascade Complex (302,376 acres, Idaho 2007). Since the study, Arizona, New Mexico, Utah, Colorado, and Idaho have all had new megafires that have exceeded the size of previous state records for the largest fire within the respective state.

Figure 17 shows the number of acres burned each year for the most of the last century in eleven Western states. In the early part of the 20th century, the West experienced numerous large fire seasons highlighted with the fires of 1910. Following World War II until the late 1980's, the extent of wildfire occurrence throughout the West decreased significantly, with an upswing in acres burned throughout the West exceeding five million acres in 2001 and then six million acres burned annually in 2006 and 2007. In the West, 2012 was the worst fire season on record. Western wildfires accounted for 91 percent of total acreage burned in the U.S., with the average-sized western wildfire at least ten times larger than wildfires in the Northeast or Southeast. Table 2 shows the total number of wildfires for each region, average acres burned, and average wildfire size. While figure 17 depicts only eleven Western states, table 2 includes all 17 Western states.

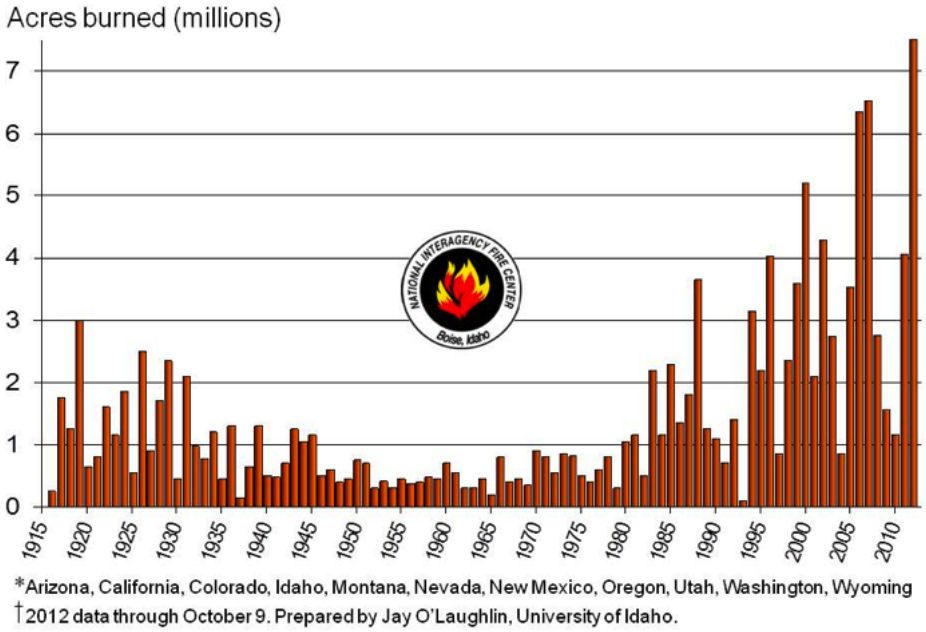


Figure 17. Acres burned in the 11 Western States between 1916 and 2011.

Table 2. U.S. wildfire statistics by region, 2012.

	Northeast	Southeast	West	Total U.S.
Number of wildfires	10,053	16,316	23,203	49,572
Acres burned by wildfires	350,954	444,184	8,050,685	8,845,823
Average wildfire size	35 acres	27 acres	347 acres	178 acres

Not only is the West unique, diverse and vast it also has an ownership pattern that is comprised of predominately federal lands, as compared to other two geographic areas. Public lands comprise more than half the total land area of within the West. In many of the far western states the public ownership is over 60% with Nevada the highest at 83%. When compared to other areas of the country this is a significant component and critical factor when looking at active management and landscape level treatments in the West.

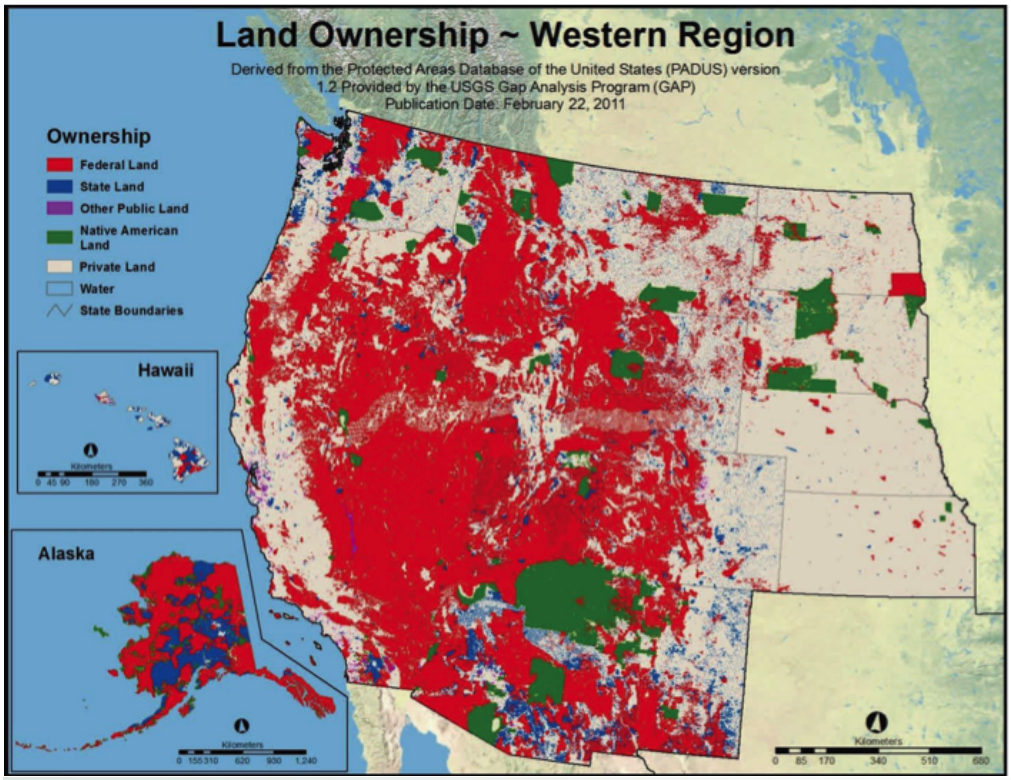


Figure 18. Land ownership in the Western US.

Derived from the Protected Areas Database of the United States (PADUS) version 1.2 provided by the USGS Gap Analysis Program, production date February 22, 2011.

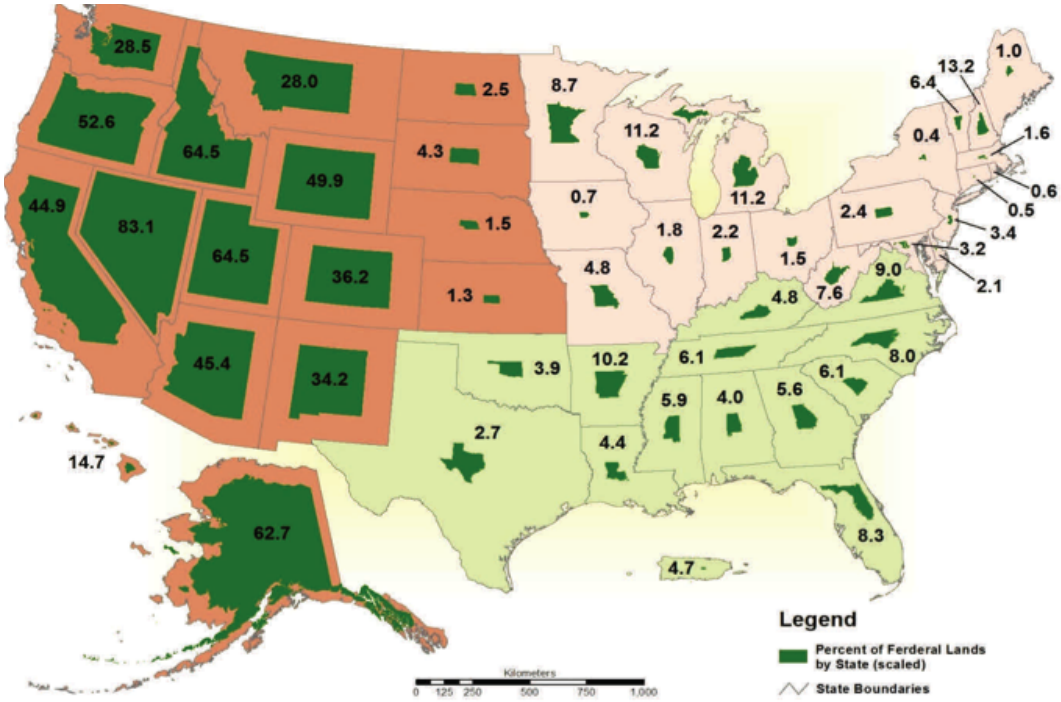


Figure 19. Percentage of each state administered by the federal government.

Source: Dr. Jay O'Laughlin, University of Idaho.

This ownership pattern creates many thousands of miles of common boundaries between federal lands, other lands and state or private forest and rangelands. Often times the different ownerships have differing management and suppression objectives and rules and laws that govern management. The ability to work across borders from state and private lands to federal lands will be critical in creating a cohesive strategy to implement large landscape level treatments. Currently, large areas of public lands are at risk for catastrophic wildfire and have many insect and disease issues, with a significant decline in forest health and resilience. Primarily due to the lack of an integrated active management approach, these lands which comprise over half of the West, are in need of increased active forest and range management – fuels management. This can be accomplished through prescribed fire or natural fires that can have positive benefits in restoring healthy landscapes, while not transferring risk.

Due to the vast ownership of public lands, forest and range health conditions, potential transference of risk, and communities adjacent to public lands, it is very important that a more active management posture is achieved in Goal 1, as a key factor in reducing long term risk.

Native American Cultural History

Native American cultural identity is at risk throughout the West. The territorial map figure 20 shows the historical tribal linguistics patterns across the United States and approximates individual tribal territorial boundaries. Each tribe within the linguistic group delineations is a distinct political community with unique traditional management practices. Practices such as pruning, burning and coppicing at regular intervals once contributed significantly to historic landscape resiliency and community livelihood. Access to abundant and quality hunting, fishing, and gathering areas as well as other traditional, ceremonial, or religious fire use factors have experienced significant decline following fire exclusion. The Traditional Ecological Knowledge (TEK) that is maintained in the West is at risk of loss if incorporation of this knowledge to practice, utilization, and adaptation cannot be revitalized. To mitigate this risk, the focus needs to be at the homeland scale as an intergenerational process within tribal communities that wish to uphold their inherent responsibilities over tribal lands, territory, and resources. The land

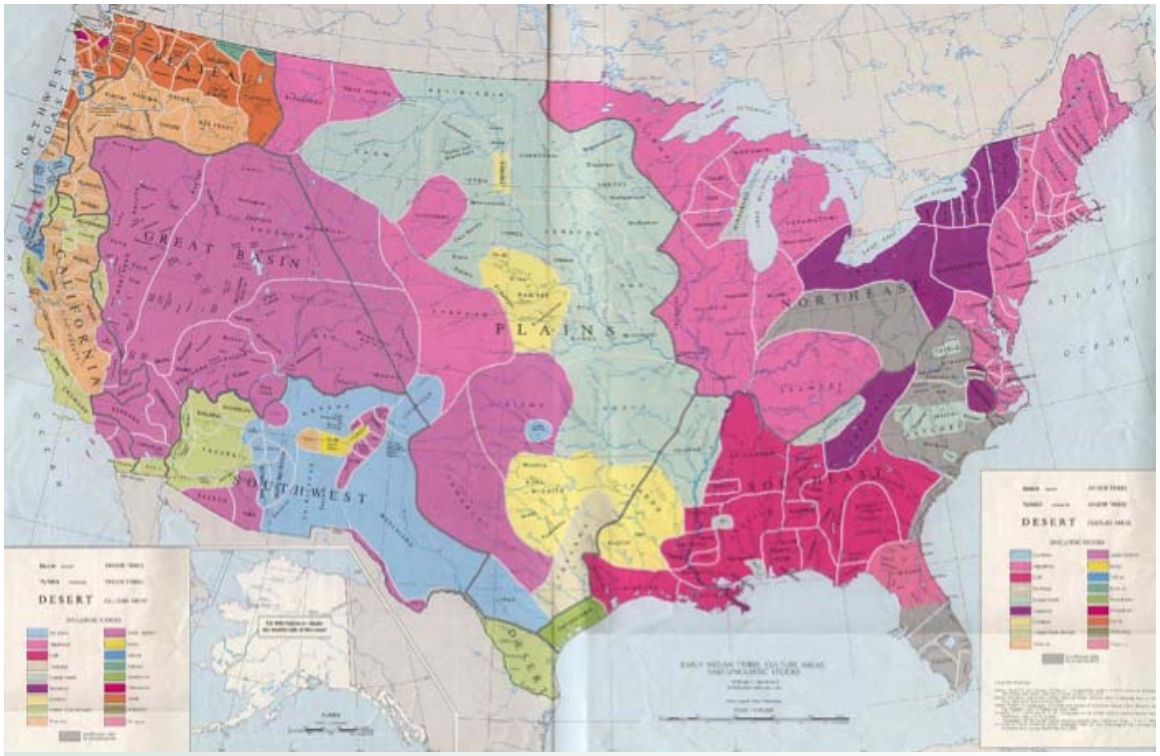
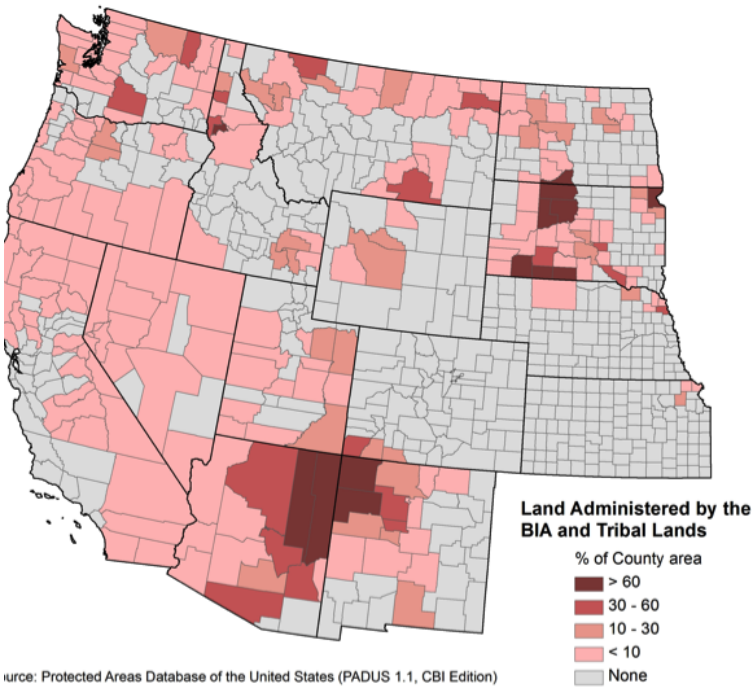


Figure 20. Native American Linguistic map.



administered by the BIA and Tribal Lands Map, figure 21, displays lands administered by the BIA and recognized tribal lands on a percent county basis. The map also shows an approximate location where tribal community TEK based collaborations could revitalize cultural land and fire use practices to restore resilient landscapes and to reduce wildfire risks.

Figure 21. Percent of county land area administered by the BIA and recognized tribal lands.

Smoke Management

Smoke management is a concern throughout the West as concentrations of smoke can cause human health impacts and impair visual quality. High concentrations of smoke from wildfires with high fuels accumulations are both a nuisance and a health hazard to the public. Smoke management is an important consideration in using fire to restore and maintain resilient landscapes. Figure 22 shows the mean annual count of smoke plumes passing over each county. While the entire West is affected by smoke, the northwestern section has the largest number of annual smoke plumes.

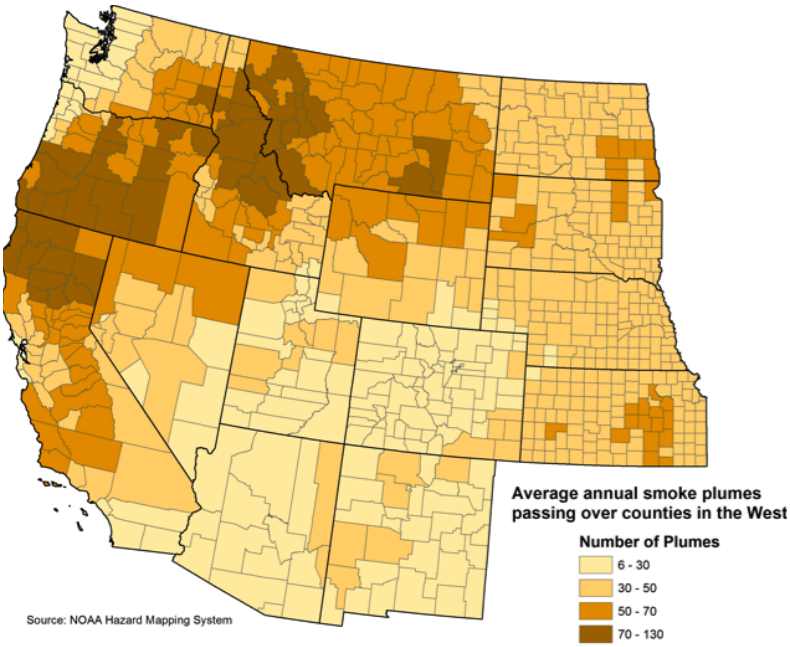


Figure 22. Average annual number of smoke plumes passing over counties.
Source: Summarized from NOAA Hazard Mapping System.

Alternative #2: Fire Adapted Communities

Alternative #2 emphasizes fire-adapted communities in which all stakeholders and affected publics are collaboratively engaged in protecting communities and WUI residents from wildland fire and in fulfilling a stewardship role for their surrounding landscape. A fire adapted community carries out an integrated plan of action, working in cross jurisdictional partnerships to achieve all three goals of the Cohesive Strategy. The degree of adaptation among communities varies, depending upon the relationship of each community to its surrounding landscape and the capacity of its citizens to prepare for and respond to fire. Complete fire adaptation is an ideal state to be worked toward through collaborative efforts within the community. By working together, communities can reduce their risk of catastrophic losses to of life, property, and way of life.

Focus Areas:

1. **Community wildfire and disaster preparedness planning:**
   a. State and local representatives, tribes, community members and stakeholder groups, federal and state land managers, and other concerned interests collaborate in developing and carrying out a CWPP or equivalent.
   b. Community response planning includes establishment of adequate local response capabilities and a joint community wildfire response plan that links CWPPs with federal, tribal, and state fire management and all-hazard plans.
   c. Multi-scale risks are identified, and communities develop or acquire needed risk assessment and decision support tools.
   d. Communities at risk understand their risk, are actively involved in mitigating that risk, and are prepared for wildfire.
   e. Communities use fire adapted community mitigation tools to reduce risk (Firewise, fuel buffers, local protection capacity, Ready-Set-Go, etc.)
   f. Establishment and maintenance of local, cooperative interagency mutual aid, assistance by hire, or compact agreements is emphasized.
   g. A strong program of rural fire assistance funding to increase local fire response capabilities is supported and used effectively.
2. **Strategic reinvestment in wildfire prevention and mitigation programs.**
   a. Identification and prioritization of areas in and around communities, which are at high risk from excess fuels and non-native vegetation.
   b. Mitigation and prevention efforts targeted to protect high risk areas:
      - **In the WUI area** – this includes fuels treatments to create defensible space and make other needed site modifications and improvements around homes and other structures, and to establish and maintain community safety zones, fuel buffers around communities, and emergency evacuation routes. Other key actions include the hardening of structures against fire intrusion and the provision of necessary related infrastructure such as adequate ingress/egress roads, water sources, dry hydrants, etc.
      - **In the middle ground** – This includes treatment of high value middle ground areas necessary for the protection of watersheds, forestlands, wildlife habitat, cultural use areas and sites, utility corridors, evacuation routes, and other high value areas and assets. Appropriate areas for hazardous fuels reduction and the removal of excess or non-native vegetation to create fuel breaks, expand defensible space, and increase landscape resiliency are also treated.
      - **In all areas** – Stakeholders are encouraged to organize and/or participate in collaborative efforts to restore and increase the resiliency of the community and the surrounding landscape. State, private, tribal and federal landowners and managers should facilitate compatible management across boundaries, whenever possible. Priority based funding of collaborative fuel treatment

projects that support the expansion of local partnerships is emphasized. Landowner cooperation and coordination in invasive species control, wildlife habitat management, fire prevention, and response to insect and disease issues is encouraged and assisted.

3. **A coordinated approach to increasing community self-reliance through capacity building.**
   a. Conduct public outreach to provide information to community members, to increase public awareness of wildland fire risk and firesafe practices.
   b. Involve the local people in risk assessment determinations and in carrying out, monitoring, and evaluating the effectiveness of fire prevention and mitigation activities.
   c. Work toward recognition and acceptance by community members of responsibility for their property and life safety in the event of a wildfire.
   d. Educate the public, local officials, and the building community of the value of fire hazard zoning, WUI fire codes, defensible space, and the use of non-combustible building and development practices.
   e. Expand the adoption of preparedness/implementation programs such as:
      - Ready-Set-Go Wildfire Action Plan
      - Firewise Communities/USA
      - Fire Safe Councils
      - Firefree
      - Living with Fire, and similar programs.
   f. Implement programs that include homeowner and private landowner incentives, such as financial and technical assistance for both protection of private property and for improving forest and rangeland health.
4. **Increase community capacity and increase employment and business opportunities in rural communities by implementing landscape resilience and community wildland fire mitigation and protection efforts.**
   a. Opportunities are created in fuels reduction and landscape restoration work and through biomass energy projects, green waste reduction, enhanced recreational uses, and related manufacturing and service businesses.
   b. Communities can enhance economic opportunities by offering targeted education including skills training, and other workforce development services.
   c. Federal stewardship end-result contracts, compacts and/or agreements can be entered into by Tribes, communities, states, and for-profit or non-profit organizations to conduct fuels and restoration activities on nearby BLM or Forest Service lands.

Risk to Fire Adapted Communities

When considering wildfire risk and fire adapted communities, we focus on communities at risk – what can be done to protect them from wildland fire, and what has been done up to this point. Fire has been, and will continue to be, present in the ecosystems of the West. Landscapes near communities, and within the communities themselves, can be modified to reduce the likelihood that damage will occur to communities. In the event of a wildland fire, the community itself becomes fuel for the fire.

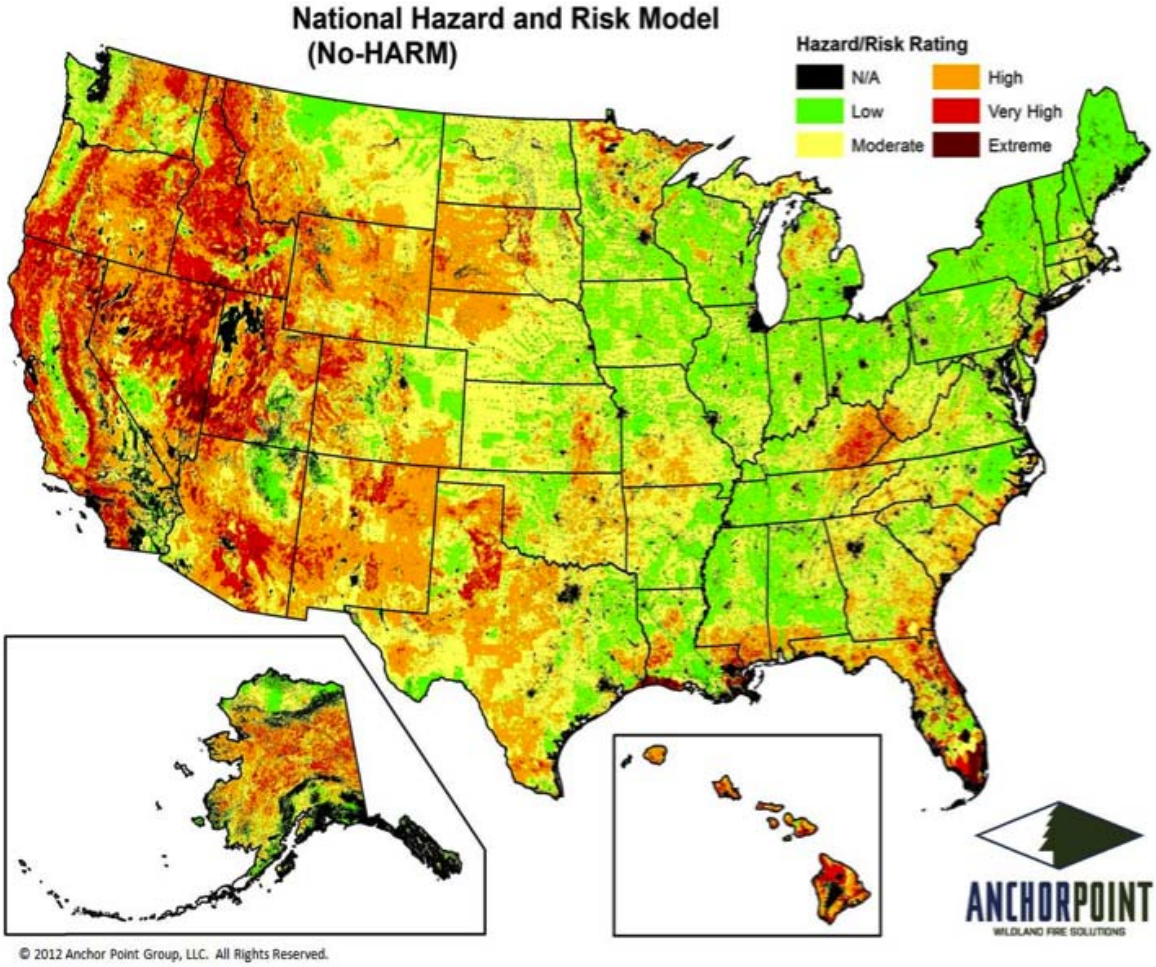


Figure 23. National Hazard and Risk of Wildfire

The No-HARM[1], (National Hazard Risk Model) map, figure 23, is based on models of fire behavior and probability, using information about fuels, weather, topography and historic fire occurrence, to show the areas of highest wildfire risk across the country. The largest areas of high risk are in the Western states. This map was created by identifying the levels of risk at the "fireshed" level of approximately 175 acre units. Communities located in moderate, high, very high and extreme fire risk areas need to become fire adapted.

Fire adapted communities (FACs) are defined as human communities consisting of informed and prepared citizens collaboratively planning and taking action to safely coexist with wildland fire. Fire adaption by communities starts with the ability of the community to prepare their homes and other structures for a wildfire, using known techniques to reduce structural ignitability. Ideally, the structures would be able to withstand a fire without intervention by firefighters, as there are not enough trucks or manpower to protect every structure during a wildfire event. Homeowners need to protect against the threat of fire from both direct flames and burning embers, as most home losses are a result of contact with burning embers, which can often fly miles ahead of a wildfire. People living in fireprone environments need to think about fire safety at all times and prevent ignitions, whenever possible.

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[1] Copyright by AnchorPoint Group, Boulder CO, 2012.

Housing Density in the WUI

County summaries of existing home/housing density and high, very high and extreme fire risk show that many communities, and even cities, across the West are in harm's way due to the relationship of homes to fire-prone areas. WUI within the counties vary from high density to low density, with the highest density areas in southern California and Arizona.

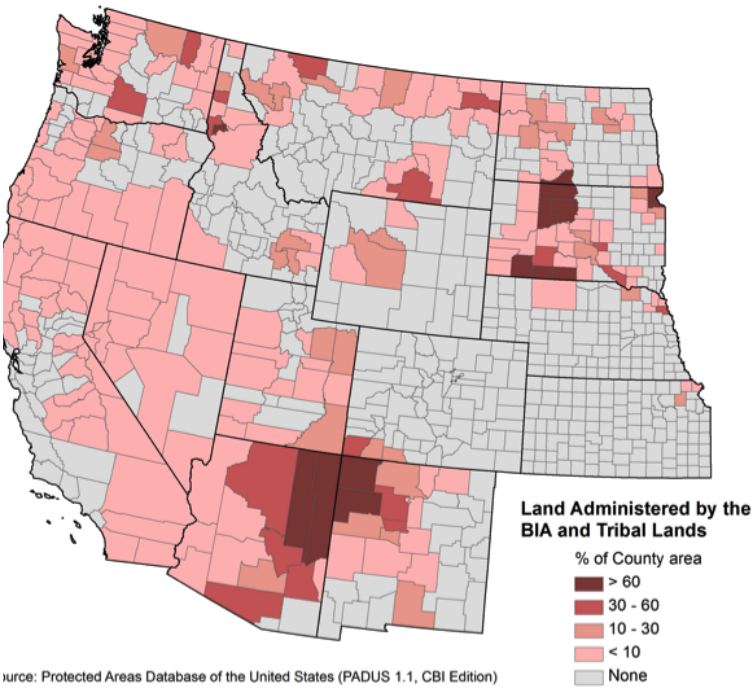


Figure 24. Counties with moderate or higher burn probability and a large percentage of housing units in the WUI.

Despite the slow down in the housing sector in the past few years, the West is still demonstrating strong pressure for residential growth, particularly in WUI areas. The West has many low density, rural communities scattered across the landscape in fireprone environments. The National Association of State Foresters (NASF) has documented 6,796 communities at risk in the Western region. Communities are not visible on the county level maps, since they are considerably smaller than counties. Local assessments will need to be done at the community level to document vulnerabilities and identify areas for mitigation. However, that is beyond the scope of this report.

Smoke Hazards

Smoke from wildfires poses a risk to communities in terms of respiratory health effects on the elderly, the very young, and those with weakened respiratory and immune systems (Noonan, et al 2009). An increased concentration of particulate matter in the air is associated with a large number of health problems including: asthma, COPD, and cardio-vascular disease in people and animals (Pope, 2011). Smoke also causes traffic accidents with subsequent fatalities and injuries. The smoke negatively affects the tourism industry, discouraging summer visitors to Western communities.

Figure 25. Smoke Plume viewed from space.

This low angle September 2012 International Space Station photograph captures smoke from numerous central Idaho wildfires. It was taken over extreme western Montana with a view toward the west-southwest over the Salmon River Mountains and adjacent ranges. Smoke fills the Salmon River valley at the center of the image and to the north (right) the Selway and Lochsa River valleys that have their headwaters in the Bitterroot range (lower right).
[SOURCE: http://earthobservatory.nasa.gov/IOTD/view.php?id-79303&src = eoa-iotd].

Advantaged and Stressed Communities

Some communities have more resources to be able to prepare their homes for wildfire, and some have less and may need assistance. All stakeholders should work with economically stressed communities and the tribes to address hardening homes. Creating defensible space for at-risk populations and firesafe living.

Populated areas contribute to the West's wildfire risk, by adding homes, people, infrastructure, and places of cultural significance to the areas that are threatened. An increasing population with home development in the wildland urban interface/intermix, and increasing potential losses characterize risk.

Census data regarding income and education give us broad indications of where people live who may need assistance in addressing the risks and recovery from wildland fire. Counties with higher than the mean income most likely have some capacity to undertake programs to address their risks and recover if fire occurs. The shaded areas in the Demographic Stress Map, figure 26, show the location of Western counties with apparent disadvantages in terms of socio-economic elements that might indicate they may lack the capacity to undertake programs, without economic or technical support, to address their risks and recover if fire occurs.

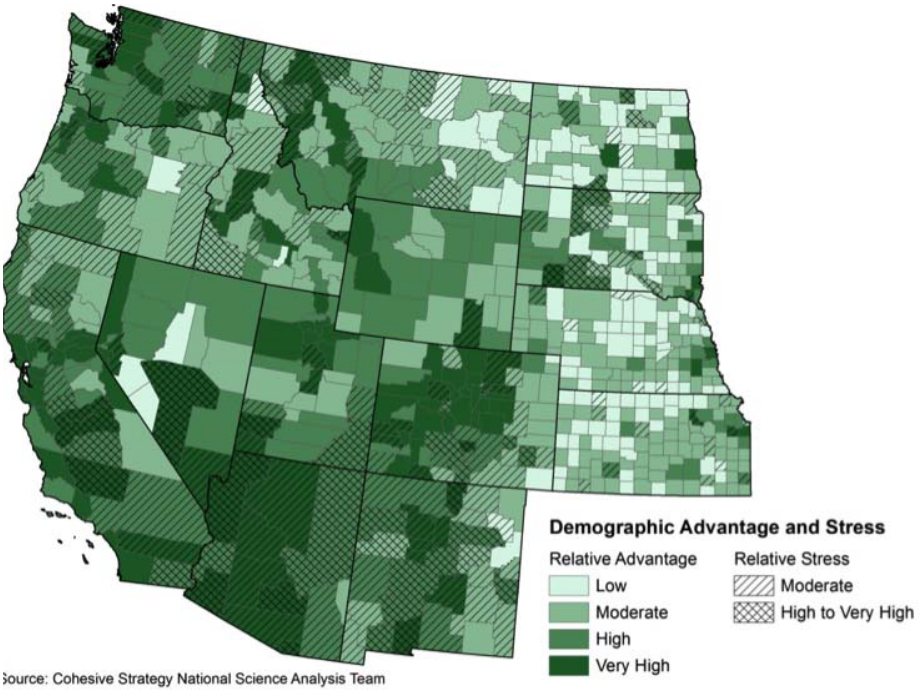


Figure 26. Western counties categorized by socio-economic stress and advantage.

Since the data is shown at the county level, many counties have both people of higher income levels and lower levels. To target stressed communities, we will need to look at a finer scale than at the county level. However, this analysis gives us a general idea of the counties to look at.

Open Space Islands

WUI areas are commonly envisioned as a community within the wildland, or at the edge of the wildland. The occluded WUI consists of wildland within a community. The occluded WUI is created as wildlife habitat, park and open space, a watershed, or perhaps a wildland that was not buildable, within the borders of the community. Occluded WUI presents the same issues of forest resiliency, fire response, and fire adapted community in a smaller, more populated situation. These "open space islands" as they are also called, are native vegetation with all of the management challenges faced in the wildlands, but with the added challenge of being surrounded by homes and development. The resilience of these lands is critical to the local community; the response to these lands expands the requirements of the local fire department and requires them to seek new or expanded assistance agreements. Risks associated with open space islands should be evaluated at the local level. In subdivisions where some lots remain undeveloped, lack of maintenance on the undeveloped lots poses a risk to the nearby homes.

Hazard and Risk at the County Level

The map below is based on the county level No-HARM data. It shows the percentage of land area of each county that is located in areas of high, very high, and extreme wildfire risk. Counties with large percentages of land in the highest risk categories are shown in the darkest shades of red. In this way we show relative risk at the county level. The NO-HARM data is aggregated at the fireshed level, which is significantly finer than the county level information collected for this study. In figure 27 we aggregate the data at the county level to coordinate the No-HARM wildfire risk information with all the other variables in this study. Communities located in counties with a large percentage of high risk lands should be identified for fire adapted community activities.

It should be noted that the county level aggregation, as seen in figure 27, eliminates detail important to the evaluation of hazard and risk at the community level, as presented in the native No-HARM data.

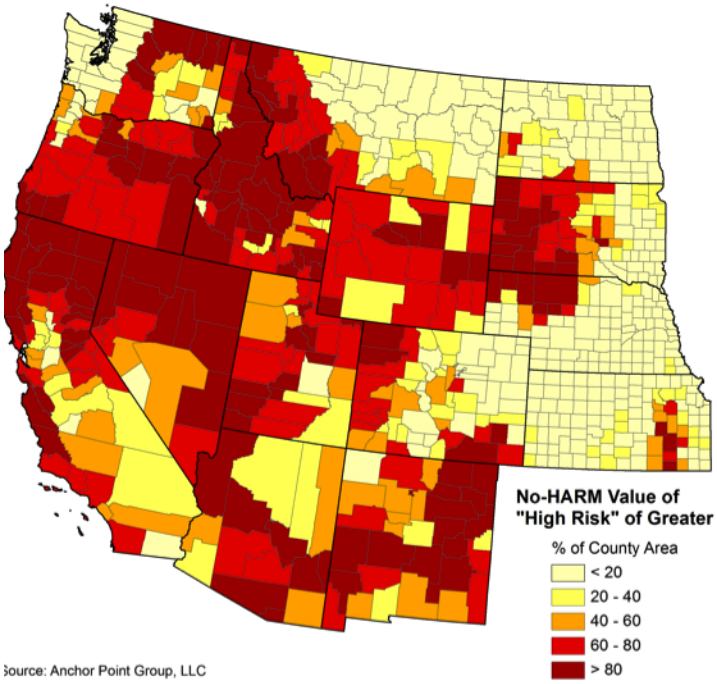


Figure 27. Counties categorized by the percent of county area rated as high-risk or greater by AnchorPoint's No-HARM wildfire risk model.

Social Science and Fire Adapted Communities

A fire adapted community is a knowledgeable and engaged community in which the awareness and actions of residents regarding siting, construction, and/or modification of infrastructure, buildings, and landscaping and appropriate management of the surrounding ecosystem lessens the need for extensive protection actions and enables the community to safely accept fire as a part of the surrounding landscape. The goal is to reduce risk from wildfire in at-risk communities, reduce damage from wildfire when it does occur, and reduce fire suppression and structural protection costs, while also enhancing firefighter or civilian safety.

Community members work together to prepare for wildland fire through fire adapted community activities such as: educating residents about wildfire risk and taking action to mitigate those risks, managing fuels on public and private lands in and around the community, developing and maintaining a firebreak around the community, and designating and protecting evacuation routes, and/or establishing safety zones. Preparing and carrying out a CWPP or equivalent document, becoming a Firewise Communities/USA or Firesafe Council/Chapter community, and participating in the Ready-Set-Go program are three important actions that help a community adapt to fire. Individual homeowners and families prepare for wildland fire by reducing fuels around their homes (creating defensible space), building/retrofitting and maintaining their homes with ignition-resistant building materials, and preparing for evacuation or other emergency efforts.

When a community works together and undertakes mitigation and management activities, the community moves toward a more fire adapted state. The more activities the community engages in, the greater the fire resistance of the community. Studies have shown the synergistic effect of multiple activities to protect homes and communities from wildfire (Renner et al. 2010). A community becomes fire adapted as it takes action to reduce risk. Figure 28 shows a list of actions and programs that an existing community can undertake to become fire adapted, or better suited to the fire prone environment in which it exists.

Figure 28. Elements of a fire adapted community.
Source: US Forest Service.

Community Wildfire Protection Planning

The most important first step in becoming a Fire Adapted Community is the creation of a CWPP. The CWPP brings together a core group of stakeholders within the community to collaboratively craft a plan for reducing the wildland fire risk to the community. Following a risk assessment, which identifies the areas in which the community is vulnerable, they prioritize fuels treatments within and around the community. The stakeholder group educates local homeowners about hardening their homes against fire, and they consider all of the available options, using the best available knowledge, to mitigate the risk the community faces. CWPPs define a WUI boundary for the community, which can include areas of importance to the community, such as watersheds, evacuation routes, recreation areas, wildlife habitat or cultural areas, utility corridors or more. These areas, which lie outside the jurisdictional boundary of a community and have importance to the community, are the middle ground. Since communities have the ability to define their own WUI boundary, the middle ground can be protected and actively managed within the community's WUI boundary. CWPPs have proven to be an effective tool in moving toward accomplishment of all three goals of the Cohesive Strategy.

A CWPP can be a very powerful tool, however, not every CWPP gets implemented. The level of community involvement in CWPP planning is a good indicator of the power of the individual CWPP. A study of three communities that created CWPPs and implemented some fuels treatments, found that the treatments enabled easier fire suppression and contributed positively to community protection when a wildfire occurred. In addition, the relationships developed during the planning process improved communication and cooperation during the fire. (Jakes and Sturtevant 2012).

The Community Wildfire Protection Plan map shows that most counties in the West have completed a CWPP or its equivalent, and many individual community-level CWPPs have been developed to further refine mitigation planning at the local level.

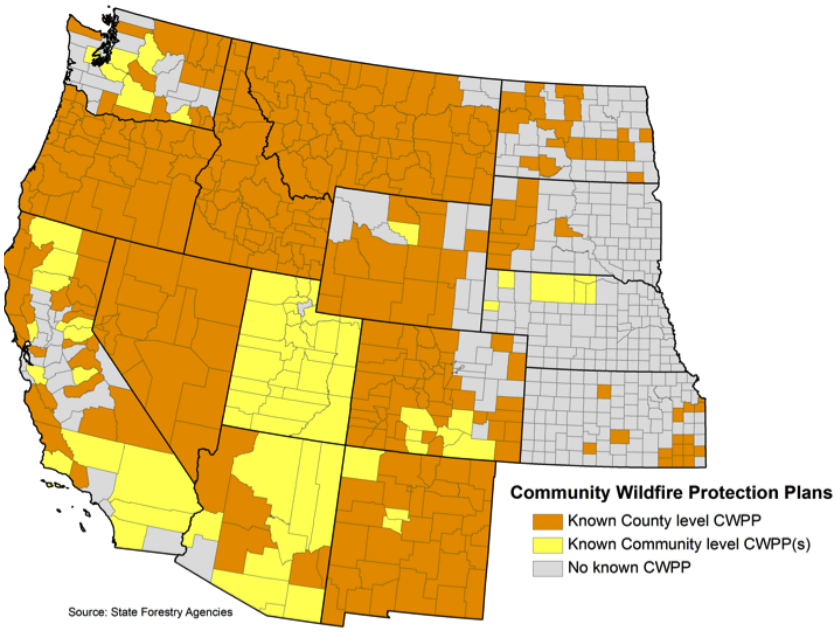


Figure 29. Counties that include communities with CWPPs or with county-wide CWPPs.

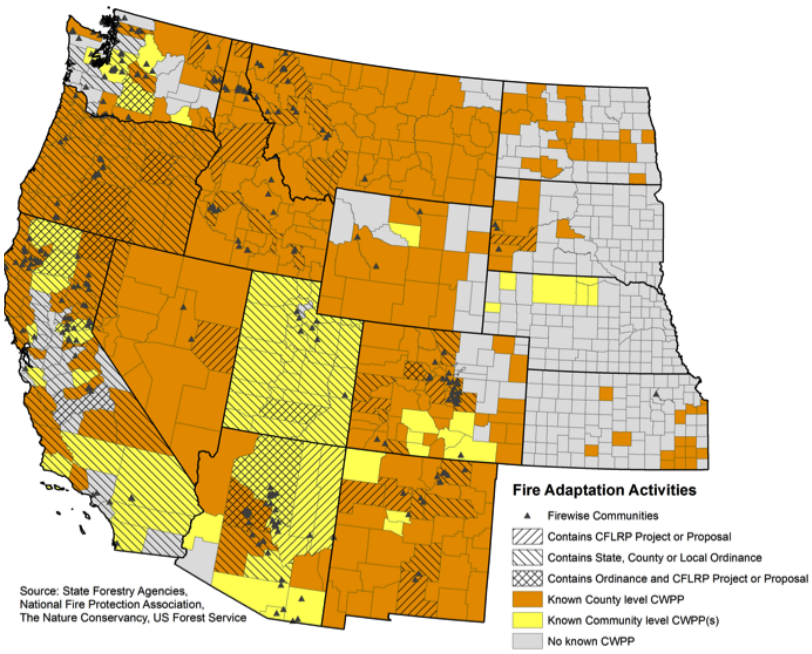


Figure 30. Counties reporting adaptation activities including CWPPs, ordinances, and CFLRP projects.
Source: State Forestry Agencies, National Fire Protection Association (NFPA), The Nature Conservancy (TNC), and USDA Forest Service

Fire Adaptation Activities

The Fire Adaptation Activities map, figure 30, shows the locations of county and community level CWPPs plus other wildfire mitigation programs, including the locations of Firewise communities, and states, counties and municipalities with ordinances requiring defensible space. The two most important actions to protect structures from wildfire are the creation of defensible space and the installation of a Class A roof. Three states — California, Oregon, and Utah have adopted statewide laws relating to defensible space and other parameters of reducing risk, including Class A roofs and ignition-resistant building materials on houses in high risk zones. The ordinances are different in each state, but the common denominator is the requirement for defensible space.

Model WUI ordinances, such as the International Code Council's Wildland Urban Interface Code, or NFPA's Standards1144 Standard for Reducing Structure Ignition Hazards from Wildland Fire and 1141 Standard for Fire Protection Infrastructure for Land Development in Suburban and Rural Areas, contain a network of standards for homes - including defensible space, roof and building component requirements - and neighborhood standards for - site planning and preparation, roads, bridges, water quantity for fire fighting and other requirements. These ordinances can be adopted at the municipal, county, or state levels. Wildfire mitigation requirements can be incorporated into zoning ordinances, subdivision regulations, building and fire codes, nuisance ordinances, or even adopted in neighborhood covenants, codes, and restrictions (CC&Rs). Many jurisdictions believe that ordinances are the most effective means to motivate homeowners to prepare for wildfire. It is important for the ordinance to have requirements for maintenance of defensible space over time and an enforcement clause in the regulation.

The map also shows the locations of Collaborative Forest Landscape Restoration Program (CFLRP) projects. These are large-scale projects to reduce fuels and restore landscapes funded under the Collaborative Forest Landscape Restoration Act. The goals of these projects parallel the goals of the Cohesive Strategy.

This map clearly shows that the West has been mobilizing at the state, county and community levels to reduce wildfire risk. The states have been active for the past 10 years under the National Fire Plan

and the 10 Year Implementation Strategy. Programs exist in many states for education, homeowner assistance with prescriptions for fuels reductions around homes, assistance with debris disposal – such as offering free chipping of slash or waste collection, and 252 fire departments across the West that promote the Ready-Set-Go program for fire and evacuation preparedness.

Fire adaptation is a process that requires continual updating and renewal of efforts to be prepared and to keep fuels reduced. Communities need technical and financial support to continue to move closer to a fire adapted status. Efforts by the federal agencies, states, counties, and local governments need to continue to grow to reach more communities and more individuals.

Public Perceptions of Wildland Fire in Social Science

Research from the field of social and behavioral science informs our understanding of fire adapted communities, and how people deal with living in a high risk environment. Recent studies have shown that residents are often well informed about fire and the role of fire in the ecosystem, and generally are supportive of fuel reduction. McCaffrey, *et al* found that "particularly for those in high fire hazard areas, individuals often have a fairly sophisticated understanding of fire's ecological role", and further that "overall, results clearly show that prescribed fire and mechanical thinning are, at some level, acceptable management practices for over three-quarters of the public" (McCaffrey, 2012). Several studies have shown that the public thinks fire management planning is primarily the responsibility of (federal or state) agencies, but they want to be informed about management activities and involved in the planning. Another survey found that respondents supported resident involvement in planning focus groups and advisory committees, and believed that education and outreach should be part of a fire hazard reduction program (McCaffrey, 2012).

Research has revealed some key mechanisms that lead to action and how to help a community mobilize. The McCaffrey report conclusively finds that "interactive outreach at the local level" (i.e. people talking to people) is the most effective means of communicating about wildfire issues, and that raising public awareness/education promotes individual action, builds public-agency trust, and builds broad support for fuels management efforts – all key factors in effective fire management. Local action and education are essential.

The conditions for local action include:

1. A trusted source of information. Local fire departments and local state and federal fire and land managers are often the sources.
2. A trusted local convener/facilitator for local regular discussions, planning, learning
3. Fire information set in a local context.
4. An experience with risk or high risk awareness.
5. A feeling of "agency", that what they do will make a difference in fire behavior and effects and that the actions will actually take place.
6. True "agency": the local capacity to "get work done"
7. A feeling of reciprocity among neighbors and landowners, "shared risk/shared responsibility".

The model below shows the relationship of key elements of the of fire and fuels management public acceptance model. It shows how people can become accepting of thinning activities including prescribed fire and mechanical treatment. It shows the interactive communication process leading to understanding of the ecological benefits of thinning activities, and building trust in the source of the information, which leads to acceptance of fire and fuels management.

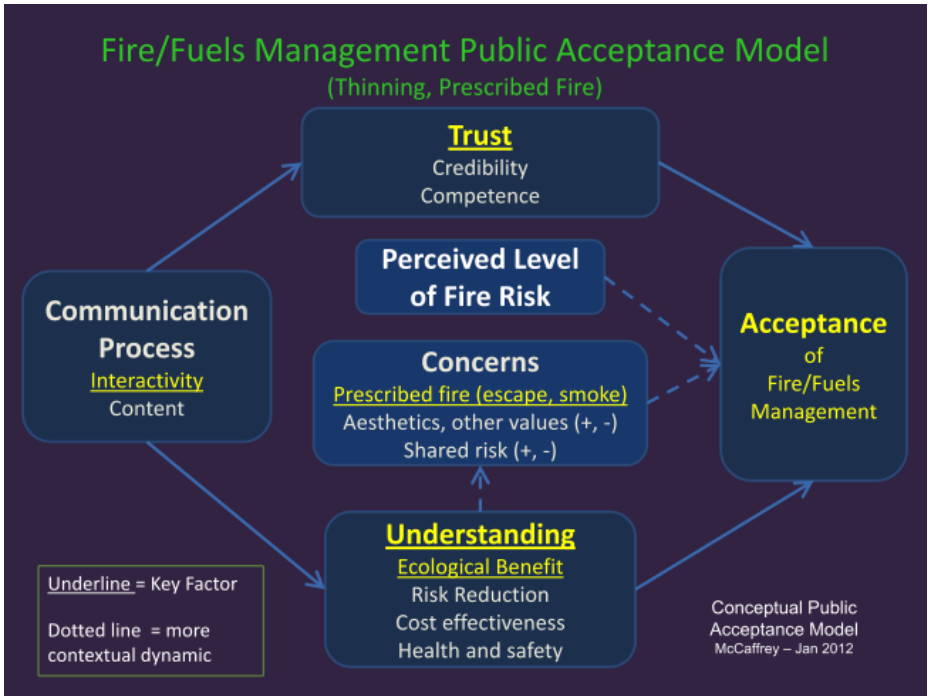


Figure 31. Factors influencing public acceptance of fire and fuels management activities.
Source: Sarah McCaffrey, USDA Forest Service, Northern Research Station.vancy (TNC), and USDA Forest Service

Attention should be paid to every step of this process. Agencies working with the public should be sure to institute an interactive communication process at the local level.

Regional Models of Fire Adapted Communities in Resilient Landscapes

There are many model programs for use of FAC tools, techniques, and technical assistance. There are multiple web resources, including CWPP handbooks and examples, the Firewise Communities/USA program, Ready Set Go! And, and numerous federal and state websites offering information on wildfire risk mitigation to homeowners and communities. The fire adapted communities website - fireadapted.org, is designed to assist local leaders through the many elements of adaptation. However, tools, handbooks, and expertise by themselves, do not lead people to action. Research shows they are effective:

1. In peer-to-peer learning venues (Goulette 2012).
2. When accompanied by federal and state agency and/or NGO technical assistance, (Goulette 2012).
3. When trust is created through experience and personal relationships (McCaffrey, 2012).

The Fire Learning Network (FLN), sponsored by the Nature Conservancy, the US Forest Service, and the land management agencies of the Department of the Interior, is an example of large scale application of the concept of creating fire adapted communities in a resilient landscape. The FLN started in 2002 to provide a social learning network for the people engaged in ecological fire restoration. By 2010, it had 15 regional networks working on 157 landscapes totaling 150 million acres, and 177,000 acres had been treated with prescribed fire. (FLN, 2011). The FLN nurtures expertise in ecological fire restoration and collaborative planning by linking multi-stakeholder collaboratives to regional communities of practice. Additional examples of large-scale projects for landscape resiliency, reducing risk to communities, and improving local economies can be found in the CFLRP in 23 locations across the country.

Potential Outcomes

Fire adapted communities are a good investment. A recent post-fire assessment by FEMA in Colorado Springs, CO found a benefit cost ratio of 517:1. That is, for every dollar FEMA invested in wildfire mitigation projects in Cedar Heights subdivision, there was a savings in suppression cost of $517.00. (Randall, 2012). Firefighters were able to save 82% of the homes in the three neighborhoods impacted by the Waldo Canyon Fire. Colorado Springs has been working on education homeowners and reducing fuels around homes for ten years. This preparation led to orderly evacuations when needed, and a minimal loss of structures. Similar investments are needed in communities in high wildfire risk areas throughout the West.

Potential Impact of Fire Adapted Communities Actions

If greater investments are made in increasing the fire adaptation of communities, that is, moving communities along the continuum from start-up communities through active communities to innovator communities, the residents of those communities will be empowered to reduce their own wildfire risk. This will result in greater neighborhood safety, reduced stress and general feeling of well-being within the at risk communities. Two examples illustrate the potential impacts of fire adapted communities activities. The Whitefish, MT story is one of preparedness and development of a multi-faceted mitigation program within a community, done in implementing a CWPP. The Hughes Creek, ID example is the story of cooperative effort between the community and the Forest Service in fuels treatments in the middle ground, which protected the community from a recent catastrophic wildfire.

The Whitefish area of Flathead County in northwest Montana has year-round population of about 8,000. Most of the land surrounding Whitefish is forested and managed by federal, state and private industrial landowners. Flathead County did a CWPP in 2005. In 2007, a number of substantial fires in northwest Montana – including one just 20 miles west of Whitefish – motivated the entire community to take action. Over 50 community members participated in the development of a community level Whitefish Area CWPP, and the Whitefish Area Fire Safe Council (WAFSC) was formed to ensure that the community's CWPP would be implemented. WAFSC developed a list of projects to pursue, which together span all three goals of the Cohesive Strategy. Regular monitoring and reporting to the community was also built into the work program

Prevailing winds in the Whitefish area blow out of the southwest, so wildfires starting to the south and west generally present the greatest threat to the community. A major focus of WAFSC's activities has been the creation of continuous shaded fuelbreaks west and southwest of Whitefish. State land managers, several homeowners' associations, and numerous private landowners all have participated in the fuelbreak effort and forest improvement activities. Local non-profit organizations have secured several hazardous fuels mitigation and forest health improvement grants that provide cost-share funding to local landowners to create defensible space and reduce fuels on their property.

Flathead County's subdivision code requires that the Final Plat for any new subdivision in the WUI have printed on it:

- "This subdivision is located in the Wildland Urban Interface wildfire priority area where wildfires can and do occur.
- Only Class A and Class B fire-rated roofing materials are allowed.
- Firewise defensible space standards shall be incorporated around all primary structures and improvements".

At least five area subdivisions have achieved certification as Firewise communities. WAFSC has an aggressive wildfire public education effort. The Whitefish Fire Department also actively promotes increased awareness and mitigation efforts.

Another good example of collaboration and preparation for wildfire is the Hughes Creek fuels treatment project. Located in eastern Idaho, near the Montana border, Hughes Creek is surrounded by national forests. In conjunction with Lemhi County's CWPP, the Forest Service conducted the Hughes Creek fuel reduction project from 2009-11 to help protect the community of Gibbonsville. Property owners

along Hughes Creek also reduced fuels on their land. In September 2012 the Mustang Fire, which had burned over 290,000 acres of land, burned into the fuels reduction project area, located about 5 miles west of the town. When it encountered the reduced fuel area, the crown fire dropped to the ground and the fire fighting crew was able to contain the fire on that side. The Hughes Creek fuels reduction project not only saved the town, and structures along Hughes Creek, but it also significantly reduced the cost of suppressing the fire in that location.

Strategy for Fostering Fire Adapted Communities

The FAC strategy is designed to speed up the development of fire adapted communities and link them into a sub-regional communication and learning network for continued development and innovation. Communities should be encouraged to move along a continuum toward fire adaptation.

1. **Start-up Communities** are those that have not yet begun to organize for integrated fire management. They may need assistance to catalyze their social interaction, build trust, and set up the collaborative processes necessary for development and implementation of CWPPs, Firewise, Ready-Set-Go, WUI ordinances, etc. Active or innovative communities may be able to help start-up communities with peer-to-peer counseling, sharing of informational materials, and other assistance that minimizes "wheel reinvention" and enables start-ups to benefit from the lessons already learned by those who are further along the path toward fire adaptation.
2. **Active Communities** are those already in the process of mobilizing to address wildfire risk. They have achieved many of the planning goals of FACs and/or landscape resilience, and are using existing resources (volunteers, grants, etc.) to begin carrying out their plans. Their CWPPs and action plans still might need to add a population protection plan, but they are ready or have begun efforts to reduce fuels in accordance with the CWPP.
3). **Innovative Communities** are community and countywide groups that are working on integrating all three goals of the Cohesive Strategy. They are likely to be key players in supporting and networking "start-up", "active", and other "innovative communities " in the region. They may need resources to complete fuels treatments in accordance with their CWPPs and to train residents to mobilize in local fire emergencies.

Alternative #3 – Fire Response

Alternative #3 emphasizes increased stakeholder effectiveness in risk-based wildland fire responses that enhance firefighter and public safety. The alternative includes aggressive, effective initial attack capability where it is deemed appropriate by the local fire management cooperators. The protection of life, property, and resources is the core objective of the alternative. Wildland fire for multiple objectives is encouraged, where desired, and when risk will not be transferred to a landowner or manager without their knowledge and consent. This alternative illustrates a commitment to fiscal integrity which means wise use of taxpayer funds to include: the integration of local, state, tribal, federal, and private response capability in the areas of protection responsibility; resource mobilization; training; and, qualifications at the regional and national level. Much of the contributing risk in this area is connected to workload as displayed by fire occurrence and measures to reduce that workload. Varying levels of resilient landscape restoration and improvement, hazardous fuel reduction treatment, and fire-adapted community work will all contribute to achieving the three goals of the Cohesive Strategy.

Recommendations:

I. Improve initial attack success
II. Prevent wildfires
III. Improve Public information before, during, and after incidents
IV. Enhance existing capacity
V. Improve firefighter and public safety

Focus Areas

Focus Area 1. Public and firefighter health and safety.

- Wildfire response is a shared responsibility. Stakeholders should identify their appropriate contribution to wildfire response and commit to providing it.
- A rigorous fire prevention program will be maintained by all jurisdictions and coordinated at appropriate landscape scales across agencies, tribes, and partner organizations the safest, least expensive, least destructive wildfire is the one that does not start. Planned ignitions are not wildfires and are highly appropriate both for restoration of fire resilient landscapes and the reduction of fire threat to firefighter and public safety, property, ecological services, resources, and other community-values-at-risk through fuels reduction.
- Develop human factors based prevention programs.
- At all levels, risks, hazards, values and fire management approaches will be discussed among stakeholders throughout the year to adapt to changing conditions and apply lessons learned.
- Aggressive, effective initial attack capability to prevent ignitions from growing into large, expensive, damaging, and dangerous wildfires.
- Use efficient and effective combinations of prevention, initial attack, and fuels treatments to manage ignitions in an area to prevent fires from becoming large, expensive, damaging, and dangerous.
- Use efficient and effective combinations of fuels treatments, resilient landscape restoration, and fire adapted communities to improve public and firefighter safety, property and resource protection, and suppression effectiveness resulting in acceptable cost plus net value change, thus achieving the greatest benefit for public expenditures on large fire management.

Focus Area 2. In most settings, an ignition management approach that uses prevention of human-caused wildfire; fuels treatments and hazard mitigation; and aggressive initial attack in a cost-effective combination is the best approach to reduce risk, costs, and losses.

- Enables increased collaborative capacities to facilitate integrated roles in local fire management, decision making, training, and response
- Increased collaborative capacity of stakeholders to facilitate integrated local response to fire threats and ignitions.
- Focus on determination of community-based priorities addressing local issues.
- Encourage greater integration of private sector response capabilities and broader application in the West where private sector resource is more cost-effective. Potential uses of private sector resources in fire prevention education, mitigation, fuels treatments, initial attack, and large fire management should be evaluated for economic efficiencies.

Focus Area 3. Many, but not all, stakeholders recognize that fire is necessary for sustaining fire dependent and resilient landscapes, ensuring flows of ecological services from forests and rangelands to maintain and improve rural and urban economies and lifestyles, and reduce fire risks, costs, and losses.

- Provide for the exchange of fire knowledge and experience among stakeholders and sustained collaborative dialogue leading to more completely shared understandings and goals.
- Educate stakeholders across all agencies and publics about the physical, biological, social and ecological dimensions of wildland fire, fire effects and fire management to enable them to better collaborate on landscape scale coordinated fire response.
- Develop a value among stakeholders to ensure that their decisions about land use and management practices, maintenance, building practices, development, fire response, or activities that might ignite fires do not pass risk or costs to adjoining cooperators or land owners, or constrain their options to use fire in land management and fire protection without their consent.
- Multi-objective fire management activity will require an increased capability to identify multi-scale risks with improved risk assessment and decision support tools.
- In some cases, stakeholders may manage ignitions in ways other than immediate, full suppression, for a variety of objectives, where risk will not be transferred to others without their knowledge and consent.

Focus Area 4. Leverage response capability to make use of public sector funds as effective as possible.

- Integrate local, municipal response capability and non-suppression activities at the regional and national levels especially in the arenas of training, qualifications, and mobilization.
- Although many of the actions in this alternative would require a high degree of social, political, or organizational support, if implemented they could save lives, reduce damage, and be a better investment for the public.
- Facilitate interstate sharing of resources - both the logistical and fiscal components.
- Maintain a national mobilization system for resource sharing and enhance sharing of resources between and across states and regions.
- Integrate fire prevention and education across jurisdictions and among nongovernment organizations to take education and information to settings where it will be most effective for the intended audiences.
- Review all burnable acres for protection responsibility. Where lands are not formally assigned protection responsibility, negotiations will designate appropriate protection responsibility.

Opportunities for Intervention

- Focus on prevention education programs.
- Focus on fuels treatments to reduce risk.
- Focus on preparing communities for wildfire.

Improving the probability of success on initial response should be the highest priority, followed by reducing the cost and damages caused by escaped initial attack fires.

The success can be improved by firefighters arriving on scene sooner, while the fire is in the incipient stages. The options are:

- Faster response by initial attack equipment
- Faster response by initial attack aircraft
- Improved and dispatch functions
- Improved transportation system in remote areas
- Sending the closest response resources.
- Increase response capacity as determined by workload.

Reducing the fire intensity to a level equal to the initial response force arrival in the time specified. Options include:

- Vegetation treatments to reduce the heat generated
- Compartmentalizing vegetation to limit the spread of the fire
- Reducing the vegetation available for an ignition to start

Fire Response

Large expenditures of public funds are made in the West for response preparedness and for response to wildfires. The extent of damage depends on the extent and intensity of the fire and how many homes or acres with other values are affected. In most cases the cost of damage far exceeds the suppression costs. The issue in the West is a matter of local and regional social choices and collaborative decision-making. Mitigating and managing regional risk requires collaboration among landowners, land managers, planners, elected officials, and citizens.

Also, consideration needs to be given to the role that fire might play in ecosystem maintenance and restoration. It is possible, in some cases, to achieve conditions under which fire can spread with little or no damage to values and effectively "treat" the landscape. Under such circumstances there may be beneficial aspects of fire on the landscape. Collaborative fire planning and management options can directly affect factors contributing to wildfire risk.

In this section we will briefly describe some of the key factors that contribute to risk in the response to wildfires in the West. To illustrate the contributing factors, we will describe five themes that represent the current situation. The themes below will help us categorize some key contributing factors to organizational risk in fire response.

Vegetation Profile as it Relates to Fuels

The first map shows vegetation portrayed as fuels clusters in the West. This representation is useful for determining potential fire occurrence, workload, where potential impact to acreages exists, and how fuel types contribute to risks in fire response.

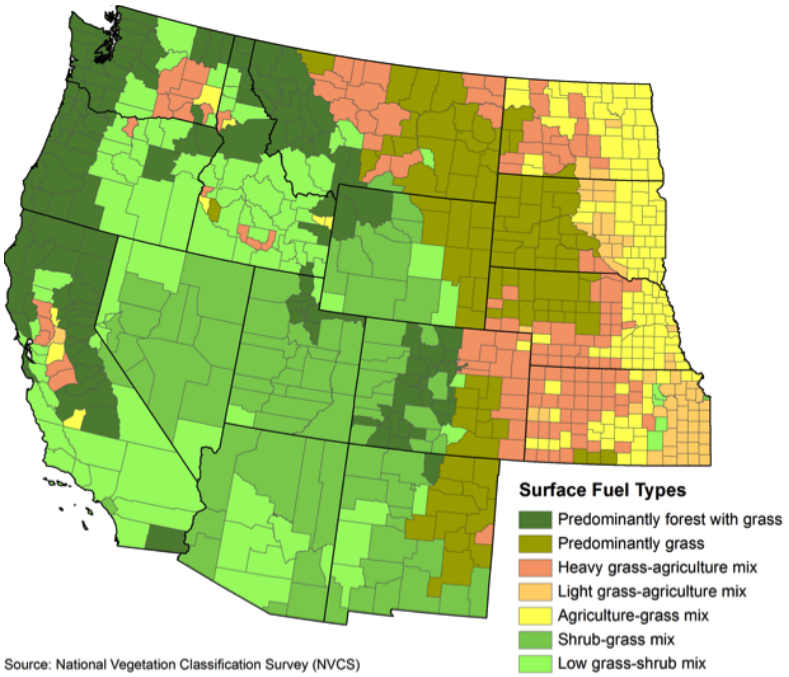


Figure 32. Western counties categorized in seven broad categories of surface fuel type based on proportion of area in the county.
Source: National Vegetation Classification Survey (NVCS).

The following four maps show the location of hotspots across the West, areas where multiple fires have started, and the locations and percentage of accidental and arson caused fires. The arson fire map shows the percent of human-caused wildfire ignitions that were identified as intentional. Intentional fires are a prevalent problem in the West. As noted earlier in Table 1, approximately two thirds of all Western fires are human caused, and lightning causes one third of the fires. However, lightning caused fires burn considerably more acres each year than human-caused fires.

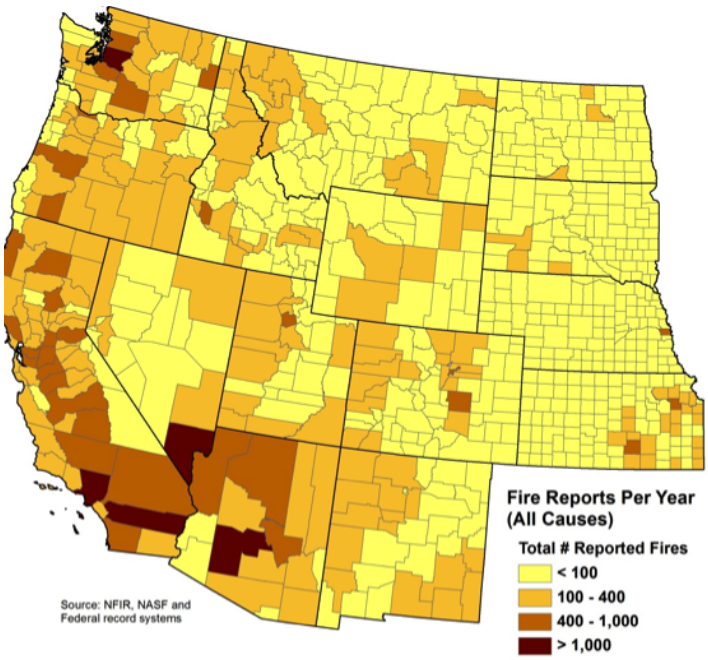


Figure 33. Mean annual MODIS hotspot detections per 100 square miles, from 2001-2011.

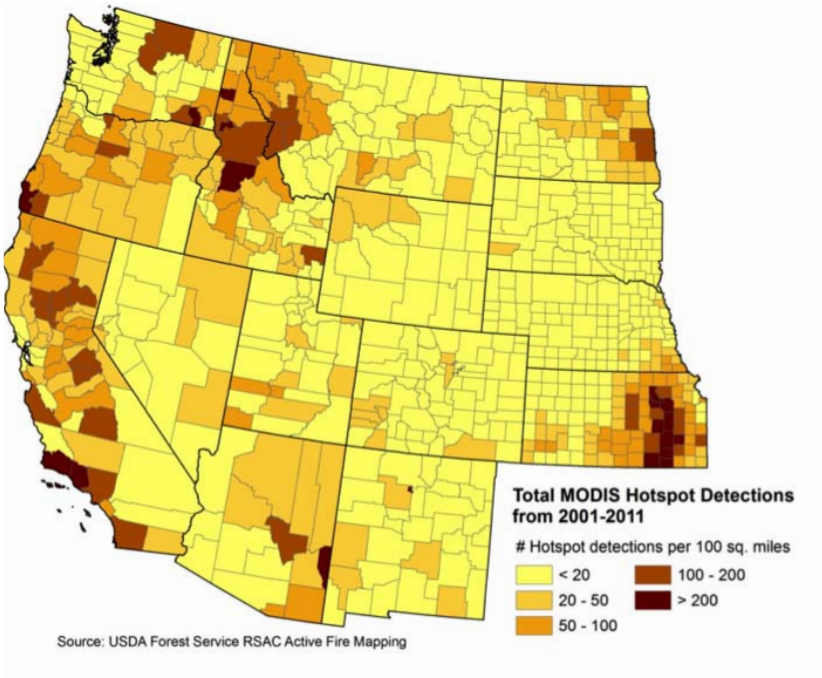


Figure 34. Reported incidents attributed to accidental ignitions using state, federal and local (NFIRS) data of known cause.

Figures 34, 35, and 36 show the reported annual fire incidents from three reporting sectors: federal lands, state datasets, and local fire stations (NFIRS) for all causes (Figure 34), accidental fires (Figure 35), and arson fires (Figure 36).

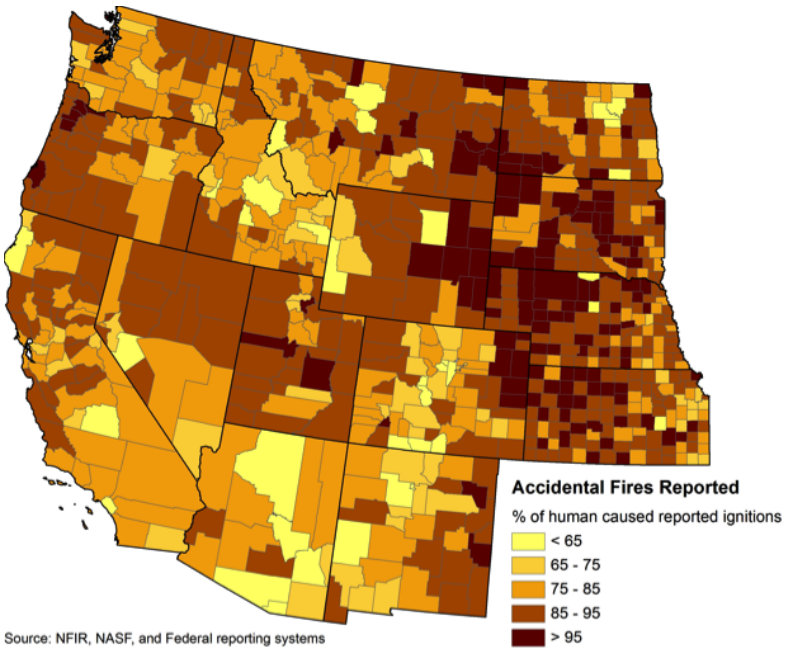


Figure 35. Reported incidents attributed to accidental ignitions using state, federal and local (NFIRS) data of known cause.

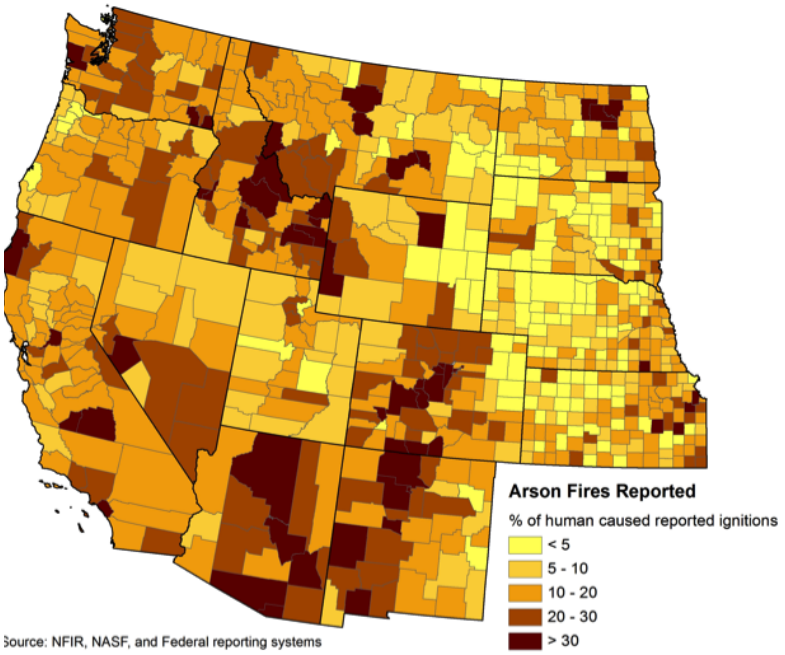


Figure 36. Reported incidents attributed to intentional ignitions using state, federal and local (NFIRS) data of known cause.

The map of large wildfires shows the locations and extent of area burned by fires greater than 100 acres in size, with the highest levels in the Great Basin and Northern Rockies areas.

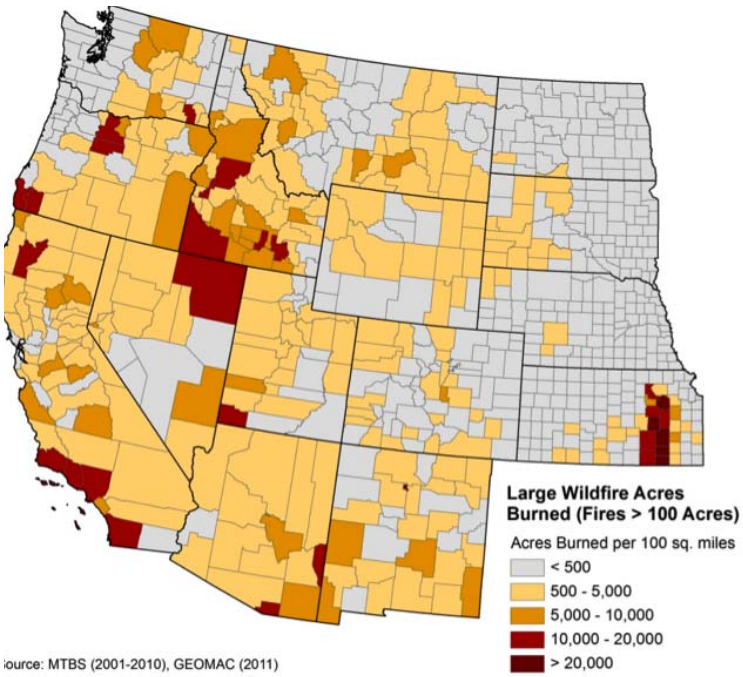


Figure 37. Acres burned per 100 square miles by large fires (300 acres or greater in size) between 2001 and 2011.

Workload

Workload is defined by the number and locations of ignitions, and by the number and locations of annual (and historical average) acres burned. Consideration of the ignitions causes also influences this risk factor. While natural ignitions will not be reduced through prevention activities, they can be influenced by fuels treatment activities in some cases. Human ignition occurrence can be influenced by aggressive fire prevention measures. The risk of ignitions is related to the kinds and distribution of human activities in an area. This gives us an opportunity to intervene, and set a goal of fewer fires and reduced acres burned, through prevention activities, education, engineering, and law enforcement.

The appropriate application of fire for multiple objectives and prescribed fire will impact risk and workload related to fire response in the future.

Land Ownership and the Dynamics that Affect Response

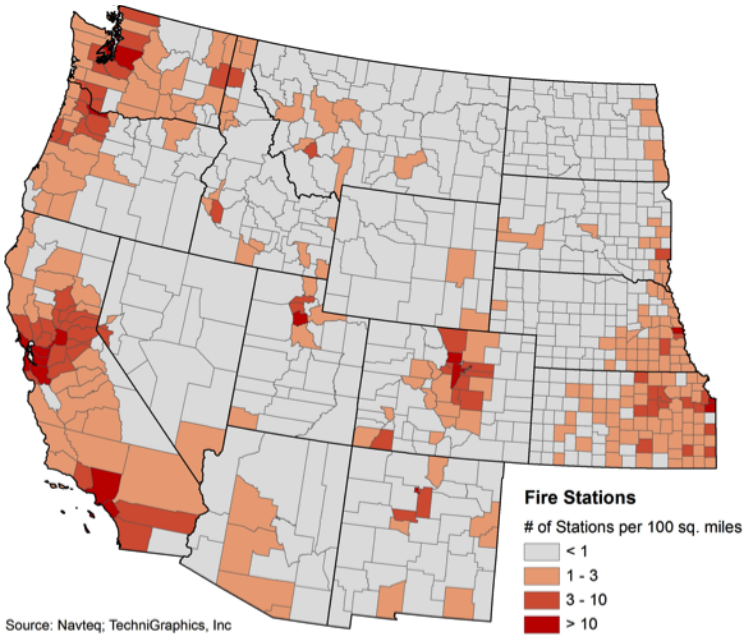
- Who has protection responsibility?
- Is the current protection organization reducing risk at the desired extent?

Jurisdictional responsibility and protection responsibility in the West is varied. A unique situation in the West exists in that over 50% of the land base is federally managed, and most of our acreage impacted by fire exists in those areas. This poses both opportunities and barriers in the context of risk. Some challenges include the ability to manage a piece of ground consistent with the needs and values of all stakeholders, and the differences in perception of acceptable risk, damage, and values. The opportunities include landscape level planning, integration of response capability at the level of local, state, federal, tribal, and private response capability before, during, and after incidents. With limited investment capability for response, there is a need to leverage all responder capacity in the most effective manner to leverage capability and overcome differences. Where we are not fully integrated, we see disconnected response efforts, limits in communications and operational interoperability, and safety related incidents. All of these areas can cause increased responder and organizational risk.

Wildfires on federal land have become larger and more resistant to containment on the land of origin. Fires starting in the WUI may trespass onto neighboring jurisdictions; therefore it is important to extinguish all initial attack fires with a combined force.

Response Capacity, Limitations, Challenges

- Where is our capacity in relation to the workload?
- Where is our capacity limited and why?
- What are we currently doing to overcome our limits in capacity?
- Topography, road access, and response arrival time?



The Number of Fire Departments Map shows the number of stations per unit area, summarized at the county level. This shows the variation that exists in the number of fire stations across the West. Some counties have very low density of fire stations while others have a high density, resulting in a highly variable ability to respond to wildfire.

Figure 38. Western counties categorized by the mean number of fire stations per 100 square miles.

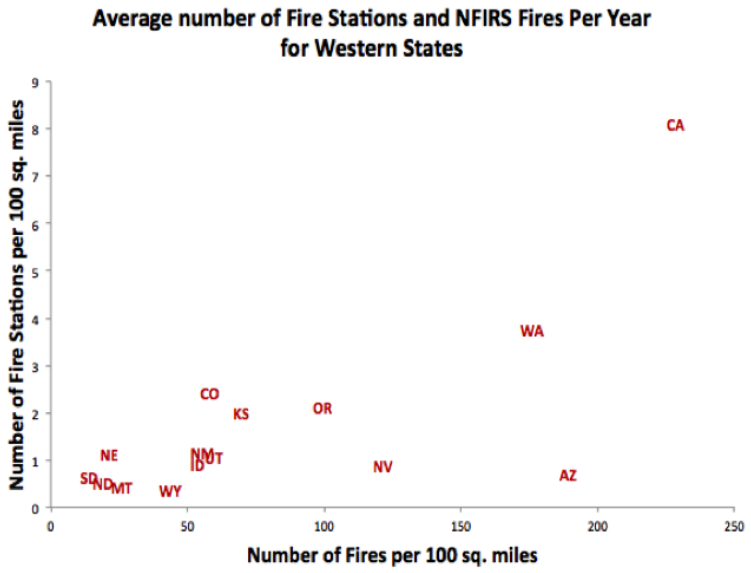


Figure 39. Average number of fire stations and locally reported fires per year for Western states.
Fire data are from the Department of Homeland Security's National Fire Incident Reporting System (NFIRS), 2006-2010.

The scatter plot chart, figure 39, shows the number of fires per county plotted against the number of fire departments in a county. From the data it appears that workloads are not evenly distributed. California, Arizona and Washington have the highest number of fires per 100 square miles, and California and Washington have the highest number of fire stations. Nevada and Arizona have high numbers of fires, but low numbers of fire stations. Risk is characterized by local response workload in relation to existing and potential response capability.

On the average, 95% of wildfire ignitions are suppressed at less than 300 acres by a combined force of closest appropriate resources (Report to WFLC, August 2004). This combined force may include federal, state, tribal, local, and private firefighters, working under the incident command system. Interoperability is a challenge that is being addressed. The firefighting response force has largely been preplanned based on the fuel, weather and topography, in consideration of the predetermined initial attack requirements of the primary agency having jurisdiction and the neighboring supporting or assisting agencies. Controlling unwanted fire in the initial attack phase has proven to be the safe and cost effective practice for the firefighters and the public. These forces are made up of ground and air tactical assets as well as supervisory overhead.

The federal response force has been determined by the agencies responsible for wildland fire management, and is funded through Congress. For example, tribal response forces are a part of the federal allocation. Tribes own fee parcels as well, and have rights and jurisdiction over tribal lands, territory, and resources. The nonfederal fire fighting force is either a state or a local resource funded and staffed by their jurisdiction based on the risk or standards that they have adopted. Mutual aid, automatic aid, and assistance for hire agreements may be entered that allow for reciprocal use or temporary use of resources belonging to different jurisdictions. Nonfederal firefighting resources are mostly staffed, equipped, and located based on structural fire response criteria. The categories of station location and staffing are typically commercial/industrial, urban, suburban and rural. The fire stations are denser in a commercial/industrial area, and become incrementally farther apart, with rural areas having the least number of fire stations per square mile.

Fire Prevention and Evacuation Preparedness

The fire triangle is the controlling influence of all fire responders; the triangle consists of fuel, weather and topography with the additional variable of ignitions. The fuel or vegetation can be manipulated to reduce risk, and is part of a resilient landscape; the topography is a fixed variable over which we have no control. The weather is a variable that is predictable but not controllable. There are preventive measures that can reduce most human ignitions, but we cannot prevent all ignitions, and there are natural ignitions (lightning) that are predictable but not preventable.

Whenever the topography, fuel, weather, or number of ignitions exceed the capacity of the firefighting force that can be assembled, fires escape initial attack and move into a larger phase. It is the 5% of all fires that escape initial attack that account for over 90% of suppression funds used.

Firefighting forces include a fire prevention component that provides enforcement, education, and engineering services with a goal to reduce risk or ignitions, and improve public safety in the event of a fire. Examples include: engineering efforts may have a goal to reduce ignitions from power lines and railroads. The engineering component will assess risk from fire, and work to reduce those risks through vegetation management and weed abatement, to reduce the risk that a fire might spread into the community. Enforcement operations may target an arson problem or other intentionally set fires such as debris burning. The education component could include team teaching children about fire safety, or a community program such as Ready-Set-Go for preparedness in the event of a wildfire.

One area that contributes to risk is the need to develop a more comprehensive evacuation program for the West. Spontaneous evacuations may restrict responders and expose evacuees to accident and injury. Immediate evacuations ordered by the initial responder may pose hazards to responders and evacuees. Planned evacuations generally occur later in an incident, under more controlled circumstances. Repopulation of an area poses logistical and safety concerns involving many entities. The Ready-Set-Go program is intended to increase preparedness and reduce the hazards of evacuations.

Response Capacity and Coordination

The Response system has evolved under the principle that no one agency is capable of managing the entire emergency workload alone. The resource augmentation processes consist of short term free assistance and long term assistance for hire agreements. These resources include: engines, crews and equipment, aircraft, and support assets.

Federal agencies participate in both forms of augmentation, short term free and long term assistance for hire. Wildfires on federal lands can be long in duration and require a larger firefighting force, resulting in the federal firefighting agencies hiring local and state resources to fill overhead and suppression positions.

The mobilization system that coordinates wildland firefighting resources has evolved and expanded to include filling orders for non-fire resources such as caterers, medical staff, logistical functions etc. The system has the ability to process requests and track resources across the country and around the world, and does so on a recurring basis. The response workload moves across the West as the weather changes, and the need moves as depicted in figure 40, showing hotspots by season.

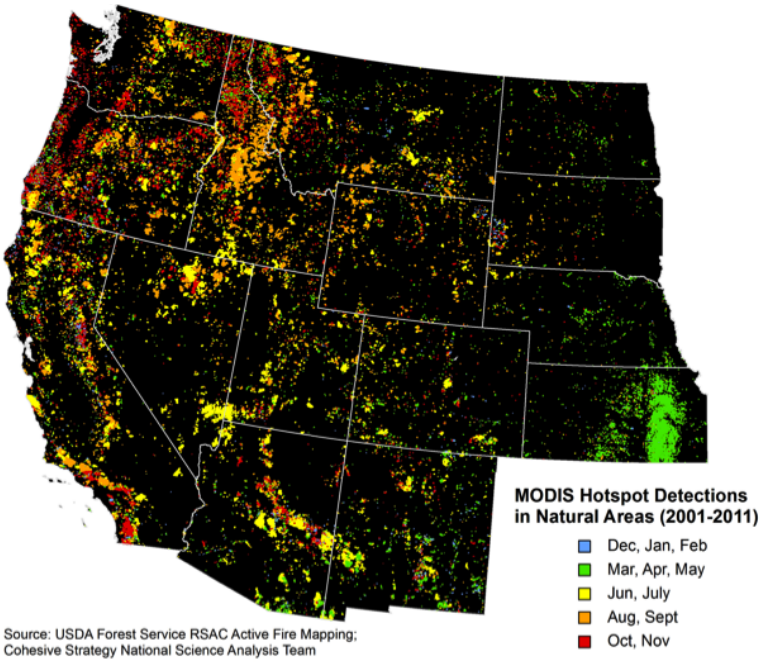


Figure 40. Seasonality of hotspots detected from space by the Terra and Aqua satellites since 2000.
The majority of these hotspots are from wildfire, prescribed fire, and agricultural fires.
Source: USDA Forest Service Remote Sensing Applications Center.

If the coordination system did not exist one would be invented. The system that has been developed should not be duplicated nor reduced in its effectiveness.

Static firefighting resources are the fire engines and supporting resources normally assigned to a geographic location. Dynamic firefighting resources are fire engines, crews, aircraft, equipment, and supporting resources that are sent to assist in other geographic locations as necessary in response to an emergency or an anticipated emergency need.

The mobilization system has the capability to move resources, federal and nonfederal, in response to weather predictions such as lightning and high wind events. These short duration events can produce ignitions or fire rates of spread that will overload the static firefighting forces. Once the static resources are exhausted due to the number or severity of the fires, the coordination system will be used to bring in resources. The fires will grow in size as the augmented resources travel to the incidents, resulting in more damage and increased costs.

Static fire response was developed during different weather and climatic conditions. Today the fire seasons are longer and the fire problem is covering a larger geographic area.

Mobilizing nonfederal resources to a federal incident has fiscal, legal and qualifications challenges. One solution is to rely more heavily on the federal firefighting forces responding to the fire, to the point that all federal management units would have a minimum drawdown level of one fire engine remaining

on the unit. The one remaining federal fire engine would be augmented on initial attack by the neighboring mutual aid or assistance by hire resources. This practice would provide more federal resources on federal incidents, reducing the issue of qualifications and cost. This practice would allow local resources to perform their mission and assist as necessary on new fires locally.

The USDA Forest Service Large Airtankers Modernization Strategy, Feb 2012 recommends the following:

- USFS and DOI should invest in the next generation of large airtankers;
- Explore flexibility and cost effective airtankers contracting;
- Federal aircraft should be a mix of types and sizes of fixed wing assets.

Findings include: Initial attack on new fires is critical to keep fires small. A 1.5% drop in the success rate of IA could equate to 150 additional fires over 300 acres for an additional $300-450 million in suppression cost to the USFS. When multiplied by the Western Forestry Leadership Coalition 2010 analysis of the true cost of wildfires, which determined that indirect costs are 2 to 30 times the suppression costs. Therefore the $300 million in added suppression costs could equate to $1.2 billion to $8.7 billion increase added cost to the community of the true cost of wildfire.

Protection Values and Incident Prioritization

Protection values and the complex interagency nature of response capability help us to define a pre-determined response. Typically the incident response is dictated by where it is, what is at risk, the existing fire potential, and available response forces. This works well when very few incidents occur at one time. When we anticipate that we may exceed response capability, the need to prioritize incidents increases. Those priorities are normally protection of life, including responder and public safety, as well as the density of affected populations. The next consideration is initial attack. The next priority for the interagency group is typically protection of residences, followed by high value assets, either natural or infrastructure. In a given similar fire situation, we would prioritize the fire with the highest values at risk.

This system is logical, yet often causes us to have larger remote fires on the rural landscapes because of the lower affected population. This often contributes to large, extended attack fires that eventually require an extended commitment of responders for long durations in large, heavy fuels, for weeks or months at a time.

The risk to fire adapted communities has been characterized at the broad level, using information related to factors that influence risk, with county level information. Integrating the many layers of information through available models allows decision makers to better understand what is likely to influence risk and where opportunities to reduce and manage risk might be effective. Decision makers should use the relationships among the various ecological, social, and fire behavior information to examine options to focus energy toward reducing risk. Windowing down with more detailed analyses, at a community level scale, will prove useful in addressing the specific risks within counties. The broad scale information provides the context within which finer resolution decision making can be most effective. As has been demonstrated, collaborative efforts are most likely to yield positive outcomes for communities at risk.

Measuring Progress Toward the Goals

In Phase I national goals and performance measures were established. The goals are ideals that we hope to approach by taking the specific actions that will be described in the regional and national action plans. It is assumed that if we can restore and maintain landscapes, and create more fire adapted c ommunities and improve fire response, then we will be able to rein in escalating wildfire suppression costs. The national goals and performance measures are broad, and they should be further refined with objectives and actions by the regional strategy committees. As work progresses with the Cohesive Strategy and the development of the Action Plan, the WRSC will address regional performance measures. This is the next step in the Cohesive Strategy process.

National Performance Measures

These are the National Goals and Performance Measures:

Restore and Maintain Landscapes: GOAL: *Landscapes across all jurisdictions are resilient to fire-related disturbances in accordance with management objectives.*
Outcome-based Performance Measure:

- Risk to landscapes is diminished.

National output-based metrics, in support of the national measure, will center on risk to ecosystems at landscape scales.

Fire Adapted Communities: GOAL: *Human populations and infrastructure can withstand a wildfire without loss of life and property.*
Outcome-based Performance Measure:

- Risk of wildfire impacts to communities is diminished.
- Individuals and communities accept and act upon their responsibility to prepare their properties for wildfire.
- Jurisdictions assess level of risk and establish roles and responsibilities for mitigating both the threat and the consequences of wildfire.
- Effectiveness of mitigation activities is monitored, collected and shared.

National output-based metrics will include indicators relevant to communities with mitigation plans and planned or completed treatments.

Wildfire Response: GOAL: *All jurisdictions participate in making and implementing safe, effective, efficient risk-based wildfire management decisions.*
Outcome-based Performance Measure:

- Injuries and loss of life to the public and firefighters are diminished.
- Response to shared-jurisdiction wildfire is efficient and effective.
- Pre-fire multi-jurisdictional planning occurs.

National output-based metrics will reflect trends in changing risk to support the national measure. Indicators will include pre-season agreements and annual operating plans, integrated wildfire response scenarios, and shared training. Risk exposure to firefighters will be based on a balanced consideration of values protected and the probability of success.

How Decision-makers Can Use the Alternatives

As the alternatives, actions and activities are presented to local decision makers, particularly at the county level, CWPPs (or their equivalent) should be developed and modified to reflect priorities determined by the local entity. In alignment with local community values and land management objectives, the various actions associated with these alternatives should help to guide practical and sensible decision-making. Collaborative groups that encompass larger areas, outside of a county geographic boundary,

are a valuable tool when discussing priorities at the landscape level. Collaborative groups have proven to be successful in identifying priority treatment areas and leveraging resources to accomplish hazardous fuels reduction treatments, as well as larger scale forest restoration and management across the landscape. Collaborative groups can also help to develop alternatives and priorities that are acceptable, especially in multi-jurisdictional landscapes, to present to local, tribal and state decision makers.

In the attempt to provide a higher level of wildfire protection for their community, many localities will find reduction of hazardous fuels on both private and public lands to be a very high priority. To achieve favorable results, it is often most productive to determine the best method of performing such tasks through collaborative efforts. In many cases, the most efficient of these methods could be through active forest management- commercial timber and salvage sales, and/or prescribed fire, which improve forest health and can provide economic opportunities, including biomass utilization. Although this may be simply accomplished on private, tribal, or state lands, it should be recognized that laws applying to federal lands would complicate, delay, or even preclude such activities. Fully implementing all existing federal authorities such as the Healthy Forest Restoration Act and Categorical Exclusions should be considered to accomplish landscape level treatments to restore forest health. Local governments, private forestland owners, interested parties, state agencies and federal agencies are encouraged to participate with collaborative efforts to expeditiously find local solutions that address barriers and reduce risk to communities.

It is anticipated that the Cohesive Strategy and the datasets and maps collected by the NSAT will influence the cascade of decisions that flow from the Western recommendations aimed at achieving the three broad goals. The information, data, and models developed through the Cohesive Strategy can be used to further explore options to address risk at multiple scales. The strength of the information lies primarily in its further use as opposed to any individual report that may be developed.

Federal decision makers from national, regional, and local levels should use the data, models, and recommendations of the Cohesive Strategy to inform their decisions. The expectation also exists that decision makers within the state agencies, tribal organizations, and non-governmental organizations should also use the data, models, and recommendations to inform their decisions. Where collaborative groups are already engaged in discussing solutions to wildfire risks in regional, state, or local areas there is an expectation that the Cohesive Strategy information will inform their discussions. The process for use of the information should be within the context of risk assessment and decision-making. The county-level information that has been assembled in support of the Cohesive Strategy along with the models set the stage for additional analyses that can assist decision-makers with setting context, considering priorities, and examining potential emphases.

There can be no standard approach that will be the best approach in all areas. The alternatives can and should be used to evaluate procedures and methods to achieve local priorities as outlined and delineated in CWPP's and through collaborative groups. As such, specific actions from the alternatives should inform decision-makers as they develop the most effective approach to accomplish local priorities across the landscape.

Recommendations

The WRSC reviewed the risk analysis in light of the three goals and the three alternatives. They found merit in many different recommendations put forward by the planning groups and analysts. Some recommendations were overarching recommendations that addressed the entirety of wildland fire issues. Some crossed over between focus areas, such as a recommendation for population protection plans in CWPPS for communities at risk, which could be either in the domain of fire adapted communities or fire response. And some recommendations came out of one group, but were appropriate for all aspects of the Cohesive Strategy, such as the recommendation by the landscape resiliency group that collaborative groups be involved in decision making. All of the recommendations are broad-based.

Here are key recommendations put forward by the WRSC. Details on how these recommendations will be carried forward and fully developed in the Regional Action Plan is described in the Next Steps section.

Overarching Recommendations

- Recognize the depth and importance of the communications framework and provide resources to implement communications recommendations, as it establishes the foundation of our collaborative process.
- Ensure the coordinated implementation of the Cohesive Strategy among all stakeholders.
- Enhance collaboration through incentives.
- Emphasize landscape treatments where existing collaborative groups have agreed in principle on management objectives and areas for treatment, and encourage and facilitate the establishment of collaborative groups.
- Expand collaborative land management, community and fire response opportunities across all jurisdictions, and invest in programmatic actions and activities that can be facilitated by Tribes and partners under the Indian Self-Determination and Education Act (as amended), the Tribal Forest Protection Act, and other existing authorities in coordination with the UN Declaration on the Rights of Indigenous Peoples.
- Address identified barriers and promote critical success factors across the region and at all levels.
- Provide resources to support local government officials, such as fire chiefs, in the integration of the Cohesive Strategy into their communities and operations – i.e., support the development of an International Association of Fire Chiefs (IAFC) Leaders' Guide for the Cohesive Strategy.
- Formalize a comparative risk model that includes federal, state, and local costs. Use the model to complete a trade off analysis and establish a risk base point.
- Establish the use of the model, including training and data descriptions for local decision makers, such as counties. Facilitate local updates to the models to enable updates to the national models.
- Identify data gaps and inconsistencies, including describing the purpose of the data in monitoring and evaluating progress to accomplishing the goals of the Cohesive Strategy. Prioritize action toward addressing gaps and inconsistencies.

Landscape Resiliency Recommendations

- Encourage US Forest Service and Department of the Interior/Bureau of Land Management to use existing authorities under Healthy Forest Restoration Act, Healthy Forest Initiative, and other contracting authorities to expedite fuels treatments. Assess what is currently being spent on these tools and increase that amount. Project criteria to be worked out during action planning may include: Project has to be 5,000 acres or larger, reduces risk to landscapes and/or communities by focusing on areas that have a high burn probability or departure; has to be initiated within 2 years; and is based on collaborative processes.

- Explore data to identify and prioritize landscapes for treatment. This information would be provided to sub-geographical stakeholders, decision makers, as well as state and federal officials for their consideration and use.
- Expedite coordinated identification, prioritization, and restoration of damaged landscapes as a result of natural disturbances including, insect/disease, hurricanes, wildfire, invasives, changing climatic conditions. Identify where investments are not likely to restore areas to assist in prioritization of resources.
- Work with Council on Environmental Quality (CEQ) in developing categorical exclusions for landscape restoration.
- Where appropriate, utilize CEQ alternative arrangements when restoring damaged landscapes as a result of natural disturbances.
- Examine legislative related barriers that are impeding implementation of collaboratively developed landscape health related projects and pursue reform of the existing process to increase our effectiveness in active forest and rangeland management. (e.g., Endangered Species Act, Equal Access to Justice Act, National Environmental Policy Act (NEPA)). Encourage and enlist local, state, tribal, and federal environmental regulatory agency representatives to participate actively in collaborative efforts to restore resilient landscapes.

Fire Adapted Communities Recommendations

- Accelerate achievement of fire adapted communities using existing tools; offer incentives, such as chipping/disposal and incentives for collaboration, etc.
- Enhance campaigns to educate the public about the urgent need for homeowners to take action, including having statewide, Western, and other coordinated campaigns. Use videos such as how to protect homes from fire, the importance of fire in nature, and the need to live with fire.
- Facilitate shared learning among communities for fire adaptation.
- Continue to create and update Community Wildfire Protection Plans (CWPPs) using Secure Rural Schools Community Self-Determination Act and identify new funding sources. Be sure to include offices of emergency management and local response entities, such as the sheriff's office in planning efforts. Update CWPPs in areas that have had a wildfire event.
- Review and modify requirements for technical and financial support of communities through Federal Emergency Management Agency (FEMA), i.e. NEPA administrative processes, and applications for funding.
- Develop and promote local collaborative capacities to implement fuels treatments and respond to fires.

Fire Response Recommendations

- Improve response effectiveness by convening state level groups to identify where fire protection exists for all areas within each state. Eliminate unprotected areas by establishing/extending jurisdictional responsibilities. Response cooperators in each state should identify those voids and negotiate to ensure that every acre within the state has designated protection. Promote realignment of protection responsibilities to the organization that is best suited to provide protection (e.g., block protection areas, offset protection agreements, protection contracts).
- Improve firefighter and public safety. Maintain and/or improve an aggressive human caused ignition prevention program. Involve all stakeholders in the prevention campaign.
- Integrate local, state, federal, and tribal response capacity. Identify where the greatest opportunities exist in communications, training, qualifications, mobilization, and instruments.
- Increase capacity where necessary in order to improve overall local response effectiveness and reduce the need for external (non-local) resources.

Next Steps

Phase III will continue with development of a national risk analysis and a national action plan. The NSAT will develop a comparative risk model using the data sets, and will develop a national trade-off analysis. When the comparative risk and trade-off analyses are complete, a National Phase III Risk Analysis Report will be written to bring together the issues and alternatives discussed in the three regional reports. A National Action Plan will be developed based on the national risk and trade-off analyses.

As stated previously in the report, the Western Region is tremendously diverse, both physically and socially. As a result the region is not well suited to a monolithic implementation of a detailed list of actions. However, given the similarities the region shares; such as large natural landscapes dominated by federal ownership and the presence of large catastrophic wildfire; it is well suited for implementing actions, decided upon at a local or state level, that are in concert with the goal areas of the Cohesive Strategy.

The challenge is how to enable the local decision making process to be made within the framework of the Strategy. It is clear that directing or attempting to regulate local and state level decision processes is doomed to fail, and is not the most sustainable approach to achieving "cohesive action". The path forward seems to come from one of the foundational components discovered in the development of the Strategy -- *collaboration*.

In order to sustain the momentum gained while developing the strategy, we must facilitate and expand collaboration in decision making at all levels, and at multiple scales, within the Western Region. Experience has shown us that collaboration does not spontaneously happen. It requires structure, process, focus, and resources. To that end, the next step is to establish a coordination structure that will exist under the umbrella of the Wildland Fire Executive Council (WFEC). This structure will facilitate the broad scale implementation of the recommendations and strategy identified in the Western Regional Report.

It is envisioned that the structure will be a coordinating body, composed of representatives of the decision making and jurisdictional authorities in the West. The coordinating body will be supported by a full time staff lead to assist in the continued engagement of stakeholders throughout the development and implementation of a Western Regional Action Plan. The group will focus on identifying priorities and emphasis areas among the recommendations, identifying solutions to break down barriers, and identifying actions for exploration. They will seek outcomes that are measurable at the regional, state, county, community, and individual property owner levels.

To facilitate implementation, this coordinating body will need resources to provide regional coordination and a communications component. It is recommended that these resources be acquired through new or existing agreements with the Western Governors' Association and/or Western Forestry Leadership Coalition. The objective of the coordinating body will be to facilitate coordinated development and implementation of actions, provide consistent communications with stakeholders, and to foster tools and information to enhance local, state, and regional decision making.

The creation of the Western Regional Action Plan is fundamental to achieving the goals of the National Cohesive Wildland Fire Management Strategy in the West. The WRSC recognizes that the Cohesive Strategy efforts to-date have been very successful. Continued success will rely on a commitment of support, the allocation of assets and resources, and a coordinated, collaborative approach with stakeholders - at all levels. The Action Plan will not restrict or direct local authorities and associated collaboratives in their decision-making.

The FLAME Act requires a five-year update to the Cohesive Strategy. However, the WRSC sees a need for the Action Plan to be more dynamic than that. It will need to change over time, as conditions or other factors (i.e. large fire seasons, economics, insects and disease outbreaks, etc.) warrant such change. Unless otherwise directed, it is the intent of the WRSC to continue operations and move forward with the implementation of our recommendations, action plans, etc. without interruption.

Western Regional Science-Based Risk Analysis Report Appendices

Appendix 1 - Glossary

The National Wildfire Coordinating Group (NWCG) maintains an extensive glossary of fire management terminology and acronyms (found at www.nwcg.gov/pms//pubs/glossary/index.htm). Some terms used in this document that have specific meaning in the context of wildland fire management, but are not found in the NWCG glossary are defined below.

Affected party A person or group of people who are affected by the outcome of a decision or action

Biomass Any organic matter that is available on a renewable or recurring basis. Under the Farm Security and Rural Investment Act of 2002 (Title IX, Sec. 9001), biomass includes agricultural crops, trees grown for energy production, wood waste and wood residues, plants (including aquatic plants and grasses), residues, fibers, animals wastes and other waste materials, and fats, oils, and greases (including recycled fats, oils, and greases), but not recycled paper or unsegregated solid waste. (From Farm Bill Glossary on the National Agricultural Law Center Web site http://nationalaglawcenter.org/#.)

Fire-adapted community Human communities consisting of informed and prepared citizens collaboratively planning and taking action to safely coexist with wildland fire.

Fire-adapted ecosystem An ecosystem is *"an interacting, natural system, including all the component organisms, together with the abiotic environment and processes affecting them"* (NWCG Glossary). A fire-adapted ecosystem is one that collectively has the ability to survive or regenerate (including natural successional processes) in an environment in which fire is a natural process.

Fire community Collectively refers to all those who are engaged in any aspect of wildland fire-related activities.

Fire exclusion Land management activity of keeping vegetation or ecosystems from burning in a wildland fire.

Fire management community A subset of the fire community that has a role and responsibility for managing wildland fires and their effects on the environment [according to the Phase I report glossary].

Fire science community Subset of the fire community consisting of those who study, analyze, communicate, or educate others on the components of fire management that can be measured, such as fire behavior, fire effects, fire economics, and other related fire science disciplines.

Fragmentation Physical process whereby large, uniform areas are progressively divided into smaller fragments that are physically or ecologically dissimilar. Fragmentation can occur through natural disturbances such as wildfire, or more commonly, through land use conversion by humans (e.g., urbanization).

Landscape resilience The ability of a landscape to absorb the effects of fire by regaining or maintaining its characteristic structural, compositional and functional attributes. The amount of resilience a landscape possesses is proportional to the magnitude of fire effects required to fundamentally change the system.

Middle Ground or Middle Lands Those nearby areas that contribute to the identity, structure, culture, organization, and wellbeing of a community, and are often considered essential to its economic, social, and ecological viability.

Parcelization Process of subdividing a large, intact area under single ownership into smaller parcels with multiple owners. The term can also apply to an administrative process of dividing a landscape into multiple management units with different management objectives. Parcelization is often a precursor of fragmentation because of differences in management priorities among property owners.

Silviculture *"The art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis"* - definition from John A. Helms, ed., 1998. *The Dictionary of Forestry*. The Society of American Foresters, Bethesda, Maryland.

Stakeholder A person or group of people who has an interest and involvement in the process and outcome of a land management, fire management, or policy decision.

Traditional Ecological Knowledge, also called by other names including Indigenous Knowledge or Native Science, (hereafter, TEK) refers to the evolving knowledge acquired by indigenous and local peoples over hundreds or thousands of years through direct contact with the environment. This knowledge is specific to a location and includes
The relationships between plants, animals, natural phenomena, landscapes and timing of events that are used for lifeways, including but not limited to hunting, fishing, trapping, agriculture, and forestry. TEK is an accumulating body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (human and non-human) with one another and with the environment. It encompasses the worldview of indigenous people, which includes ecology, spirituality, human and animal relationships.

Viewshed An area of land, water, or other environmental element that is visible to the human eye from a fixed vantage point.

Appendix 2 - Acronyms

BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
CAR	Community at Risk
CRAFT	Comparative Risk Assessment Framework and Tools
CS	Cohesive Strategy
CSSC	Cohesive Strategy Subcommittee
DOI	Department of the Interior
EMDS	Ecosystem Management Decision Support System
EPA	Environmental Protection Agency
FACA	Federal Advisory Committee Act
FEMA	Federal Emergency Management Agency
FFT2	Firefighter 2
FLAME Act	Federal Land Assistance, Management and Enhancement Act of 2009
FLN	Fire Learning Network
FPA	Fire Program Analysis
FPU	Fire Planning Unit
GACC	Geographic Area Coordinating Center
GAO	General Accountability Office
HFI	Healthy Forests Initiative
HFRA	Healthy Forests Restoration Act
HVR	Highly valued resource
IAFC	International Association of Fire Chiefs
ICS	Incident Command System
IQCS	Incident Qualification and Certification System
ITC	Intertribal Timber Council
JFSP	Joint Fire Science Project
LLMPs	Land Management Plans
LRMPs	Land and Resource Management Plans

MOU	Memorandum of Understanding
NACo	National Association of Counties
NASF	National Association of State Foresters
NEMAC	National Environmental Modeling and Analysis Center (UNC Asheville)
NEPA	National Environmental Protection Act
NFPA	National Fire Protection Association
NGO	Non governmental organization (e.g. nonprofit)
NICC	National Interagency Coordination Center
NIFC	National Interagency Fire Center
NLC	National League of Cities
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
OMB	Office of Management and Budget
PPE	Personal protective equipment
QFR	Quadrennial Fire Review
RFA	Rural Fire Assistance
RFD	Rural fire department
RSC	Regional Strategy Committee
SFA	State Fire Assistance
TNC	The Nature Conservancy
USDA	U.S. Department of Agriculture
USFS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VFA	Volunteer Fire Assistance
VFD	Volunteer fire department
WFDSS	Wildfire Decision Support System
WFEC	Wildland Fire Executive Council
WFLC	Wildland Fire Leadership Council
WG	Working Group
WGA	Western Governors' Association
WRSC	Western Regional Strategy Committee
WUI	Wildland Urban Interface

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Appendix 4 - Science and Models

Data and Methods for Exploring Opportunities to Reduce Risk

Introduction

Wildland fire is a complex issue that involves multiple interacting factors spanning the natural, human, and built environments. During Phase II, the National Science and Analysis Team (NSAT) examined various aspects of wildland fire and developed conceptual models specific to each component. The purpose of these models was to display the interactions and relationships among factors, such as the relationship between fuel treatments and the extent and intensity of wildfire. The NSAT also identified various data sets that might be used in Phase III to build analytical models consistent with the concepts articulated in Phase II. Building on these efforts, Phase III has involved an extensive effort to collect data necessary to quantify relationships and provide a rigorous examination of risk.

The types of data collected can be broadly categorized into five general types: biophysical, socioeconomic, land-use and ownership, wildfire frequency and extent, and incident response. Biophysical variables include physical measures such as precipitation, temperature, and terrain. They also include characteristics of vegetation that contribute to wildfire behavior. Socioeconomic variables describe the demographic and economic characteristics of populations and communities within each county, and also describe the distribution of homes within the wildland-urban interface. Land-use and ownership describes the mixture of public and private lands and also helps quantify the extent to which lands might be suitable for active management, e.g., by highlighting areas that historically supported timber harvest. Variables describing wildfire frequency and extent have been gathered from various reporting systems that have been put in place by federal, state, and local fire departments. They also include data from independent monitoring systems that track wildfire using satellites and other remote devices. Finally, they include a series of modeled products from governmental and private entities. Similarly, incident response information has been gathered from many of the same reporting systems. These variables track who responded to wildfire, how long they took to arrive on site, and how long was required before the fire was contained. Information on injuries and casualties can also be found in these same reporting systems. All of the variables available for use in the Phase 3 analyses are listed in Appendix A.

Before data were used in analysis, three additional steps were accomplished. The first step was one of quality control. Obvious errors in the data were corrected where it was apparent that the corrections would enhance the fidelity of the original data. In some cases limited numbers of observations were omitted from further consideration due to obvious mistakes that could not be corrected or missing information. The second step involved compiling, reformatting, or summarizing data to fit within a common sampling frame—the county. For some data sets, for example many of the social economic variables, data were originally provided at the county level and no reformatting was necessary. Other, higher-resolution data were processed using GIS techniques to provide a county-level summary. Many data were also normalized to provide comparative area-based or incident-based metrics such as acres burned per hundred square miles or firefighter injuries per 1000 incidents.

The third step in data preparation involved filtering and consolidation. In this step, a preliminary correlation analysis was used to identify common patterns among the data that allowed a subset of the data to be used to characterize conditions efficiently. That is, a smaller set of variables were identified that were highly correlated with other variables and could be used alone without significant loss of information. Statistical techniques including factor analysis and clustering were used to reduce the number of variables further by creating super variables that were either linear combinations of other variables (from factor analysis) or categorical groupings of counties based on their similarities (using cluster analysis). The combination of filtering and consolidation techniques allowed the total number of variables considered to be reduced by nearly 2/3. Even so, there were over 100 variables available for potential analysis.

Modeling

Various analytical models were constructed for the primary purpose of relating causal or contributing factors to variables which collectively index levels of risk. These risk metrics include measures of hazard such as frequency and magnitude of wildfire, any direct measures of loss or injury, and various measures related to exposure, such as the number or density of homes in the wildland-urban interface. Although hazard and loss are often combined into single measures of risk, such measures were not constructed in our analysis due in part to the county-level resolution of the original data. For example, we know that there are homes distributed throughout the wildland urban-interface and large wildfires are likely within the county, but we cannot tell which portion of the county is most likely to experience wildfire or which off-site effects of wildfire might be relevant to overall impacts. Such spatial interactions are important for producing an accurate and precise estimate of risk. Lacking more specific information, we use a more straightforward and simple assumption that the total risk is proportional to county-level hazard, exposure, and potential loss.

Within the Western Region, we found that the most useful indices of risk were the following: vegetation and fuels maps, the causes of fire starts, the locations of fire departments, and the counties and communities with CWPPs and ordinances.

Many of the analytical models used in our analysis were constructed using Bayesian networks. Bayesian networks are decision analysis tools that use conditional probabilities to link variables together and express the degree of relationship between them. They provide a highly flexible modeling environment that works equally well with simple and complex problems. Here, we use a simple example using climate, fuel, and wildfire to illustrate the basics behind a Bayesian network. Consider the two graphs shown in Figure 1. In the first graph on the left, it is assumed that climate affects both vegetation (fuels) and wildfire, but vegetative fuels and wildfire are independent given climate (i.e., there is no connection between fuels and wildfire that does not pass through climate). The second graph uses the same three notes, but specifies a different relationship in that vegetative fuels and wildfire are both related to climate, but vegetation has an additional direct on wildfire. The principal difference in the two graphs is that the first graph suggests that manipulation of vegetation would have no measurable effect on wildfire. Only by changing climate could one expect wildfire to change. In contrast, the second graph allows for changes in vegetation to have an effect on wildfire independent of changes in climate. Importantly, quantitative models based on either graph could be based on exactly the same data, but they would have very different implications for management.

Bayesian networks begin with graphs like these, but then quantify the relationships using empirical data or expert opinion. Each node in the network can be represented by a single quantitative variable. Arrows are used within the Bayesian networks to identify conditional dependencies, much as the arrows in the graph above are used to relate one variable to another. The direction of the arrows are important, in that they indicate causal dependencies as well as determine how information can flow from one node to another. In this context, information is defined explicitly as that which causes a change in probability assignment. To facilitate calculation—as well as communication—continuous variables are often broken into discrete classes; discrete or categorical variables require no such modification.

As an example, consider the Bayesian network shown in Figure 2 and Figure 3. This simple network has three nodes: Region, Annual Ignitions, and Normalized Area Burned. Region simply refers to the three regions identified within the Cohesive Strategy. Annual Ignitions is the mean number of outdoor fires reported per year, summed from three separate reporting systems representing federal, state, and local response units. Normalized Area Burned is an estimate of the expected number of acres burned in these reported incidents during a high-fire-occurrence year (i.e., the 95th percentile). This network was parameterized (trained) using data from all of the counties in the conterminous United States (lower 48 states), where each county was treated as a single observation and weighed equally regardless of area. The unconditional network (Figure 2) shows the marginal distributions of the values of each variable. One can see from the probability histograms, for example, that 33.4% of the counties are in the Northeast, 15% of the counties reported between 50 and 75 outdoor fires per year, and 14.3% of the counties might expect to burn 2000 or more acres (much more in some counties) in a bad wildfire year. Conditioning on region (Figure 3) provides a quick visual comparison of the differences among regions. For example, the West stands out in that it has a higher than normal percentage of counties with relatively few incidents, but also higher than average numbers of counties with very high expectations for area burned.

The Bayesian networks constructed for our analyses are necessarily more elaborate than the simple graphs depicted above, but they use the same basic concepts. For example, the network depicted in Figure 4 uses logic similar to Figure 1 regarding the relationship between climate, fuels, and wildfire, but expands that concept by using multiple nodes or variables for each component. This particular network uses three super variables (*Warmness Factor 1, Wetness Factor 2, and Terrain Factor 3*) from a factor analysis of physical attributes including seasonal precipitation and temperature, elevation, and slope, and regional cluster analyses of vegetation and surface fuels. It also includes Region, Annual Ignitions, and Normalized Area Burned from Figures 2 and 3, and additional nodes from an independent modeling exercise, Mean Burn Probability and Mean Flame Intensity. A primary difference between

the networks in Figure 4 and Figure 2 is the relationship between Region and Normalized Are Burned now passes through a series of intermediate nodes related to climate and vegetation, which allows for greater exploration of the causal factors influencing area burned by wildfires.

Five basic models or templates were created for use by the WRSC in order to explore opportunities for reducing risk. They are described only briefly here. The first was an Ignition Model, which focused on understanding where human-caused wildfire ignitions occurred and where they might be reduced through targeted actions at preventing either accidental or intentional ignitions alone or in combination. The second template—Fire, Fuels, and Homes—explored the intersection of homes and wildfire and included variables that might suggest where either mechanical treatments or prescribed fire might be productively employed to alter the composition of surface fuels and affect wildfire behavior. Conversely, they could also be used to identify areas where such options are problematic. The third template—Prescribed Fire and Ecological Resiliency—focused more on the potential application of prescribed fire in areas removed from human communities where the primary goal might be to restore a fire regime more consistent with historical conditions. Fire Adapted Communities formed the basis of the fourth template, which used information about current programs to suggest the extent to which evidence of local actions are tied to socioeconomic factors as well as to factors more directly indicative of risk to human communities from wildfire. Finally, the fifth template emphasized Incident Response Capacity and Workload. The purpose of this template was to help understand the relative contribution of federal, state, and local departments to incident response and explore the factors contributing to variation in response metrics such as arrival and containment time and fire size.

These templates and associated data were customized for each region and shared with the regional work groups during a workshop in Denver in early September. Ensuing discussions with each workgroup led to the creation of a series of summary tables, graphs, and maps that highlighted findings relevant to objectives and goals articulated by each region. These summary products have been incorporated in the regional reports as noted.

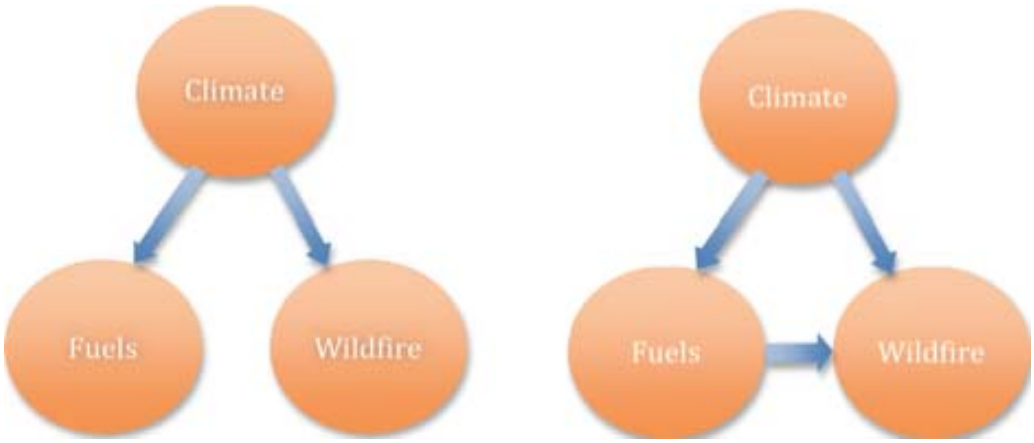


Figure 1. Simple graphical models of two possible hypotheses of the relationships among climate, vegetative fuels, and wildfire.

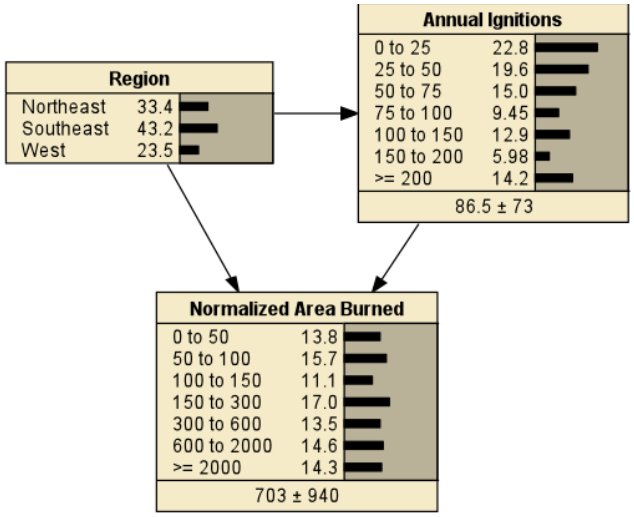
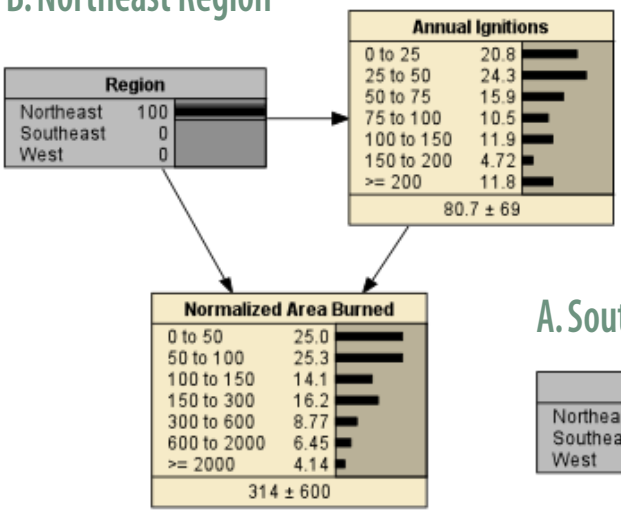
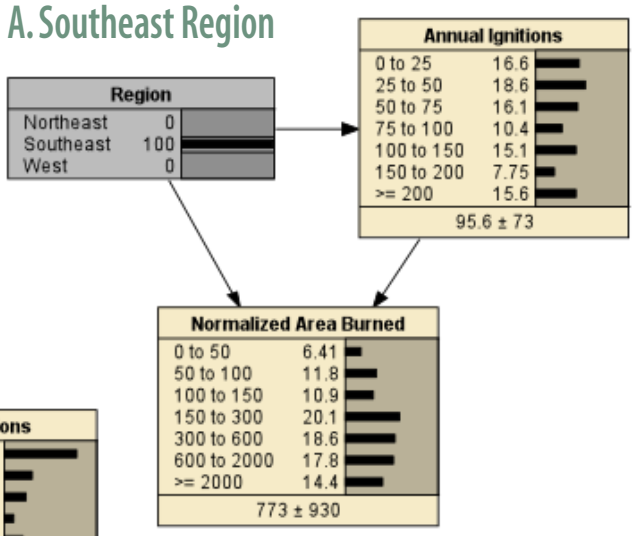


Figure 2. Simple Bayesian network illustrating the relationships among Cohesive Strategy *Region*, Annual Ignitions, and Normalized Area Burned. Probability histograms represent the percent of the counties within the contermi-nous United States within each class.

B. Northeast Region



A. Southeast Region



C. Western Region

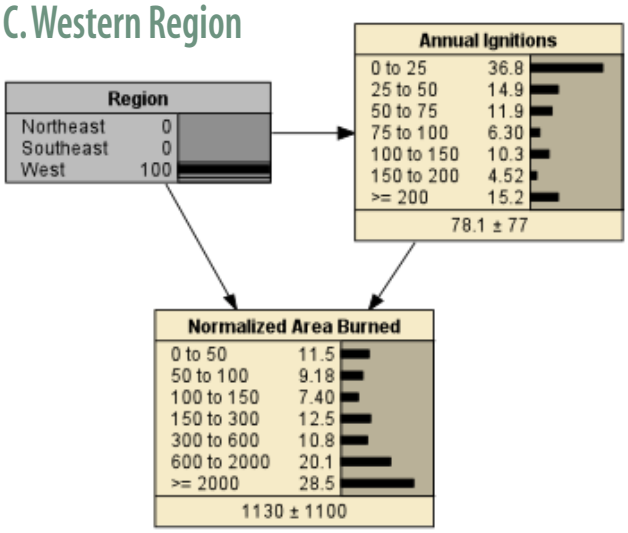
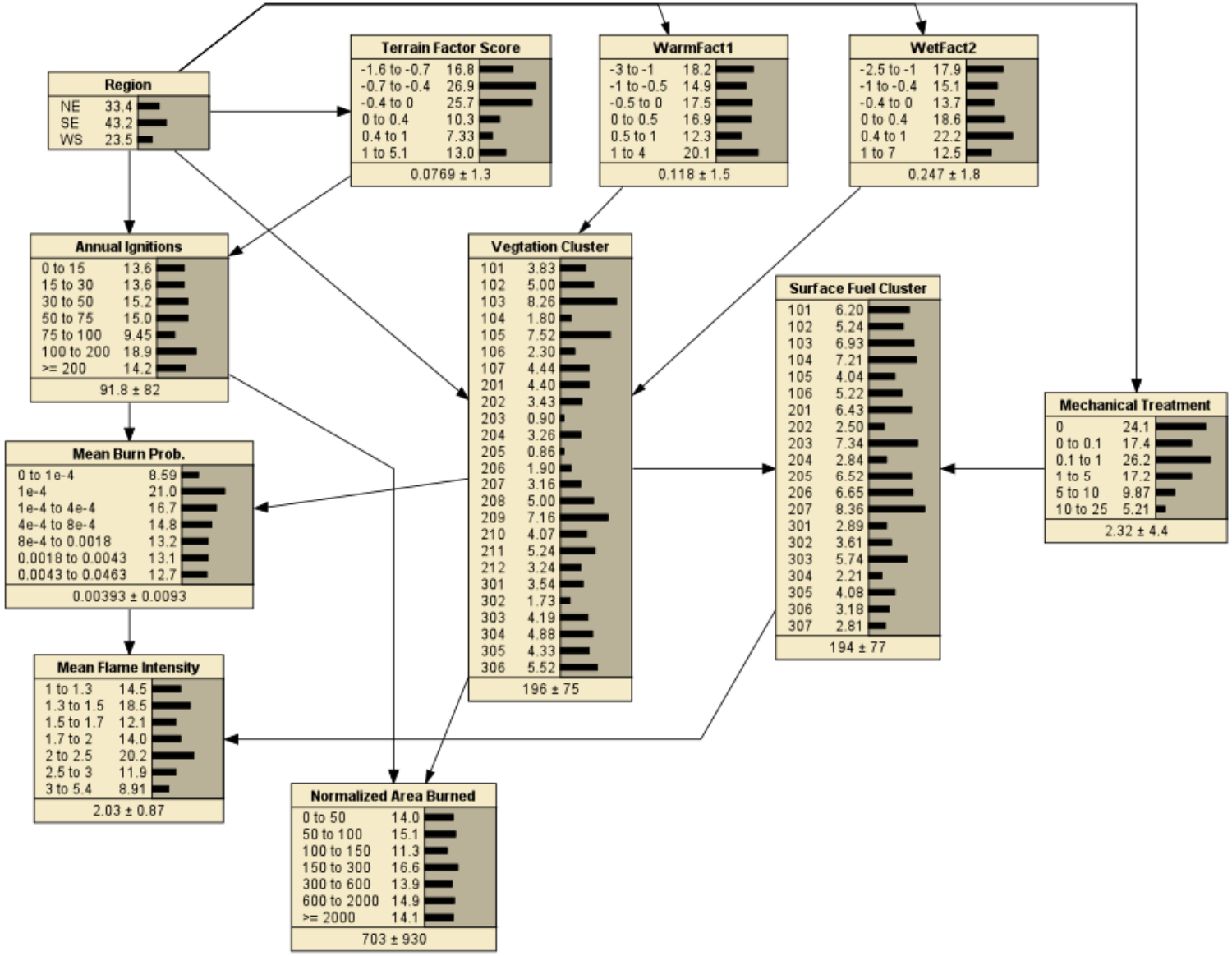


Figure 3. Simple Bayesian network illustrating the relationships among Cohesive Strategy *Region*, Annual Ignitions, and Normalized Area Burned, conditioned on *Region*. Probability histograms represent the percent of the counties within each region within each class.

Figure 4. Bayesian network illustrating relationships among variables reflecting the physical environment, vegetation and surface fuels, mechanical treatments in forested areas, wildfire ignitions, and various measures of wildfire extent and intensity.



Appendix A. Variables available for use in the Phase III analyses.

Variable	Group	Description
COUNTY	A	County FIPS code
FIPS5	A	5-digit state and county combined FIPS code
STATE	A	State FIPS code
D_Mchn_pct	B	Landfire disturbance by mechanical treatment (%)
Dom_PAD	B	primary conservation partner
Log_All_Prds	B	index of forest product production
rdbuff_pct	B	percent of county withn 540 m of road
region	B	Cohesive Strategy region
SQMI	B	area of county in square miles
stateabv	B	state abbreviation
tot_dstb_pct	B	Landfire disturbance by all causes (%)
tot_pct_fed	B	federal ownership (% of area)
Tot_Pct_PAD	B	total conservation partner (% of area)
fmech_35	B	forested area available for mechanical treatment (% of county)
nfmech_35	B	non-forested area available for mechanical treatment (% of county)
Ecoregion	C	Bailey's ecoregion (modal value)
FuelClusR	C	Surface fuel cluster
FuelDist	C	deviation from cluster mean
ModeFRG	C	modal fire regime group
pct_forest	C	forested area (% of county)
TerrFact3	C	physical factor score weighted to terrain and summer precip.
VegClusR	C	existing vegetation cluster
VegDist	C	deviation from cluster mean
WarmFact1	C	physical environment factor score weighted to seasonal temperature
WetFact2	C	physical environment factor score weighted to seasonal precip.
Avg_vdep_NN	C	mean veg departure in natural areas
STD_vdep_NN	C	STD of veg departure in natural areas
Avg_vdep_Nm	C	mean veg departure in mixed natural areas
STD_vdep_Nm	C	STD of veg departure in mixed natural areas
APG90_10	D	annualized population growth 1990 - 2010
DemoFact1	D	demographic factor score (stress)
DemoFact2	D	demographic factor score (advantage)
EconType	D	dominant economic activity
HUWUI00	D	housing units within WUI 2000
MeanUrban	D	Mean urban value from Hargrove and Edwards map

Variable	Group	Description
Pct_Tmbr_Jbs	D	Forest industry jobs (% of employment)
Timber_Jobs	D	Number of forest industry jobs
Total_Popu	D	total population 2010
UrbanInf	D	Urban economic influence (ERS typology)
WUIFact1	D	WUI factor score (WUI area weighted)
WUIFact2	D	WUI factor score (weighted toward urban or % agriculture)
WUIFact3	D	WUI factor score (home density in interface and % of homes)
Pct_Nm	D	area in mixed-natural landcover (%)
Pct_NN	D	area in natural vegetation landcover (%)
FAC_index1	D	fire adapted community index (version 1)
FAC_index2	D	fire adapted community index (version 2)
Avg_HARM	E	mean HARM values from Anchorpoint product
b_fil_pct	E	area of county with burnable fuel types (%)
bp_b_MEAN	E	mean burn probability of burnable area
bp_b_STD	E	STD of burn probability of burnable area
D_fire_pct	E	Landfire disturbance by fire (%)
MeanFIL	E	mean fireline intensity level (FSIM modeled)
mode_HS	E	landcove type with most hotspots
NHrm_HPlus	E	area with high or greater HARM index (%)
norm_avg_brn	E	mean normalized area burned
norm_p95_brn	E	95th percentile of normalized area burned
nrmHS_A	E	hotspot density in agricultural areas
nrmHS_All	E	hotspot density in all areas
nrmHS_D	E	hotspot density in developedareas
nrmHS_Nm	E	hotspot density in mixed-naturalreas
nrmHS_NN	E	hotspot density in naturalareas
PrbFIL_4P	E	proportion of county with FIL = > 4
PrbFIL_5P	E	proportion of county with FIL = > 5
RX_ac_100sm	E	MTBS prescribed fire per unit area
RxF_pct	E	MTBS prescribed fire in forested area (% of Rx fire)
WF_ac_100sm	E	MTBS wildfire per unit area
for_rx	E	area available for prescribed fire in forested landscapes (%)
nfor_rx	E	area available for prescribed fire in non-forested landscapes (%)
RxSum	E	Hotspots attributed to prescribed fire
WfSum	E	Hotspots attributed to wildfire
log10_RxHS	E	Index of hotspot density (wildfire)

Variable	Group	Description
log10_WfHS	E	Index of hotspot density (Rx fire)
RxWf_HSratio	E	ratio of prescribed fire to wildfire
arv_ratio	F	index of variation in containment time (NFIRS)
cnt_ratio	F	index of variation in arrival time (NFIRS)
Combined_FPY	F	incidents per year, all sources combined
FED_FPY	F	federal incidents per year
FF_DEATH	F	fire-fighter injuries per 1000 incidents (NFIRS)
FF_INJ	F	fire-fighter deaths per 1000 incidents (NFIRS)
max_fsz_fed	F	max fire size, federal records
max_fsz_sf	F	max fire size, NASF records
med_arv_nfir	F	median arrival time, NFIRS (minutes)
med_cnt_nfir	F	median containmnet time, NFIRS (minutes)
med_dur_fed	F	median incident duration, federal (days)
med_dur_sf	F	median incident duration, NASF (minutes)
med_fsz_fed	F	median fire size, federal
med_fsz_nfir	F	median fire size, NFIRS
med_fsz_sf	F	median fire size, NASF
NASF_FPY	F	fires per year, NASF
NFIR_FPY	F	fires per year, NFIRS
p95_arv_nfir	F	95th percentile for arrival time, NFIRS
p95_cnt_nfir	F	95th percentile for containment time, NFIRS
p99_fsz_nfir	F	95th percentile for fire size, NFIRS
pct_int_HCF	F	intentional fires as percentage of human-caused ignitions
pct_nat_KNF	F	natural ignitions as percentage of all known causes
PctRep_FED	F	federal repsonse as percent of total reported incidents
PctRep_NASF	F	state repsonse as percent of total reported incidents
PctRep_NFIR	F	loacl (NFIRS) repsonse as percent of total reported incidents
pers_p_100sm	F	first responders per 100 square miles
stat_p_100sm	F	fire stations per 100 square miles
stat_p_10Kpop	F	fire stations per 10,000 people in county
SUP_PER	F	total suppression personnel in county
TOTALPERS	F	total response personnel in county
bldg_p_1K	F	mean buildings involved per 1000 incidents (NFIRS)
Natural_FPY	F	natural caused fires per year (total, extrapolated)
Human_FPY	F	human caused fires per year (total, extrapolated)
Arson_FPY	F	intentional human caused fires per year (total, extrapolated)

Appendix 5 – Stakeholder Involvement

a. Description of Stakeholder Engagements/Feedback

Representatives of the Western Region Strategy Committee attended local, regional, and national meetings and made presentations about the progress and current status of the Western Cohesive Strategy, as well as upcoming opportunities for comment and feedback. During those engagements, representatives made note of significant discussion topics, questions that "could not be answered", and potential contacts who may have helpful "success stories" to share. Presenters reported the meeting information using "trip reports". The trip report summaries are included below.

These engagements took place in the period from February 3, 2012 through August 3, 2012 and included 27 meetings in 9 western states as well as Washington, D.C. Over 935 people attended these meetings representing a broad array of interests and affiliations.

Figure 1. Western Region Cohesive Strategy Engagement Record as of 8/3/2012

Date	Event	Presenters	Location	Attendees
2/3/12	Madison County CWPP update (stakeholder meeting)	Terina Mullen	Ennis, MT	12
2/17/12	Anaconda-Deer Lodge Pre-disaster mitigation plan update (stakeholdermeeting)	Terina Mullen	Anaconda, MT	23
2/17/12	Granite County Pre-disaster mitigation plan update (stakeholder meeting)	Terina Mullen	Phillipsburg, MT	20
3/5/12	National Incident Commander and Area Commander Meeting	Joe Stutler, Tom Harbour, Jim Hubbard, Roy Johnson	Denver	50
3/8/12	BIA National Fire and Forestry Management Meeting	Jim Erickson	San Diego	NR
3/13/12	PNWCG Monthly Meeting	Pam Ensley and Joe Stutler	Portland	30
3/20/12	Intermountain Region Fire Management Pre-Season FMO meeting.	Sue Stewart, Joe Freeland	Ogden, UT	40
3/22/12	BLM National Mitigation Education and Fuels Workshop	Joe Freeland, Brad Washa John Ruhs	Boise	30
3/27/12	IAFC/ Western Governors Assn.	Ann Walker	Reno	100
4/4/12	Great Basin Incident Management Team Meetings	Joe Stutler	Reno	150
4/10/12	BLMs Fire Leadership Team annual pre-fire season meeting.	Joe Freeland	Boise	30
4/11/12	California Nevada Hawaii Fire Council	Caitlyn Pollihan	Hawaii	NR

Date	Event	Presenters	Location	Attendees
4/16/12	Madison County CWPP update (stakeholder meeting)	Terina Mullen	Ennis, MT	6
4/18/12	NWCG Monthly Meeting	TBA	Boise	NR
4/25412	WGA Staff Council	Ann Walker	Phoenix	30
5/1/12	USFS Region 2 Forest Supervisors Meeting	Dana Coelho	virtual	NR
5/8/12	Utah Interagency Fuels Workshop	Joe Freeland, Brad Washa, Erin Darboven	Salt Lake City	30
5/16/12	Western Forestry Leadership Coalition	Corbin Newman, Bob Harrington, Ann Walker, Sam Foster	Salt Lake City	50
5/17/12	National Indian Timber Symposium	Jim Erickson	Warm Springs, OR	NR
5/17/12	BLM Deputy State Directors, Resources & Minerals & WO Division Chiefs	Joe Freeland, Linda Booty	Washington D.C.	20
5/18/12	National Association of Counties - Western Interstate Region	Ann Walker, Bob Cope, Ryan Yates	Santa Fe, NM	35
5/22/12	BLM Field Committee meeting (associate State Directors & Deputy Assistant Directors)	Joe Freeland	Washington, D.C	20
5/24/12	USFS Region 6 Fire and Aviation Leadership Team Meeting	Joe Stutler	Portland, OR	100 +
6/7/12	Madison County CWPP update (stakeholder meeting)	Terina Mullen	Virginia City, MT	70
6/22/12	Western Regional Partnership Subcommittee on Disaster Response	Joe Freeland	Albuquerque, NM	30
7/11/12	Jackson and Josephine Counties Fire Board of Directors Meeting.	Joe Freeland	Medford, OR	10
7/17/12	"Revitalizing the National Forest System" Conference	Jim Golden, METI Inc.	Sacramento, CA	50

NR = No Report

Summary of Trip Reports through 8/3/2012

Number of Meetings/Events (reported) 267
Meeting or Event Name (see list above)
Number of Attendees 935+
Locations by State Arizona, California (2), Colorado, Idaho (3), Montana (5), Nevada (2), New Mexico(2), Oregon (4), Utah (3), Washington D.C. (2)
Stakeholder/Affiliations Represented

- Firefighters
- Collaborative Landscape Treatment Groups
- Regional, State, Local Land Managers
- Insurance Industry
- Firewise Communities
- County Commissioners
- Federal Government
- Tribal Government

Unique Discussion Points (beyond the general CS Briefing)

- Using the Deschutes Collaborative Forest Restoration Project to explore the immediate successes of the Cohesive Strategy as an example from Oregon
- What is the crosswalk between the Cohesive Strategy and the new Planning Rule?
- How will things be different in 5 years because of the Cohesive Strategy?
- Concerns were expressed related to the value and meaning of the effort. Comments along these lines related to concerns that this effort has not been clearly outlined and that the expectations for success are still not clear.
- There was a concern expressed that the Western Region is too large to represent only one common strategy.
- There was concern that some of the actions are daunting and could be a very big workload.
- With concepts on local stakeholders and other plans, could there be a collision down the road?
- Still continuing to do CWPPs, etc.; can we take a step further when prioritizing projects on private ground? An "active" community should be one of the priorities – not color schemes on the map.
- Questions ranged from: Do we anticipate significant organizational changes to result from these efforts as well as the current budget climate?
- Why are we not consolidating capability in an interagency manner when it makes sense?
- There were several questions related to expected outcomes, the answers were consistent with reducing our risk trajectory in all three goals by using and leveraging all levels of government and stakeholders in a more effective way than ever before.
- What's the worst thing that can happen to "us" if this fails, or how do you think the products or implementation actions will be used in the future?" There was some concern that the FS was not strongly represented on the technical or strategic groups during the NSAT interaction, certainly no one stepped up to volunteer, comfortable with information now.
- Several questions and some discussion on how some of the actions in the Western Region are consistent with fire management consolidation and leveraging of capability within the Forest Service Intermountain Region.
- There was discussion relating to how this effort builds on and evolves previous strategic efforts such as FPA, the National Fire Plan etc...
- There were concerns expressed that this was a top down effort e.g. The Flame Act, but we were able to illustrate how the all hands, all lands approach was being use and in fact the assessments in Phase II and again in Phase III were shaped by comments from all stakeholder that came from the ground and not from the beltway.

- On two occasions, with direct conversations with State Foresters and Regional Foresters, we talked through real life situations each were having in their respective states and gave several example of how the goals of the CS would work for them to resolve issues that directly relate to CS implementation.
- One Regional Forester asked specifically, "if you were me, what you do to help facilitate the CS efforts?" Response was look for those immediate opportunities in your region and personally recognize those efforts particularly when the successes involved multiple stakeholders including the FS.
- The importance of promoting inclusive CWPP efforts to build capacity and to achieve the goals of the CWPP, as well as the CS. Copies of the Community Guide to Preparing and Implementing a CWPP were given to each participant along with a WFLC CS Support document.
- Two participants inquired about how the CS would help them? They live in an area with high conflict between the federal agency and the county and with environmental groups not participating in the collaborative group. The county wants to retain access rights to public lands and the USFS is suing the county. The fact remains there will be litigation and groups that choose to litigate instead of participating in the local collaborative. There are examples of collaborative group members banding together to testify in court, against environmental groups, in support of the projects identified by their collaborative group/CWPP.
- Interest in how science would be included in the phase III process.
- Concepts related to how the strategy relates to collaborative efforts in the southern Oregon.
- What will we in the field see that is different? We hope to see allocation processes local, state, and federal that recognize and reward active vegetation management, broad collaboration, and shared responsibilities.
- Does this have the likelihood for more fuels money, more prevention people, or more firefighting resources? In some areas those things may be the result, but in some cases there will be re-prioritization and subsequent reductions based on limited public sector investment capability.
- How can it be budget neutral? Local, State, and National public sector funds are flat or declining. It appears that that trend will persist for some time. Market based solutions, proponent supported off-site mitigation, and non-public sector investments need to be nurtured and leveraged.
- What are the incentives and dis-incentives for forests to get on board? There has been extensive non-federal participation in to all three phases thus far. Much of the federal wildland fire management force continues to be skeptical or unaware of the effort. If that sector of the stakeholder group does not participate, then they may not like the outcome.
- How the strategy relates to other collaborative efforts in the Southwest. There were several questions as to who might be participating in the Southwest.

Questions That Could Not Be Answered

- When will we have conversations about shifting the budgets?

Leads for Immediate Actions/Success Stories

- Deschutes Collaborative Forest Restoration Project - Katie Lighthall
- Quincy Library Group - Frank Stewart
- All 23 CFLRP projects funded in 2010 and 2012
- Paul Summerfelt from Flagstaff Fire Department has taken the 3 goals of CS and applied to his department and area, separate attachment coming.
- Mike Morcom, State FMO for BLM Idaho will use the update of the Master mutual aid agreement and identify existing barriers for implementation, particularly for local government and volunteer fire departments.
- Pam Ensley has some specific PNW lessons learned success stories she wants to post on the Western Portal that can be used for our outreach efforts.

- Sue and Craig Glazier will begin exploration of an Island Park, Idaho collaboration effort with a current, interested county commissioner that is very excited about this topic and has connection bridges between the agencies and the community.
- The PNW will identify a person from Fire and Aviation who will be a specific contact for SORO (State Office/Regional) office and suggest we need to contact regional fire directors and State FMO's looking for similar points of contact
- Policy will be adopted by the governors during their annual meeting on June 11th and posted to the web at www.westgov.org. The final policy will be shared with the WFLC, WFEC, WRSC, and others.
- Presentation by Doyel Shamley, Natural Resources Coordinator for Apache County, AZ, Illustrated an aggressive approach to treating the WUI around the community of Greer AZ, utilizing local community resources. The community asserted a "right" to treat the surrounding federal forest in the name of public safety, and, in a sense, "brought" the USFS along.
- Efforts on the border area regarding state of the art efforts in emergency response communications interoperability.(From Western Regional Partnership)

Appendix 6 – Communications Activities (Communications Team)

Summary of Efforts in Phase III

The Western Region identified the need early in Phase III for a working group focused on communications, outreach, and improving our connectivity to our diverse group of stakeholders. To that end we solicited participation of a variety of stakeholders with a passion for the efforts related to the three goals. The Region, with the support of the WFLC focused a degree of energy on continuing to identify and share success stories that illustrate cohesive strategy behavior and actions. We also spent some energy on the collaboration part of the equation, especially as it relates to communities and what elements lead to successful outcomes. We also spent some energy on expanding the scope and effectiveness of the Community Wildfire Protection Planning (CWPP) process. Through these efforts we were able to gain a common understanding of community capacity, how we might use the success from one area to translate in to potential solutions for other areas, and how we might improve the effectiveness of CWPPs and related efforts. Below, you will find a summary from those three efforts as well as some recommendations for moving forward on the specific topic or for the West in general. To see the complete versions of each of these efforts please refer to the following link and look at the reports section. http://sites.nemac.org/westcohesivefire/

Living with Wildfire: The State of Practice in Western Communities

Executive Summary

In order to integrate the experience and insights of community stakeholders working on fire management issues in the west, leaders responsible for the Western Region Cohesive Strategy needed a strong understanding of current trends, needs and opportunities. This assessment was designed to provide that information and is intended to inform strategies, policies and programs emerging through the Cohesive Strategy and in subsequent national fire management investments and priorities going forward. We framed the assessment around the three goals set out in the Cohesive Strategy: response to wildfire, fire adapted communities, and resilient landscapes. The following findings represent a synthesis of the information offered by over 500 individuals reflecting on their experience with fire management:

- A majority of respondents were working across multiple fire management goals in their communities, indicating opportunity for realizing integration and synergy among the three Cohesive Strategy goals.
- Collaboration, cooperation and shared-leadership were highly utilized and highly valued.
- Increased collaboration, communication and sharing of responsibility and authority at the local level can yield improved and sustained partnerships, and improve fire management outcomes.
- Community stakeholder capacity and engagement, supported by flexible programs and partnership arrangements, are important to successfully accomplishing the three Cohesive Strategy goals.

- In both the provision of technical information and assistance, and in learning about new developments in support of fire management, respondents strongly favored various forms of in-person and interactive communications (peer networks, personal contacts, workshops, field tours, etc.) as the most effective tools. However, they also drew on the full array of tools and resources available.
- A diversity of leaders and stakeholders are working through partnerships to plan and implement effective and innovative fire management strategies. However, their successes are constrained by a wide range of social, policy and physical challenges that will require strategic and concentrated actions and investments at multiple levels to overcome.

We hope these findings will guide the Western Region Cohesive Strategy in addressing challenges and supporting at-risk communities as they work to better live with wildfire.

Recommendations

- Focus on fostering integration among the three Cohesive Strategy goals
- Continue investing in collaboration, cooperation and shared-leadership at the local level
- Increase investment in stakeholder capacity and engagement, supported by flexible programs and partnership arrangements, at the local level
- Increase investments in the various forms of in-person and interactive communications (peer networks, personal contacts, workshops, field tours, etc.)
- Continue investing in the full array of outreach and communications tools and resources currently available.

Cohesive Strategy Success Story Framework

Executive Summary

Stakeholder comments provided during Cohesive Strategy (CS) development emphasized the need to streamline the transfer of technology and knowledge from those experiencing success, to those seeking it. Success Stories can serve as one way of building and strengthening the important cultural connection needed between the diverse fire-adapted landscapes and stakeholders who inhabit the West.

Collectively success stories are seen as:

1. A tool to provide <u>examples or illustrations</u> how to move toward or achieve the goals, objectives, and actions associated with the CS and
2. Demonstrations of <u>immediate actions</u> that could be taken by stakeholders to adapt and live with fire in their communities consistent with the goals, objectives and actions described within the Western Region Strategy and Assessment.

Stakeholder engagement and involvement has been a cornerstone of the CS development effort. Building on and strengthening stakeholder engagement and expanding stakeholder networks provides a foundation for leveraging increasingly scarce resources needed for implementation. Stakeholder networks must be expanded and strengthened. However, an improved delivery method or framework for developing, organizing, and sharing success stories is needed.

The Success Story Framework directly addresses these needs and is designed to:

A. Align and Distribute Success Stories Consistent with CS Objectives and Actions

Making a link between Success Stories and the goals, objectives and actions developed for the Western Region is a key step in implementation. Simply collecting Success Stories from across the West and making them available to stakeholders using web-based search engines, etc. does not accomplish this alignment. It is important to use Success Stories as illustrations of the outcomes envisioned during the collaborative development process and to anchor them to the objectives and actions described in the CS.

This alignment will also address needs communicated by stakeholders to provide concrete examples of how their peers are making progress toward or achieving outcomes described in the CS. Peer-to-peer networks have been identified as one of the most effective methods of providing the transfer of knowledge and experience.

B. **Identify Success Stories for the Full Range of CS Objectives and Actions**

A preliminary analysis of existing Success Stories posted on Forest and Rangelands.gov, wildlandfireprograms.usda.gov, and others developed during Phase III has identified a "gap" in examples associated with the full range of objectives and actions described in the CS and the diversity of situations faced by stakeholders in different "operating environments".

C. **Provide Stakeholders Relevant and Meaningful Examples of Success Stories Corresponding to their Operational Situation**

The Western Region is recognized as ecologically and culturally diverse. The Framework is designed to provide stakeholders a resource to search for Success Stories about objectives and actions accomplished using different collaborative schemes in socio-economic settings similar to their operating environment.

D. **Provide a basis for monitoring implementation of the CS**

Success Stories can provide empirical evidence over time for monitoring progress in implementing the CS's guiding principles and collaborative efforts. An evaluation or "snapshot" of the approaches described can provide the basis for monitoring the change in community problem solving methods being employed and the range of CS objectives and actions being addressed.

Delivery of accurate and integrated information to stakeholders consistent with the principles and goals of the CS must be sustained during implementation. Success Stories provide illustrations and examples of stakeholders working toward the goals and objectives of CS and will provide a durable and expanding stakeholder resource during implementation. An improved web-based delivery mechanism and system for generating Success Stores that incorporates the features of the Success Story Framework is needed to meet these demands.

Recommendations:

Delivery of accurate and integrated information to stakeholders consistent with the principles and goals of the CS must be sustained during implementation. Success Stories provide illustrations and examples of stakeholders working toward the goals and objectives of CS and will provide a durable and expanding stakeholder resource during implementation. An improved web-based delivery mechanism and system for generating Success Stores that incorporates the features of the Success Story Framework is needed to meet these demands.

CWPP to Protect Landscapes & Communities: CWPPs and the Middle Ground

Executive Summary

Community Wildfire Protection Plans (CWPPs) are planning documents in which communities and counties in the Wildland Urban Interface (WUI) strategize to reduce the threat and potential impact of wildland fire. During the Cohesive Wildland Fire Management Strategy stakeholder input process, many WUI residents made it clear that they value many aspects of the landscape as much as they do their homes. They spoke movingly of the need to protect watersheds, wildlife habitat, cultural use areas and sites, utility corridors, evacuation routes, forested views, and other high value areas and assets. Tribal representatives talked about the need to consider the home and the homeland in unison, and not as two separate entities. The Western Regional Strategy Committee (WRSC) identified the "middle lands" or "middle ground," areas between the WUI and the backcountry, as an area of concern for fuels treatments, to protect both landscapes and communities. Concern about protecting communities and community values can extend well beyond the community's boundaries.

This study looks at how the middle ground is being addressed in existing CWPPs, and at the guidance with which CWPP planning groups are working. Setting the WUI boundary is one of the steps in doing a CWPP. The WUI is located near communities at risk. It's important to consider the relationship of the WUI to the community at risk when determining the WUI boundary. This study examined the CWPP guidance and many CWPPs to determine if CWPPs, as they are currently being done, address the middle

ground adequately. This paper discusses the results of the study, and shows a few examples of CWPPs, and how they protect values-at-risk beyond the WUI boundary. The examples also show methods of prioritization of actions for implementation.

A review of many Western CWPPs shows that there are different definitions in use for at-risk communities and the WUI boundary. The definitions of at-risk communities and the WUI have changed in practice since they were first defined in the Healthy Forest Restoration Act (HFRA) and in the Federal Register. The differences center around whether a community at risk must be near federal land, and if there is a set distance for the WUI boundary. Where there is no CWPP, HFRA sets a maximum distance around the community for the WUI. However, where there is a CWPP, the WUI boundary is defined by the collaborative group, which creates the CWPP. Proximity to federal land is not a requirement if the community is located in an environment that is deemed a high wildfire risk area. The CWPP process gives members of communities and counties with CWPPs the opportunity to provide input into the prioritization process for fuels treatments on public land. The ability to define the WUI boundary in accordance with the unique circumstances of their community and to provide input in the prioritization process are two of the best reasons for communities or counties to create CWPPs.

Across the West, most states did CWPPs at the county level, or at the county level with additional specialized CWPPs focusing on smaller regions within the county. The approaches to defining the WUI and prioritizing projects are varied in CWPPs, with many creative and valid methods employed. The study found that CWPPs done at the county level frequently address the middle ground and consider fuels treatments in the middle ground as part of the prioritization process.

The study finds that there is nothing in the definitions or guidance relating to CWPPs that prevents communities or counties from designating WUI boundaries where they see fit. However, some groups doing CWPPs are not aware of the flexibility of the definition. States, counties and municipalities should educate CWPP groups about the benefits of setting their own CWPP boundary.

As the examples contained in this study show, there are many ways in which CWPPs have successfully incorporated middle ground planning. CWPPs done at the county level often treat the entire county as the area of concern, and may not identify a WUI boundary at all. An example of this method is the Trinity County, California CWPP. Other CWPPs identify a WUI boundary, but plan beyond it by designating areas of concern or areas of special interest (ASIs) such as in the Montrose, Colorado CWPP. Other techniques include identifying a WUI Zone-2, which has prescriptions for fuel treatments that are less stringent than in the more urbanized WUI Zone-1, as in the Mill Creek Canyon, California CWPP. And some CWPPs identify the WUI in relationship to other factors of community importance, not just proximity to structures, as in the Mill Creek Watershed, Oregon/Washington CWPP and the Orleans/Somes Bar, California CWPP.

To best address the middle ground, it is advisable to do a tiered approach to CWPP development, with local, tribal, state and federal entities sharing information on values at risk, whenever possible. Adjoining states, tribes and communities can work together, sharing information across boundaries. In this way, ecological regions, which span multiple counties can have almost seamless CWPP planning. Or, as is done in the Mill Creek Watershed, Oregon CWPP, the entire area of concern can be defined within the WUI boundary. In that case, a valuable watershed, which provides drinking water to the nearby city and covers parts of four counties in two states (Oregon and Washington), is all within the WUI boundary. Additionally, the Orleans/Somes Bar CWPP spans three counties to include landscapes of community importance, even though each county CWPP breaks the planning area up along county lines. To address the need for planning centered around communities at risk, implementation of the CWPP is coordinated with Tribal planning efforts, and is tiered to tribal and county CWPPs and equivalents. By using a more open definition of WUI, we are taking a holistic approach to the location of communities within the landscape and the interdependence of the community and its surrounding landscape.

Recommendations from this study include:

1. CWPPs or equivalents should be scaled to the county, tribal territory, and/or area of community importance to include middle ground areas as delineated by how communities identify themselves with the landscape concerned.
2. Targeted community CWPPs can be done to supplement the county and/or tribal CWPP or equivalent(s).
3. Adjacent counties, states, tribes, and municipalities should share information and coordinate plans across boundaries for a seamless approach to wildfire planning.
4. Doing small projects first builds community involvement and capacity for larger projects.
5. Weighting systems for hazardous fuels treatments should be sensitive to the differences between the types of places, such as urban, suburban, rural, watershed, evacuation route, etc.
6. In the prioritization analysis, extra weight should be given to fuels treatments in close proximity to communities, to provide protection to both the community and the landscape, and these fuels treatments should be done regularly to keep fuel loads low.

States, counties, tribes and municipalities should give guidance to CWPP planners about the importance of setting the WUI boundaries in coordination with tiered documents to address areas of concern and ecological values at risk.

Information and Resources for Communities, Agencies, and Other Stakeholders

There is a great deal of material (how-to guides, training manuals, collections of success sotries, etc.) available to help communities, federal and state agencies, and other stakeholders better understand how to initiate and/or become effectively engaged in collaborative processes.

The Forest Service's Partnership Office website
http://www.fs.usda.gov/main/prc/tools-techniques /collaboration
begins with "The Art of Collaboration" and follows it with sections on partnership development, finding funding for collaborative efforts, and monitoring and joint learning. It also includes a series of training modules on partnerships and collaboration

There is also a great deal of helpful information on the Forest Service's restoration website. Much of it was developed in response to the authorization of stewardship end result contracting (SERC), and that has been augmented with lessons learned from the more recently initiated Collaborative Forest Landscape Restoration Program (CFLRP). The Forest Service's SERC information (including training materials and success stories) can be found at
http://www.fs.fed.us/restoration/Stewardship_Contracting/training.shtml
The CFLRP information begins at
http://www.fs.fed.us/restoration/CFLRP/index.shtml/index.shtml.
The "Results" tab leads to reports on individual projects and success stories, and the "Training" section to recorded peer learning sessions, some of which focus on collaboration.

The Pinchot Institute for Conservation has been conducting yearly programmatic monitoring of SERC projects for the Forest Service (since 1999) and the BLM (since 2005). The resulting annual reports are available at
http://www.pinchot.org/gp/Stewardship_Contracting
One of the major issues which has been tracked over time is how Forest Service and BLM personnel can increase and improve agency engagement in local collaborative processes. The results are usually worth the effort, but the up-front investment of time that has to be made can be substantial. The regional monitoring teams assessing the information gathered each year have consistently said that

1. collaboration needs to be part of the job – not an add-on to it – and
2. there needs to be appropriate recognition of good work in collaboration – positive performance evaluations, etc.

The Council on Environmental Quality has an excellent handbook on collaboration in the NEPA process that explains how agency personnel can be productively involved in collaborative efforts without

running afoul of the Federal Advisory Committee Act (FACA). That document can be downloaded from http://ceq.hss.doe.gov/nepa/nepapubs/Collaboration_in_NEPA_Oct2007.pdf.
The Bureau of Land Management's recently issued National Natural Resources Policy for Collaborative Stakeholder Engagement and Appropriate Dispute Resolution focuses on preventing, managing, and resolving conflicts or disputes through collaborative stakeholder involvement. It's at http://www.blm.gov/pgdata/etc/medialib/blm/wo/Planning_and_Renewable_Resources/adr_conflict_prevention.Par.44228.File.dat/ADR.pdf

The BLM's ADR program website provides a list of available training programs as well as an extensive bibliography "for those interested in learning more about Alternative Dispute Resolution, collaborative engagement, public participation, and related disciplines" at http://www.blm.gov/wo/st/en/prog/more/adr/training_and_resources.html

The National Forest Foundation's Collaboration Resources website

(http://www.nationalforests.org/conserve/resource) has a "Learning Topics and Tools" section that provides "examples, best practices, and other resources for practitioners working in the field of conservation and collaboration". NFF also offers technical assistance and some grant assistance for qualifying organizations.

The Red Lodge Clearinghouse's Collaboration Handbook
(http://rlch.org/content/collaboration-handbook)
provides a step-by-step "how-to" guide for collaborative groups, with chapters on:

- when to collaborate,
- getting started,
- the first meeting,
- subsequent meetings,
- strategic planning,
- gathering resources,
- organization structure,
- dealing with problems, and
- the maturing collaborative.

While not focused on long-term collaborative efforts, the BLM's *Earning Bridges: Strategies for Effective Community Relations Before, During, and After the Fire*, provides practical, common-sense guidance "about building and maintaining relationships" – the core of any collaborative process. As to why that matters, *Earning Bridges* says:

> *There are pockets of the West where BLM fire programs have developed and maintain positive, productive relationships with special publics, particularly the ranching community. These relationships have multiple benefits that lead to cooperation and a safer environment when fires occur. Where these relationships do not exist, a lack of understanding, communication, and coordination results in unnecessary obstacles and challenges, and safety issues that threaten both firefighters and the public.*

The handbook is available at
http://www.blm.gov/pgdata/etc/medialib/blm/wo/Information_Resources_Management/policy/ib_attachments/2007.Par.23468.File.dat/ib2007-075attach1.pdf

Conclusions and Next Steps for Communications

These efforts show the need for continued communication efforts among stakeholders on all topics related to the Strategy. We need to exchange information on successes through a variety of methods and approaches. We have learned that communities and collaborative processes are the cornerstone to success in all three goal areas. Continued efforts to create a broad, common understanding and support among all stakeholders for the underlying principles of the Strategy need to be prioritized. We also have learned that the hub and spoke peer networks between agencies, collaborative efforts, various Non-government organizations, and academia are working very well and those networks will be key in the success of the three goals. We do have four specific recommendations that can be added to the sets above:

1. We recommend the upgrade or design of an improved delivery platform as a vehicle for Cohesive Strategy tools such as success stories. This can be done by modifying existing sites such as forestsandrangelands.gov or choose an existing site that is already configured for continuous updating and modification.
2. We recommend the establishment of a monitoring function to evaluate our success in our efforts related to stakeholder engagement and success towards the three goals.
3. We recommend continued regional outreach and engagement to increase participation and shared understanding of Cohesive Strategy principles.
4. We need to continue to develop collaboration tools, increase communications networks, and strengthen the common adoption and understanding of Cohesive Strategy principles.

Monthly Updates

Ongoing communication activities include monthly updates, a brief newsletter format which provides highlights of:

- National Science and Analysis Team Activities,
- Progress and process items from the Western Regional CS effort,
- Items from current events from outside, but relevant to the Cohesive Strategy process,
- And links to the latest "Success Stories" developed by the team.

The update also includes links available for additional information about the CS, as well as to the co-chairs of the WRSC.

"Success Stories" are one of the more effective means of assisting stakeholders in their pursuit of information about techniques and challenges that will facilitate their movement toward achieving the goals of the Cohesive Strategy. Actual situations and events from around the Western US are compiled and made available at the WRCS website, and local contacts are often included for additional help and information.

Monthly Updates and "Success Stories" are posted to the WRSC website beginning in July of 2011 and continuing to the present. These are available at http://sites.nemac.org/westcohesivefire/updates/ or http://www.forestsandrangelands.gov/strategy/index.shtml

Presentation Materials

The WRSC members and representatives also maintained a variety of presentation tools and materials, including briefing papers and Power Point Slide Presentations, some of which can be found on the following pages.

Cohesive Strategy Briefing Paper

The National Cohesive Wildland Fire Strategy was requested by Congress to address the wildfire problems facing communities, such as: loss of life and property, suppression costs, damage to natural and cultural resources, and coordination between fire jurisdictions. The Western Strategy is one of three regional strategy efforts being developed with the participation and assistance of a wide variety of stakeholders and interests across the country.

The three principal goals of the National Cohesive Strategy are:

- Restore and Maintain Resilient Landscapes: reduce the risk to forests and rangelands.
- Create Fire-Adapted Communities: withstanding a wildfire without loss of life, property, and community assets.
- Respond to Wildfires: All jurisdictions participate in safe, effective, efficient wildfire management through improved intergovernmental coordination.

The Western Regional Cohesive Strategy group has:

- adopted those three goals
- contributed ideas to shape the future of wildfire management
- produced the "Western Regional Assessment and Strategy"

In the next phase, the Group will develop:

- a regional wildfire risk assessment
- an evaluation of options and alternative scenarios for the Western Strategy
- performance measures to assure the strategy is effective
- guidance on implementing the strategy

The outcomes from the Western Regional Cohesive Strategy are:

- Improved efficiency for all state, federal, tribal, and local firefighting organizations.
- Forests and rangelands that will better withstand wildfire.
- Communities with reduced risk of loss of life and property when wildfire occurs.
- Communities and agencies positioned to work collaboratively on wildfire management issues.

The three regional strategies will be integrated to produce a National Cohesive Strategy that reflects the unique cultures and environments of the West, the Northeast, and the South. Remain engaged by following the latest information at www.forestsandrangelands.gov/strategy/ .

Western Regional Cohesive Strategy Slide Presentation

Cohesive Strategy Briefing

The National Cohesive Wildland Fire Strategy was requested by Congress to address the wildfire problems facing communities, such as:

- Loss of life and property
- Suppression costs
- Damage to natural/cultural resources
- Coordination between jurisdictions.

National Cohesive Strategy

Goals

1. Resilient Landscapes
2. Fire-Adapted Communities
3. Wildfire Response

Restore/Maintain Resilient Landscapes

Reduce risk to forests and rangelands

Create Fire-Adapted Communities

Withstanding a wildfire without:
Loss of life - Property - Community assets

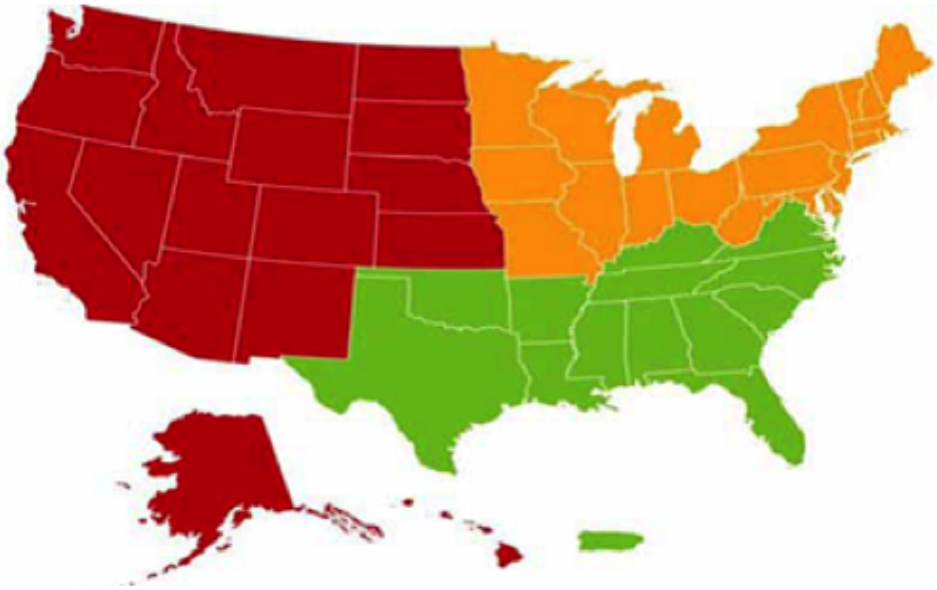
Wildfire Response

All jurisdictions participate in safe, effective, efficient wildfire management through improved intergovernmental coordination

Regional Cohesive Strategies

Regions: North, South, West

Stakeholder participation around the country



Western Regional Cohesive Strategy Group

- Adopted and developed the 3 national goals
- Contributed ideas to shape the future of wildfire management
- Western Regional Assessment and Strategy

Western Regional Cohesive Strategy

NEXT PHASE

- Regional wildfire risk assessment
- Evaluation of options and alternative scenarios
- Performance measures
- Guidance on implementation

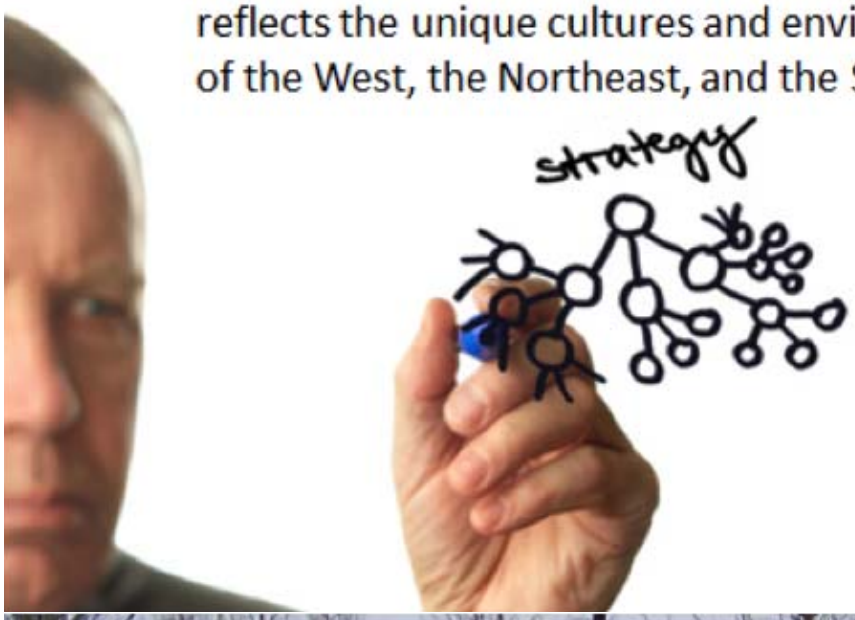
Western Regional Cohesive Strategy

Results:

- **Improved efficiency**
  … federal, state, tribal, local
- **Better withstand wildfire**
  … for forests and rangelands
- **Reduced risk to communities**
  … loss of life/property
- **Positioned to collaborate**
  … with Communities/agencies

National Cohesive Wildland Fire Strategy

The three regional strategies will be integrated to produce a **National Cohesive Strategy** that reflects the unique cultures and environments of the West, the Northeast, and the South



www.forestsandrangelands.gov/strategy/

Appendix 6 - Communications Plans and Actions - Regional Webpage Information and Content

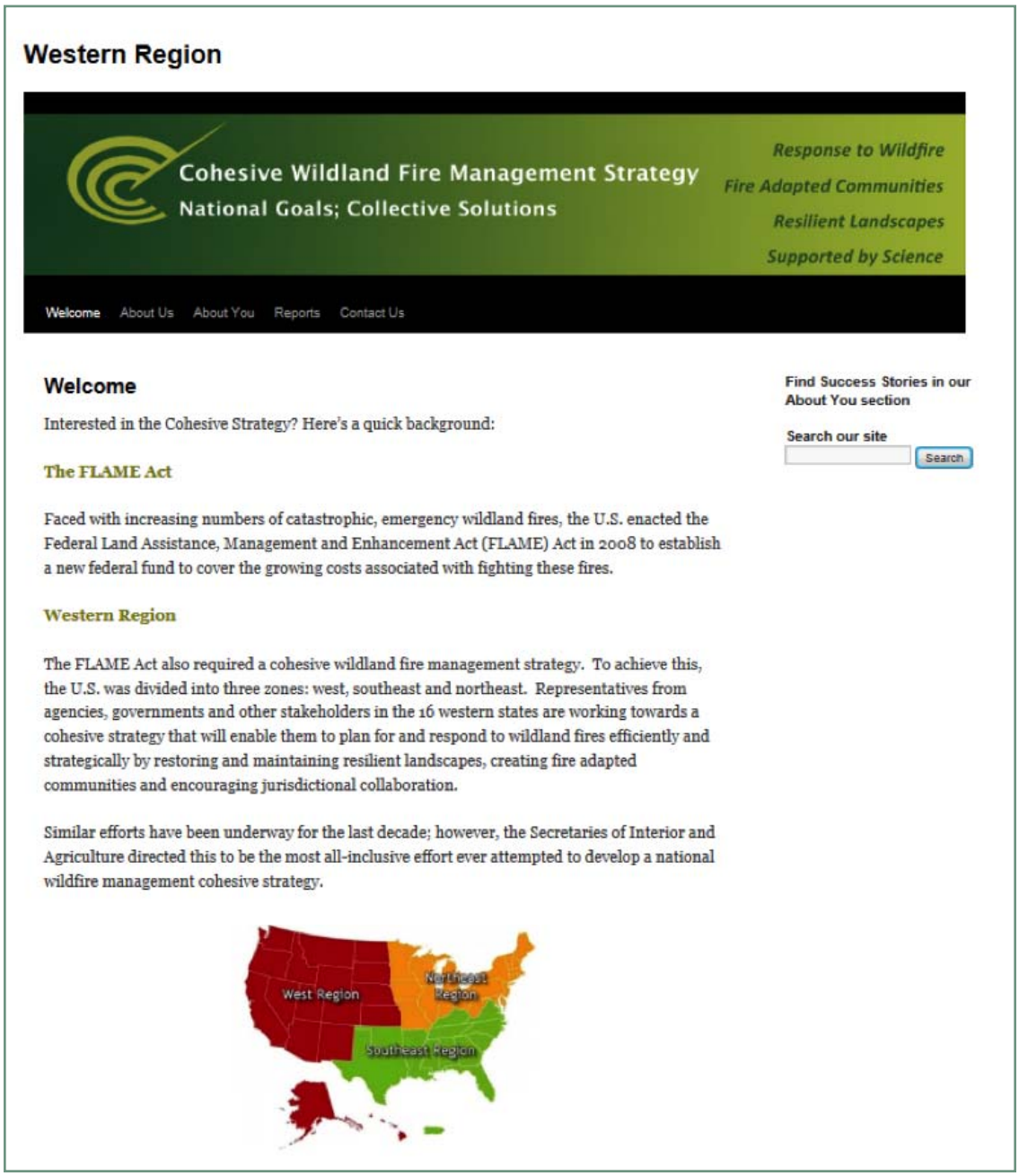
The Western Regional Strategy Committee maintains a webpage at http://sites.nemac.org/westcohesivefire to provide stakeholders with current and useful information and to serve as an outreach site to collect comments about the CS effort at the appropriate times.

The "Welcome Page" provides a brief introduction to the CS effort and describes the three CS regions.

The "About You" page serves as the site where "Success Stories" are found. There are also links to other resources which may be useful to communities and groups of stakeholders who are seeking information about the techniques, processes, tools and challenges of working together to achieve the three goals of the Cohesive Strategy.

The "Reports" page provides stakeholders with the links to the monthly updates as well as links to the Western Regional Strategy and Assessment, Content Analysis from two outreach efforts, and a link to the National Cohesive Strategy home page.

Those web pages are shown on the following pages for illustration. They are available at http://sites.nemac.org/westcohesivefire .



Western Region

Cohesive Wildland Fire Management Strategy
National Goals; Collective Solutions

Response to Wildfire
Fire Adapted Communities
Resilient Landscapes
Supported by Science

Welcome | About Us | About You | Reports | Contact Us

About You

Stakeholder Collaboration

This is an all inclusive, wildland fire management stakeholder effort – a long-term, iterative process with ongoing dialogue. We are seeking the most diverse opinion-base possible to help develop the National Wildland Fire Management Cohesive Strategy (Strategy) within the time limitations agreed to by Congress and the Administration.

- The Strategy is to establish national direction for wildland fire management, representing the needs and capabilities of all cooperators, including the public.
- The Strategy is about more than fire suppression. It emphasizes restoring resilient landscapes and promoting fire adapted communities.
- The Strategy is designed to better align national level decision-making with the broad diversity of regional and local interests.

Find Success Stories in our About You section

Search our site

Search

Success Stories from Western Stakeholders

Success Stories are examples of communities, tribes, agencies, organizations, and individuals making progress toward achieving the vision defined by the Cohesive Strategy *"...to safely and effectively extinguish fire, when needed; use fire where allowable; and as a nation, to live with wildland fire."* Progress is made toward one or more of Cohesive Strategy's three goals consistent with the Guiding Principles adopted during Phase I. Click on those stories below that interest you -

- Structure Protection at Elk Stream Ranch - The First 48 Hours of the Weber Fire and how a small community in western Colorado managed to protect their homes from wildfire.
- Northern California Prescribed Fire Council - While there are many impediments to the use of prescribed burning, an organization with a participatory professional culture can pave the way for reviving fire use in land.
- Spring Mountains National Recreation Area Hazardous Fuels Reduction Projects -Less than an hour's drive west of Las Vegas, Nevada (population 583,756), the Spring Mountains rise high above the desert that completely surrounds them, reaching nearly12,000 feet at the summit of Mount Charleston.
- Selway-Bitterroot Wilderness Fire Program - Restoring wildland fire to restore fire-adapted ecosystems and reduce longterm management costs.
- Karuk Tribe – Bringing Fire to the People – Using traditional ecological knowledge to manage resilient ecosystems, create fire-adapted communities, and respond to wildfire.
- Upper Deschutes River Coalition – Mission: "To protect Upper Deschutes River Communities by restoring and sustaining healthy fire-resistant forests, pure and abundant river flows and wildlife habitat."
- Whitefish Area Fire Safe Council – Working together to educate and facilitate the Whitefish Community to reduce wildfire risks and to maintain a Fire Safe environment.
- Flagstaff Fire Department – Establishing performance metrics to measure progress toward collaborative objectives set for each of the three Cohesive Strategy Goals.
- Colorado Bark Beetle Collective – Addressing the impacts of the very serious mountain pine beetle outbreak in the area, through intergovernmental cooperation between Federal and State land management agencies, and municipal and county governments.
- Ashland Forest Resiliency Stewardship Project – Implementing landscape scale treatments of Ashland's municipal watershed in an effort to restore fire-adapted ecosystem, improve water quality and provie economic and social benefits to the community. Multiparty partnership and monitoring includes municipal, Federal, and NGO collaborators. More at this project's website.
- Wallow Fire - When the Wallow Fire tries to burn into the communities of Alpine and Greer, a "triple punch" helps to thwart and stop this high-intensity crown fire before it reaches homes.

Resources for Connecting Nationally

- www.forestsandrangelands.gov
- Fire Adapted Communities at fireadapted.org

Topics of interest in followup to the Western Region's Strategy Assessment

- Enhancing Collaboration
- Home and Homeland
- Community Protection
- Fully Utilizing Existing Authorities
- Using Economic Principles to Achieve Ecosystem Objectives

Western Region

Cohesive Wildland Fire Management Strategy
National Goals; Collective Solutions

Response to Wildfire
Fire Adapted Communities
Resilient Landscapes
Supported by Science

Welcome | About Us | About You | Reports | Contact Us

Reports

Preliminary Alternatives and Performance Measures

From **June 11** through **July 10** we collected feedback on the preliminary alternatives and performance measures being developed by the Western Regional Strategy Committee. The comment period is now closed but you may access the material reviewed at the link above.

WRSC General Updates

- **August 2012**
- July 2012
- June 2012
- May 2012
- April 11, 2012
- December 5, 2011
- November 4, 2011
- October 21, 2011
- October 6, 2011
- September 15, 2011
- August 5, 2011
- July 15, 2011
- July 5, 2011

Western Regional Strategy and Assessment

- Full report [pdf]
- Appendix 7: Phase II Outreach and Content Analysis of Comments on Goals, Objectives and Actions (includes communication plan) [pdf]
- Appendix 8: Immediate Opportunities (ideas submitted to the WRSC from METI) [pdf]
- Content Analysis of Comments on Regional Strategy and Assessment
- Phase III Content Analysis of Comments on Preliminary Alternatives and Performance Measures

Cohesive Strategy Reports

A National Cohesive Wildland Fire Management Strategy and the *Report to Congress: The Federal Land Assistance, Management and Enhancement Act of 2009* – as well as foundational documents for this effort - is available at www.forestsandrangelands.gov.

Find Success Stories in our About You section

Search our site

Search

Appendix 6 - Communications Plans and Actions - Phase III Communication and Outreach Plans

Western Region Phase III Communication and Outreach Plan

The Western Regional Strategy Committee (WRSC) desires to continue an emphasis on stakeholder communication and outreach during Phase III of the National Cohesive Wildland Fire Management Strategy. Communication and outreach objectives identified in the Western Region's Phase II Outreach Communication Plan will persist and be built upon during Phase III, and include:

1. Engaging people affected by this strategy in its development within the timeframes identified by the Wildland Fire Leadership Council (WFLC).
2. Following a collaborative, rigorous, transparent development path.
3. Collecting data representing interests and opinions of stakeholders.
4. Using local, regional, and traditional knowledge and insights, as well as science and technology, to inform the western strategy assessment.
5. Disseminating clear and current information to stakeholders using multiple media on a routine basis.
6. Identifying and sharing on-the-ground success stories, including "key ingredients to success" that could be of immediate help to other communities or organizations.
7. Seeking input from stakeholders to develop Cohesive Strategy implementation plans, and applying their ideas and "key ingredients" associated with successful projects to implementation planning.

Desired Outcomes for Phase III Communication and Outreach

The Western Region Outreach and Communication Plan dovetails with and supports the objectives of the National Communication Framework. This update includes activities leading to and through Strategy Implementation (February 28, 2013).

Outreach and communication efforts during Phase II provided the WRSC/WG with valuable information used to develop the Western Assessment. Efforts by the WRSC/WG to fully engage all stakeholder groups across the West was hampered by a combination of the time of year outreach was conducted and time limitations established by WFLC. As a result, opportunities remain to strengthen and expand stakeholder engagement during Phase III and set the stage for successful implementation of the Cohesive Strategy

The WRSC has identified the following desired communication and collaboration outcomes and activities to be achieved during Phase III:

- Strengthen and expand stakeholder support throughout the West and ensure all affected stakeholder "voices" are heard and engaged.
  - Share the Western Assessment - expand the dialog and stakeholder participation and continue to identify and add good ideas.
  - Seek specific input to the Goals, Objectives, Sub-Objectives, Actions and broad policy questions described in the Western Assessment.
  - Expand stakeholder support beyond that developed in Phase II by actively reaching out to engage "new voices" in the conversation.
- Continue to identify "Immediate Opportunities for Success" in the West focused on those examples where the three national goals are being met.
  - Identify and describe "key ingredients" including performance measures and metrics that effectively work on the ground.
  - Actively share and expand the application of these techniques with willing stakeholder groups.
- Facilitate agency efforts to streamline processes and increase the pace and effectiveness of implementation by taking full advantage of existing authorities to accomplish goals outlined in the Strategy.
  - Solicit ideas from successful collaborative efforts on ways to cut through process and achieve results.
  - Identify perceived and actual procedural barriers to accomplishment of work and provide guidance or materials that clarify procedural options and/or identify options to improve procedures.

- Provide tools and materials to assist the WRSC/WG in communicating with stakeholders regarding procedural options available to them.

- Actively engage with the Science Team during the Phase III effort.
  - Keep western stakeholders updated on progress, products, and opportunities to provide input.
  - Clarify what the Phase III trade off analysis is, and provide tangible descriptions of Phase III's expected outcomes to western stakeholders.
- Continue to keep the CSSC, WFEC and other Regions appraised of Western Region communication and outreach efforts.
  - Coordinate West-wide efforts with the national communication strategy and team.

Western Region Communication Strategy Working Group Goals

The Western Region Communication Strategy Working Group's goals support the WRSC's desired outcomes for Phase III communication and outreach:

1. Strengthen and expand existing WRSC/WG stakeholder engagement and support.
2. Improve elements of the Western Assessment by providing opportunity for stakeholder comment prior to Phase III development work.
3. Create opportunities for continuous and expanded stakeholder involvement using multiple media and networks (newsletter/updates, website, social media, etc.).
4. Distribute accurate, timely information regarding Phase III objectives, progress, and participation opportunities.
5. Emphasize elements and tools for successful National Cohesive Strategy implementation that can be pursued immediately.

Phase III Western Region Outreach and Communication Actions

A detailed action plan for the Western Region will be developed by the Communication Strategy Working Group to support the updated Western Region Outreach Communication Plan. The following actions are not intended to be all-inclusive, but illustrate the range of actions that could be taken during Phase III. In some instances, actions can achieve more than one of the desired outcomes described above:

1. Provide communication support and assistance to the WRSC/WG.
   - Assist WRSC/WG members assigned to maintain and pursue expanded stakeholder engagement by providing communication tools and outreach materials.
   - Maintain a calendar of Western CS engagements and track information from those engagements using a "trip report". The trip report will be used to record discussion topics, identify additional communication support needs, and note any immediate success story "leads".
   - Identify key opportunities for the RSC to provide NSAT with information needed to generate program option tradeoffs and performance measures and integrate those opportunities into the Western Region's communication and outreach plan.
   - Develop communication tools/messages to describe NSAT's role and purpose, and how the outcomes from the trade-off analysis may be used in implementation.
2. Provide stakeholders the opportunity to review and comment on the Western Assessment. Analyze comments and provide the WRSC a portrait of comments and stakeholder response.
3. Identify stakeholder groups that were not engaged or were inadequately represented in Phase II, and expand outreach to connect with these groups to ensure that the WRSC/WG hears from these "new voices" and engages them in the process.
   - Identify sub-regions and communities of interest not engaged (e.g., conservation groups and organizations, agency non-fire staff, business and industry, and urban stakeholders)
   - Attract and retain these groups' attention. Strive for understanding, acceptance and support for the Western Assessment and the Cohesive Strategy.

4. Identify success stories and examples of successful implementation that can be shared with Western stakeholders:
   - Identify groups and individuals that have demonstrated "on the ground" success in achieving the goals of the CS, and encourage them to support the broader application of their successful methods throughout the West.
   - Solicit ideas from successful collaborative efforts about their techniques to reduce process barriers and achieve results.
5. Use a variety of media to sustain and expand stakeholder outreach and communication to create the social connection and traction needed for a collaborative foundation for strategy implementation. Use these communication methods to enhance understanding of the Western RSC and the Strategy effort by filling in the picture of who we are, what we are doing and why.
   - Develop monthly stakeholder update messages and materials. Develop coordinated messaging that considers: current work of the NSAT, activities of the Western Region Strategy Group and Technical Group, Communication Strategy Working Group, RSC/WG activities, and collaboration and outreach activities. The activities and products of these groups will all feed into the messages developed for internal and external use.
   - Maintain a current mailing list to be used for outreach and updates
   - Maintain information on the Western Region's webpage regarding status, comment opportunities, and who and how to engage in development of the West's strategy.
     - include current updates to reflect the status of the CS Phase III
     - include success stories gleaned from around the West
     - describe immediate actions that can be taken to move communities toward the three goals of the CS
     - promote any opportunities for stakeholders to comment on the development of Phase III

Appendix 7 - Useful Links

National Cohesive Wildland Fire Management Strategy Foundational Documents

2009 Quadrennial Fire Review (QFR),
http://www.iafc.org/files/wild_QFR2009Report.pdf

National Policy Framework Documents including:

- *A Call to Action*, 2009, http://forestsandrangelands.gov/strategy/documents/ call_to_action_01232009.pdf
- Artley, Donald, *Wildland Fire Protection and Response in the United States The Responsibilities, Authorities, and Roles of Federal, State, Local, and Tribal Government*.
  International Association of Fire Chiefs, 2009 (Missions Report).
  http://forestsandrangelands.gov/strategy/documents/wildlandfireprotectionandresponseusaug09.pdf
- *Mutual Expectations for Preparedness and Suppression in the Interface*,
  http:// forestsandrangelands.gov/strategy/documents/mutual_expectations_2010.pdf
- *A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: A 10-Year Strategy Implementation Plan*. Western Governors Association, 2006,
  http:// forestsandrangelands.gov/resources/plan/documents/10-yearstrategyfinal_dec2006.pdf

Reference Documents

A National Cohesive Wildland Fire Management Strategy, 2010.
http://forestsandrangelands.gov/strategy/ documents/reports/1_CohesiveStrategy03172011.pdf

Federal Land Assistance, Management and Enhancement Act of 2009 Report to Congress, 2010.
http://forestsandrangelands.gov/strategy/documents/reports/2_ReportToCongress03172011.pdf

Jakes, P. et al. Improving Wildfire Preparedness: Lessons from Communities Across the U.S., *Human Ecology Review*, Vol 14, No 2, 2007, Society of Human Ecology. http://www.sfrc.ufl.edu/faculty/monroe/ jakesetal.pdf

O'Laughlin, Jay. 2011. "Federal Land as a Percentage of Total State Land Area," Fact Sheet #8, Policy Analysis Group, College of Natural Resources, University of Idaho, Moscow. Available online at http://www.cnrhome.uidaho.edu/default.aspx?pid=120573

Western Regional Strategy Committee. 2011. *A National Cohesive Wildland Fire Strategy: Western Regional Assessment*. September 30, 2011. 61 p.

Appendix 8 - Committee and Work Group Members

West Region Strategy Committee – as of October 2012

Doug MacDonald	Co-Chair/WFEC Liason- IAFC
Corbin Newman	Co-Cair/Regional Forester, FS
Robert Cope	Lemhi County, ID – NACo
Pam Ensley	FWS
Sam Foster	Station Director, FS
Bob Harrington	MT State Forester, NASF
Tony Harwood	Confederated Salish and Kootenai Tribes
Warren Day	USGS
John Philbin	BIA
John Ruhs	BLM
Sarah Craighead	NPS
Ann Walker	WGA
Dick Bahr	NPS
Joe Freeland	BLM
Leon Ben	BIA
Tom Quigley	NSAT/Contractor
Joe Stutler	IAFC (resigned 7/1/12)

West Region Work Group

Joe Freeland	Team Lead/BLM
Carol Daly	Co-Lead/Flathead Policy Center
Alan Quan	FS
Bill Avey	FS
Bill Tripp	Inter-Tribal Council
Travis Medema	Oregon Dept. of Forestry/NASF
Alan Ager	FS
Craig Glazier	Local Government
Eric Knapp	FS
Jesse Duhnkrack	NPS
Joshua Simmons	BIA
Kevin Ryan	FS
Laura McCarthy	TNC
Lynn Jungwirth	Watershed Research and Training Council (WRTC)
Sue Stewart	FS
David Seesholtz	FS PNW Research Station
Joe Stutler	IAFC (resigned 7/12)

West Region Technical Work Group

Carol Daly	Flathead Policy Center
Joe Freeland	BLM
Tom Quigley	NSAT/Contractor
Alan Quan	FS
Bill Tripp	Inter-Tribal Council
Jesse Duhnkrach	NPS
Kevin Ryan	FS
Laura McCarthy	TNC
Karen Prentice	BLM
Cheryl Renner	WGA/Contractor
Geoff McNaughton	Utah State
Jay O'Laughlin	University of Idaho
Chuck Bushey	IAWF
Brad Washa	BLM
Joe Stutler	IAFC (resigned 7/12)

West Region Strategic Work Group

Carol Daly	Flathead Policy Center
John Ruhs	BLM
Ann Walker	WGA
Joe Freeland	BLM
Tom Quigley	METI/NSAT
Alan Quan	FS
Doug MacDonald	WFEC Liason/IAFC
Laura McCarthy	TNC
Tim Burke	BLM
Caitlyn Pollihan	WFLC/USFS
Danny Lee	USFS/NSAT
Jim Fox	UNC/NSAT
Matt Hutchins	UNC/NSAT
Dick Bahr	NPS
Sarah Craighead	NPS
Joe Stutler	IAFC (resigned 7/12)

West Region Communication Work Group

Carol Daly	Flathead Policy Center
Ann Walker	WGA
Joe Freeland	BLM
Bill Tripp	Inter-Tribal Council
Kevin Ryan	FS
Lynn Jungwirth	WRTC
Laura McCarthy	TNC
Steve Solem	METI
Jim Golden	METI
Julie Woldow	METI
Shelley Gregory	BLM-Wyoming
Terina Mullen	BLM-Montana
Judith Downing	FS
Erin Darboven	OWF
Mary Jacobs	National League of Cities
Candace Iskowitz	IBHS
Mark Beighley	METI
Michelle Medley-Daniels	WRTC
Jon Skinner	BLM
Pam Leschak	FS
Jennifer Myslivy	BLM-New Mexico

The True Cost of Wildfire in the Western U.S.

Promoting science-based forest management that serves the values of society and ensures the health and sustainability of western forests.

Original publication date: April 2009
Conclusions and recommendations updated: April 2010

WESTERN FORESTRY LEADERSHIP COALITION

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ABOUT THE WESTERN FORESTRY LEADERSHIP COALITION

The Western Forestry Leadership Coalition is a State and Federal government partnership. The members of the coalition include: the 23 State and Pacific Island Foresters of the West and the 7 western Regional Foresters, 3 western Research Station Directors, and Forest Products Lab Director of the USDA Forest Service.

This partnership creates a clear voice on western forestry, strengthening our ability to address pertinent issues and help meet the needs of society.

The mission of the WFLC is to promote science-based forest management that serves the values of society and ensures the health and sustainability of western forests.

Acknowledgements

Many thanks to our lead author, Dr. Lisa Dale, at the University of Denver for her time and thoughtful contributions to this report.

VALUING ECOSYSTEM SERVICES

Ecosystem services are the benefits we derive from ecological processes and functions. Examples from the forests and grasslands affected by wildfire include timber and non-timber forest products, wildlife enjoyed for viewing or hunting, regulation of water quality and quantity, carbon sequestration and storage, soil creation and retention, nutrient cycling, and satisfaction of recreation, cultural, and spiritual needs and desires.

Because many of these services are not directly used or may be worth very different amounts to different people, it is difficult to assign dollar values.

Damages following wildfire can significantly impact water quality and recreational opportunities for months or years after the burn.

Introduction

The millions of dollars spent to extinguish large wildfires are widely reported and used to underscore the severity of these events. Extinguishing a large wildfire, however, accounts for only a fraction of the total costs associated with a wildfire event. Residents in the wildland-urban interface (WUI) are generally seen as the most vulnerable to fire, but a fuller accounting of the costs of fire also reveals impacts to all Americans and gives a better picture of the losses incurred when our forests burn.

A full accounting considers long-term and complex costs, including impacts to watersheds, ecosystems, infrastructure, businesses, individuals, and the local and national economy. Specifically, these costs include property losses (insured and uninsured), post-fire impacts (such as flooding and erosion), air and water quality damages, healthcare costs, injuries and fatalities, lost revenues (to residents evacuated by the fire, and to local businesses), infrastructure shutdowns (such as highways, airports, and railroads), and a host of ecosystem service costs that may extend into the distant future.

Day-lighting the true costs of fire highlights opportunities to use active management to curb escalating costs. Unhealthy forests can increase the risk of fire.[1] Investing in active forest management is therefore valuable in the same way as investing in one's own preventative health care. Upfront costs can be imposing, and while the benefits may seem uncertain, good health results in cost savings that benefit the individual, family, and society. This analogy helps to highlight the importance of fostering resilient ecosystems before fires occur, as a tool for reducing the costs associated with suppression and recovery as well as extending the potential benefits of fire.

This report begins with an analysis of the many costs associated with wildfire. Several case studies illustrate a range of the full extent of fire impacts, suggesting patterns that can be included in future budgeting and planning processes at all levels of government. The true costs of wildfire are shown to be far greater than the costs usually reported to the public, anywhere from 2 to 30 times the more commonly reported suppression costs. Finally, a series of recommendations help focus the way these costs might be better considered. As the number of acres burned each year continues to increase, there is a justifiable sense of urgency. With a new administration and an incoming Congress with many new faces, the Western Forestry Leadership Coalition sees a fresh opportunity to address this long-standing forest management challenge.

[1] See, for example: Ecological Restoration Institute. 2003. Fuels Treatments and Forest Restoration: An Analysis of Benefits. Working Paper 4; Ecological Restoration Institute. 2006. Effects of Forest Thinning Treatments on Fire Behavior. Working Paper 15; Snider, Gary, P.J. Daugherty, and D. Wood. 2006. The Irrationality of Continued Fire Suppression: An Avoided Cost Analysis of Fire Hazard Reduction Treatments Versus No Treatment. Journal of Forestry: 431-437.

Costs of Wildfire

Firefighters respond to the Missionary Ridge fire. Expenditures on personnel and equipment to suppress wildfires are easily quantified and frequently measured.

Suppression costs alone are too often incorrectly cited as the "cost of wildfire". As a result, the vast majority of true costs are ignored from a planning and budgeting perspective. Costs associated with wildfire extend beyond both the acres burned and the days or weeks of the fire event. In many cases, suppression cost figures capture only the immediate costs for the WUI and the wildfire itself. Residents of those areas benefit from suppression activities through protection of their lives and homes. However, even if the fire is extinguished before it escapes public land to consume private property, the broader community is likely to experience longer-term impacts. Air quality will decline during the event, often leading to a spike in respiratory health problems for the young, old, and those with weak respiratory or immune systems. During and following the fire, the area may be closed to visitors, resulting in both short- and long-term revenue losses. Flooding and debris flows after a fire event pose further risks. Ecosystem services provided by healthy forests, including water filtration and wildlife habitat, can be permanently hampered. All American taxpayers will benefit from a fire management system that includes systematic monitoring of true costs and seeks to reduce indirect impacts.

Detailing the costs of wildfire is best done in a tiered format; first by describing the costs that tend to fit into specific analytical categories (direct and rehabilitation costs), and then by exploring longer-term costs that often evade quantification (indirect and additional costs). In all cases, the terms "losses" and "costs" are used synonymously when referring to infrastructure, ecosystem services, or property; losses may be whole or partial, and we do not distinguish between these layers here.

Direct Costs

Wildfire costs are most easily measured when they have immediate and direct impacts. This category prominently includes federal, state, and local suppression costs. These costs, in turn, can be broken down into expenditures on aviation, engines, firefighting crews, and agency personnel. In addition to suppression costs, other direct costs include private property losses (insured and uninsured), damage to utility lines, damage to recreation facilities, loss of timber resources, and aid to evacuated residents. Most of these costs are incurred during or immediately following the fire. Data are readily available from a host of organizations, including: US Forest Service (USFS), Bureau of Land Management (BLM), Natural Resources Conservation Service (NRCS), National Interagency Fire Center (NIFC), states, counties, Federal Emergency Management Agency (FEMA), Department of Homeland Security (DHS), insurance companies, and the American Red Cross.

Rehabilitation Costs

According to the case study reports profiled here, immediate emergency rehabilitation costs are sometimes considered direct, since those costs are incurred in the days, weeks, and months following the fire and are clearly attributable to the wildfire event. The costs are shouldered by federal, state, and local agencies and, again, the data are relatively accessible. Longer-term rehabilitation costs, however, are harder to measure, and ongoing rehabilitation expenses may not be clearly connected to the wildfire event. Watersheds damaged by fire, in particular, can take many years to recover and require significant restoration activities. Post-fire flooding events can create additional damage to the already scarred landscape, and subsequent impacts may include an increase in invasive species and erosion. The USFS has tended to focus on short-term rehabilitation efforts funded through the Burned Area Emergency Rehabilitation (BAER) program.[2] These data are useful but incomplete; BAER funds are tracked annually, while rehabilitation costs tend to span multiple years. These data also fail to account for total need; the damaged landscape may require comprehensive rehabilitation, but federal funding is limited.

Impacts to local economies after a wildfire are difficult to anticipate or to quantify.

Indirect Costs

Once the fire has been extinguished and rehabilitation efforts have begun on the affected landscape, additional indirect costs continue to accumulate. These costs have historically escaped accounting by land management agencies, and may extend years beyond the wildfire event. Indirect wildfire costs include lost tax revenues in a number of categories such as sales and county taxes, as well as business revenue and property losses that accumulate over the longer term. For example, properties that escape damage in the fire may still experience dramatic drops in value as the area recovers. In several of the case studies summarized here, these indirect costs are labeled "impact" costs.

Additional Costs

Beyond the indirect costs associated with wildfire are longer-term additional costs, often called "special" costs in the case studies outlined in this report.[3] Putting a numerical value on human life is always a dubious effort, but some standardized numbers do exist for guidance. When a firefighter perishes in the line of duty, families receive a set sum for their loss; this number serves as a proxy for the cost of lost life. Loss of civilian life, ongoing health problems for the young, old, and those with weak respiratory or immune systems, and mental health needs also fall into this category but are rarely quantified. Additionally, the extensive loss of ecosystem services, some of which are inherently difficult to quantify—aesthetic and scenic beauty, wildlife existence value, and others—can be included here.

[2] The objective of the BAER program is to determine the need for, prescribe, and implement emergency treatments on federal lands to minimize threats to life or property resulting from the effects of a fire or to stabilize and prevent unacceptable degradation to natural and cultural resources. (http://www.fs.fed.us/biology/watershed/burnareas/background.html)

[3] Lynch, Dennis L. 2004. What Do Forest Fires Really Cost? Journal of Forestry Sept.: 42-49

Case Studies

While many agency documents address suppression and rehabilitation costs (directly funded by federal programs), case studies that provide detailed analyses of costs associated with wildfire are surprisingly few. Those that are available are of high-profile events that had significant property and ecosystem losses – likely why they were studied in depth. Here, the WFLC has collected and summarized several analyses that delve into longer-term and indirect expenses associated with wildfire. All of these case studies are located in the western U.S., and all illustrate the degree to which total costs exceed suppression costs (Table 1).[4] The true costs of wildfire are shown to be far greater than the costs usually reported to the public; total expenses range from 2 to 30 times reported suppression costs. Such a wide range hints at the complexity of accurately tallying wildfire impacts. Estimates of total costs appear to be determined by a host of factors including fire severity, nearby population density, terrain, and the boundaries of the analysis itself.

In addition to the case study analyses presented here, the USFS, in cooperation with the Department of Interior, gathers aggregate data on all public land fires each year. These data include rigorous accounting of the costs of wildfires, but do not account for additional or indirect costs during the wildfire event or over time. Explicit in recent cost assessments has been an effort to "move beyond cost per acre", a number traditionally used to represent the cost of a fire and widely used for comparison between fires. Based on the most recent complete data available, the 2007 fire year saw 27 large fires nationally, resulting in a total of $547 million in suppression costs alone.[5] Of those, all but two fires occurred in the west. Nation-wide, indirect costs amounted to 34 percent of total costs. Specific costs included in the "indirect" category in the Large Fire Cost Review are listed as part of "direct" costs in other studies and longer-term costs of all kinds are absent from these data.

Table 1. Summary of Cost Information

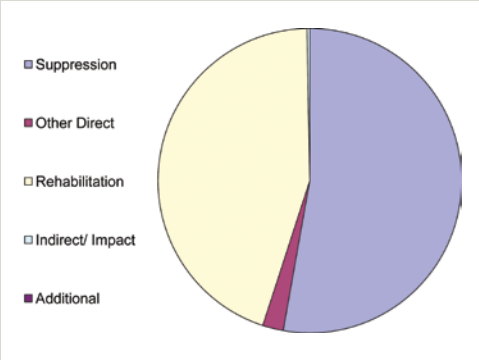
	COST CATEGORY							
FIRE	Suppression Costs	Other Direct Costs	Rehabilitation Costs	Indirect Costs	Additional Costs	Total Costs	Total / Suppression	Suppression / Total
Canyon Ferry Complex (MT 2000)	$9,544,627	$400,000	$8,075,921	$55,310	n/a	$18,075,858	1.9	53%
Cerro Grande (NM 2000)	$33,500,000	$864,500,000	$72,388,944	n/a	n/a	$970,388,944	29.0	3%
Hayman (CO 2002)	$42,279,000	$93,269,834	$39,930,000	$2,691,601	$29,529,614	$207,700,049	4.9	20%
Missionary Ridge (CO 2002)	$37,714,992	$52,561,331	$8,623,203	$50,499,849	$3,404,410	$152,803,785	4.1	25%
Rodeo-Chedeski (AZ 2002)	$46,500,000	$122,500,000	$139,000,000	$403,000	n/a	$308,403,000	6.6	15%
Old, Grand Prix, Padua (CA 2003)	$61,335,684	n/a	$534,593,425	$681,004,114	n/a	$1,276,933,224	20.8	5%

[4] Summary figures presented in Table 1 are: 1) a ratio of total costs to suppression costs, and 2) suppression costs as a percentage of total costs.

[5] USFS, 2007 Large Fire Cost Review.

A structure destroyed by the Cave Gulch fire, part of the Canyon Ferry Complex

Flames from the Bucksnort fire threaten a community



Canyon Ferry Complex cost categories

Canyon Ferry Complex (MT 2000)

Summary

In July 2000, two fires, the Cave Gulch and the Bucksnort, burned on opposite shores of Canyon Ferry Lake. Together, this complex burned in the Helena National Forest with spillover damage to adjacent state, private, and BLM lands. The complex burned 43,944 acres, approximately one quarter of which was on private land. Six houses were destroyed.

Methodology

Data for this case were gathered by Yale University researchers[6] from state and federal agencies involved in the recovery effort. Rehabilitation costs were unusually high, as the fire resulted in ongoing flooding and mudslides near the Lake. Replacing culverts and remediating watershed damages was conducted by the USFS, BLM, Bureau of Reclamation and NRCS. Longer term damages to recreation and archeological resources led to costs shouldered by these and other federal agencies.

Conclusions

Suppression costs totaled $9.5 million, and the value of lost homes was estimated to be within the $300,000-$450,000 range. Rehabilitation costs included range improvements, invasive species removal, reseeding, erosion barriers, and reforestation for a total of more than $8 million. In the two to three years following the fire, recreational visits to the national forest declined by 10 percent; this number has not been translated into a dollar value. Damage to archeological sites resulted in a $48,000 restoration cost. Estimates of all direct, rehabilitation, indirect, and additional costs for the Canyon Ferry fire complex exceeded $18 million. Suppression costs accounted for approximately 53 percent of the total. The lack of attention given to additional costs might explain why the proportion of suppression costs to total costs was higher than in other case studies.

[6] Morton, Douglas C., Megan E. Roessing, Ann E. Camp, and Mary L. Tyrrell. 2003. Assessing the Environmental, Social, and Economic Impacts of Wildfire. Yale University: GISF Research Paper 001.

Cerro Grande Fire (NM 2000)

Summary

The Cerro Grande fire in central New Mexico began when a prescribed burn escaped fire lines on the Bandelier National Monument due to high winds on May 4, 2000. As the fire approached the Department of Energy's Los Alamos National Laboratory (LANL) it became international news. The 42,873 acre fire destroyed 260 residences as well as facilities and equipment at the laboratory, led to the evacuation of approximately 18,000 people from nearby communities, and caused extensive damage to the utility infrastructure. Given the high profile of this fire and the fact that blame was placed on federal employees in charge of the prescribed burn, much attention was paid to the costs associated with the Cerro Grande fire.

Methodology

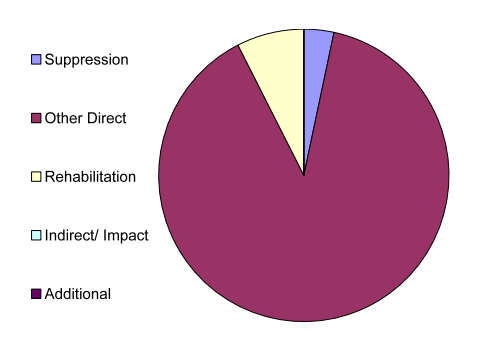
The Cerro Grande Fire Assistance Act, passed in 2000 to compensate communities for the damage suffered during and following the fire, created a $450 million fund available to individuals, businesses, tribes, non-profit organizations, and local governments. Claims submitted for damages were carefully tracked and LANL kept detailed records of costs incurred, providing the primary data for this case study.[7] While the accounting for costs is uncharacteristically thorough for this fire, longer-term costs are still likely under-reported.

Conclusions

Suppression for the Cerro Grande fire cost $33.5 million. While population density within the fire area was relatively low, resulting in limited damage to private property, the impacts sustained by LANL and nearby cultural sites more than made up for those avoided costs. Repairs at LANL cost $138 million immediately following the fire, and the Department of Energy spent an additional $203 million to replace damaged equipment and facilities. A host of federal agencies, including FEMA, the Bureau of Indian Affairs (BIA), NRCS and the USDA Farm Service Emergency Conservation Program shouldered additional short-term rehabilitation costs for a total of $72.4 million. Longer term rehabilitation costs include re-seeding and re-mulching, thinning and fuels reduction, and flood control. Cultural sites such as the Puye Cliff Dwellings were exceptionally expensive to restore and data on those projects remains incomplete. Estimates of all direct, rehabilitation, indirect, and additional costs for the Cerro Grande fire exceeded $970 million. Suppression costs accounted for approximately 3 percent of the total.

The smoke plume from the Cerro Grande fire reached from central New Mexico to the Oklahoma panhandle.

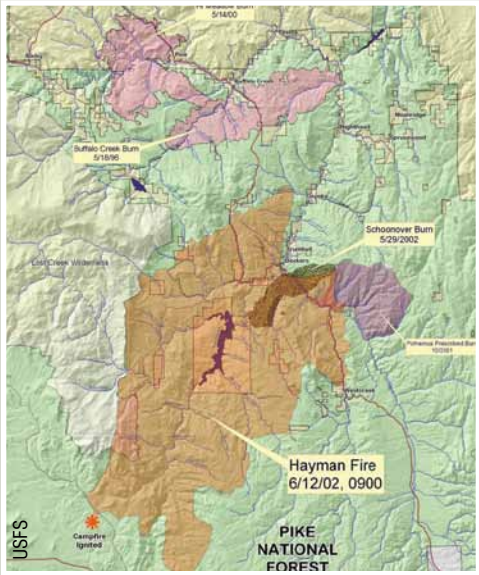
A structure destroyed during the Cerro Grande fire



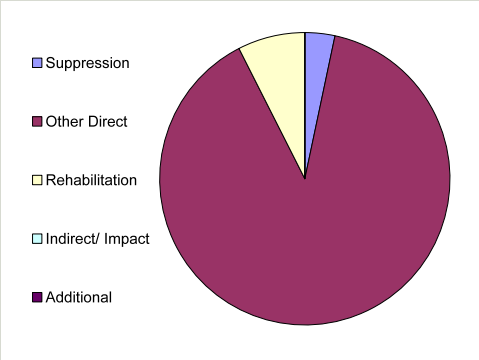
Cerro Grande fire cost categories

[7] Morton, Douglas C., Megan E. Roessing, Ann E. Camp, and Mary L. Tyrrell. 2003. Assessing the Environmental, Social, and Economic Impacts of Wildfire. Yale University: GISF Research Paper 001.

Impacts to water quality and stream habitat persisted long after the Hayman fire stopped burning.



Extent of the Hayman fire, measured on June 12, 2002. The fire grew beyond these boundaries.



Hayman Fire cost categories

Hayman Fire (CO 2002)

Summary

In June, 2002 the Hayman Fire erupted in the highly populated Front Range corridor south of Denver, Colorado. Burning 137,759 acres, it was the largest fire in state history. Four counties were directly impacted by the fire: Jefferson, Park, Douglas, and Teller. Immediate impacts of the fire included the destruction of 132 residences, one commercial building and 466 outbuildings, and an estimated suppression cost of over $42 million.

Methodology

Following the fire, U.S. Representative Mark Udall (CO) asked the USFS to conduct an analysis of the fire. In response to this request, five teams of researchers assembled to review numerous aspects of the fire including its economic and social dimensions.[8] Utilizing established research frameworks, the team attempted to quantify ongoing and predicted impacts to social and economic systems. Given the difficulty of estimating future costs, the researchers focused on four main areas: suppression and rehabilitation expenses, regional economic impacts, property-related losses, and resource/output values.

Conclusions

Research revealed substantial costs incurred during and following the Hayman Fire. Among the results calculated were total suppression expenses of $42,279,000, including USFS, state, and county expenses, some of which were ultimately reimbursed by FEMA. Other direct costs included property losses, utility losses, and USFS facility and resource losses. Total direct costs were $135,548,834. Rehabilitation expenses included costs incurred by USFS emergency rehabilitation programs, Denver water, US Geological Survey (USGS) mapping, and USFS restoration for a total of $39,930,000. Impact costs, incurred after the fire was extinguished, included tax revenue losses and business losses, plus reduced value of the surviving structures within the fire area. Total impact costs were $2,691,601. Finally, special costs recorded were one asthma victim and losses to wilderness and roadless values, for a total of $29,529,614. All direct, rehabilitation, indirect (impact), and additional (special) costs for the Hayman fire topped $207 million. Suppression costs accounted for only 20 percent of the total.

[8] Graham, Russell T., Technical Editor. 2003. Hayman Fire Case Study. Gen. Tech. Rep. RMRS-GTR-114. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Missionary Ridge Fire (CO 2002)

Summary

The Missionary Ridge fire burned in southwestern Colorado in the summer of 2002. It burned over 70,000 acres across three counties and touched federal, state, and private land. Thousands of people were evacuated and property losses included 57 homes and 27 additional structures.

Methodology

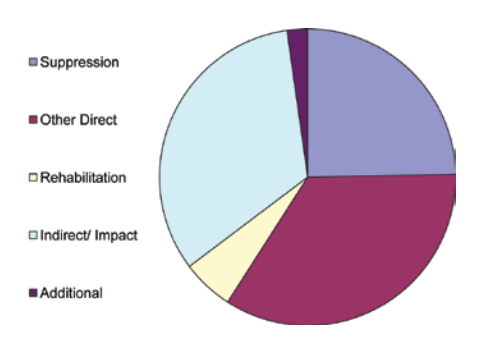
Suppression costs were widely reported for this fire, but further study was needed to explore costs that accumulated following containment.[9] Fire costs were divided into four categories: direct costs, defined as those incurred during the fire itself; rehabilitation costs, mostly incurred immediately following the fire and shouldered by the USFS and the USGS; impact costs, which occurred following the fire, including tax revenue losses; and special costs, such as loss of life and impacts to habitat for sensitive species.

Conclusions

Suppression costs totaled $37,714,992. Other direct costs included property losses, both insured and uninsured, and losses incurred by the USFS in the form of facilities, range, timber, and other resources. The American Red Cross, the local utility, and the National Guard also experienced immediate losses that were included in this category, bringing total direct costs to $90,276,323. Rehabilitation losses included $8,623,203 worth of USFS emergency and long-term expenses, USGS debris flow hazard mapping costs, NRCS losses on state and private lands, and USFS archeological site rehabilitation. Note that even "long-term" losses in this category were measured for only one to two years following the fire. Impact costs included a long list of itemized expenses associated with tax losses, employment losses, and long term USFS losses in the area. The total for this category was $50,499,849. Finally, additional costs totaled $3,404,410. These were placed into a "special" category, including the loss of one firefighter and damages to wildlife species and habitat. All direct, rehabilitation, indirect, and additional costs for the Missionary Ridge fire topped $152 million. Suppression costs accounted for 25 percent of the total.

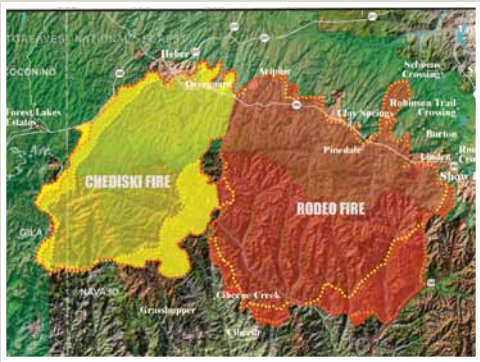
The flames from the Missionary Ridge fire could be seen for miles.

Serious erosion after the Missionary Ridge fire damaged water quality, flow regimes and aquatic habitat.



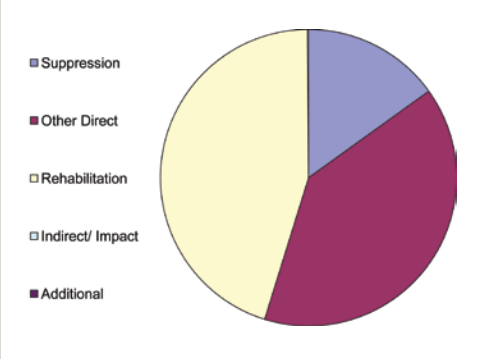
Missionary Ridgefire cost categories

[9] Mackes, Kurt, et.al. 2007. Missionary Ridge Fire Cost Assessment. *Journal of Testing and Evaluation*. 35(2): 167-171.



Rodeo-Chedeski Incident (Image credit: Sitgreaves National Forest)

Post fire damages in Show Low, Arizona



Rodeo-Chedeski fire cost categories

Rodeo-Chediski Fire (AZ 2002)

Summary

The Rodeo-Chediski fire burned 462,614 acres in June 2002, making it the largest wildfire in Arizona state history. The majority of the fire (59%) burned on the Fort Apache Indian Reservation, adding a layer of complexity to recovery efforts. The rest of the fire burned on two National Forests (38%) and private land (2%).[10] Over 490 structures were destroyed, and more than 30,000 residents of nearby communities were evacuated.

Methodology

Data for this case study come from a number of sources; costs are therefore presented as ranges and estimates, and the categories for costs used in other case studies profiled are incomplete. The Rodeo-Chediski was analyzed for public health expenses, providing unique insight into these otherwise unreported costs.[11]

Conclusions

Studies estimated suppression costs for this fire between $43 and $50 million.[12] Other direct costs, including the loss of homes and property, totaled $122.5 million. Rehabilitation costs were generated from immediate post-fire expenditures, and then projected out over three years for a total cost of $139 million. Indirect costs, including loss of sales tax revenue and job losses in the tribal community amounted to $8.1 million. Job losses in this case were particularly acute; following the fire, two local timber mills were not expected to resume pre-fire productivity, leading to a decline in merchantable timber that would impact the Tribe for multiple generagions. Generating cost estimates for such a long-term and uncertain future is a challenging (and incomplete) task. Loss of infrastructure, damage to ecosystem services, and loss of critical habitat for the Mexican spotted owl were all recorded during the fire; however, no cost values were attached to those losses. Immediate impacts to public health were more carefully analyzed and included poor air quality, exposure to hazardous chemicals from wood ash and fire retardant, and poor water quality. Two Red Cross shelters were established to assist with physical and mental health needs; the Arizona Department of Health also received a $403,000 grant from FEMA to provide counseling services. Total cost estimates for these services are unavailable. Estimates of all direct, rehabilitation, indirect, and additional costs for the Rodeo-Chediski fire topped $308 million. Suppression costs accounted for only 15 percent of the total.

[10] BAER Team. 2002. Rodeo-Chedeski Fire BAER Team Executive Summary and Specialists Reports. Apache-Sitgreaves and Tonto National Forests. http://www.fs.fed.us/r3/asnf/salvage/pdfs/001-20020729-baer-report.pdf

[11] Arizona Department of Health Services. 2003. Public Health Assessment: Rodeo-Chediski Fire.

[12] Snider, G.B., D.B. Wood, and P.J. Daugherty. 2003. Analysis of Costs and Benefits of Restoration-Based Hazardous Fuel Reduction, Treatment vs. No Treatment. NAU School of Forestry Research Progress Reports, Progress Report #1.

Old, Grand Prix, Padua Complex (CA 2003)

Summary

The 2003 Old, Grand Prix, and Padua wildfire complex was a 125,000 acre blaze in the mountainous Santa Ana watershed in Southern California.[13] The fire led to the evacuation of approximately 100,000 residents. Property owners filed claims for 787 total losses and 3,860 partial losses. Following the fire, a team of USFS researchers gathered data from affected communities in an effort to reveal costs that extended beyond the widely reported suppression costs.

Methodology

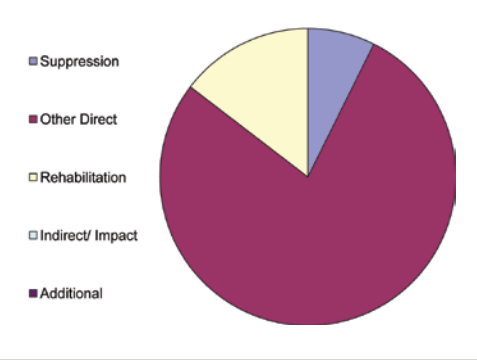
Case study authors sought to attach cost numbers to a host of impacts associated with the fire.[14] Adding socioeconomic costs to the more readily available data on biophysical costs revealed a fuller estimate of the total cost. Conducted at a landscape scale, the study outlined two cost categories: suppression and post-fire recovery/mitigation. Non-market costs were listed and noted as important, but were not included in total cost estimates. Likewise, the authors considered valuation of ecological goods and services a work in progress and did not build these values into cost estimates. Instead, case study authors captured expenditures from a variety of public and private agencies related to the fire, and forecasted future expenditures based on trend lines.

Conclusions

The estimated cost of the Old, Grand Prix, and Padua wildfire complex, including estimated future costs, was $1.2 billion. This estimate excluded many impacts that were identified but impossible to quantify. For example, the loss of recreation at the site of the fire during closure and evacuation was relevant, but no cost estimate was available. Still, researchers concluded that suppression and emergency response costs accrued by a host of public agencies — over $61 million — accounted for only 5 percent of the total, long-term cost of the wildfire. Post-fire recovery and water mitigation expenditures were the most expensive categories in the study, with government agencies (and the public) shouldering an estimated $534 million burden. The remaining costs, including expenditures by the 13 largest insurance companies in the state, topped $681 million.

Old, Grand Prix, Padua complex aerial view

Old, Grand Prix, Padua complex smoke plume



Old, Grand Prix, Padua complex cost categories

[13] Exact acreage numbers are not available for this fire complex.

[14] Dunn, Alex. 2003. The Old, Grand Prix, and Padua Wildfires: How Much Did These Fires *Really* Cost? A Preliminary Report on Expenditures and Discussion of Economic Costs Resulting from the 2003 Old, Grand Prix and Padua Wildfire Complex. USDA Forest Service.

Data Alignment and Availability Challenges

This report relies on and summarizes the few available case studies conducted by a variety of researchers, using different methodologies. These case studies, while painting a valuable picture of the true costs of wildfire, illustrate problems with both the quantity and the quality of data available. Each case study organizes costs into different categories; the lines between direct, rehabilitation, indirect, and additional costs are drawn differently each time (See Table 2). This non-alignment makes comparisons difficult. If aggregate data are to be made meaningful, they must be collected using a consistent methodology.

Table 2. Cost Category Comparison

	Direct Costs	Rehabilitation Costs	Indirect Costs	Additional "Special" Costs
Canyon Ferry Complex	Suppression and property losses	BAER expenses, plus other expenses incurred by federal agencies	Restoration of archeological sites, supervision of mushroom collectors	N/A
Cerro Grande	Suppression, plus all claims submitted to federal agencies following the fire.	BAER expenses	N/A	N/A
Hayman	Suppression, property losses, utility costs, USFS facility & resource losses	BAER expenses, costs incurred by local utilities and agencies	Called "Impact Costs", and include tax revenue, business, and property value losses	Asthma victim, loss of roadless and wilderness "values"
Missionary Ridge	Suppression and other costs incurred during the fire.	BAER expenses, and other costs incurred by federal agencies	Called "Impact Costs", and include costs incurred following the fire such as tax revenue decline.	Loss of life and impact to habitat for sensitive species.
Rodeo-Chedeski	Suppression, property losses.	Immediate post-fire expenses including estimates projecting three years in the future.	Loss of sales tax revenue and job losses	Public health expenses.
Old, Grand Prix, Padua	Suppression and emergency response expenditures	N/A	Called "Post-Fire Recovery", and include extensive list of expenses incurred after the fire ended. Includes rehabilitation costs.	None calculated. Authors note a third category for "loss of income generation potential or non-market value" but do not assign cost values.

Detailed case studies of the extended costs of wildfire are few and inconsistent in how they handle different categories of costs. Suppression cost data are carefully tracked, broken down, and debated in Congress, but as this study and others indicate, suppression costs represent only a portion of the total costs associated with wildfire. As noted by researchers at Yale University, "current data collection policies capture only a snapshot-in-time of wildfire impacts."[15] In particular, long-term socio-economic impacts are rarely calculated; even the most thorough analyses profiled here offered insights only into costs during and immediately following the fire. The upshot: lawmakers and resource managers are working with an incomplete picture when they engage in wildfire budgeting and planning efforts.

[15] Morton, Douglas C., Megan E. Roessing, Ann E. Camp, and Mary L. Tyrrell. 2003. Assessing the Environmental, Social, and Economic Impacts of Wildfire. Yale University: GISF Research Paper 001. Page 50.

Insufficient Emphasis on Active Management Before Fire

Suppression funding accounts for more of the total USFS budget each year. From 2000 to 2008, suppression funding increased from 25 to 44 percent of the USFS budget.[16] As a result, resources are unavailable for other programs. Some of these under-funded programs include forest management efforts with the explicit goal of contributing to wildfire prevention or protection. In 2008 the total expenditures on wildfires was $1.46 billion. This included $260 million that was transferred from other programs and subsequently repaid via an emergency supplemental process. These important programs are being squeezed on the front end during the budgeting process and again when funds are transferred or "borrowed" in emergency situations, impacting not only agency programs but work with partners.

Although the need to suppress fires will never vanish, "it is becoming clear, in the arid West, that long-term damage to forest watershed resources may be the most serious and perhaps ultimately the largest costs we face through time."[17] As the extended costs associated with fire become more widely recognized, investments in various treatments to the forest, including thinning and "pre-suppression" activities, are nearly unanimously favored over the current reactive system that gives funding priority to suppression.[18]

Hazardous Fuels Reduction is the most frequently cited example. Only 14 percent of total appropriated funds went toward this effort in Fiscal Year 2007. While no treatment can *prevent* fire, active management can improve the health and resiliency of the land, reducing fire hazard. Harvest of merchantable timber during treatment also creates economic benefits. These treatments can reduce the severity of inevitable fire, improve recovery time, and contribute to ecosystem functioning before, during, and after a blaze. Scientists agree that aggressively reducing fuels in forests that have become "out of whack" can significantly reduce the risk of catastrophic fire.[19] Indeed, the notion of "ecosystem resiliency" is predicated on a number of factors that contribute to overall forest health. Healthy ecosystems that experience a disturbance such as fire are more likely to recover without long-term or devastating negative effects.[20]

The cost of reducing fuel loads continues to be prohibitive in locations where timber prices are low or the product itself is not marketable. However, when non-market values are considered, fuels reduction treatments are shown to be cost effective. For example, the state of Washington found that the benefits of treating medium and high risk stands exceeded costs by $1,000-$2,000/acre.[21] Following this logic, investing in healthy forests well before fire occurs is the wisest course of action. Instead of prioritizing a response to inevitable fire with costly suppression and rehabilitation efforts, funding forest health efforts will serve to minimize costs across the full spectrum of fire-associated impacts. Despite these insights, funding for hazardous fuels reduction has not kept pace with the need, and states are unable to provide adequate assistance to private landowners with forest stewardship.

[16] Statement of R. Max Peterson, F. Dale Robertson, Jack Ward Thomas Michael P. Dombeck, and Dale N. Bosworth Retired Chiefs of the Forest Service On the FY2008 Appropriation for the U.S. Forest Service. http://www.wildfirelessons.net/documents/Fire%20Funds%20Statement.doc

[17] Lynch, Dennis L. 2004. What Do Forest Fires Really Cost? *Journal of Forestry*. Sept.: 42-49.

[18] Snider, Gary, P.J. Daugherty and D. Wood. 2006. The Irrationality of Continued Fire Suppression: An Avoided Cost Analysis of Fire Hazard Reduction Treatments Versus No Treatment. *Journal of Forestry*. December: 431-437.

[19] Market and Non-Market Values Associated with Fire Risk Reduction Treatments. 2003. Appendix 5 in Investigation of Alternative Strategies for Design, Layout and Administration of Fuel Removal Projects. University of Washington. Available at: http://www.ruraltech.org/pubs/reports/fuel_removal/index.asp

[20] See, for example: Snider, Gary, P.J. Daugherty and D. Wood. 2006. The Irrationality of Continued Fire Suppression: An Avoided Cost Analysis of Fire Hazard Reduction Treatments Versus No Treatment. *Journal of Forestry*. December: 431-437

[21] Hulsey and Ripley. 2006. Forest Health and Wildfires: A Net Cost Approach to a True Wildfire Protection Program. Washington State Department of Natural Resources.

Conclusion

Fire suppression costs, while often considered synonymous with the full costs of a wildfire, are only a fraction of the true costs associated with a wildfire event. Synthesis of case studies in the report reveals a range of total wildfire costs anywhere from 2 to 30 times greater than the reported suppression costs. A more robust accounting of these costs would facilitate improvement in budgeting and planning processes at all levels of government and would lead to better understanding of the value of investing in hazardous fuels reduction and other forest management activities before a fire occurs. Strategic and targeted active management can improve the health and resiliency of the land, while reducing fire hazard and associated costs of large fires.

Conducting a prescribed burn to control hazardous fuels on the Coconino National Forest.

Improved awareness of the complete costs of wildfire will enrich the search for sustainable solutions. The Council of Western State Foresters (CWSF) and the National Association of State Foresters (NASF), along with key partner organizations, worked together as the Partner Caucus on Fire Suppression Funding Solutions to craft a comprehensive and cost-effective solution to fund emergency wildland fire suppression separately from other suppression expenses. The President signed the Federal Land Enhancement and Management Act (FLAME) into law in October 2009. This first step towards a new budgeting framework for wildland fire suppression within the US Forest Service (USFS) and the Department of the Interior (DOI) is an important move towards realizing the 'true costs of fire' and avoiding the painful trade-off between fire mitigation and fire suppression activities.

Recommendations

Continued investment in active management across the landscape will contribute to a reduction in the broader costs associated with wildfire; such an approach to forest management will also increase public benefits from healthy forest ecosystems. The timeline here is critical. High, long-term fire recovery costs underscore the importance of fostering resilient ecosystems before fires occur. CWSF recommendations include:

- Implement and fully fund the FLAME Act in the upcoming years. The Act establishes a partitioned account for wildfire suppression costs associated with emergencies for both the USFS and the DOI. The Act also includes new reporting requirements for the agencies.
    - Funding for these partitioned accounts must not come at the expense of already depleted agency budgets. Funding for this separate account must not be counted against agency budgets or be included in the 10-year rolling average of 'normal' suppression activities that are factored into the agencies' budgets.
    - Funding for these separate accounts must not be counted against agency budgets or be included in the 10-year rolling average of 'normal' suppression activities that are factored into the agencies' budgets.
    - Develop the Cohesive Strategy for Wildland Fire Management, required in the FLAME Act, using an intergovernmental approach with key partners such as State Foresters, related agencies and the International Association of Fire Chiefs, prior to the deadline of October 30, 2010.

- Continue to invest in and utilize the West Wide Wildfire Risk Assessment, being developed by the WFLC and CWSF, to communicate the magnitude of the wildfire problem in the West and to prioritize management actions across the landscape to mitigate the risk and costs of catastrophic wildfire.
- Reinvest in agency programs that have been severely reduced due to increasing fire suppression costs.
- Invest in management activities that improve forest health. Investment in existing federal line items such as hazardous fuels reduction, State Fire Assistance, the Cooperative Forest Health Program, and the Forest Stewardship Program to name a few, will substantially improve outcomes.
- Support improved data collection by government agencies. Increased funding for research and development within the USFS could focus on long-standing data gaps. Improved capture of cost totals by local, state, and federal agencies will foster more effective budgeting.
- Adjust the rules that govern FEMA's budgets to account for the true costs of fire. Currently, the agency focuses almost entirely on impacts of fire to private homes. A fuller picture of the costs of fire would expand the agency's role in serving the public.

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National Significant Wildland Fire Potential Outlook

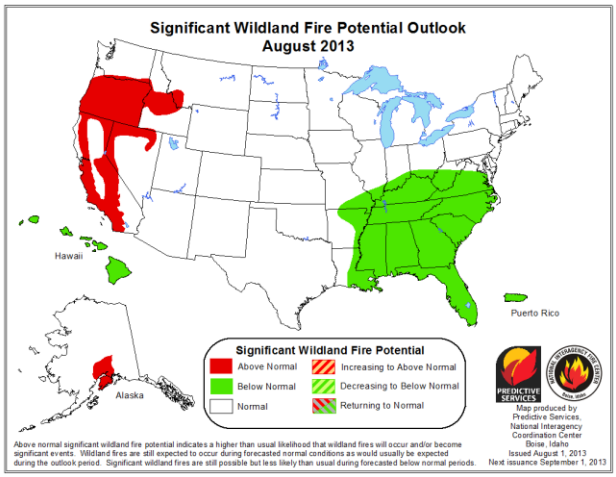
Predictive Services
National Interagency Fire Center

Issued: August 1, 2013
Next Issuance: September 1, 2013

Outlook Period – August, September and October through November

Executive Summary

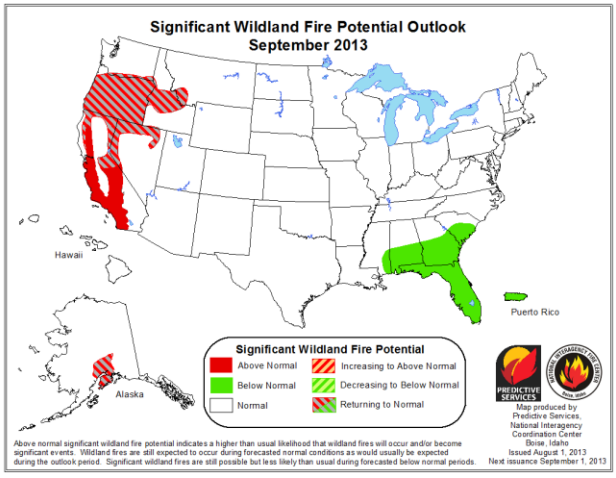
The August, September and October through November 2013 significant wildland fire potential forecasts included in this outlook represent the cumulative forecasts of the eleven Geographic Area Predictive Services Units and the National Predictive Services Unit.



August
- Significant fire potential remains above normal for a large portion of the Northwest and the California mountains as fuels remain much drier than normal.

- South central Alaska will have higher significant fire potential in early August.

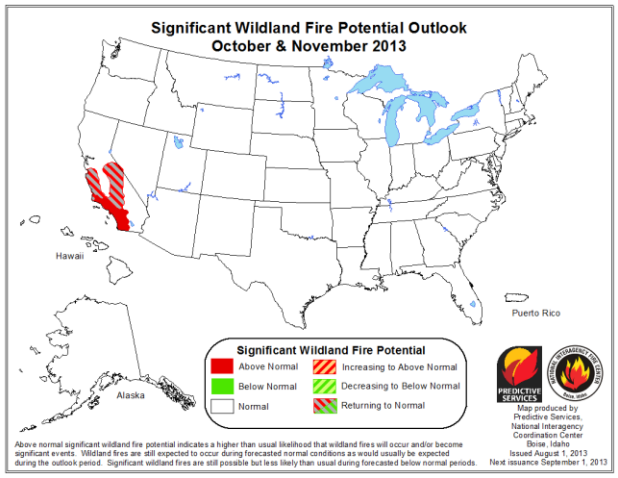
- The East will remain wet through August.



September
- Significant fire potential will decrease to normal across the Northwest, the northern Great Basin and the northern Sierras as Fall approaches.

- The mountains of northwestern and southern California will continue with above normal significant fire potential, especially as the chance for off-shore wind events increases.

- Below normal fire potential will continue in Florida and southern parts of Alabama, Georgia, and South Carolina.



October and November
- Mountains of southern California will remain above normal potential early, gradually returning to normal.

- Elsewhere potential across the U.S. returns to normal for the fall and winter. Typically this means little fire activity except in the Eastern and Southern Areas.

Past Weather and Drought

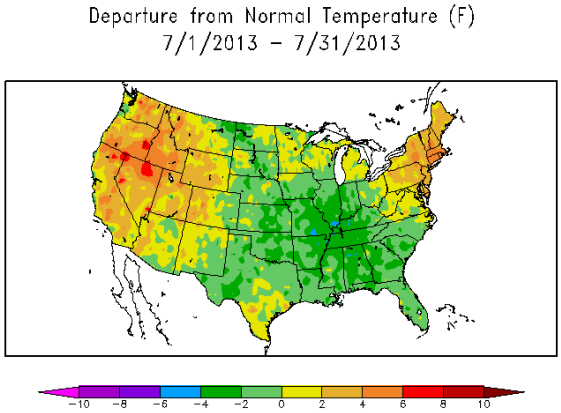
Strong high pressure over the West at the start of July brought extremely hot and dry conditions to the region while low pressure over the Mississippi kept cool and wet conditions over much of the central U.S. Soon after, the pattern weakened and shifted to a strong ridge in the East with a mostly flat pattern in the West. By the end of the month, things switched again as a trough settled into the East while a weak ridge and a series of weak lows moved through the West. A strong and persistent monsoon pattern setup across the Southwest.

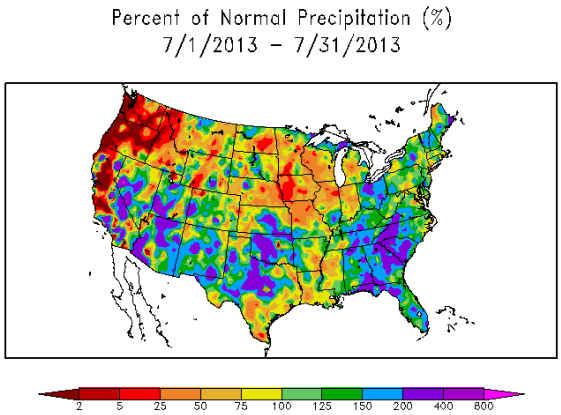
Extreme heat for the West brought several days of 100+ degree weather to much of the region to start. By mid-month, the Northeast was in the pressure cooker with record heat across the region. However, cool temperatures returned with fall-like weather at the end of the July in the East. Temperatures in the much of the East were below normal except for the New England states where temperatures were as much four to six degrees above normal. In the West, readings were above normal with parts of the Northwest and northern Great Basin 4-8 degrees normal.

Frequent fronts through the East and a strong monsoon produced above normal precipitation for much of the eastern third and the southwest quarter of the country. Parts of the Southeast and the desert Southwest received as much three to six times normal precipitation. The Northwest through the upper Midwest as well as much of California were very dry, with the Northwest receiving less than 25 percent of normal rainfall.

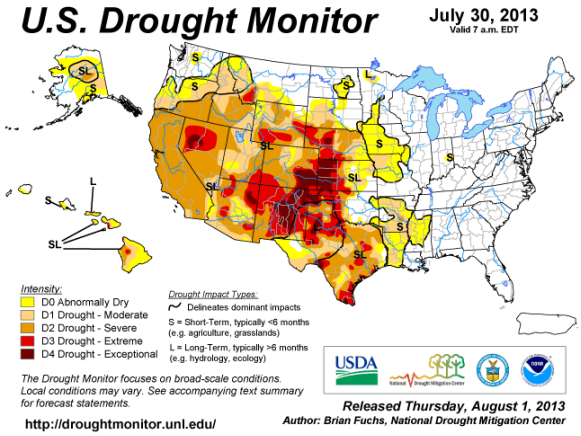
Drought continued across much of the western half of the nation with severe to exceptional drought from the central and southern Plains to the West Coast.

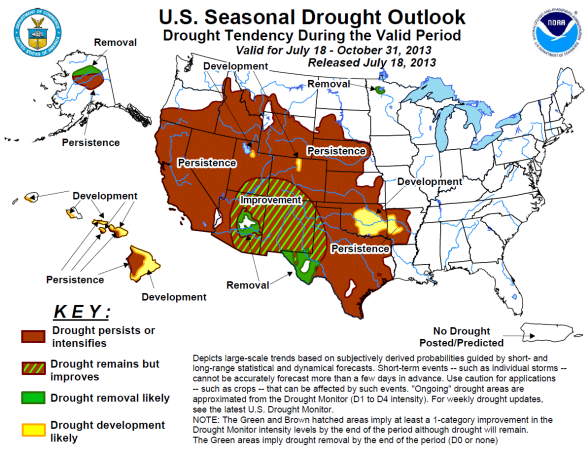
Left: Departure from Normal Temperature (top) and Percent of Normal Precipitation (bottom) *(from High Plains Regional Climate Center).* **Right: U.S. Drought Monitor (top) and Drought Outlook (bottom)** *(from National Drought Mitigation Center and the Climate Prediction Center)*





Generated 8/1/2013 at HPRCC using provisional data. Regional Climate Centers





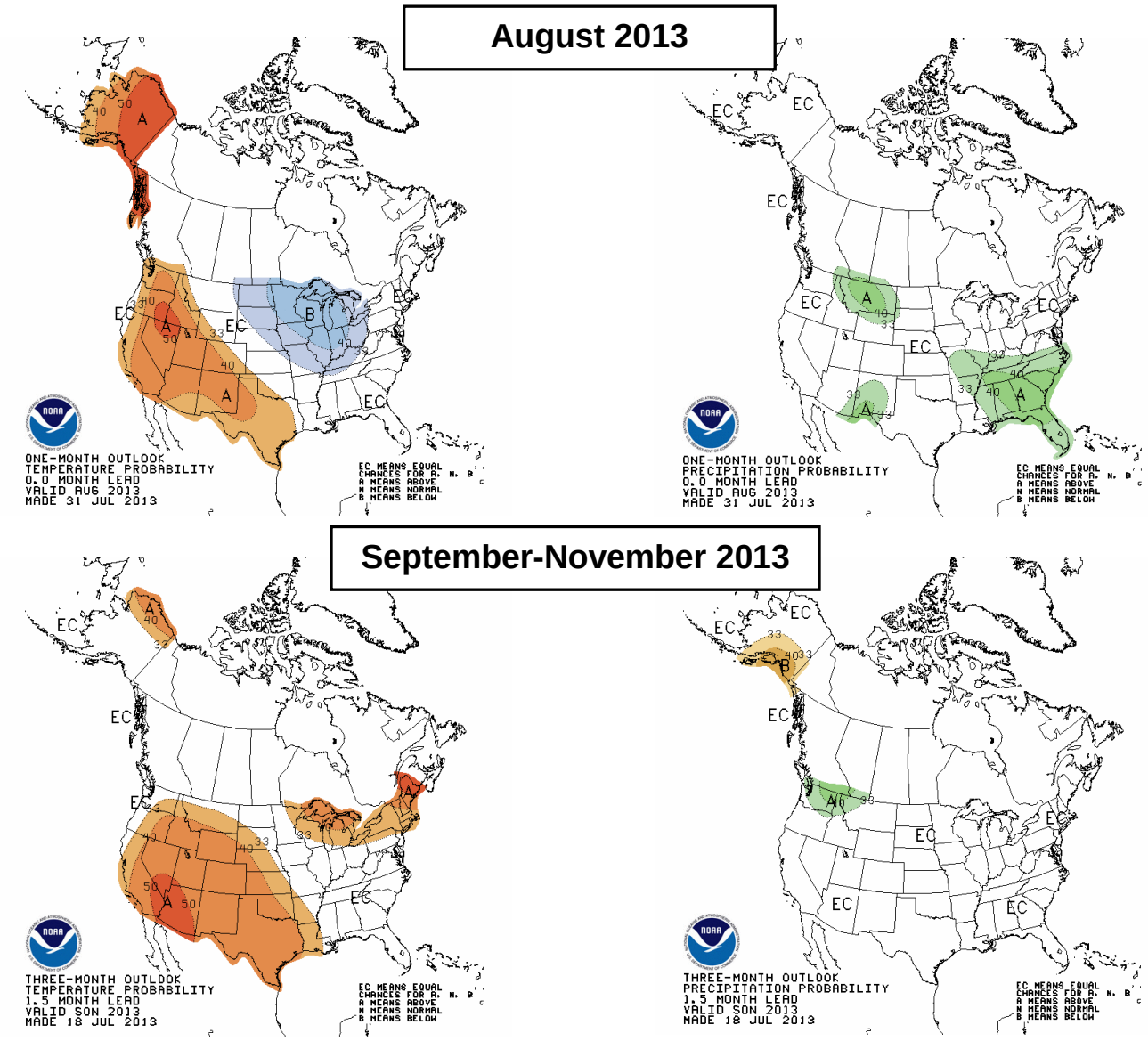
Weather and Climate Outlooks

Sea surface temperatures over the equatorial Pacific continued slightly cooler than normal but maintained a neutral ENSO pattern, offering no clear signal for long-term climate trends. Other global circulations also provide no clear indicators. The latest guidance suggests a continued wet and cool pattern across much of the eastern U.S. from the Mississippi Valley to the Southeast and mid-Atlantic coasts. The West will remain very warm with typical summertime precipitation.

Current projections for August by the Climate Prediction Center (CPC) indicate higher probabilities of warmer than normal conditions for much of the West, including Alaska, and the southern Plains. Cooler than normal conditions are expected across the northern Plains, the upper and lower Mississippi Valley, and the Great Lakes region. Precipitation is expected to be above median for most of the Southeast, the northern Rockies and the parts of the Southwest.

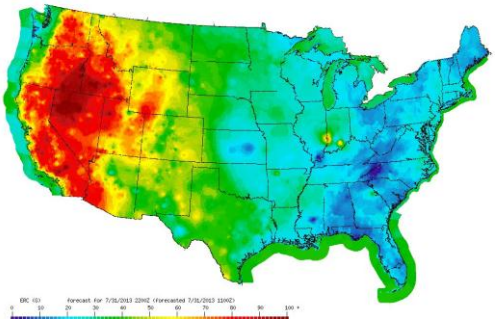
Temperatures for September through November are expected to be above normal for most of the western and central U.S., northern Alaska, the Great Lakes and New England. Precipitation is expected to remain near median with pockets of below median precipitation in southern Alaska and above median over the far Northwest.

Top row: One-month (August) outlook for temperature (left) and precipitation (right). Bottom row: Three month (September-November) outlook for temperatures (left) and precipitation (right). *(from Climate Prediction Center/NOAA)*

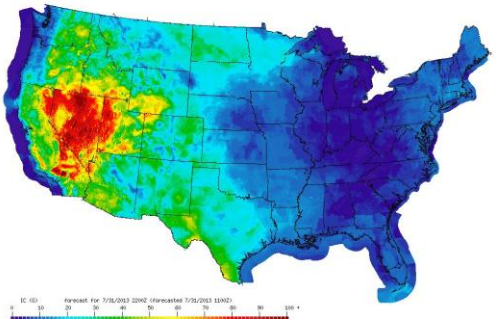


Fuel Conditions

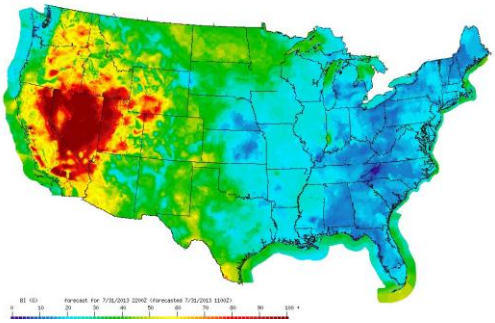
Energy Release Component



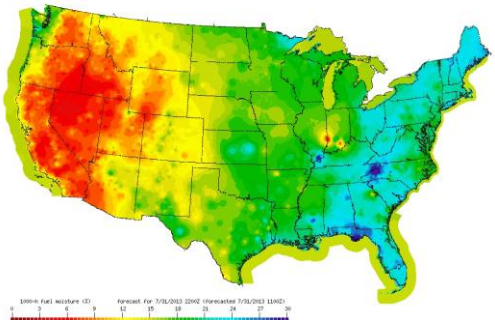
Ignition Component



Burning Index



1000 hour Fuel Moisture



Energy Release Component, Ignition Component, Burning Index and 1000 hr Fuel Moisture as of 7/31/2013 *(from Wildland Fire Assessment System)*

In Alaska, the Interior and South Central show persistent very high to extreme levels of dryness. It's expected that the pattern will bring precipitation to southern Alaska during the first week of August, while Interior fuels will continue to be dried under above normal temperatures. The rest of the state shows normal to below normal fire danger indices.

The very dry weather throughout July led to a steady increase of fire danger across the Northwest, western Montana and central Idaho. By late July near record high Energy Release Component (ERC) values and near record low 1000-hour fuel moistures were reported. Fuel moisture values have been steadily dropping, in most areas and are below normal for late July. An outbreak of large fires in late July reveals that fire danger is high enough to support large fires. Elevated fire danger is expected to continue west of the continental divide into September. Grasses in the northern Plains, except eastern Montana and the Dakotas, have cured. With forecasts indicating conditions will improve east of the continental divide, a significant improvement is expected with the fuel moistures at the beginning of August.

Fuels have dried significantly in July in northern California, except for 1000-hour fuels which have lagged behind due to the heavy rain event of late June. Additional wetting rains from thunderstorms in late July moderated fuels of all classes. The driest areas remain the eastern half of the Coastal Range, mainly south of the Trinity Alps to the East Bay Hills. Cool onshore flow should keep immediate coastal areas more moist than normal. Southern California continued in significant drought and fuel conditions remain very dry as a result. Most of southern California continues to be in conditions significant enough to warrant a Fuels and Fire Behavior Advisory and is not expected to moderate in the near term.

Due to very hot temperatures in July, fuels completely cured across the Great Basin. Live fuel moisture dropped to below normal in many areas. Dead fuel moisture improved somewhat through July thanks to wetting rains in many areas. In the north however conditions decreased significantly again at the beginning of July due to hot and dry weather. Drought stress is being observed in some of the larger fuels. Fine fuel growth was stunted through most of the spring due to very dry conditions, but improved over parts of western and northern Nevada with May and June rains. However, growth is still near normal at best and short and discontinuous in many areas. As drier and windier weather returns by early August, fuels will dry out again in all areas.

ERCs are at or below the seasonal averages across the Rockies, the Southwest, the East and the South.

Fire Season Timing

Alaska is nearing the end of the fire season. Southwest flow aloft usually engulfs the state for a period at the end of July or beginning of August, either ending the fire season, or creating a significant break in fire activity. With southerly flow expected over the state and low pressure moving into the Bering Sea by the second week of the month, it is likely that southwest flow will move in to end the fire season as normal around mid to late August.

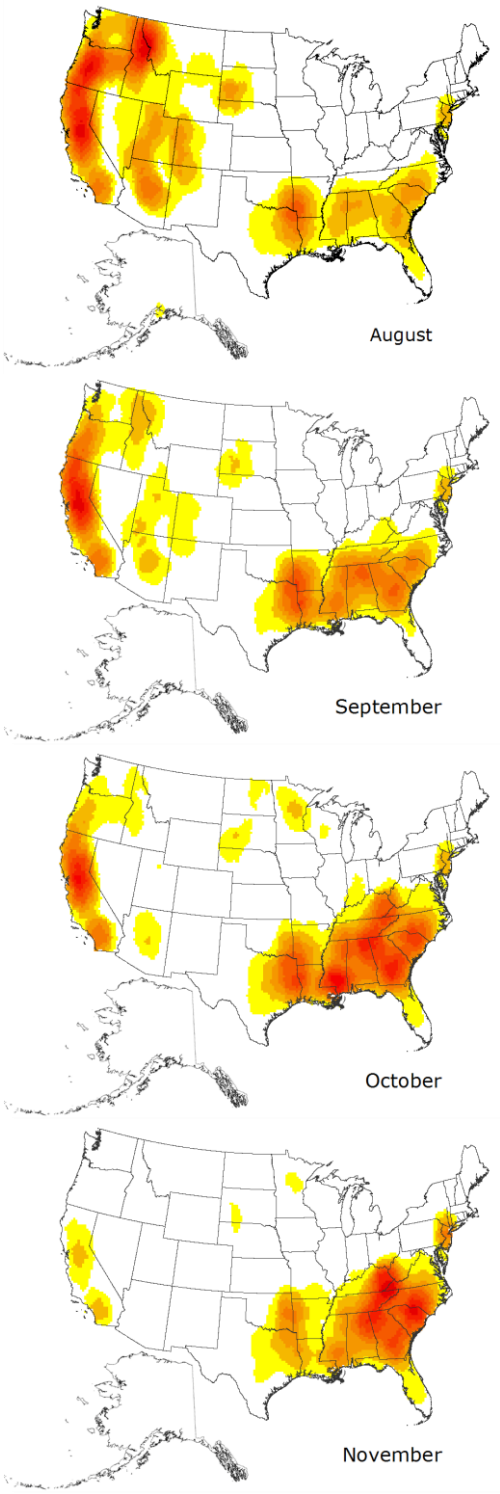
In the Northwest, western Montana, central Idaho and northern California mountains significant fire potential typically diminishes in late September when the frequency of lightning declines rapidly. Forecasts of unusually warm weather through August and into September seem likely to perpetuate fire season at least into the middle to end of September.

In the foothills of California and southern California mountains expect significant drought to remain in place and leave fuels drier than normal. This will lead to fire season continuing in southern California through at least October and possibly through November.

Fire season is in full swing in August and typically winds down in September across the great Basin. Expect a normal end to fire season with low pressure troughs bringing wetter and cooler weather from mid to late September.

Significant fire potential decreased in late June and early July across much of Colorado, New Mexico and Arizona which is normal for the time of year. Fire season over Wyoming has been delayed due to wet conditions in June and early July, and almost none existent in western South Dakota due to cool and wet conditions during the last two months. Significant fire potential will likely reduce earlier than normal this season.

In the eastern and southern U.S. a normal start to the fall fire season is anticipated. No particular indicators suggesting the onset of a longer duration fire pattern during the outlook period. The only potential exception would be any amplified drying west of the Mississippi into Arkansas, Louisiana, Texas and Oklahoma



Normal fire season progression across the contiguous U.S. and Alaska for August, September, October and November as shown by monthly fire density (number of fires per unit area). Fire size and fire severity cannot be inferred from this data. (Based on 1999-2010 FPA Data)

Geographic Area Forecasts

Alaska: Alaska will experience normal significant wildland fire potential from August through November across most of the Area, except above normal conditions in August in the south Central portions of the State. These conditions will return to normal in September.

After record setting temperatures in June, July settled into more normal temperatures, but a few periods of 80 degree weather and little rainfall kept fuels quite dry for most of the month. The last ten days of July finally brought much relief statewide. Precipitation greatly reduced the fire danger north of the Alaska Range to near normal levels around July 20th. Heavy thunderstorms dampened fuels in South Central, moderating the near-record fuel conditions on the Kenai Peninsula and MatSu Valley. However, fuels there remain quite dry. The current large scale pattern has southerly flow dominating much of the state for the first week of the month. This brings moisture into southern Alaska but keeps warm, dry weather throughout the Interior. Longer range patterns show that southwest flow will be prominent in the state by the third week of the month, which is the season ending event that typically occurs during August and brings heavy precipitation statewide.

Northwest: Expect above normal significant wildland fire potential to continue in early August across most of Oregon and portions of south central and southeastern Washington. This condition will remain in place through mid-September and return to normal in September or October.

July was unusually dry for the Pacific Northwest. A few reporting stations in northern Washington and southeast Oregon recorded precipitation from passing thunderstorms but otherwise no widespread rain fell. Temperatures were at or above normal for the majority of the Area except for sections of northwest Oregon and western Washington. The very dry weather throughout July led to a steady elevation of fire danger across the Area. By late July record high ERC values were reported in sections of eastern Oregon. 1000 hour fuel moisture values have been steadily dropping, in most areas are below normal for late July. Climate outlooks for August and September continue to suggest warmer and drier weather than typical for the Area. Longer range outlooks into October and November suggest a return to seasonal temperatures and rainfall. An outbreak of large fires in southwest Oregon in late July reveals that fire danger is high enough to support significant fires in this Area. Elevated fire danger indices are expected to continue through August and diminish during September.

Northern California and Hawaii: Significant wildland fire potential will continue above normal across much of Northern California in August. During September above normal conditions will reduce to encompass only some of the western mountains of the Area.. By October through November the entire Area will be in normal significant fire potential for this time of year.

July was warmer than normal in most inland areas, while rainfall was below normal most areas, except above normal across the Sierra Cascades and parts of the northwest mountains, due to several days of wet thunderstorms. Normal precipitation and normal temperatures are expected for August. The Area will be influenced by a weak low for much of the month, with cooler onshore flow. Periodically however, the area will come under the influence of the four corners High, which will bring hot temperatures and occasional lightning. Expect minimal offshore wind activity for August. Areas that received wetting rains from recent thunderstorm activity will remain near normal for August, with only the inland sections of the Coast Range south of the Trinity Alps expecting to maintain critically dry fuels for most of the month. Portions of northeast California will dry out quickly in the prolonged southwest wind pattern early in the month. For September, offshore winds typically begin to affect the Area, mainly west of the Sierra crest. Offshore development typically gets enhanced with the longer nights across eastern areas, moderating fuels to non-critical levels. For October through November significant fire potential will remain normal, except during offshore wind events.

Hawaii will experience below normal significant wildland fire potential for August and return to normal significant fire potential for September through November. .

July brought precipitation to many areas, even hitting some of the drought stricken regions of the Big Island with much bigger impact expected from Tropical Storm Flossie at beginning of August. Hardest hit with heavy rain and flooding could be the lower islands. This unusual heavy rain event in the middle of fire season will set the tone for a below normal potential in August. Uncertainty of longer range weather and ability for grasses to dry quickly will result in normal fire potential for September through November.

Southern California: Significant wildland fire potential will continue to be above normal in all coastal, mountain, and inland valley areas, excluding the agricultural areas of the San Joaquin Valley, through September. Northern portions of the Area, including the northern portion of the Los Padres, Sierra, and Stanislaus National Forests and Yosemite National Park may see significant wildland fire potential return to normal in October.

Temperatures are expected to be near to slightly above normal over many inland areas through the remainder of the summer and into early fall. Monsoon moisture is expected to be limited across the Area during August and September, but several lightning episodes are still likely over the mountains and deserts. Significant fire potential will continue to be above normal across much of southern and central California through September, mainly due to the fact that fuel conditions are abnormally dry over the region. A recent surge of subtropical moisture brought heavy convective precipitation to the mountain and deserts, which helped to temporarily lower ERC values over portions of the Sierra, as well as the San Bernardino and Cleveland National Forests. Fuels in these areas however should dry out quickly in the days and weeks to come. Live fuel moisture values in Chamise brush are at levels more typically seen in mid-October and fires are burning actively not only during the peak heating hours of the day, but also at night. We can expect the current level of fire activity to continue throughout the Area at least through September, decreasing and returning to normal over the central portions of the state by October and November. Further south, the potential for significant offshore winds remains a possibility this fall, which will help to keep significant fire potential above normal from the coastal ranges westward and from Santa Barbara County southward to the Mexican Border.

Northern Rockies: Normal significant wildland fire potential will be prevalent across the Northern Rockies throughout the outlook period, except southwestern Montana will above normal significant wildland fire potential, which should return to normal during September.

July featured conditions that were warmer and drier than normal. Convective activity was average with occasional significant events. Lightning from these events triggered new fire starts which emerged during a dry period late in the month. The severe drought across southwestern Montana continued to slowly expand north and west into central Idaho and western Montana. August will begin with an unseasonably wet and cool system moving across the Area bringing widespread precipitation and cooler temperatures to most of the Area except southwestern Montana where wetting precipitation will be spotty. Drought is most pronounced there and live vegetation is stressed due to soil moisture values that are well below average. Though indices are at record levels across the western half of the region and fire danger is very high to extreme, both the indices and fire danger are expected to fall to noncritical levels in response to the event. The second week of the month should follow with a gradual return to warmer than normal conditions with periodic convection continuing. Long range model data suggests that another ridge will move over the region and intensify during the latter half of the month. This would lead to an active end of the month for southwest Montana and possibly central Idaho. Warm and dry conditions are expected to continue into mid-September before abating. Due to late spring precipitation and early August precipitation, eastern Montana and the Dakotas are not expected to be a major factor this fire season and should continue to see normal to below normal activity.

Eastern Great Basin: The southern Idaho mountains will experience above normal significant wildland fire potential in August, but should return to normal in September.

Monsoonal moisture moved into Utah early in the month of July quickly decreasing significant fire potential. Frequent rain producing thunderstorms moved through the state during the month although

temperatures were quite warm. Sagebrush live fuel moistures have recovered across southern and central Utah with values near normal for this time of year. Western Idaho was particularly hot and dry during July causing the sagebrush fuel moistures as well as the upper elevation heavy fuels to become critically dry. Record low 1000 hour fuel moisture values have been recorded across the western and central Idaho mountains. The focus for August turns to these areas where very dry fuels will be available to burn during warm and dry periods. Moderate to severe drought conditions persist across the entire Area, even though Utah has seen some relief to the drought with a downgrade from severe to only moderate across much of the state. The first week of August will see mild conditions across the north as a trough moves across the northern tier. Significant fire potential will be somewhat moderated Area-wide during this time. For the remainder of the month hot and dry conditions will return as the ridge rebuilds over the Intermountain West. Rather than remain a permanent feature during the month however, this ridge will likely weaken and move to the south and east for days at time brining some relief to the hot August conditions, especially across the north. Significant fire potential will decrease rapidly by the middle of September and normal fire potential is expected Area-wide for the fall months.

Western Great Basin: For August above normal significant wildland fire potential will persist across portions of the Sierra Front, northern mountains and ruby mountains and continue into September.

Although there were some very hot and dry periods in July, there were also some periods of heavier rainfall that accompanied thunderstorms. Precipitation averaged above normal over parts of western, central and southern Nevada. Areas of eastern, northeast and northwest Nevada saw below normal precipitation. Severe to extreme drought conditions continued across the northern half of Nevada, with moderate to severe long term drought over the southern half of the state and along the Sierra Front. Parts of central Nevada even saw an intensification of the drought to exceptional starting in early July. The main concern is the addition of new growth of fine fuels from late spring rains over parts of western and northern Nevada. Coupled with long term drought in those areas, as well as the very dry mid to upper slope timber and Pinyon Juniper these areas will continue to see an increased chance of significant fires. Temperatures are expected to continue to be above normal through August with equal chances of below, above and near normal precipitation. Monsoon moisture is expected to return again to Nevada in August with a return to thunderstorm activity after a period of drier and breezy weather early in the month. West coast troughs will likely bring drier and breezy weather at times, however high pressure will likely dominate at times bringing another period of hotter weather with increasing thunderstorms during August, with only brief relief from cooler temperatures and breezy conditions at times. As fuels dry out again, with soil moistures remaining very low, the drought continues and chances for lightning increase. Periods of dry and breezy weather are expected in early August with another period of hot weather from early to mid-August with chances for thunderstorms returning. In September, the potential is there for a return to a pattern where more continuous low pressure troughs move through the west again bringing cooler or wetter weather, which would bring an end to the fire season. It is anticipated that the fire season will wind down in September, but confidence is not high yet in the end to fire season.

Southwest: Significant wildland fire potential will remain normal across the entire Southwest Area through November.

July brought an end to the typical fire season weather pattern and transitioned to heavy precipitation across much of the Area associated with the monsoonal pattern. Higher humidity and wet storms will continue to dominate the pattern through the Outlook period, though short periods of dryness could lead to a short term increase in fire potential. Little to no concern for significant wildland fire potential exists Area-wide for October and November.

Rocky Mountain: The entire Rocky Mountain Area will experience normal significant wildland fire potential for August, September and October through November.

After severe fire season conditions over southern Colorado in mid to late June, activity and severity has significantly trended downward. A recent short-lived hot, dry and windy period resulted in an increase in large fire activity in northwest Colorado and western Wyoming, which is typical for this

time of year. Long term drought is still evident across much of the Rocky Mountain Area, but has improved during the month of July across much of Colorado, eastern Wyoming and across the plains of South Dakota, Nebraska and Kansas due to a persistent monsoon and associated thunderstorm activity. The main focus for large fire activity during the month of August into early September will be over extreme northwest Colorado and western Wyoming, peaking in the latter half of August. Average fire season conditions are forecast for the following several months. Fire statistics indicate a decrease in large fire activity by late August into early September, with a slight increase again in mid-September through October, due to an increase in wind flow associated with dry cold fronts and receptive fuels from dry air mass conditions that frequent the Rocky Mountain Area during the fall season. Cooler temperatures and shorter days typically limit these fires to a few burn periods. Additionally, natural ignition decreases during this time. Precipitation and temperatures are forecast to be near the seasonal averages through the seasonal outlook period. Occasional subtropical moisture surges will continue to produce thunderstorm activity through late August, but to a lesser extent over western Wyoming. By early September monsoon moisture is expected to cut-off or be suppressed south of the Rocky Mountain Area as the northern jet becomes more active, marking the beginning of dry cold front season.

Eastern Area: Below normal significant wildland fire potential will continue across the far southern reaches of the Eastern Area through August before returning to normal in September and remain normal through October and November.

Short term drying developed across parts of the western Great Lakes and the northern mid-Mississippi Valley through mid-summer. Soil moisture and precipitation anomalies were below normal at the end of July over these areas. The rest of the Eastern Area experienced near to above normal precipitation through the first half of the summer. Drier portions of the western and northern Great Lakes may see periods of above normal fire potential if below normal precipitation does occur through the remainder of the summer. Otherwise near to below normal fire potential is forecast across the remainder of the Eastern Area into the fall. Cooler conditions overall are forecast across the Eastern Area through the end of the summer and into early fall. This will lead to near to below normal fire potential in August across much of the geographic area. More normal temperature and precipitation patterns are forecast this fall. As always, any drier portions of the Eastern Area which experience any dry, warm and windy periods of weather will see an increase of fire activity.

Southern Area: Below normal significant wildland fire potential will persist across most of the Southern Area through August. In September, the focus of the below normal potential will be along the Atlantic and Gulf coasts before returning to normal potential for October through November.

Weather, soil, fuel moistures, and precipitation conditions will blend to produce normal significant fire potential. The past month's rain activity across the Southern Area is keeping a large part of the Southern Area rather moist. Stream flow, crop moisture, and precipitation anomalies are above average for most states east of the Mississippi River. Some drought exists west of the Mississippi River but periodic moderate rain events on top of a fairly moist environment have periodically moistened fuels keeping any significant fire activity at bay. The only potential area to be watched over the next few weeks into next month will be east Oklahoma and Texas where there could be some building potential should low humidities and high temperatures appear, though at this time this does not appear probable. High humidity and still a higher frequency of rain activity from impinging cold fronts will continue. Afternoon storms will still prevail through the forecast period, with tropical activity potential in the Atlantic just entering the peak of the season. Expect wetter tropical conditions to still be the trend in the southeast and Puerto Rico. The driest and still potentially the warmest areas will remain west of the Mississippi River.

Outlook Objectives

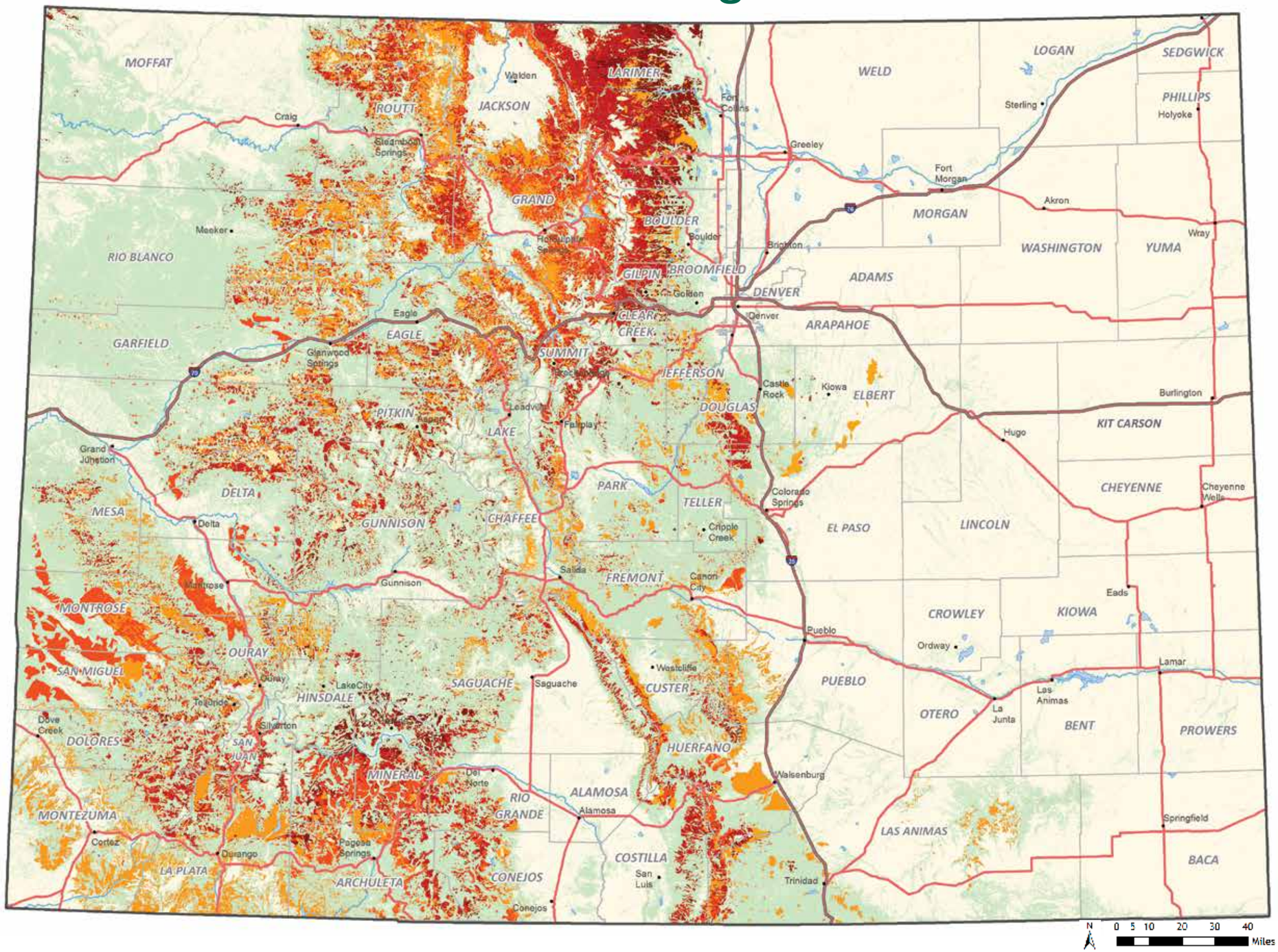
The National Significant Wildland Fire Potential Outlook is intended as a decision-support tool for wildland fire managers, providing an assessment of current weather and fuels conditions and how these will evolve in the next four months. The objective is to assist fire managers in making proactive decisions that will improve protection of life, property and natural resources, increase fire fighter safety and effectiveness, and reduce firefighting costs.

For questions about this outlook please contact the National Interagency Fire Center at (208) 387-5050 or your local Geographic Area Predictive Services Unit.

Note: Additional Geographic Area assessments may be available at the specific GACC websites. The GACC websites can also be accessed through the NICC webpage at: **http://www.nifc.gov/nicc/predictive/outlooks/outlooks.htm**

2 - Forest Health

Forest Insect and Disease Progression in Colorado from 1996 - 2012



1996 - 1997

1998 - 2000

2001 - 2003

2004 - 2006

2007 - 2009

2010 - 2012

Aerial Survey Data

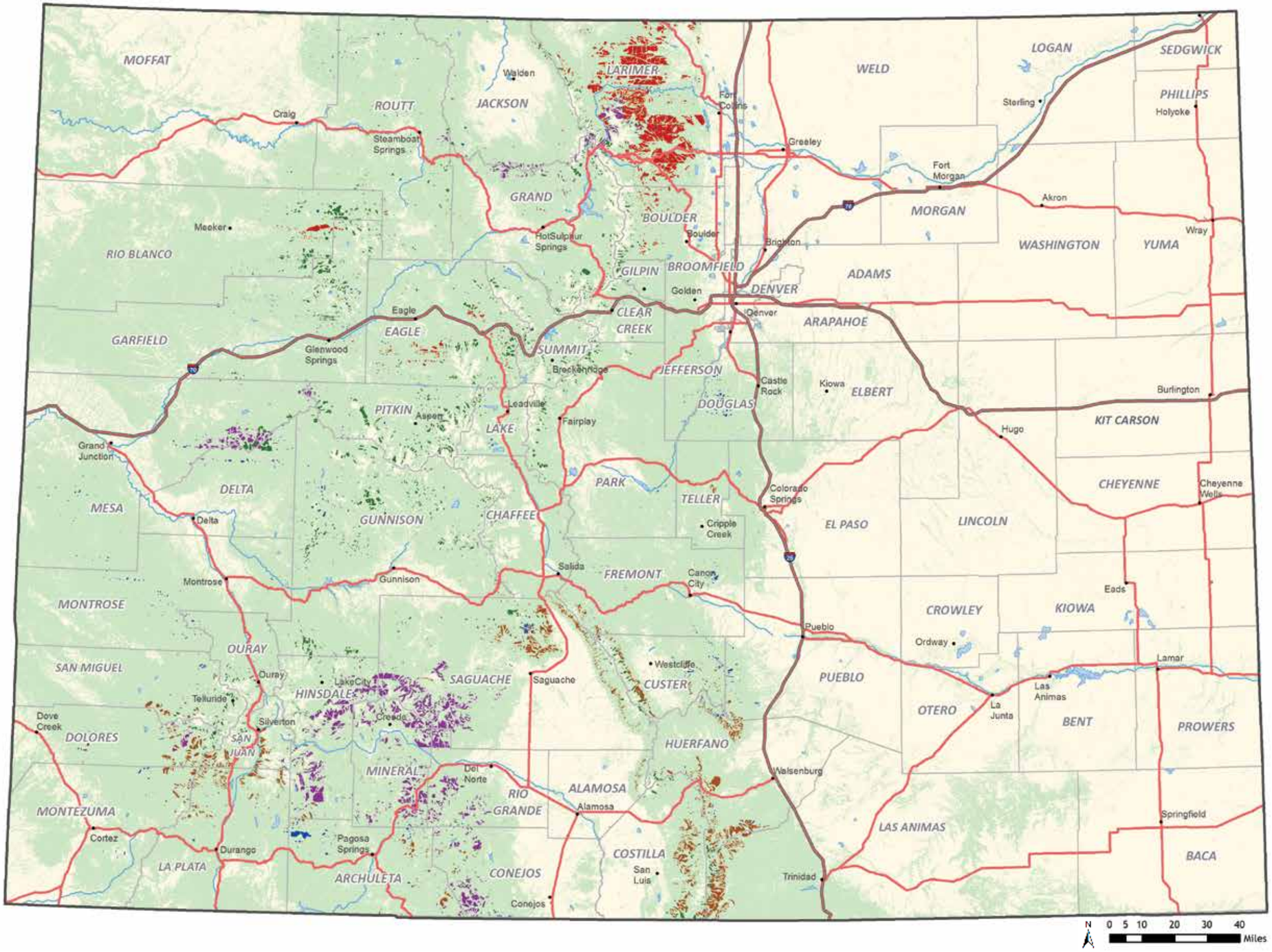
Due to the nature of aerial surveys, the data on this map will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented on the map because these agents are not detectable from aerial surveys. The data presented on this map should only be used as a partial indicator of insect and disease activity and should be validated on the ground for actual location and causal agent. Shaded areas show locations where tree mortality or defoliation were apparent from the air. Intensity of damage is variable and not all trees in shaded areas are dead or defoliated.

The insect and disease data represented on this map are available digitally from the USDA Forest Service, Region 2 Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this map for purposes other than those for which it was intended may yield inaccurate or misleading results.

Map created December 2012
For more information:
www.csfs.colostate.edu

Colorado State Forest Service

2012 Insect and Disease Activity in Colorado Forests



- Spruce Beetle — *311,000 acres*
- Mountain Pine Beetle — *264,000 acres*
- Western Spruce Budworm — *217,000 acres*
- Subalpine Fir Decline — *221,000 acres*
- Other Insects and Diseases — *71,000 acres*

Aerial Survey Data

Due to the nature of aerial surveys, the data on this map will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented on the map because these agents are not detectable from aerial surveys. The data presented on this map should only be used as a partial indicator of insect and disease activity and should be validated on the ground for actual location and causal agent. Shaded areas show locations where tree mortality or defoliation were apparent from the air. Intensity of damage is variable and not all trees in shaded areas are dead or defoliated.

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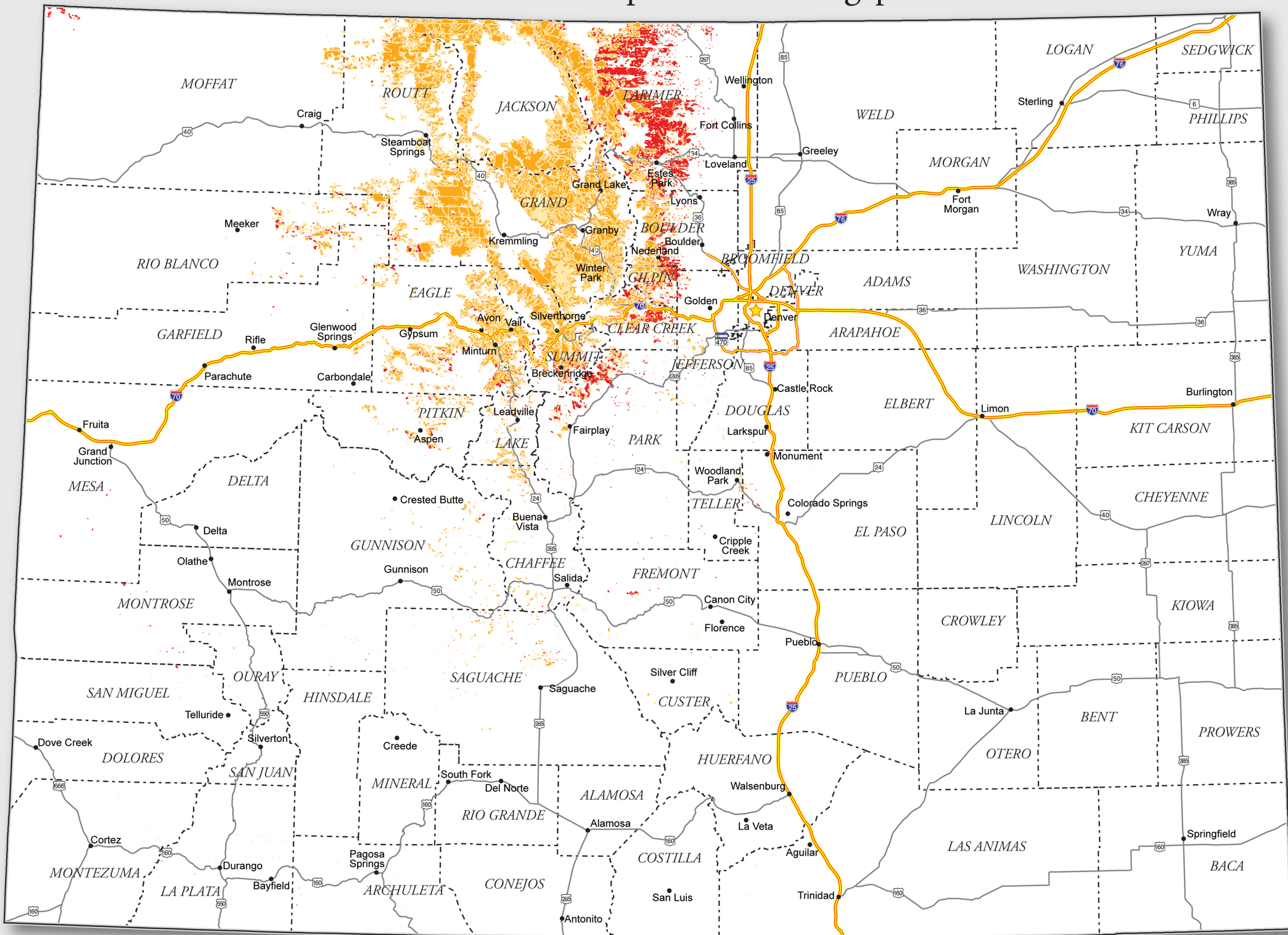
Map created December 2012
For more information:
www.csfs.colostate.edu

Colorado State Forest Service

Colorado's Mountain Pine Beetle Epidemic in Lodgepole Pine 1996 - 2009



Mountain Pine Beetle (New Acres in 2009)

Mountain Pine Beetle (Previously Affected Acres 1996 - 2009)

Interstate

US Highway

County

Cities

Mountain Pine Beetle

Tree mortality from the current mountain pine beetle infestation is unprecedented in Colorado's recorded history. Since the infestation began in 1996, approximately 1.5 million acres of lodgepole pine have been infested in Colorado.

Beetle epidemics are a natural part of forest ecosystems, but the old age of many of the state's lodgepole pine forests makes them susceptible to large-scale epidemics. Old forests, drought, warm temperatures all have had a role in fueling this epidemic.

At current rates of spread and intensification, it is likely that MPB will kill the majority of Colorado's mature lodgepole pine forests within the next 3-5 years. However, younger lodgepole pines will survive and seedlings will regenerate naturally.

During the first few years following infestation, needles turn red on infested trees and the trees die. Fifteen to 20 years later, the dead trees fall over. Wildfire is a real threat to life and property in beetle-killed areas whether trees are red and dead or years later when they fall over and litter the ground.

Aerial Survey Data

Due to the nature of aerial surveys, the data on this map will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented on this map because these agents are not detectable from aerial surveys. The data presented on this map should only be used as a partial indicator of insect and disease activity, and should be validated on the ground for actual location and casual agent. Shaded areas show locations where tree mortality or defoliation were apparent from the air. Intensity of damage is variable and not all trees in shaded areas are dead or defoliated.

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Map created January 2010
For more information:
http://csfs.colostate.edu/

2012 Report on the Health of Colorado's Forests

Forest Stewardship through Active Management

Acknowledgments

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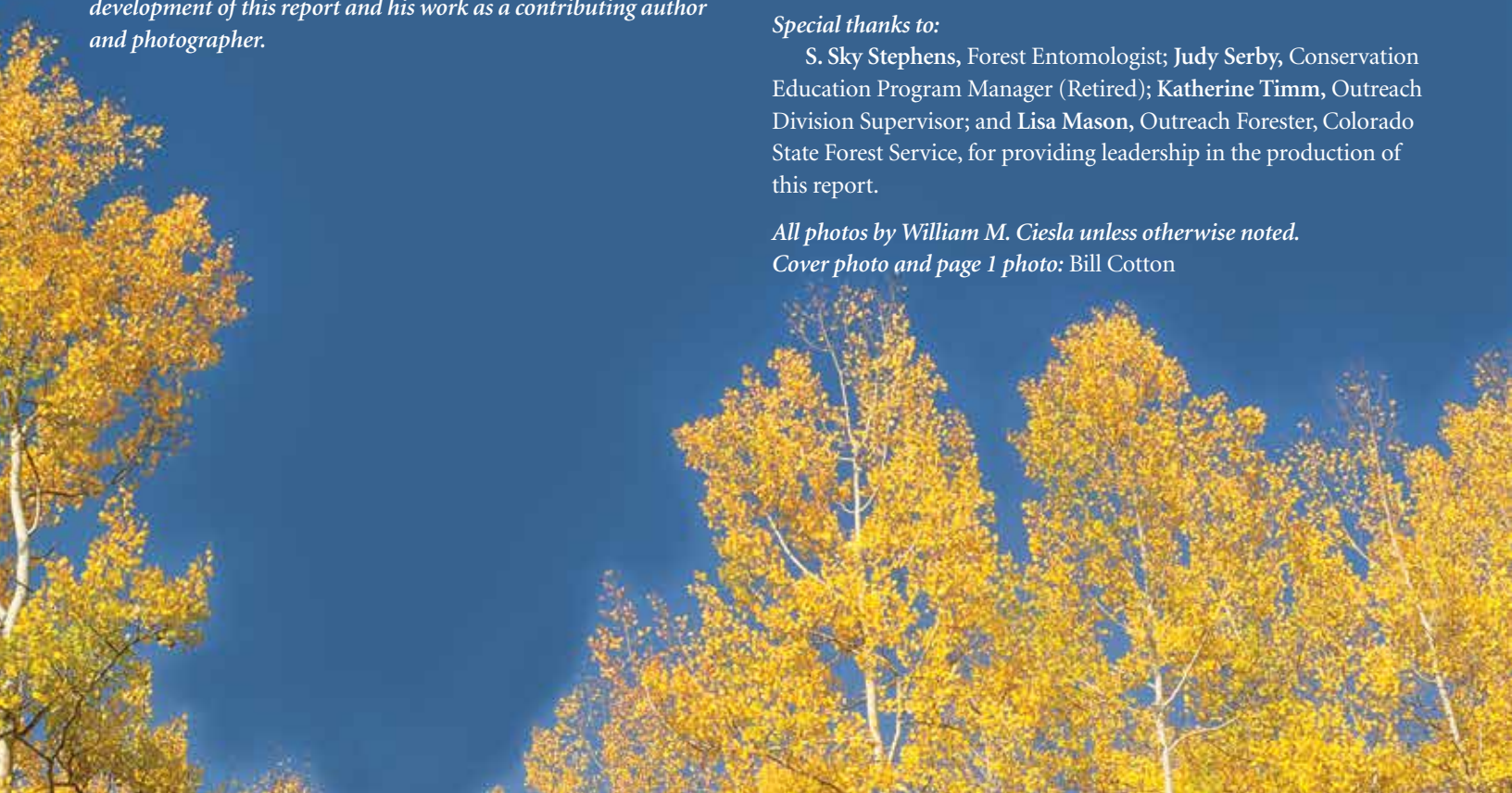
All photos by William M. Ciesla unless otherwise noted.
Cover photo and page 1 photo: Bill Cotton



January 2013

On behalf of the Colorado State Forest Service, it is my pleasure to present the annual report on the health of Colorado's forests. The theme of this year's report is "Forest Stewardship through Active Management," with an emphasis on the link between healthy forests and sound forest management efforts. This is the 12th consecutive year we have produced a report on the state of Colorado's forests and actions we are taking to mitigate forest health concerns.

Colorado's forests have experienced significant change over the past two decades. We've seen unprecedented mortality in our conifer forests, driven by poor resiliency to insects and diseases that has been exacerbated by warmer and drier weather conditions. After experiencing many years of a mountain pine beetle epidemic that has exceeded any in Colorado's recorded history, we now face another bark beetle epidemic – the spruce beetle. For the first time in recent years, the acreage impacted by spruce beetle surpassed that of the mountain pine beetle.

We've also seen significant growth in the wildland-urban interface (WUI), the area where structures and other human developments intermingle with forested environments. Management is critical in the WUI to reduce the risk of wildfire to homes, property and infrastructure. In addition, over the last 15 years, the wood products industry in Colorado has experienced a significant decline. Forest products businesses provide local employment, create economic diversity and support forest management objectives. In turn, forest management can support wood products industries while promoting forest health and reducing wildfire risk.

Last year, we asked two fundamental questions: what do we want our future forests to look like, and what do we want them to provide? The possible answers are as diverse as Colorado's forests, but what is certain is that managing for healthy forests will allow for the production of biomass and traditional wood products; clean air and water; protection of wildlife habitat; enhancement of recreational opportunities; reduced risk from wildfire; and support for local economies.

Now is the time to shape Colorado's future forests. We must seize the opportunity to take action based on the best available information and resources. The Colorado State Forest Service, the lead state agency for forest stewardship, management, applied research, technical assistance, and outreach and education, is prepared to guide landowners and stakeholders throughout Colorado to plan, implement and maintain successful forest management practices. Through sound forest management, we can help ensure that our future forests provide a variety of resources and benefits that will meet the needs and values of current and future generations.

This report provides an overview of the current condition of Colorado's forests and the recent activity of various insects and diseases. It demonstrates how responsible forest management – from wildfire risk mitigation around a single residence to the maintenance of large-scale watersheds – can be achieved. It also provides examples of how active forest management and stewardship will help ensure that Colorado's forests continue to provide all the benefits we enjoy.

I hope you find the information contained in this report to be informative and helpful. Please feel free to contact any CSFS office to learn more about our forests and what you can do to help manage and protect this precious resource.

Joseph A. Duda
Interim State Forester
Colorado State Forest Service

Executive Summary

Each year, the *Report on the Health of Colorado's Forests* provides information to the Colorado General Assembly and citizens of Colorado about the health and condition of forests across the state. In addition to providing a comprehensive overview of the current health of Colorado's forests, this year's report also includes sidebars that highlight the ongoing management and stewardship of our forests. These forest management actions help sustain production of wood and non-timber products, support Colorado communities and economies, and ensure the health and diversity of Colorado's forests for current and future generations.

The principal source of information for this report is the annual aerial forest health survey, a cooperative project between the Colorado State Forest Service and the Rocky Mountain Region of the USDA Forest Service. Other data sources include field inspections and contacts with forest landowners by CSFS personnel; the Colorado Forest Inventory and Analysis (FIA) Program; and special surveys designed to help ensure early detection of potentially invasive insect species, such as gypsy moth, emerald ash borer and exotic bark beetles.

For the first time since the mountain pine beetle epidemic began, the acreage impacted by spruce beetle surpassed that of the mountain pine beetle. A total of 311,000 acres of active spruce beetle infestation were mapped in 2012. Outbreaks of spruce beetle continued in four areas of Colorado: the San Juan and La Garita mountains in southwest Colorado, the Grand Mesa in western Colorado, the Wet Mountains in south-central Colorado and portions of the Arapaho-Roosevelt National Forest and Rocky Mountain National Park in north-central Colorado. Localized infestations also were detected on the eastern slopes of the Sangre de Cristo Range. Infestations in the San Juan and La Garita mountains continued to spread north toward Lake City and northeast into the Cochetopa Hills toward Monarch Pass. Active infestations continued in younger forests and in krummholz at the edge of timberline in these areas. However, many of the mature spruce trees in portions of

◀ The Colorado River is one of the major river systems in Colorado that provides water to 18 states. Photo Credit: CSFS

the San Juan and La Garita mountains, including areas within the Weminuche Wilderness, were killed during previous years of the outbreak.

Although surpassed by spruce beetle in 2012, the mountain pine beetle continued to be one of Colorado's most damaging forest insects. Active infestations occurred on a combined 264,000 acres of limber, lodgepole and ponderosa pine forests. This represents a decline in the overall infested acreage for the fourth consecutive year. The reason for the decline is that most of the trees susceptible to infestation – primarily mature lodgepole pines in Jackson, Grand and Summit counties, and in other lodgepole pine forests west of the Continental Divide – were attacked and killed during previous years of the outbreak. However, in 2012, moderate to severe damage persisted in ponderosa, lodgepole and limber pine forests over much of the northern Front Range. The area of active infestation in ponderosa pine forests dropped for the first time in three years, to 170,000 total acres in 2012. Most of the damage in ponderosa pine occurred in Larimer County (164,000 acres), largely north of the Big Thompson River. Infestations in both lodgepole and ponderosa pine forests also declined in areas along the central Front Range in Boulder, Clear Creek and Gilpin counties, and south of the I-70 corridor, despite the presence of a substantial number of susceptible host trees.

Douglas-fir beetle impacted mature Douglas-fir trees in portions of the Rampart Range, on the slopes of Cheyenne Mountain, in the Sangre de Cristo/Culebra ranges, across portions of the Gunnison Basin and scattered throughout other parts of southwestern Colorado. The western balsam bark beetle/root disease complex also continued to kill subalpine fir trees in many of the state's high-elevation forests. Infestations of the piñon ips bark beetle, detected north of Cañon City and Florence in 2011, increased in size in 2012.

Western spruce budworm continued to defoliate Douglas-fir, white fir and spruce in portions of the Sangre de Cristo/Culebra ranges, the Wet Mountains and the San Juan Range. Approximately 217,000 acres of defoliation were visible during aerial surveying in 2012. Top-kill and tree death continues to occur in forests that have sustained successive years of defoliation.

Several defoliating insects of deciduous trees also were observed in 2012. Defoliation of quaking aspen forests by two insects – western tent caterpillar and large aspen tortrix – increased significantly, with a total of 29,000 acres of aerially visible defoliation detected, predominately in portions of the Sangre de Cristo/Culebra ranges and the San Juan Mountains. For the second consecutive year, fall cankerworm, a defoliator of Gambel oak, also continued to have an impact south of Castle Rock, but is predicted to decline after significant frost damage to the foliage of oak forests. Other relatively minor forest pest damage detected during 2012 includes localized infestations by leaf beetles on narrow-leaf cottonwood trees and damage to piñon pine foliage by piñon needle scale.

Loss of ornamental black walnut trees infested by thousand cankers disease continued in many of Colorado's urban forests in 2012. New centers of infestation were detected in Fort Collins, Loveland, Greeley and Cañon City. Walnut trees are an important part of Colorado's community and urban forests.

Exotic and potentially invasive insects and diseases also continue to threaten Colorado's forests. Surveys were conducted for two potentially invasive exotic insects: gypsy moth and emerald ash borer. Neither species was detected during the 2012 surveys. Pine wilt nematode was identified in exotic pines along the Front Range and in Grand Junction. White pine blister rust, another invasive pest, continued to damage limber and bristlecone pines in several areas of the state, including a new area of infestation detected in the Lefthand Canyon area of Boulder County.

The drought also continued to impact many of Colorado's forests in 2012, and some experienced large wind events in late 2011. Drought conditions caused leaf scorch or severe desiccation of aspen and other broadleaf trees and shrubs in many of the state's forests. Leaf scorch also was present on a variety of broadleaf trees in urban and community forests, especially along the Front Range. In November 2011, hurricane-force winds caused extensive tree windthrow in several areas of the state. Areas of windthrown trees observed during the aerial survey occurred from Monarch Pass south towards Poncha Pass, and on the eastern slopes of the Sangre de Cristo Range south to Medano Pass. Other areas of windthrow occurred in lodgepole pine forests in the Geneva Creek Basin and in spruce forests south of Georgetown near Guanella Pass and the South Chicago Creek Basin. Like drought, windthrow that results from extreme wind events can impact a forest's resiliency to insects and diseases.

The Colorado State Forest Service continues to work with private forest landowners, cooperators and stakeholders to effectively manage Colorado's forested lands. For more information on the data presented within this report, please contact the CSFS or visit www.csfs.colostate.edu.

▲ Greg Zausen, assistant district forester on the CSFS Fort Collins District, uses an increment borer, a tool that measures a tree's age. Photo Credit: Lisa Mason

Update on Forest Insects, Diseases and Environmental Stressors

This section provides a summary of the many insect and disease agents affecting the health and vitality of Colorado's forests. The principal source of information for this section is the annual aerial forest health survey. In Colorado, this survey is a cooperative project of the Colorado State Forest Service and USDA Forest Service, Rocky Mountain Region. High-wing aircraft, such as Cessna models 206 and 210, are used to conduct the surveys. Teams of aerial observers representing the two agencies fly over all of Colorado's forest types, except piñon-juniper woodlands and the dispersed forests of the Great Plains. In 2012, however, a survey also was conducted of piñon-juniper forests in the Purgatoire River Basin south of La Junta.

Aerial observers record the location and extent of forest damage on touch-screen computers using special mapping software. From the air, they can identify impacted tree species and the damage signatures of specific insects, diseases and other threats. The data they collect are then stored using a geographic information system (GIS) and later analyzed to identify trends in forest condition and the activity levels of insects and diseases over time. When additional information is required to confirm or diagnose the agent responsible for tree mortality/decline, aerial observers conduct on-the-ground checks of areas of concern observed during survey flights.

CSFS foresters also regularly observe and report on the occurrence of forest pest activity and provide annual reports for their respective districts around the state. These reports offer information on a smaller, more localized scale, and often include information about insect and disease activity not observable from the air. Results from special surveys conducted by the Colorado Department of Agriculture and USDA Animal and Plant Health Inspection Service (APHIS) to ensure early detection of two potentially invasive exotic forest pests, the gypsy moth and emerald ash borer, also are included in this report.

◄ Diana Selby, assistant district forester for the CSFS Fort Collins District, fells a beetle-kill pine to reduce fuels at the Borden Memorial Forest, a living classroom owned by Colorado State University. Photo Credit: Peggy Ely

▼ CSFS Durango District Forester Kent Grant teaches a middle school class at St. Columba School in Durango about spruce beetle and the importance of forest management. Photo Credit: St. Columba School

Indigenous Pests

Conifer Forests

Spruce Beetle

(Dendroctonus rufipennis)

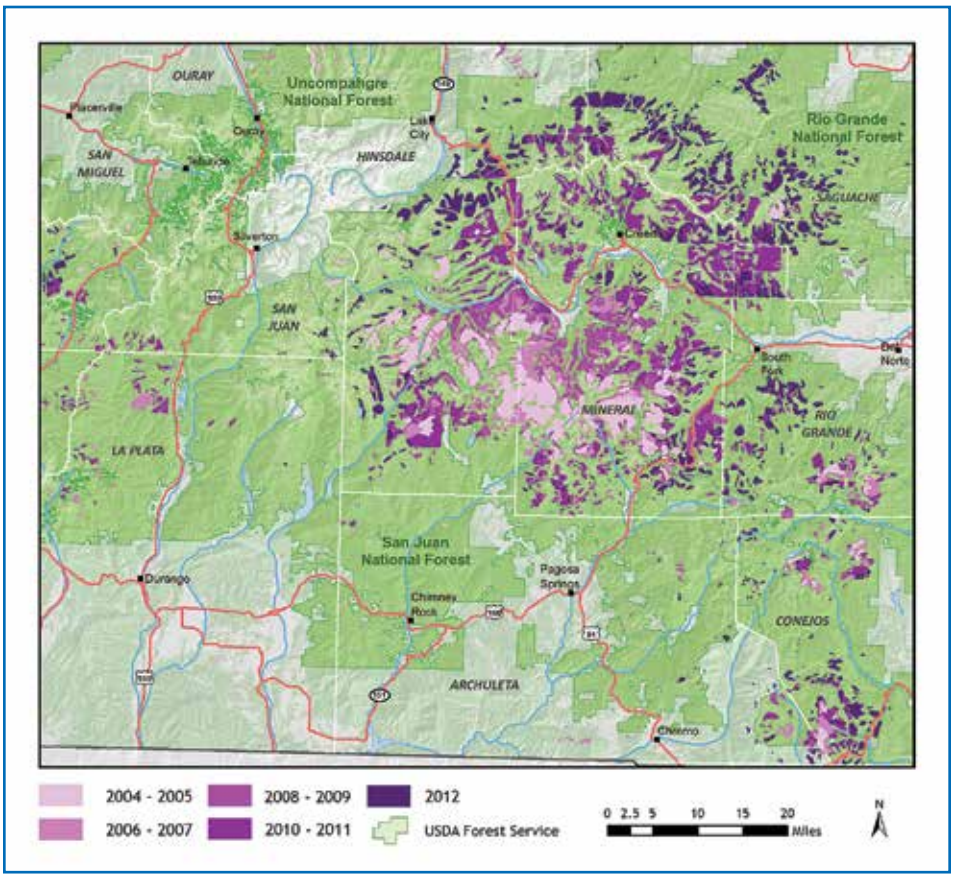
As of 2012, the spruce beetle has become the dominant active insect threat in Colorado's forests. Spruce beetle is the most destructive bark beetle in North America's spruce forests. In Colorado, the spruce beetle can cause significant mortality in mature high-elevation forests, particularly in Engelmann spruce. The spruce beetle typically requires two years to complete a life cycle and, unlike mountain pine beetle, spruce beetle can develop in downed spruce trees. Outbreaks typically occur several years after storms cause windthrow in spruce trees, which are susceptible to blowdown because of their shallow root system. Spruce beetle initially breeds in the freshly windthrown trees and subsequent generations attack and kill live, standing trees. Spruce beetle typically attacks large-diameter spruce trees in decadent stands, but when beetle populations exhaust desirable hosts, they will attack smaller and younger trees.

Unlike the mountain pine beetle epidemic, the scope of active spruce beetle infestation in Colorado has expanded over the past several years – increasing in size for the fourth consecutive year in Colorado's high-elevation spruce forests. This is largely due to an abundance of available host trees for spruce beetles, compared to a decline in susceptible host trees for mountain pine beetles. Surveyors mapped approximately 311,000 acres of tree mortality attributable to spruce beetle, compared to 262,000 acres in 2011; 208,000 acres in 2010; 114,000 acres in 2009; and 64,000 acres in 2008.

In areas where the outbreak has been underway for several years, such as the Weminuche Wilderness in southwest Colorado, most or all of the mature spruce trees already have been killed, and

▲ Pre-emergent spruce beetles overwinter in the inner bark of an Engelmann spruce.

Spruce Beetle Progression in Southwestern Colorado 2004-2012



mortality continues in krummholz – the stunted and deformed trees that live in the harsh conditions on the edge of timberline. Moderate to severe infestations continued in four areas of the state: the San Juan and La Garita mountains in southern Colorado, the Grand Mesa, the Wet Mountains and portions of the Arapaho-Roosevelt National Forest and Rocky Mountain National Park in northern Colorado. Localized infestations also were detected on the eastern slopes of the Sangre de Cristo Range.

A massive spruce beetle outbreak, which began in the Weminuche Wilderness of the Rio Grande and San Juan National Forests around 2002, continued to expand north and east in 2012. Small groups of dead and dying spruce were detected along the Continental Divide as far north as Monarch Pass. Heavy infestations occurred in the Cochetopa Hills from Cochetopa Pass south to the La Garita Range, and in Rambouillet Park and Spring Creek Pass. New areas of infestation also were detected south of Lake San Cristobal near Lake City.

Spruce beetle infestations continued in the Wet Mountains near areas affected by a blowdown event that occurred in June 2007. The heaviest damage in 2012 was noted in the Greenhorn Creek Basin and along the National Forest road, from Ophir Pass south to the Greenhorn Peak Mountain Trailhead in the San Isabel National Forest.

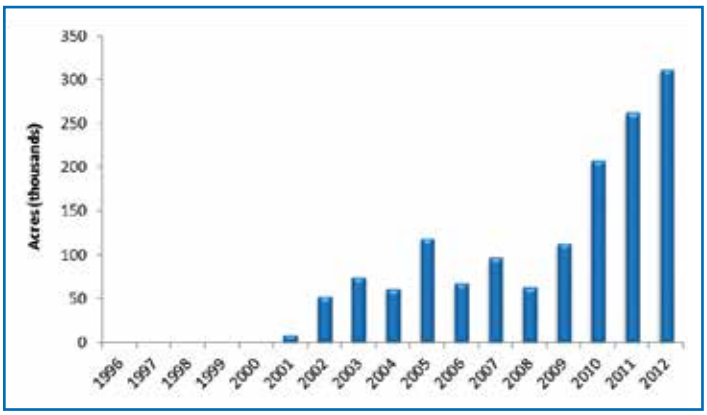
The spruce beetle outbreak in north-central Colorado, which has been underway since 2005, declined in 2012, primarily because most of the susceptible host trees were attacked and killed during previous years. However, small numbers of dying spruce could be seen amid the dead trees from previous years' attacks.

Although the spruce beetle affects high-elevation forests that are much less densely populated with people and homes than lands impacted by mountain pine beetle, it is important that this threat be addressed. The forests attacked and killed by spruce beetles are located at the headwaters of Colorado's rivers, which provide water to 18 states. Water yields may be influenced by the death of so many trees, and the impacts to water quality and quantity would be significant if wildfires occur in these altered forests. Many wildlife species unique to the subalpine communities of the Rocky Mountains also are found in these forests. Recreational opportunities such as downhill and cross-country skiing, camping, hunting and fishing are predominant in areas of the state that could be impacted by the spruce beetle.

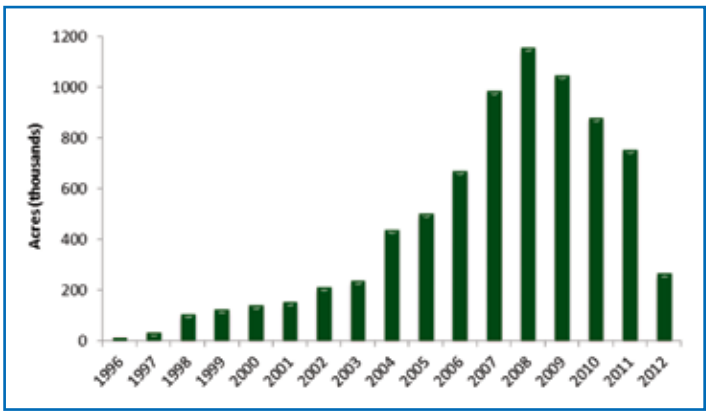
▲ Spring Creek Pass in Hinsdale County has been heavily infested with spruce beetle; infested trees turn a light yellow-green color before turning gray. Visually, spruce beetle mortality is less dramatic than mountain pine beetle-caused mortality in lodgepole pine. Large areas of spruce forests, including areas on the La Garita Range, have a ghostly gray cast.

2012 Statewide Spruce Beetle Activity

Annual Acres Affected by Spruce Beetle in Colorado



Annual Acres Affected by Mountain Pine Beetle in Colorado



Mountain Pine Beetle

(Dendroctonus ponderosae)

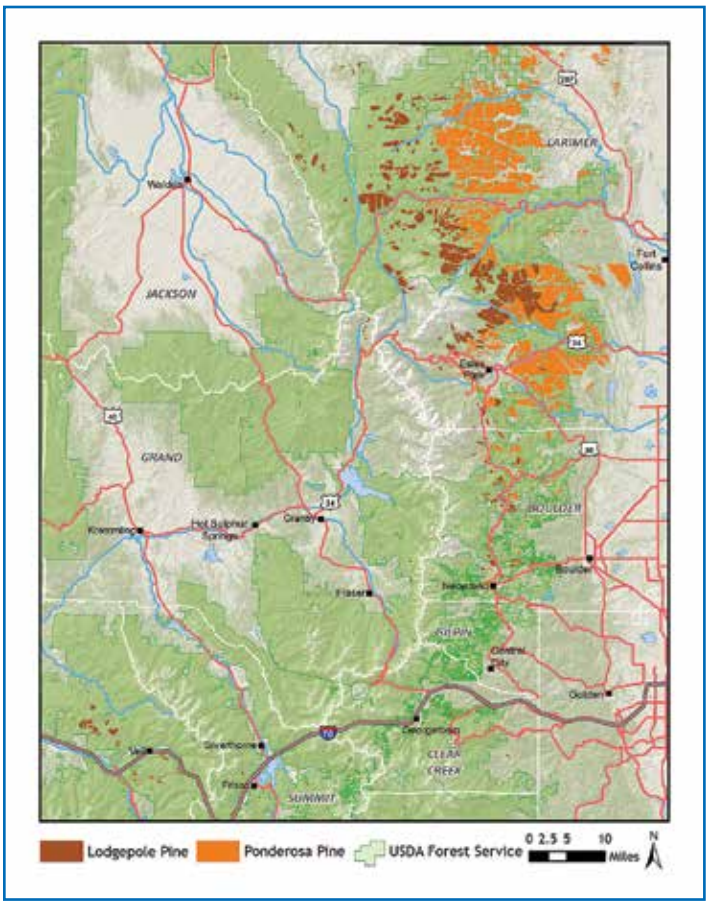
Though smaller in scope than the active spruce beetle infestation in 2012, mountain pine beetle (MPB) infestations continued to cause severe damage to ponderosa, lodgepole and limber pine forests in Colorado, primarily in Larimer County and portions of Boulder County. Aerial surveyors mapped 264,000 acres of active infestation in 2012. This represents a reduction in the area infested for the fourth consecutive year, down from 752,000 acres in 2011; 878,000 acres in 2010; 1,046,000 acres in 2009; and 1,154,000 acres in 2008. This reduction is largely due to the fact that in several areas of the state, including the West Slope and north-central Colorado, many pine forests were previously impacted, leaving fewer acres of susceptible host trees. Approximately 64 percent of the currently infested area (or 170,000 acres) is located in low-elevation ponderosa pine forests along the northern Front Range.

In Larimer County, MPB was most active in low- to mid-elevation forests, including both ponderosa pine and ponderosa pine/lodgepole pine forest types. Moderate to severe damage continued in ponderosa pine forests in the Beaver Creek Basin and on Table Mountain, east of U.S. Highway 287 near the Wyoming border. Damage also continued in ponderosa pine forests east of Red Feather Lakes and in lodgepole pine forests on the slopes of North, Middle and Bald mountains, all west of Red Feather Lakes. Moderate to severe tree mortality also continued in both ponderosa and lodgepole pine forests throughout the South Fork Cache la Poudre Basin, along Buckhorn Creek and in the lower Big Thompson River Basin.

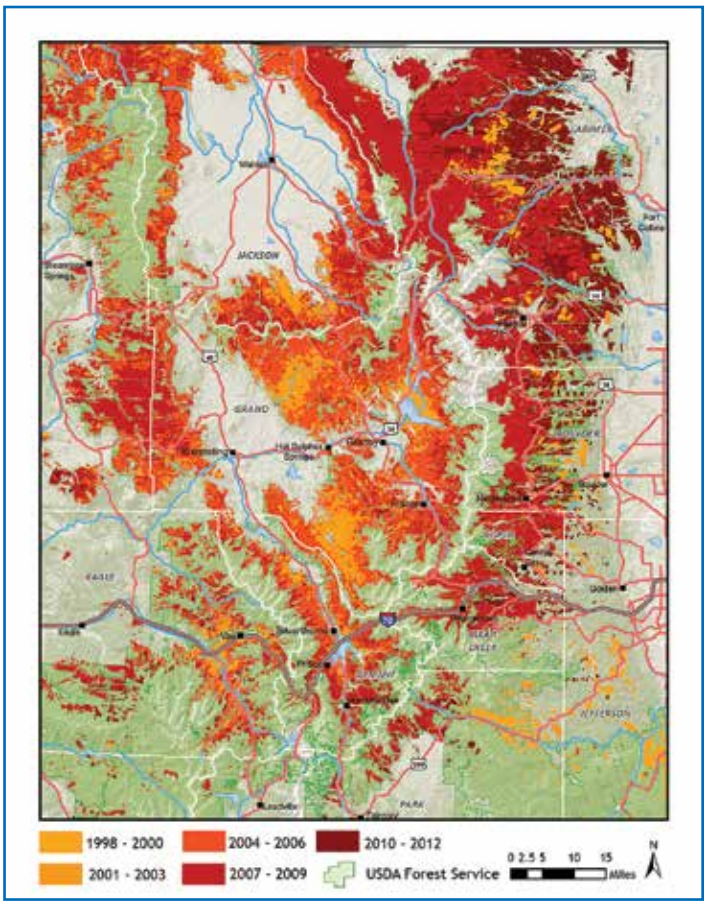
The High Park Fire, which burned approximately 87,284 acres west of Fort Collins in June 2012, occurred in the heart of Colorado's current MPB infestation. Because the fire occurred prior to the 2012 aerial survey flights, it may have reduced the acreage of mapped MPB infestation. Many pines that host soon-to-emerge adult

▲ Mountain pine beetle infestation in the lower Big Thompson River Basin. The yellow trees are ponderosa pines, and the red trees are lodgepole pines impacted by the beetles.

2012 Mountain Pine Beetle Activity by Host Species



Mountain Pine Beetle Progression, 1998-2012



beetles were destroyed in the fire; however, pine forests within the fire perimeter that did not burn still harbor active infestations. Also, some ponderosa pines that survived the fire but suffered bark damage due to scorching were subsequently attacked or may be attacked in 2013.

MPB infestations have declined to nearly imperceptible levels over much of Colorado's lodgepole pine forest type, including in the Middle and North Park areas, where the host tree population has been exhausted. Most mature lodgepole pine forests in these areas now have a gray cast because the red needles have dropped from large numbers of dead trees affected by previous years' attacks. Infestations also have declined in most high-elevation lodgepole pine forests along the Front Range from the Wyoming border south to the I-70 corridor.

▲ A ponderosa pine forest impacted by mountain pine beetle near Mount Margaret in Larimer County.

New attacks on the eastern slope of the Rawah Range and in the upper Cache la Poudre and upper Big Thompson River basins were largely confined to small-diameter lodgepole pine stands. MPB brood production in these trees likely will be insufficient to sustain outbreak populations in these areas in the near future. However, many lodgepole pine forests south of Estes Park, including the Bear Lake area of Rocky Mountain National Park and portions of Boulder, Gilpin, Clear Creek and Park counties, still appear to have a substantial component of lodgepole pine in age classes suitable to sustain an outbreak.

Mountain pine beetle infestations also declined markedly from Guanella Pass and the Geneva Creek Basin south to Fairplay; in 2008-2009, these areas appeared to be on the brink of a major outbreak. Most of the lodgepole pine stands in this area still contain a high proportion of trees suitable for brood development. Infestations in lodgepole pine forests in the Aspen/Snowmass Ski Area and on the slopes of Smuggler Mountain near Aspen have declined to low levels. Aggressive stand management occurred in this area during the outbreak, yielding some success in reducing losses to MPB.

While the impact of MPB on live trees is in decline, concerns remain about how to deal with previously impacted forests. More than 3.3 million forested acres in Colorado have been affected by MPB since the current infestation began more than a decade ago. Standing dead trees continue to dominate these landscapes, posing a hazard to residents, recreationists, infrastructure and watersheds, in the form of falling trees, increased fuel for wildfire and the potential effects on the state's watersheds.

Forest Management to Reduce Tree Mortality from Mountain Pine Beetle

Mountain pine beetle is the most damaging insect pest in Colorado's pine forests. The current outbreak began in 1996 and has killed millions of trees in northern Colorado's ponderosa and lodgepole pine forests. New groups of young trees are now emerging in areas heavily impacted by the outbreak. These emerging forests will need to be managed to ensure that they are healthy, vigorous, diverse and more resilient to forest pests in the future.

"Good forest management, including thinning, timely harvesting and natural fire regimes will help ensure that these future forests meet a diversity of needs, including biomass production and traditional wood products, as well as clean air and water. They also will provide recreational opportunities and support local and state economies," said Scott Woods, acting supervisor of the Forest Management Division, Colorado State Forest Service.

In order to be effective, it is imperative that forest management practices are tailored for specific forest types (i.e., lodgepole pine, ponderosa pine, mixed conifer) and stakeholder objectives for the site (i.e., timber production, fuels mitigation, wildlife habitat). Sound forest management takes into consideration specific tree species and site-condition variables (i.e., slope, aspect, soil type, riparian areas) prior to treating forest stands. Each forest type responds differently to management practices, so there is no one-size-fits-all approach that is best suited for all forest types. For example, reducing the likelihood and severity of mountain pine beetle attack in ponderosa pine forests requires a different forest management strategy than in lodgepole pine forests. These strategies consider silvics – the study of how climate, soil, available moisture, topography and other factors affect tree growth and health – of each forest type.

Ponderosa pine tend to grow in uneven-aged stands in which the age and diameter of individual trees are diverse. Historically, this diversity was maintained by the presence of relatively frequent, low-intensity fires. Ponderosa pines, with their thick bark and deep tap root, are adapted to these low-intensity fires.

In ponderosa pine forests, mountain pine beetle attacks dense stands dominated by smaller-diameter trees, which are under stress, have high competition for resources and display poor annual growth. These dense stands typically occur when fire has been excluded from the landscape. Periodic thinning and harvesting individual trees help maintain healthy ponderosa pine forests by mimicking the characteristics of forests that traditionally were maintained by naturally occurring fire events. Thinned ponderosa pine stands that support vigorous trees of various ages and sizes are less susceptible to mountain pine beetle attack, even when dense neighboring stands are impacted.

Lodgepole pine forests are significantly different from ponderosa pine forests, and require a different approach to stand management. Lodgepole pine forests typically develop as pure, even-aged stands. These stands typically emerge after a disturbance such as wildfire because lodgepole pines, with their thin bark, are less adapted to fire.

In lodgepole pine forests, mountain pine beetle usually attacks trees that are approximately six inches in diameter. As lodgepole pine stands mature, they contain a high proportion of individual trees that are similar in diameter. This uniformity allows mountain pine beetle to be very successful, and a high percentage of the stand can be impacted. Harvesting mature lodgepole pine stands across a landscape in patchcuts reduces the proportion of stands susceptible to mountain pine beetle attack. Unlike ponderosa pine stands, mature lodgepole pine stands, due to their shallow root system, do not respond well to thinning and are prone to windthrow; however, interval thinning of young trees is beneficial because it prevents overstocking. The harvested lodgepole pine stands regenerate naturally and before

long are occupied by a stand of young, vigorous trees. This results in a mosaic of stands consisting of different age classes over the landscape. When mountain pine beetle activity occurs in this more age-diverse landscape of lodgepole pine stands, the areas of mature stands are most susceptible to attack, while surrounding areas of younger lodgepole pines are less susceptible.

Forest management helps maintain healthy stands of lodgepole and ponderosa pine, increasing their resiliency to mountain pine beetle. “While maintaining forest health and promoting ecosystem function, we also can mitigate accumulated fuels, as well as associated fire risks and air quality impacts, preserve the integrity of watersheds and protect property and infrastructure,” said Woods. “We also can support a diverse wood products industry and sustainable forest-based enterprises, which contribute to the health of Colorado’s economy.”

▲ Patchcutting consists of removing sections or patches of lodgepole pine trees. This is an effective management strategy in lodgepole pine forests because the harvested areas regenerate naturally, creating a young stand of trees. Photo Credit: Bill Cotton

▲(Before): Young trees emerge following the mountain pine beetle epidemic. If they are continually and properly managed, forests will be more resilient to forest pests, such as mountain pine beetle. Photo Credit: CSFS

▲ (After): A thinned forest is more resilient over time because there is less competition for water, nutrients and space for individual trees to grow. Photo Credit: CSFS

Douglas-Fir Beetle

(Dendroctonus pseudotsugae)

Douglas-fir beetle continued to impact forests in several areas south of Denver and on Colorado's Western Slope. Approximately 27,000 acres of active infestations occurred in 2012, compared to 25,000 acres in 2011. Many of the identified infestations have been ongoing for several years, and trees with gray crowns from previous years' attacks are adjacent to more recent mortality.

Infestations continued in Douglas-fir forests in the northern Rampart Range and drainages north of Florence and Cañon City. Mortality also continued on steep mountain slopes from Manitou Springs south, along the eastern slopes of Cheyenne Mountain, and south to Turkey Creek. Surveyors commonly observed groups of between one and 20 trees killed by Douglas-fir beetle at the lower-elevation limits of Douglas-fir growth in drainages on the western slopes of the Culebra and Sangre de Cristo ranges. This included several large groups in the lower Medano Creek Basin of the Great Sand Dunes National Park and Preserve.

On the Western Slope, infestations continued in and around Paonia, on the rimrocks of the Black Canyon of the Gunnison, and in low-elevation forests from Gunnison south to Lake City, where mortality was detected in groups of up to 100 trees. Infestations in groups of up to 500 visibly fading Douglas-fir trees were detected in several tributaries of the Crystal River, from Marble north and east to the slopes of Mount Sopris. Infestations also were observed in multiple locations along the base of the San Juan Mountains, in the vicinity of Pagosa Springs.

Subalpine Fir Decline

High-elevation subalpine fir forests are subject to infection by two species of root disease fungi, *Armillaria* spp. and *Heterobasidion parviporum*, which weaken trees and make them susceptible to attack by western balsam bark beetles *(Dryocoetes confusus)*. Chronic levels of tree damage from this complex have been underway in Colorado for several years. In 2012, damage was especially prevalent in portions of the West Elk Mountains between McClure Pass and Independence Pass. Subalpine fir mortality also continued at moderate levels, from Guanella Pass south to Trout Creek Pass in Park County. A total area of 221,000 acres of dead and dying subalpine fir were mapped in 2012 – a slight increase from the 180,000 acres mapped in 2011.

▲ Piñon pines killed by the piñon ips bark beetle in Phantom Canyon, north of Florence.

Engraver Beetles and Piñon Twig Beetles

(Scolytus ventralis, Ips spp. and Pityophthorus spp.)

Increased mortality levels in white fir occurred in forests in the Culebra Range, from La Veta Pass south to Cucharas; on the north facing slopes of the Spanish Peaks; and along the entire eastern slope of the Wet Mountains. The fir engraver beetle is responsible for the damage. This bark beetle attacks and kills several species of true firs, increasing tree damage and mortality during periods of drought or low precipitation.

Localized infestations of the piñon ips bark beetle *(Ips confusus)*, first detected in piñon-juniper forests north of Cañon City in 2011, erupted into an outbreak in 2012. Damage occurred from Colorado Springs south and west into the Arkansas River Basin. The heaviest damage occurred in the lower elevations of Phantom Canyon, north of Florence, and in the lower Four Mile Canyon north of Cañon City. Damage to piñon pine shoots, caused by twig beetles of the genus *Pityophthorus*, also was noted in several locations along the Arkansas River Valley west of Cañon City and in Phantom Canyon. A few small areas of piñon engraver beetle activity also occurred in piñon-juniper forests south of La Junta and in the southern portions of the Flat Tops Range on the Western Slope.

Scattered tree mortality suggestive of ips engraver beetle attacks was detected in ponderosa pine stands in the Culebra Range near the New Mexico border, and east of the South Platte River between the Eleven Mile Reservoir Dam and Lake George. Top kill, a characteristic of damage caused by pine engraver beetle *(Ips pini)*, was seen in ponderosa pines in the vicinity of the Palmer Divide north of Colorado Springs.

Western Spruce Budworm

(Choristoneura occidentalis)

Historically, western spruce budworm is the most damaging defoliating insect of Douglas-fir, white fir and spruce forests in Colorado. Successive years of defoliation causes reduced growth, top kill and sometimes tree mortality. Trees weakened by defoliation also are subject to attack by bark beetles, such as Douglas-fir beetle and fir engraver beetle. Defoliation by western spruce budworm was again present over much of the southern portion of the state in 2012, with a total of 217,000 acres of aerially visible defoliation.

Localized areas of defoliation occurred in mixed white fir/Douglas-fir forests on both sides of the Culebra Range, from La Veta Pass south to Cucharas Pass and the Trincheras Creek Basin. Defoliation was more extensive from Cucharas Pass and Ojitos south to the New Mexico border, and on the south-facing slopes of the Spanish Peaks. Heavy defoliation also was noted in North La Veta Pass and on the north slopes of Mount Maestas, and in all of the susceptible host tree types on the eastern slopes of Iron Mountain and on Sheep and Little Sheep mountains.

Conspicuous defoliation of white fir and Douglas-fir again occurred on the eastern slopes of the Sangre de Cristo Range, from Methodist Mountain south to Medano Pass. From Medano Pass south to Blanca Peak, defoliation tended to be more localized. Defoliation also occurred in most forests along the western slopes of the Sangre de Cristo Range, from Blanca Peak to Mosca Pass and from Medano Pass north to Methodist Mountain.

Western spruce budworm outbreaks in the Wet Mountains also occurred for the third consecutive year. Almost all of the susceptible host trees, from Ophir Pass south to the southern terminus of the mountain range, were defoliated on both the eastern and western slopes.

Damage also was prevalent in Douglas-fir forests on the western side of the San Luis Valley, from Poncha Pass south to Bonanza and Saguache, and along the southern slopes of the San Juan Mountains, especially in the Animas and Dolores river basins.

Farther north, localized defoliation was detected in two locations north of U.S. Highway 50: in Teller County on the east-facing slopes of Raspberry Mountain, and in several drainages immediately north and northwest of Raspberry Mountain, to the southeast of the community of Divide. Two small areas of suspected western spruce budworm defoliation also were mapped in Fremont County near Mullock Gulch. This is the farthest north that defoliation by western spruce budworm has been observed in Colorado in several years.

▲ Defoliation of Douglas-fir and white fir near Lake San Isabel in the Wet Mountains.

▲ Western spruce budworm feeds on new buds and foliage of spruce and fir trees. Photo Credit: Sky Stephens

Piñon Needle Scale

(Matsucoccus acalyptus)

Piñon needle scale is a tiny insect that feeds on the needles of piñon pine. Infestations occur on older needles, which turn brown and drop from the trees. Heavier infestations can give the crowns of affected trees a thin, tufted appearance, because only the needles from the most recent year's growth remain on the trees. Repeated infestations also can weaken and kill trees. In 2012, piñon needle scale infestations appeared in several areas, including the Kerber Creek Basin in the upper San Luis Valley, and in the southern portion of the Sangre de Cristo Range north of Mount Maestas.

▲ Piñon needle scale on piñon pine in the San Luis Valley.

Helicopter Logging, Pheromones Used to Tackle Steamboat Springs Bark Beetle Infestation

In 2012, the Colorado State Forest Service Steamboat Springs District used an integrated management approach to deal with the bark beetle infestation in a very visible and high-use area of Steamboat Springs.

In June 2012, the City of Steamboat Springs requested a complete forest health assessment for the Douglas-fir trees at the Howelsen Hill Ski Jump Complex, located on the southwest edge of town. The assessment, conducted by the Colorado State Forest Service, indicated that many of the Douglas-fir trees in the stand were infested by Douglas-fir beetle, a close relative of the mountain pine beetle that has affected millions of acres of lodgepole pine forest in Colorado. Trees infested by Douglas-fir beetles ultimately fade to yellow and then reddish-brown before dying.

The CSFS determined that removing all infested trees at Howelsen Hill would help prevent further spread of the beetles and made forest management recommendations to be implemented through the summer and fall of 2012. Recommendations included tree harvesting operations, pheromone deployment and further monitoring.

"The removal of all infested trees provided the best opportunity for controlling the infestation," said Carolina Manriquez, forester with the CSFS Steamboat Springs District. She says another significant reason for removing dying trees was that, when dead, they would represent a significant hazard to recreational users and the ski jump infrastructure.

The extreme slope in the project area required a technically complex operation. Local logging company Precision Timber worked with Connors Aviation to remove more than 90 mature Douglas-fir trees from the Howelsen Hill Ski complex. The infested trees were first felled by hand in September and logs were removed by helicopter the next month. This method minimized the impact on healthy vegetation and existing maintenance trails.

To deter new attacks on healthy trees, 150 anti-aggregate pheromone patches were deployed throughout the stand. Patches were nailed on green Douglas-fir trees, about 6 feet off the ground. Although chemical spraying is highly effective, pheromones were used instead because foresters were concerned with the difficulty of spray operations on steep slopes and the use of chemicals close to town and water supplies.

▲ Douglas-fir trees infested by the Douglas-fir beetle at the Howelsen Hill Ski Jump Complex have faded to yellow and reddish-brown. Photo Credit: CSFS

"Douglas-fir beetle is an endemic species in this area, and could still pose a problem in the future," Manriquez said.

To deter future beetle attacks, foresters will continue to deploy anti-aggregate pheromones annually for a minimum of three to five years. Regular monitoring and evaluation of the stand also will be necessary to take timely and appropriate action in the coming years. The next stand assessment is scheduled for early spring 2013.

Deciduous Forests

Thousand Cankers Disease

Thousand cankers disease affects black walnut trees and has caused significant mortality of ornamental black walnuts in many of Colorado's urban forests. The disease is caused by the fungus *Geosmithia morbida*, which is spread from tree to tree by the walnut twig beetle *(Pityophthorus juglandis)*. The fungus produces tiny cankers and causes dieback on branches. Repeated attacks by walnut twig beetles, which lead to multiple infections by thousand cankers disease, eventually cause tree death.

The walnut twig beetle is native to portions of Arizona, New Mexico and Mexico, where it causes little or no damage to its host tree, Arizona walnut. In 2004, large numbers of walnut trees began to die from this disease in several Colorado communities, including the greater Denver and Boulder areas. In 2012, tree mortality from thousand cankers disease intensified in several areas where it has more recently been discovered, including Fort Collins/ Laporte, Pueblo and Cañon City. In 2012, the occurrence of thousand cankers disease was confirmed for the first time in Loveland and Greeley.

▲ Adult western tent caterpillar, a common defoliator of aspen in Colorado.

► A dying black walnut in Cañon City displays the symptoms of thousand cankers disease, including foliage decline and discoloration. Loss of ornamental black walnut trees is occurring in many Colorado communities.

Defoliating Insects of Aspen

Approximately 29,000 acres of aspen defoliation were mapped in 2012 aerial surveys, compared to 22,000 acres in 2011. Recent aspen defoliation occurred in the Sangre de Cristo and Culebra ranges, the San Juan and Wet mountains, and the West Elk Mountains. Localized areas of aspen defoliation occurred on the west slopes of Mount Sopris and immediately south of the Aspen Highlands Ski Area in Pitkin County, and near the historical mining town of Bonanza in Saguache County.

▲ Aerial view of aspen defoliated by large aspen tortrix near Lake San Isabel.

▲ Fall cankerworm was responsible for defoliation in Gambel oak woodlands in Douglas County.

► Larvae of a cottonwood skeletonizer feeding on the underside of a narrowleaf cottonwood.

Defoliation of aspen stands by western tent caterpillar *(Malacosoma californicum)* and large aspen tortrix *(Choristoneura conflictana)* increased significantly in southern Colorado in 2012. Western tent caterpillar is the more commonly occurring defoliating insect of Colorado's aspen forests. This insect also feeds on a wide range of low-growing woody plants, including mountain mahogany, wild currant, chokecherry and bitterbrush. Larvae emerge in spring and feed in colonies that construct tents of silken webbing. Defoliation from this insect continued in the North Fork Purgatory River Basin on the eastern slopes of the Culebra Range, and on the slopes of Cattle Mountain in the Park Creek drainage, south of the community of South Fork in the Rio Grande National Forest. Both of these areas have experienced defoliation for a number of years.

Large aspen tortrix is closely related to the western spruce budworm and has a similar life cycle. Mature larvae feed inside aspen leaves that have been rolled and tied with webbing. Aspen defoliation from this insect, first detected in 2011 above Lake San Isabel, expanded in 2012 to encompass aspen stands growing along the Saint Charles Mountain and Cisneros hiking trails in the San Isabel National Forest.

Sudden Aspen Decline

Sudden aspen decline (SAD) is believed to be the result of several interacting factors: drought stress, large areas of aspen stands that are more than 100 years old, and attacks by several species of fungi and insects normally not considered primary tree killers. SAD was first detected in Colorado's aspen forests in 2004, when aspen stands at the lower elevation limits of tree growth abruptly began to die off. By 2008, the decline had become so prominent that 541,600 acres, or 11 percent of Colorado's aspen forests, were affected. Since 2008, the total area of aspen forests affected by SAD has become progressively smaller. This reduction is believed to be due primarily to a return to more normal moisture conditions. Young aspen regeneration now is occurring in many of the aspen stands previously affected by SAD.

In 2012, only 3,100 acres of aspen decline and mortality were mapped. The only location of significance was South Park, where large areas of aspen stands with thin crowns, indicative of stress, were observed. However, Colorado has now endured two successive years of below-normal moisture, which may lead to an increase of SAD in the next few years.

Fall Cankerworm

(Alsophila pometaria)

Defoliation of Gambel oak woodlands by inchworms occurred for the second consecutive year in Douglas County, south of Castle Rock. Larvae observed during May 2012 were characteristic of fall cankerworm. However, several late-spring frosts occurred in the area infested by the cankerworms, killing the newly formed foliage and destroying a large portion of food available for the young caterpillars. This caused the populations to decline in many of the areas impacted in 2011.

Cottonwood Leaf Skeletonizer

(Altica sp.)

Localized infestations of a leaf skeletonizer of narrowleaf cottonwood were observed in riparian areas in the Wet Mountains and upper San Luis Valley. Affected areas ranged in size from approximately one to five acres. Adults of this group of insects, commonly known as "flea beetles," feed on cottonwood species, as well as alder and willow.

Exotic Pests

The accidental introduction of exotic and potentially invasive insects, diseases and plants is a continuing threat to the health of Colorado's forests. Two species not yet established in Colorado – gypsy moth and emerald ash borer – are of special concern because of the devastating losses they have caused in other parts of North America, and the significant impact they could have on Colorado's forests. These two insects are the subjects of specialized surveys conducted by the Colorado State Forest Service, Colorado Department of Agriculture, Colorado Parks and Wildlife, and USDA Animal and Plant Health Inspection Service (APHIS).

Emerald ash borer and gypsy moth, like most other exotic insects and diseases, often become established in new areas via the transportation of infested material, including firewood. The movement of infested material has allowed both of these

exotic pests to rapidly establish populations in new locations, often hundreds of miles from pre-existing populations.

Gypsy Moth

(Lymantria dispar)

Gypsy moth, an insect native to Eurasia, was introduced into the northeastern United States during the 1800s. The moth's larvae feed on more than 100 species of North American plants, including broadleaf trees and conifers. Since the introduction of this species to the continent, it has defoliated millions of acres of forest in portions of the Northeastern, North-Central and Mid-Atlantic states.

Should the gypsy moth become established in Colorado, it could have devastating effects on the state's native forests, shelterbelts, windbreaks, and urban and community forests. Fortunately, no gypsy moths were detected in the 621 gypsy moth traps that were deployed across the state in 2012, primarily in urban areas.

Emerald Ash Borer

(Agrilus planipennis)

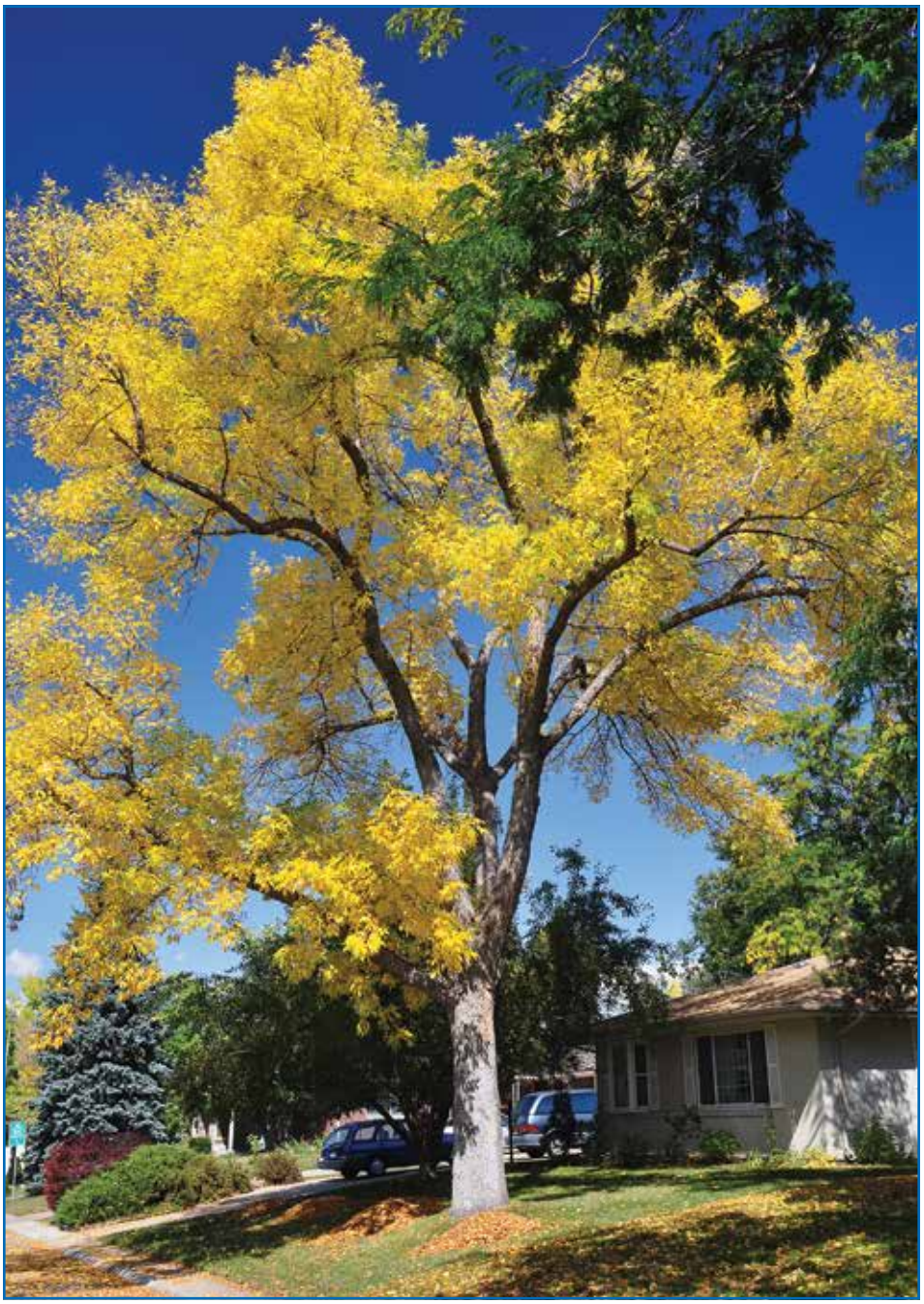
Emerald ash borer is native to Asia, but was first detected in North America in 2002 around Detroit, Mich. It has since caused extensive losses to urban forests, killing millions of ash trees in 17 states. In 2012, emerald ash borer became established in the Kansas City area of Kansas and Missouri, and could easily be introduced in Colorado. In 2012, a total of 200 emerald ash borer traps were deployed in Colorado, and no adults were detected.

Should emerald ash borer become established in Colorado, it would have devastating effects. Ash trees are fast growing and commonly are used as shade trees, ornamental plantings, or in shelterbelts and windbreaks. They have been extensively planted in many Colorado communities, and in some areas represent up to 20 percent of all planted shade trees.

Pine Wilt Nematode

(Bursaphelenchus xylophilus)

Another pest of concern for Colorado's urban and community forests is the pine wilt nematode, which impacts exotic pines and has killed numerous Austrian and Scots pines throughout the eastern United States, as well as Kansas and Nebraska. Pine wilt nematode has been observed in several communities along the Front Range, in Grand Junction and eastern Colorado. Pine wilt nematode could have significant impacts on planted pines, particularly those used in windbreaks and living snow fences.



◄ Ash trees are popular shade trees in urban areas and cities because of their brilliant fall color. All species of ash are susceptible to emerald ash borer.

Cottonwood Leaf Miner

(Zeugophora scutellaris)

Moderate to heavy discoloration of the foliage of narrowleaf cottonwood occurred in the lower portions of both the Big Thompson and Cache la Poudre canyons in 2012. A leaf mining beetle known as poplar black mine beetle, an introduced species native to Europe, has been tentatively identified as the cause of the discoloration. Poplar black mine beetle is now known to occur over most of the eastern United States and as far west as Montana, Colorado and New Mexico.

White Pine Blister Rust

(Cronartium ribicola)

White pine blister rust, a disease of white or five-needle pines, is caused by a fungus. Native to Asia, white pine blister rust was introduced into North America via infected nursery stock during the early part of the 20th century and has caused extensive damage to white pines in many parts of the United States.

White pine blister rust was first detected in Colorado in 1998 on limber pines in Larimer County. In 2004, the disease was detected in the Wet Mountains and the Sangre de Cristo Range, where both limber and bristlecone pines were infected. More recently, localized infections have been found in Rocky Mountain National Park, near the community of Ward, and on the north slope of Pikes Peak. A new area of white pine blister rust infection was detected in May 2012 in the Left Hand Canyon area of Boulder County.

Environmental Influences

Drought

Exceptionally dry weather during the summer of 2012 caused extensive leaf scorch in several forested areas of Colorado. Leaf scorch is characterized by dry, brown leaf margins and is caused by a plant's inability to take up sufficient moisture to meet its needs. Leaf scorch was present in both shade and ornamental trees last year, including ash, aspen, boxelder, dogwood, linden, Norway maple, oak and other broadleaf trees in many urban areas along the Front Range.

Leaf scorch was especially prevalent in some aspen forests in Boulder and Gilpin counties, including the South Boulder Creek Basin. Aspen stands with a gray cast to the foliage, suggestive of leaf scorch, were seen during aerial surveys in the South Fork South Platte River Basin and at the base of the Arizona and Montana mountains in Gilpin County. Leaf scorch so severe that it could be seen during the aerial forest health survey also was detected on serviceberry shrubs in the Crystal Creek drainage near Gould Reservoir in early July.

Wind Damage

The first winter storm of the 2011-2012 season was accompanied by hurricane-force winds that caused power outages, snarled traffic and blew down thousands of trees in Colorado. Winds up to 125 miles per hour were recorded in the Wet Mountain Valley community of Westcliffe on Nov. 11, 2011. Extremely high winds also were recorded in portions of Summit County.

The heavy winds associated with this winter storm caused moderate to severe windthrow in conifer forests around the state. Approximately 117 areas with windthrown trees totaling 4,100 acres were mapped in Colorado during the 2012 aerial forest health survey. Counties impacted include Chaffee, Clear Creek, Custer, Fremont, Gunnison, Larimer, Park and Saguache. Many of the downed and injured trees are susceptible to attack by several bark beetle species, including spruce beetle, Douglas-fir beetle and engraver beetles. These bark beetles attack and reproduce in the damaged and windthrown trees, eventually building large populations. The subsequent generations may then attack and kill standing trees.

Large patches of windthrown trees were detected in the Sawatch Range, from

▲ Leaf scorch on aspen is characterized by dry, brown leaf margins and discoloration.

Monarch Pass south to Poncha Pass. Patches of windthrow also were detected on the eastern slope of the Sangre de Cristo Range, with 35 areas totaling 1,220 acres and nearly 100-percent blowdown from Methodist Mountain south to Medano Pass. Most of the affected areas occurred in high-elevation Engelmann spruce forests near the edge of timberline. However, several areas of windthrow also were detected in mid-elevation mixed conifer forests.

Two small areas of windthrow were detected on the western edge of South Park, one in the Beaver Creek drainage, and the other below Panther Mountain. Both occurred in Engelmann spruce stands and each covered less than two acres. Several small areas of windthrow also were detected in lodgepole pine forests on the north-facing slopes of the lower Geneva Creek Basin, north of Kenosha Pass.

Windthrow also was mapped in several areas south of Georgetown, including the South Chicago Creek Basin, several areas in upper Cabin Creek near Guanella Pass and in the lower Leavenworth Creek Basin. Eleven locations totaling 300 acres of windthrow were mapped in these areas. Another small area of windthrow was detected in the upper Willow Creek Basin, a tributary of the upper Cache la Poudre River. Additional areas of scattered windthrown trees, not visible from the air, were reported in many areas affected by the November 2011 storm.

▲ High winds in November 2011 caused heavy windthrow in an Engelmann spruce forest on the eastern slope of the Sangre de Cristo Range. This location will become more susceptible to spruce beetle.

▲ Lodgepole pine trees are already susceptible to windthrow because of their shallow root system; after being killed by mountain pine beetle, the risk of windthrow increases. Photo Credit: CSFS

Maintaining Healthy Forests through Active Management

Maintaining healthy forests is essential to Colorado's social, economic and ecological health. Forests require proper management to remain vigorous and productive. Forest management involves the practical application of biological, physical, quantitative, socio-economic and policy principles to the regeneration, management, utilization and conservation of forests. Proper planning and the application of forest management and stewardship practices on all scales, from the single homesite to the regional watershed level, can help promote and sustain healthy forests. When management actions are suitably matched to each forested ecosystem and site objectives, Colorado's forests will be better able to meet our diverse current and future needs, including aesthetics, fish and wildlife habitat, recreation, urban benefits, water yields, wilderness protection and wood products.

In 2010, the Colorado State Forest Service produced the Statewide Forest Action Plan, which was developed in cooperation with the many stakeholders concerned about Colorado's forests. The Statewide Forest Action Plan was established around three key themes: conserve working forest lands, protect forests from harm and enhance public benefits from trees and forests. The plan identifies threats to Colorado's forests, as well as forest management strategies and tactics for mitigating those threats.

Forest management decisions address many values and concerns, including, but not limited to, the wildland-urban interface, the forest products industry, insect and disease issues, watershed health, invasive species, community forests, wildfire risks, air quality, climate change and forest fragmentation.

▲ This wildland-urban interface community has been heavily impacted by mountain pine beetle. The accumulation of beetle-killed trees has altered aesthetics and property values, and increased wildfire risk. Photo Credit: Sky Stephens

▲ Thinning can create more resilient forests, which will reduce the likelihood of landscape-level mortality caused by insect epidemics. Photo Credit: CSFS

◄ Sam Pankratz, forester on the CSFS Gunnison District, records field measurements on private land. Photo Credit: CSFS

The Wildland-Urban Interface

The wildland-urban interface (WUI) is commonly characterized as any area where structures and other human developments meet or intermingle with forested environments. Expansion of low-density residential development in the WUI is expected to increase 300 percent by the year 2030, to almost 2.2 million acres in Colorado. This trend poses many challenges to human and natural communities, including wildfire risks to property and infrastructure, the spread of invasive species, loss and fragmentation of wildlife habitat, and water and air pollution. The CSFS provides education, technical assistance and forest management planning to landowners within the WUI to help mitigate these risks. The CSFS also administers funds to help landowners reduce wildfire-related risks to life and property. Forest management and fuels mitigation within the WUI can protect community values at risk by improving the security of property, infrastructure and watersheds, and the safety of residents and first responders during wildfires.

▲ Most of the forests in the Santa Fe Trail Ranch subdivision were overly dense, increasing wildfire concerns. The community recognized the risks to their lives, homes and forests, and took action to lower those risks. Photo Credit: CSFS

Southern Colorado Community's Efforts Exemplify Effective Fuels Mitigation

After treating 325 acres in 2012 to complement existing fuelbreaks in the community, a mountain subdivision along the New Mexico border has now treated more than 3,000 forested acres. With fuels mitigation work completed on nearly 20 percent of its land area, Santa Fe Trail Ranch provides a model that illustrates how Colorado communities can band together to reduce wildfire risk.

The subdivision covers approximately 17,000 acres in the foothills southwest of Trinidad. Treatments to reduce wildfire risk in the community have been ongoing since 2005, when community leaders first utilized funding and assistance from the Colorado State Forest Service to stimulate widespread landowner involvement. Nearly 15 miles of fuelbreaks along roads, trails, ridgelines and other focal areas within or adjacent to the subdivision will slow the spread and diminish the intensity of an approaching wildfire.

"Now we stand a chance when the big one hits," said Dave Skogberg, a community leader and catalyst to collective efforts.

A Community at Risk

Santa Fe Trail Ranch (SFTR) consists of 454 lots on steep terrain, each approximately 35 acres. Historic fires created a forest mosaic of ponderosa and piñon pine, juniper and Douglas-fir, with a thick shrub understory. Fire history studies show that natural, low-intensity fires once burned in this type of ecosystem every 13 years or less. But the vegetation grows dangerously dense in the absence of regular fires, which creates the potential for more intense wildfire events. And in the long run, wildfire in this area is inevitable.

"Having a fire here is not a matter of if, but a matter of when," said R.C. Ghormley, another resident who has been pivotal to community-wide fire mitigation.

Besides lightning-strike fires that occur almost annually on the ranch, large wildfires are common in the surrounding area. The Morley Fire burned 300 acres within the subdivision in 1978. In 2002, three large fires together burned 40,000 acres near the subdivision. Then, in 2011, the 27,000-acre Track Fire was within 3 miles and headed for the ranch before a wind shift diverted it away and across I-25, which provides primary access to the ranch. Mark Loveall, assistant district forester with the CSFS La Veta District, says these events highlight the need for communities to be prepared before a fire arrives.

"To prevent loss of structures during a wildfire, each landowner needs to take the necessary steps to protect his or her property," said Loveall.

Recent Fuelbreaks Focus on Escape Routes, Fire Spread

Two fuelbreaks, each several miles long and 300 feet or more wide, were completed in the summer of 2012. Many of the 325 treated acres were located along the Gallinas Parkway, which leads to the only major exit route for residents in an emergency. The other major fuelbreak was created along a four-wheel-drive trail inside the community's southern borders to help prevent fire spread within the community. A logging contractor completed the fuelbreaks, and volunteer crews from the subdivision used chainsaws to complete smaller, complementary fuels reduction efforts.

Ghormley took the lead in applying for $240,000 in Emergency Supplemental Funds, administered by the CSFS, to cover the cost of the fuelbreaks and additional mitigation work on private lots. Landowners also personally covered other costs to treat hundreds more acres on their own properties.

The SFTR fuelbreaks are considered shaded fuelbreaks, in which trees and shrubs are selectively thinned to encourage approaching wildfires to transition from catastrophic crown fires to less-intense ground fires. Using five pieces of heavy machinery, loggers reduced tree densities in the fuelbreaks from approximately 300 trees per acre to between 30 and 80 trees per acre – a more natural tree density. Machinery ground most of the woody material into mulch.

CSFS Funding Pivotal to Implementation of Past Work

The 2012 fuelbreaks are only the latest in a series of projects Santa Fe Trail Ranch has implemented to protect the community from wildfires. From 2005-2009, SFTR used CSFS-administered State Fire Assistance grants and Colorado Forest Restoration Pilot Program funds to help create defensible space around homes and implement earlier fuelbreaks. Thousands of hours of landowner labor were used to help match grant funding.

CSFS foresters have made frequent trips to the subdivision to guide property owners through the steps needed to create effective fuelbreaks and obtain grant funding. Loveall says that heavy involvement by residents has been essential to making the subdivision safer.

"I am confident that the work done in this community will aid firefighters in keeping most fire starts from destroying structures and threatening public safety," Loveall said.

▲ Residents of the Santa Fe Trail Ranch subdivision made their community a safer place to live by managing the surrounding forests. Photo Credit: CSFS

Forest Products Industry

Over the last 15 years, Colorado has experienced a significant decline in the number of businesses that harvest and/or manufacture wood products. Facility closures have directly affected the ability to conduct forest management activities and meet land management objectives, and have had negative impacts on many local economies. On an annual basis, more than 90 percent of the forest products Coloradans currently use are imported from other states or countries. Also, less than 10 percent of the net annual growth of Colorado forests is harvested each year. Without harvesting a more substantial percentage of growth, the density of our forests is constantly increasing and natural processes like wildfire and insect and disease outbreaks will continue to have significant impacts on our landscape.

The forestlands available for management in Colorado, which exclude wilderness areas, National Parks and other areas administratively withdrawn for cultural, social and ecological reasons, should be actively managed for a wide array of benefits. Forest products businesses and the markets they create for wood provide local employment, support economic diversity, provide products for local use and help offset forest management costs. Currently, these costs are covered largely through federal and state grants. However, grants can only cover a small fraction of the funding needed to accomplish Colorado's long-term forest management needs, especially within the WUI. Only through active forest management can we achieve healthy forests that can sustain a wood products industry, protect watersheds, reduce wildfire risk and mitigate losses from insects and diseases.

▲ Trees removed during forest management projects can be utilized for a variety of wood products. This supports local economies and the wood products industry. Photo Credit: CSFS

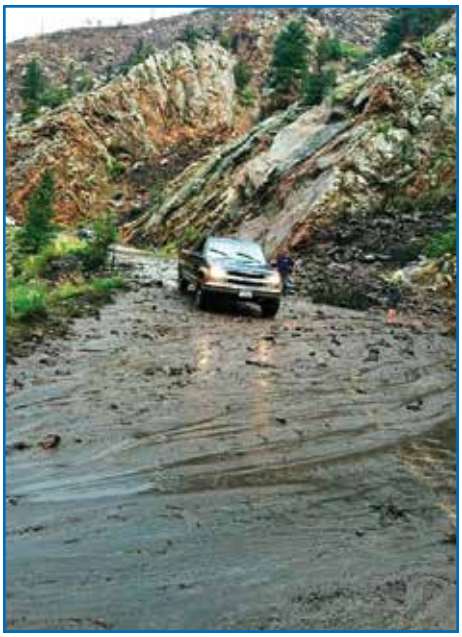
► Beetle-kill trees are often utilized for wood products, including dimensional lumber. Photo Credit: Dan Bihn

Forest Insects and Diseases

Insects and diseases are a natural part of forest ecosystems and play important roles in regulating forest health. However, Colorado has recently seen several of its native forest pests, including mountain pine beetle and spruce beetle, cause widespread tree mortality. These large-scale mortality events typically arise when forests are unhealthy and have experienced high levels of stress. Changing climatic conditions, including more frequent periods of extreme drought and increased temperature, as well as the suppression of natural wildland fire regimes, can exacerbate tree stress and allow insect and disease activity to escalate. Forest management, which decreases competition for water and nutrients and reduces individual tree stress, is the best solution. Active management can maintain healthy forests that are more resilient to insect and disease activity, and reduce the likelihood of forest pest epidemics.

Watershed Health

Colorado's forested watersheds and the water they provide to 18 states often suffer the same fate as the forests themselves; when forest health declines, so does the quality of the water yield flowing through those forests. Soil stability often is compromised in forests that have sustained extensive mortality from wildfires, increasing the likelihood of debris flow that can affect the quality and quantity of drinking water. The timing of snowmelt and runoff from forests can be negatively impacted in forests that have altered canopy conditions caused by insects and diseases. Forest management, particularly in critical, high-priority watersheds, can mitigate these concerns by improving overall forest watershed health, reducing the risk of insect, disease and wildfire-related tree mortality, thus conserving the supply of clean water.



▲ A mudslide in the lower Poudre Canyon after the High Park Fire impacts the highway and increases debris flow in the Cache la Poudre River, an important water resource in northern Colorado. Photo Credit: CSFS

▲ Extensive tree mortality from mountain pine beetle around Dillon Reservoir could impact water quality and quantity. Forest management in watersheds can reduce the risk of large-scale mortality and help protect our water sources. Photo Credit: Sky Stephens (2010)

Invasive Tree Species

Many of Colorado's landscapes, including forests, are threatened by invasive tree species and the displacement of native species. Colorado's riparian ecosystems in particular are declining in many areas, due to invasive species that have out-competed native vegetation. Several invasive species, including tamarisk and Russian-olive, can impact water flow and availability, adversely impact wildlife habitat and reduce recreational opportunities. Forest management can restore native vegetation in riparian and other forested areas and alleviate negative impacts on wildlife and water.

▲ Community forests include parks and open spaces. Photo Credit: CSFS

Community Forests

Urban and community forests provide numerous benefits to populated areas throughout the state, including improved quality of life, clean air and water, windbreaks, shade, energy savings and landscape beautification. These forests are at risk from a number of natural and human-caused factors. Native and exotic insects continue to impact our community forests and have the potential to cause extensive tree mortality. A contributing factor is the lack of diversity in many of our community forests, which can be heavily impacted by the establishment of an insect or disease that targets certain tree species. A good example is the emerald ash borer. Many Front Range communities are dominated by planted ash trees – up to 20 percent of the trees in some communities are ash species. If emerald ash borer, an exotic insect currently established as far west as Kansas City, Kan., becomes established in Colorado, we would expect to lose the majority of these ash trees. Community forests also face a number of challenges unique to the urban environment, including road improvement and maintenance, high traffic and pollution, and resource limitations in hardscapes (i.e., paved areas and sidewalks). Forest management can promote community forest health and diversity, and maintenance of urban forest cover.

▲ Communities benefit from tree cover, which provides shade, energy savings, aesthetics and other values. Photo Credit: CSFS

▲ Creating defensible space by removing or altering fuels around homes can reduce the risk of loss or damage during a wildfire.

Wildfire

Wildfires present risks to many community values, including life, property, water supplies, power lines, communication towers, recreation sites and landscape aesthetics. The record-breaking 2012 fire season was responsible for the loss of six lives and the destruction of more homes than in any other year. The 2012 fires impacted the lives and livelihoods of thousands of Coloradans, including those not directly impacted by wildfire. Hundreds of homes were lost within the WUI, infrastructure was damaged and tens of thousands of acres of forest were impacted. The loss of forest cover may result in slope destabilization, with increased debris flow in waterways, continued risk to infrastructure from mudslides and rock falls, reduction of property values and loss of forest-based economic opportunities. Wildfires and wildfire recovery efforts present a significant financial strain on the state. For example, $26 million have been spent on wildfire recovery activities on Strontia Springs Reservoir following the 1996 Buffalo Creek Fire and the 2002 Hayman Fire. Forest management can reduce the risk of intense wildfires that negatively impact the WUI and the forest landscape, and can help restore forest ecosystem functions.

▲ The 2012 fire season resulted in the loss of six lives and hundreds of homes, and impacted thousands of residents and visitors. The most devastating wildfire season in Colorado's recorded history will have lasting impacts on communities, forests and other natural resources. Photo Credit: National Interagency Fire Center

Air Quality

Our forests, including trees within our communities, constantly interact with the atmosphere to change the composition of the air around us. Trees sequester many pollutants from the atmosphere, including carbon dioxide, nitrogen dioxide, ozone, carbon monoxide and particulate matter. Trees also produce oxygen. Forest management can encourage active new tree growth, which sequesters more carbon dioxide from the atmosphere and improves air quality. As noted earlier, forest management also can reduce the risk of wildfires that release significant amounts of carbon into the atmosphere and negatively impact human health.

Climate Change

Forests are sensitive to climatic variability and change. Climatic factors influencing forest health include temperature, precipitation, atmospheric levels of carbon dioxide and other greenhouse gases, and extreme weather conditions. Forest management can improve the resiliency of forests and make them better able to adapt to climate dynamics. A key approach to climate risk management is diversification of forest management strategies between neighboring forest stands to promote forest structure diversity across landscapes on larger geographic scales.

Fragmentation

Fragmentation of forested landscapes and their conversion to non-forest uses is a growing threat to forests throughout Colorado. Fragmentation is the division of forested landscapes into smaller blocks, often separated from each other by roads, non-forested lands and urban development. Fragmentation can adversely affect wildlife habitat, biodiversity, watershed function and the ability to effectively manage forests. Smaller parcels of forest are more expensive to manage and can limit the ability to achieve forest management objectives on a landscape scale. The Colorado State Forest Service encourages participation in programs that conserve working forests and establish cooperative forest management efforts among multiple landowners.

Fuelbreaks Utilized for Firefighting Efforts during High Park Fire

As the High Park Fire bore down on the northwest corner of Lory State Park west of Fort Collins, foresters who had spent three years thinning a 375-acre fuelbreak in the area held their breath wondering if it would work.

The crown fire roared through the treetops, pushed by high winds and consuming swaths of unbroken canopy comprised of bone-dry, highly flammable pine needles and branches. But when the fire hit the fuelbreak – an area where trees had been thinned out but not completely removed – it no longer could jump from tree to tree, so it dropped to the ground, just as foresters hoped it would.

Later inspection revealed that the flame front became a much more benign ground fire as it burned through the fuelbreak, where it merely torched individual or patches of trees until it hit a control line established by retardant drops from aircraft. And there it stopped, sparing not only the park, but a large section of the watershed for Horsetooth Reservoir.

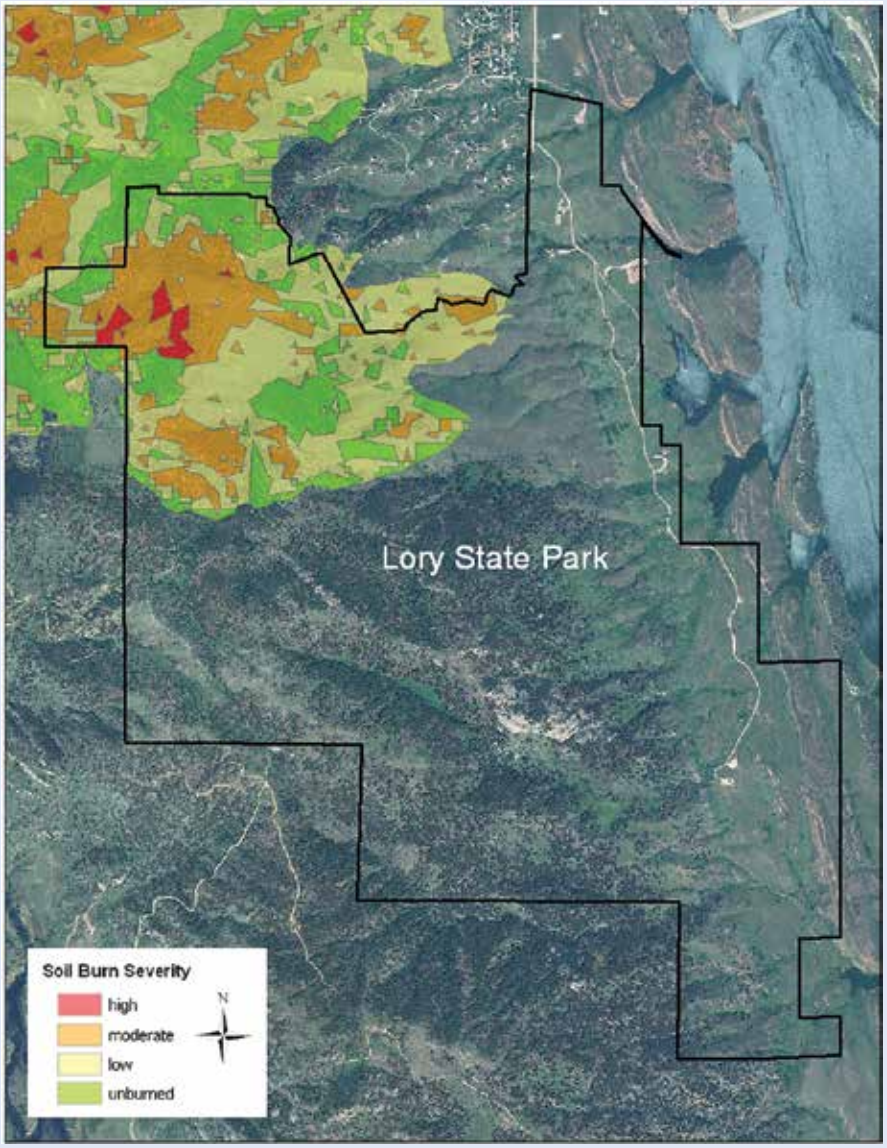
"So many variables affect fire behavior that it's difficult to point to one factor and say that this is what stopped that portion of the fire," said Diana Selby, assistant district forester with the CSFS Fort Collins District. "But we can say that the fire behaved like we wanted it to and that firefighters took the opportunity to stop the fire in the park using retardant drops."

An Ounce of Prevention…

For the past decade, Colorado Parks and Wildlife has been working with the Colorado State Forest Service to actively manage hazardous fuels, including beetle-killed stands, in 20 state parks. The CSFS provides technical forestry assistance and helps plan and implement treatments.

The Lory State Park project was funded by a $250,000 FEMA pre-disaster mitigation grant from the Colorado Division of Emergency Management, matched by $120,000 from Colorado Parks and Wildlife through Great Outdoors Colorado. Treatments included ridge-top shaded

▲ The 87,284-acre High Park Fire burned west of Fort Collins in June 2012. Photo Credit: Mike Hughes



▲ The High Park Fire burned at various intensities, as illustrated on the map. The 375-acre fuelbreak in Lory State Park helped lower the intensity of the fire in the south portion of the burn area.

fuelbreaks – areas where trees and brush are reduced to limit a wildfire's ability to spread rapidly – which firefighters used for retardant drops during the High Park Fire in June 2012. The fuelbreaks also helped prevent erosion in the area from monsoon rains that occurred immediately after the fire.

"The value of fuels mitigation treatments at Lory State Park during the High Park Fire underscores the successful partnership that Colorado Parks and Wildlife and the Colorado State Forest Service have developed over the decade since the Hayman Fire," said Matt Schulz, Colorado Parks and Wildlife forest management coordinator.

Additional Fuels Mitigation in Nearby Communities, on CSU Property

Complementing the fuels treatments implemented in Lory State Park was pre-fire work done by landowners in neighboring Redstone Canyon and by CSFS personnel in the Borden Memorial Forest, a living classroom owned by Colorado State University (CSU).

In Redstone Canyon, community members met every Saturday for four months to thin trees along community roads, creating a shaded fuelbreak and safer conditions for entry and exit during a fire. The group's sweat equity reduced the cash cost of the overall project, resulting in additional acres treated. During the High Park Fire, the established Redstone Canyon fuelbreaks also were used for retardant drops and fire perimeter work.

Further north in Rist Canyon, fuels mitigation work helped keep the fire on the ground in the Borden Memorial Forest, potentially saving homes and minimizing damage to the forest. The 70-acre private forest, a certified Tree Farm that was donated to CSU, provides experiential learning opportunities for CSU students.

Part of a Larger Forest Management Effort

The Lory State Park, Redstone Canyon and Borden Memorial Forest fuels mitigation projects are all part of a larger forest management effort aimed at reducing hazardous fuels, mitigating the impacts of mountain pine beetles and restoring forest health in an area stretching from the lower Poudre Canyon south to Masonville.

Smaller fuelbreaks like the 375-acre fuelbreak at Lory may be dwarfed by massive fires like High Park, but they underscore the benefits of partnerships and well-placed fuels treatments that can keep a large fire from becoming even more damaging and dangerous.

"In addition to protecting Lory State Park, Redstone Canyon and surrounding communities from wildfires, the fuelbreaks established safe zones for firefighters to battle the blaze," said Selby. "The treatments would not have been possible without the partnerships, funding and collective will of everyone involved, and they are a testament to the importance of coordinated efforts to mitigate hazardous fuels."

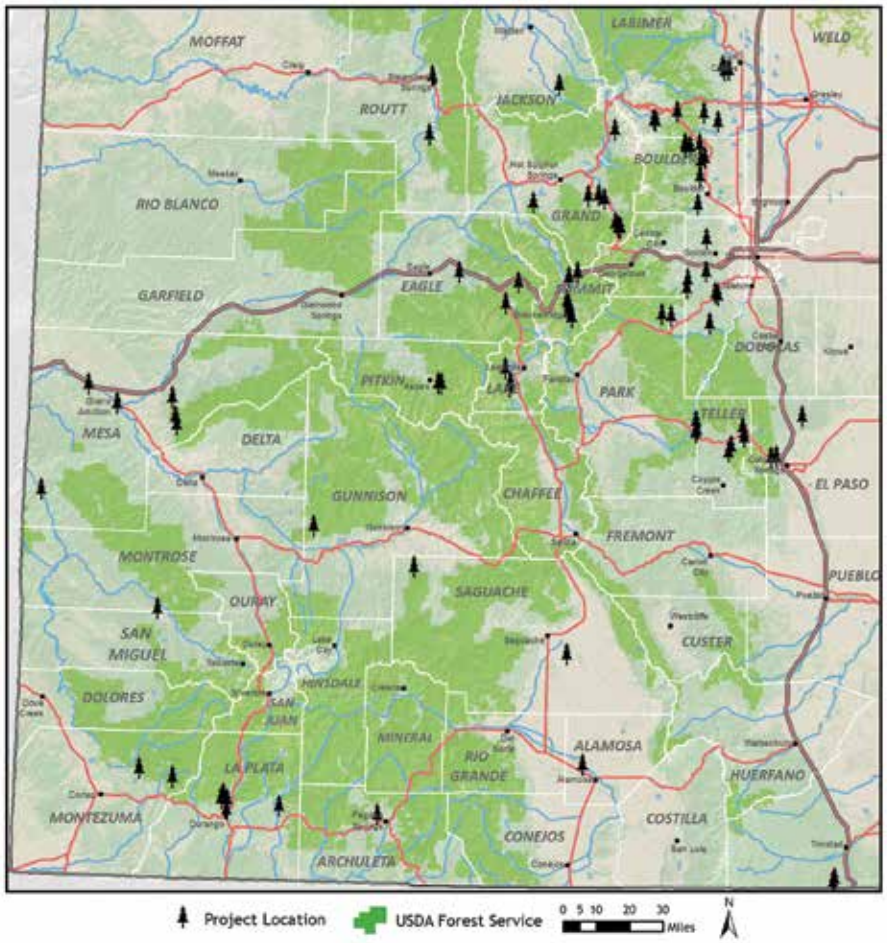
2012 Forestry-Related Legislation in Colorado

Colorado residents and visitors alike value healthy, resilient forest landscapes. Understanding this value, the Colorado General Assembly continues to support forest health efforts, promoting legislation that will help improve the health and vigor of Colorado's forests.

Through the passage of multiple pieces of legislation in recent years, the Colorado General Assembly has supported forest management actions that demonstrate community-based approaches to forest restoration and watershed health. The Colorado Forest Restoration Pilot Grant Program (CFRPGP) is a cost-share program that provides funding for up to 60 percent of total costs for projects. This program was authorized in 2007 through House Bill 1130; that year, projects were implemented with Colorado Water Conservation Board funds. During the 2008 and 2009 legislative sessions, Senate Bill 071 and House Bill 1199, respectively, supported the program and authorized funding from the state's severance tax operation account to implement forest management projects. To date, more than $4.7 million in state funds and another $1 million in leveraged federal funds have been awarded to 86 projects across the state. Those funds additionally leveraged more than $8 million in matching funding to restore more than 12,000 acres of forest, and the 17 CFRPGP projects currently in progress will result in treatments on an additional 1,200 acres.

In 2012, the Colorado General Assembly passed six bills and one resolution addressing forest health, the forest products industry and related public safety. This continued level of legislative interest illustrates the importance and value Coloradans place on our forests. We look forward to continued support as we work together to promote healthier, more diverse forests that are resilient to insect and disease epidemics for the benefit of present and future generations.

Forest Restoration Grant Projects



2012 Forestry Legislation Summary

Bill Number	Bill Name	Bill Summary
HB 1032	Continue Forest Restoration Program	The bill continues the Forest Restoration Program and its associated funding from severance taxes for five years, and specifies that the program is no longer a pilot program. The bill also extends for five years annual transfers of $1.45 million from the operational account of the severance tax trust fund to the healthy forests and vibrant communities fund, and $50,000 to the wildland-urban interface training fund.
HB 1045	Tax Exemption From Beetle-Killed Trees	Wood wholesalers must certify on a Department of Revenue form that a product is lawfully harvested in Colorado from a salvaged tree killed or infested by spruce beetles. The sales tax exemption for these timber products is in effect from July 1, 2012, to July 1, 2020. The bill also extends until July 1, 2020, the sales and use tax exemption for the sale, storage and use of wood from salvaged trees killed or infested in Colorado by mountain pine beetles.
HB 1283	Department of Public Safety, Renaming, Reorganizing Certain Entities	This bill consolidates homeland security functions of Colorado into the Department of Public Safety (DPS). It also transfers wildfire command and control responsibilities from the Colorado State Forest Service (CSFS) to the DPS.
HB 1285	Intergovernmental Cooperative Wildland Fire Mitigation	This bill modifies statutory requirements regarding intergovernmental cooperation for wildland fire mitigation where a municipality owns land inside a county for utility purposes.
HB 1352	State Commission to Address the Lower North Fork Wildfire	This bill creates a commission to study the causes of the Lower North Fork Wildfire and to develop recommendations for preventing similar events from happening again. The commission consisted of five people: two from the House, two from the Senate and the executive director from the Department of Public Safety. Their report was due by the end of 2012.
HB 1361	Concerning Claims Arising under the "Colorado Governmental Immunity Act"	This bill eliminates the state's immunity from damages sustained by citizens due to prescribed fire. It also lifts the $600,000 per event/$150,000 per person cap, and specifies how citizens who sustained damages can receive additional compensation beyond specified limits.
SR 003	Management for Healthy Forest Ecosystems and the Use of Colorado Forest Biomass	This bill requests the Colorado State Forest Service, the Colorado Economic Development Commission, the Colorado Department of Public Health and Environment, and the Governor's Energy Office to work toward promoting and/or developing opportunities for sustainable forest management that can support a forest energy industry.

Forest Stewardship through Active Management: The Key to Healthy Forests

This report highlighted current concerns related to Colorado's forests, and demonstrated how responsible forest stewardship is the most effective way to mitigate these threats. Forest management practices also can help achieve many forest use objectives. Healthy forests are more resilient to insects and disease, and by reducing the likelihood of landscape-level mortality from forest pest epidemics, it is possible to mitigate fuels and associated wildfire risks. Proper forest management also reduces air quality impacts, preserves the integrity of watersheds, and protects property and infrastructure. Additional benefits of forest management include a diverse wood products industry and the economic security of sustainable, forest-based enterprises. These enterprises effectively reduce the cost of forest management, allowing more land to be treated.

Because the benefits of forest management are so readily apparent – from clean drinking water to biomass fuels to the recreation/tourism and timber industries – one must ask: why *wouldn't* we choose to manage our forests? We all have a responsibility to be good stewards of Colorado's forests, and to ensure that they are healthy and will continue to provide the myriad benefits we have come to rely on and enjoy. Through ongoing forest management maintained over the lifetime of Colorado's forests, we can create forest environments that are more resilient to large-scale insect and disease epidemics, while helping to protect human lives, homes and communities from the potentially devastating effects of wildfires. As the impacts of the recent bark beetle epidemics suggest, it is imperative that we act now to achieve our shared vision of healthy future forests.

Colorado is known throughout the world for its unparalleled beauty, recreational opportunities and overall quality of life. Our forests contribute significantly to all of these attributes, and they deserve the benefit of our collective wisdom to make management decisions that will allow present and future generations to continue to enjoy all that Colorado has to offer.

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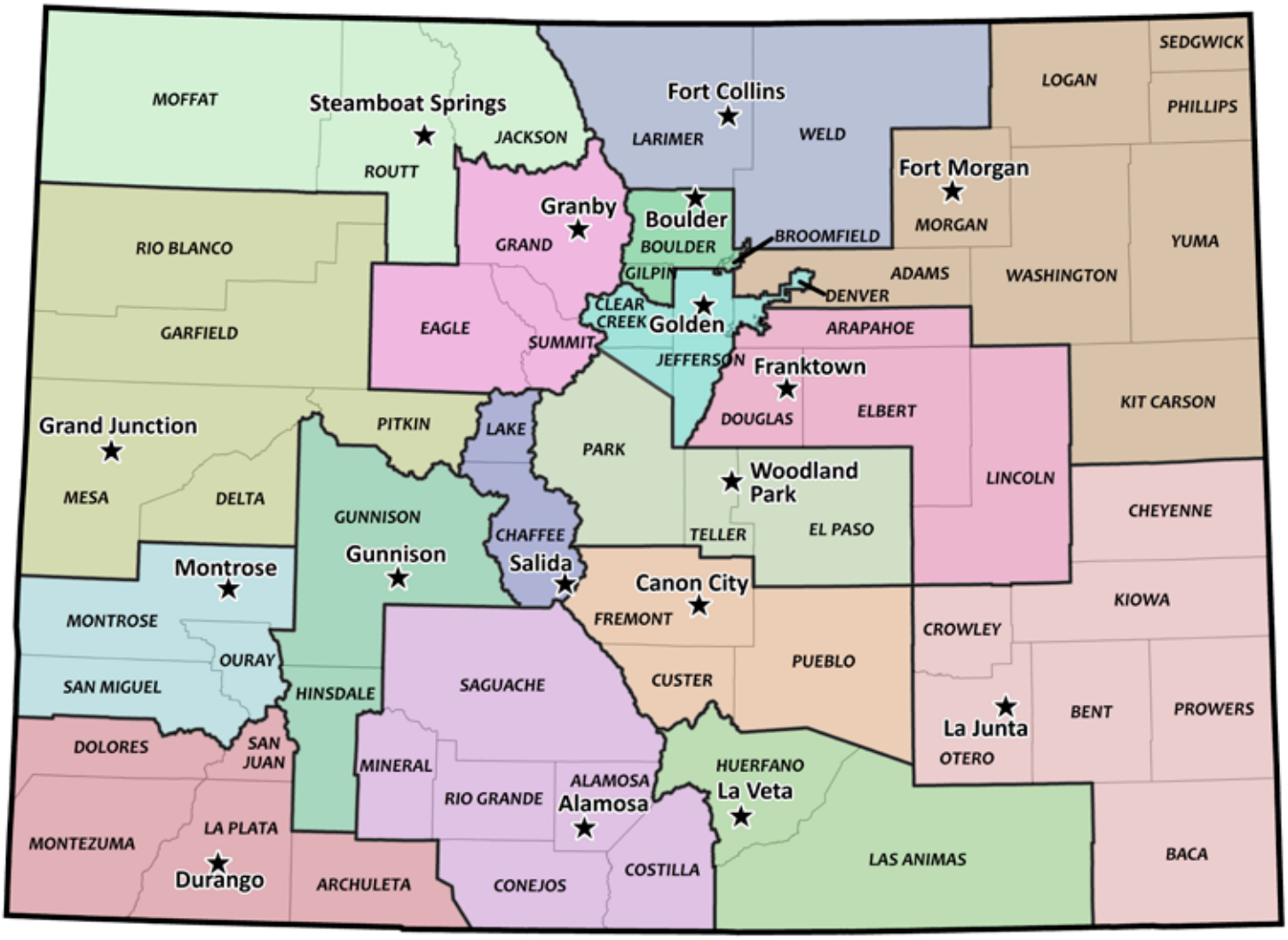

The mission of the Colorado State Forest Service is to achieve stewardship of Colorado's diverse forest environments for the benefit of present and future generations.

For more information, please visit the Colorado State Forest Service website at www.csfs.colostate.edu.

► Forest management practices achieve a variety of objectives, including this fuelbreak which has improved safety along the road and reduced wildfire risk. Photo Credit: Bill Cotton

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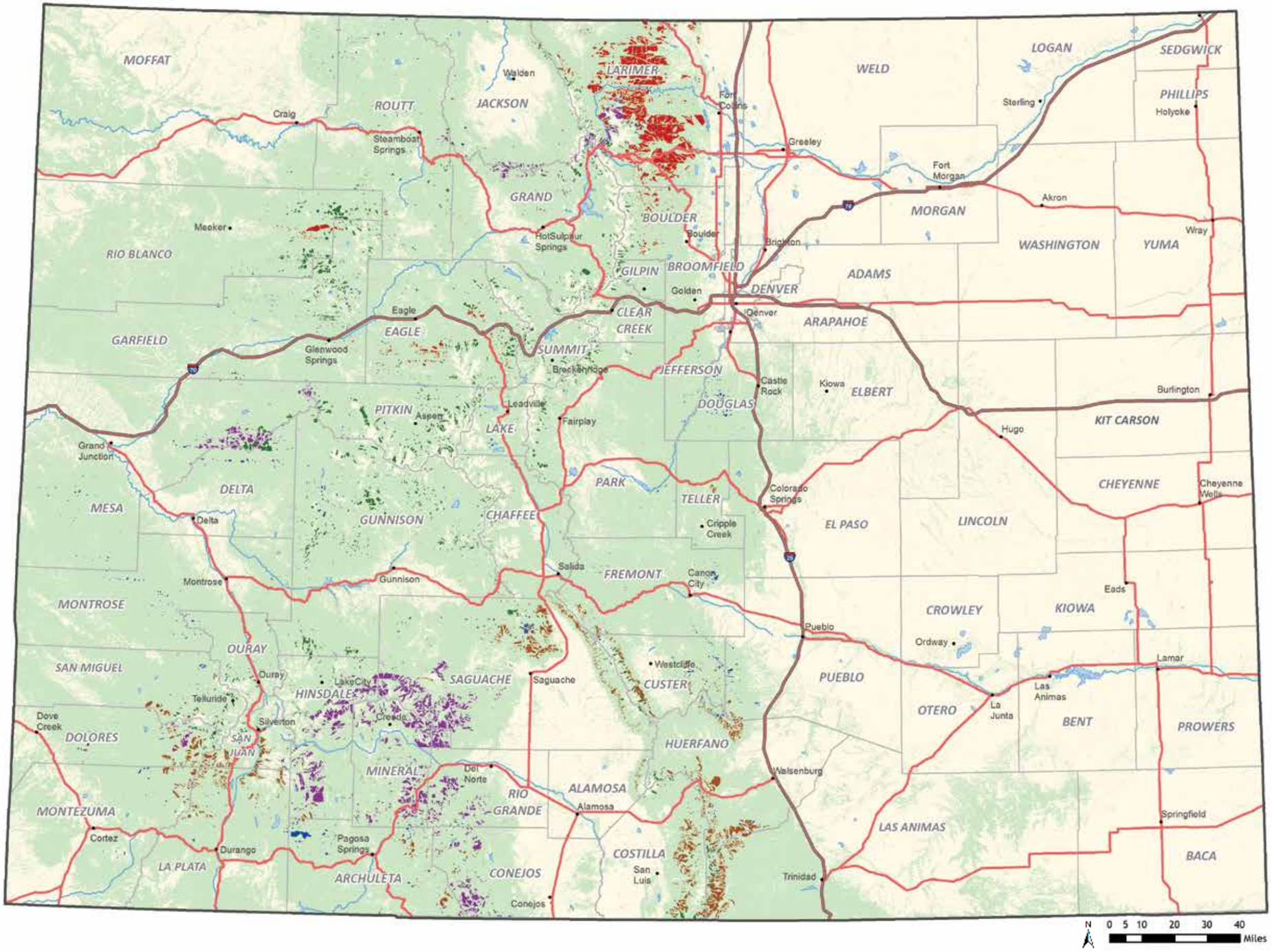
2012 Insect and Disease Activity in Colorado Forests



- Spruce Beetle — *311,000 acres*
- Mountain Pine Beetle — *264,000 acres*
- Western Spruce Budworm — *217,000 acres*
- Subalpine Fir Decline — *221,000 acres*
- Other Insects and Diseases — *71,000 acres*

Aerial Survey Data

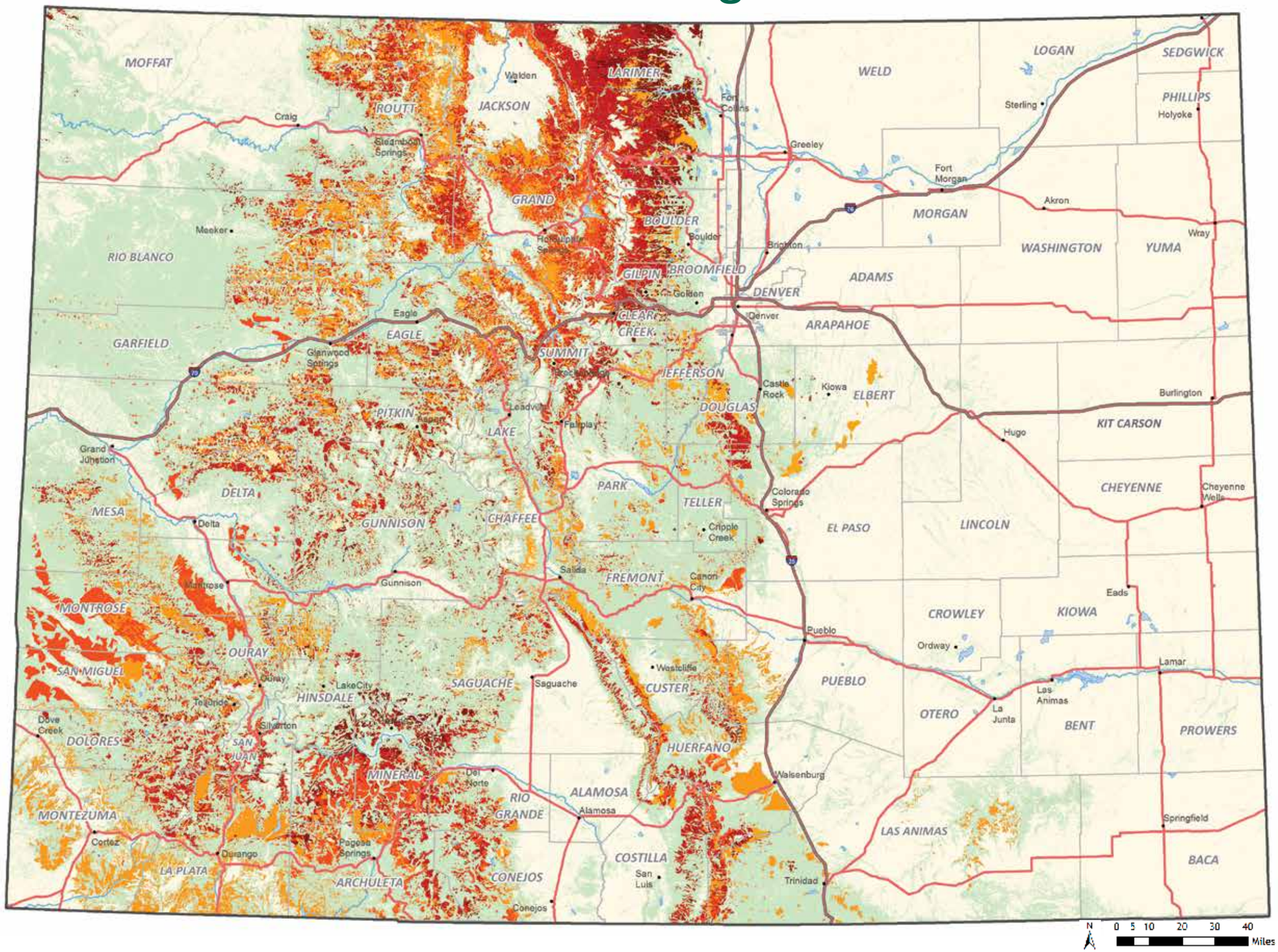
Due to the nature of aerial surveys, the data on this map will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented on the map because these agents are not detectable from aerial surveys. The data presented on this map should only be used as a partial indicator of insect and disease activity and should be validated on the ground for actual location and causal agent. Shaded areas show locations where tree mortality or defoliation were apparent from the air. Intensity of damage is variable and not all trees in shaded areas are dead or defoliated.

The insect and disease data represented on this map are available digitally from the USDA Forest Service, Region 2 Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this map for purposes other than those for which it was intended may yield inaccurate or misleading results.

Map created December 2012
For more information:
www.csfs.colostate.edu

Colorado State Forest Service

Forest Insect and Disease Progression in Colorado from 1996 - 2012



1996 - 1997

1998 - 2000

2001 - 2003

2004 - 2006

2007 - 2009

2010 - 2012

Aerial Survey Data

Due to the nature of aerial surveys, the data on this map will only provide rough estimates of location, intensity and the resulting trend information for agents detectable from the air. Many of the most destructive diseases are not represented on the map because these agents are not detectable from aerial surveys. The data presented on this map should only be used as a partial indicator of insect and disease activity and should be validated on the ground for actual location and causal agent. Shaded areas show locations where tree mortality or defoliation were apparent from the air. Intensity of damage is variable and not all trees in shaded areas are dead or defoliated.

The insect and disease data represented on this map are available digitally from the USDA Forest Service, Region 2 Forest Health Management group. The cooperators reserve the right to correct, update, modify or replace GIS products. Using this map for purposes other than those for which it was intended may yield inaccurate or misleading results.

Map created December 2012
For more information:
www.csfs.colostate.edu

Colorado State Forest Service

TREES & SHRUBS

Mountain Pine Beetle no. 5.528

by D.A. Leatherman, I. Aguayo, and T.M. Mehall[1]

Quick Facts...

Mountain pine beetles (MPB) are the most important insect pest of Colorado's pine forests. MPB often kill large numbers of trees annually during outbreaks.

Trees that are not growing vigorously due to old age, crowding, poor growing conditions, drought, fire or mechanical damage, root disease and other causes are most likely to be attacked.

For a long-term remedy, thin susceptible stands. Leave well-spaced, healthy trees.

For short-term controls, spray, cover, burn or peel attacked trees to kill the beetles. Preventive sprays can protect green, unattacked trees.

Mountain pine beetle (MPB), *Dendroctonus ponderosae*, is native to the forests of western North America. Periodic outbreaks of the insect, previously called the Black Hills beetle or Rocky Mountain pine beetle, can result in losses of millions of trees. Outbreaks develop irrespective of property lines, being equally evident in wilderness areas, mountain subdivisions and back yards. Even windbreak or landscape pines many miles from the mountains can succumb to beetles imported in infested firewood.

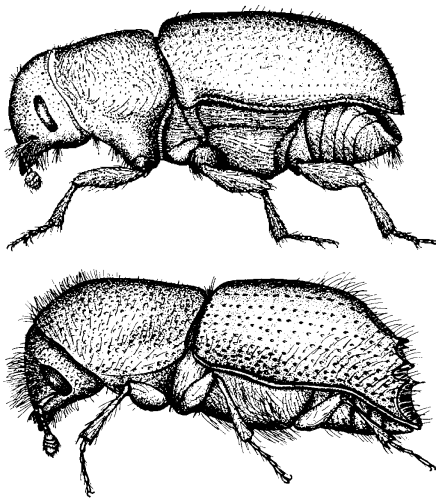


Figure 1: Adult *Dendroctonus* (top) versus *Ips* (bottom). Note gradually curved wing of *Dendroctonus*. Actual size of *Dendroctonus* from 1/8 to 1/3 inch, *Ips* 1/3 to 1/4 inch.

Mountain pine beetles develop in pines, particularly ponderosa, lodgepole, Scotch and limber pine. Bristlecone and pinyon pine are less commonly attacked. During early stages of an outbreak, attacks are limited largely to trees under stress from injury, poor site conditions, fire damage, overcrowding, root disease or old age. However, as beetle populations increase, MPB attacks may involve most large trees in the outbreak area.

A related insect, the Douglas-fir beetle (*D. pseudotsugae*), occasionally damages Douglas-fir. Most often, outbreaks are associated with previous injury by fire or western spruce budworm. (See fact sheet 5.543, *Western Spruce Budworms*). Spruce beetle (*D. rufipennis*) is a pest of Engelmann and Colorado blue spruce in Colorado. Injured pines also can be attacked by the red turpentine beetle (*D. valens*).

Mountain pine beetles and related bark beetles in the genus *Dendroctonus* can be distinguished from other large bark beetles in pines by the shape of the hind wing cover (Figure 1, top). In side view, it is gradually curved. The wing cover of *Ips* or engraver beetles, another common group of bark beetles attacking conifers, is sharply spined (Figure 1, bottom).

Signs and Symptoms of MPB Attack

- Popcorn-shaped masses of resin, called "pitch tubes," on the trunk where beetle tunneling begins. Pitch tubes may be brown, pink or white (Figures 2 and 6).
- Boring dust in bark crevices and on the ground immediately adjacent to the tree base.

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Figure 2: "Pitch tubes" indicating trunk attacks by MPB. Success of the attacks is confirmed by looking under the bark with a hatchet for beetles, their tunnels and/or bluestaining.

- Evidence of woodpecker feeding on trunk. Patches of bark are removed and bark flakes lie on the ground or snow below tree.
- Foliage turning yellowish to reddish throughout the entire tree crown. This usually occurs eight to 10 months after a successful MPB attack.
- Presence of live MPB (eggs, larvae, pupae and/or adults) as well as galleries under bark. This is the most certain indicator of infestation. A hatchet for removal of bark is needed to check trees correctly (Figures 3, 5 and 8).
- Bluestained sapwood (Figure 9). Check at more than one point around the tree's circumference.

Life History and Habits

Figure 3: Top view of adult MPB (actual size, 1/8 to 1/3 inch).

Mountain pine beetle has a one-year life cycle in Colorado. In late summer, adults leave the dead, yellow- to red-needled trees in which they developed. In general, females seek out large diameter, living, green trees that they attack by tunneling under the bark. However, under epidemic or outbreak conditions, small diameter trees may also be infested. Coordinated mass attacks by many beetles are common. If successful, each beetle pair mates, forms a vertical tunnel (egg gallery) under the bark and produces about 75 eggs. Following egg hatch, larvae (grubs) tunnel away from the egg gallery, producing a characteristic feeding pattern.

Figure 4: Mountain area infested by MPB, showing three years of mortality. Old, dead trees are gray; newly killed trees are straw yellow or orange. Some trees may also be infested but do not turn color until nine months or so under attack.

MPB larvae spend the winter under the bark. Larvae are able to survive the winter by metabolizing an alcohol called glycerol that acts as an antifreeze. They continue to feed in the spring and transform into pupae in June and July. Emergence of new adults can begin in mid-June and continue through September. However, the great majority of beetles exit trees during late July (lodgepole pine) and mid-August (ponderosa pine).

A key part of this cycle is the ability of MPB (and other bark beetles) to transmit bluestain fungi. Spores of these fungi contaminate the bodies of adult beetles and are introduced into the tree during attack. Fungi grow within the tree and assist the beetle in killing the tree. The fungi give a blue-gray appearance to the sapwood.

Figure 5: Larva of MPB (actual size, 1/8 to 1/4 inch). They are found under the bark in tunnels.

Figure 6: Not all pitch tubes indicate successful attacks. Note the beetle trapped in this large pitch tube. If the majority of tubes look like this, the tree may have survived the current year's attack.

Infested Trees

- Once MPB infests a tree, nothing practical can be done to save that tree.
- Under epidemic or outbreak conditions, enough beetles can emerge from an infested tree to kill at least two, and possibly more, trees the following year.
- *Ips* and related beetles that emerge early in summer often are mistaken for mountain

Figure 7: Checking beneath the bark for MPB. This attack was successful (note tunnels and stain).

pine beetle, leading to early reports that "MPB is flying." Be sure to properly identify the beetles you find associated with your trees.

- Trees from which MPB have already emerged (look for numerous round, pitch-free exit holes in bark) do not need to be treated.
- The direction and spread rate of a beetle infestation is impossible to predict. However, attacked trees usually are adjacent to or near previously killed trees.

Figure 8: Characteristic tunnels (galleries) of mountain pine beetle made by the adults and larvae. The underbark area looks like this in late spring. Bluestained wood is caused by fungi the beetles introduce.

Control

Natural controls of mountain pine beetle include woodpeckers and insects such as clerid beetles that feed on adults and larvae under the bark. However, during outbreaks these natural controls often fail to prevent additional attacks.

Extreme cold temperatures also can reduce MPB populations. For winter mortality to be a significant factor, a severe freeze is necessary while the insect is in its most vulnerable stage; i.e., in the fall before the larvae have metabolized glycerols, or in late spring when the insect is molting into the pupal stage. For freezing temperatures to affect a large number of larvae during the middle of winter, temperatures of at least 30 degrees below zero (Fahrenheit) must be sustained for at least five days.

Figure 9: Cut tree killed by MPB, showing the characteristic blue-staining pattern.

Logs infested with MPB can be treated in various ways to kill developing beetles before they emerge as adults in summer.

One very effective way to kill larvae developing under the bark (though very labor intensive) is by peeling away the bark, either by hand or mechanically; this exposes the larvae to unfavorable conditions—the larvae will dehydrate, starve and eventually die. Logs my also be burned or scorched in a pile—preferably when there is snow on the ground (contact your local forester for assistance). They can also be buried under at least eight inches of soil, or chipped. Following beetle emergence, wood can be used without threat to other trees.

Figure 10: Large, uninfested pine being preventively sprayed. This protects high-value trees and should be done annually between April 1 and July 1.

Chemical control options for MPB larvae have been greatly limited in recent years. At present, there are no labeled pesticides for use on MPB.

Solar treatments may be appropriate in some areas of Colorado to reduce beetle populations in infested trees. For the treatment to be effective, the temperature under the bark much reach 110 degrees Fahrenheit or more. Such treatments can be performed with or without plastic. This method is also labor intensive; contact your local forester for more details on solar treatments.

Figure 11: The appearance of a forest thinned to help prevent MPB. This can also improve mountain views and reduce fire hazard.

Prevention

An important method of prevention involves forest management. In general, MPB prefers forests that are old and dense. Managing the forest by

creating diversity in age and structure with result in a healthy forest that will be more resilient and, thus, less vulnerable to MPB. Most mature Colorado forests have about twice as many trees per acre as those forests which are more resistent to MPB. Contact your local forester for more information on forest management practices.

Certain formulations of carbaryl (Sevin and others) permethrin (Astro, Dragnet and others), and bifenthrin (Onyx) are registered for use to prevent attacks on individual trees. These sprays are applied to living green trees in early summer to kill or deter attacking beetles. This preventive spray is generally quite effective through one MPB flight (one year). During epidemic conditions, the pressure from beetle populations may result in less satisfactory results due to several factors:

Always carefully read and follow all label precautions before applying insecticides for MPB prevention.

- Misidentification of healthy trees: Under dry conditions, trees may not produce pitch tubes when infested, therefore healthy trees are not as obvious. Time may need to be spent looking for sawdust around a tree's circumference and at the base of the tree.
- Timing of application: Trees sprayed after June may already have been attacked.
- Improper coverage: Spray may not have been applied high enough (up to where the trunk tapers to less that six inches), or spray coverage of the tree did not begin at ground level, or was not applied to the entire circumference of the tree (thus creating "windows" for beetle attack).
- Improper dosage/mixing of chemical: Low dosage—effective dosages for bark beetles are higher than the percent used for other insects. Mixture—the carbaryl and water were not fully mixed.
- Environmental conditions: Significant rain or moisture within two hours of application may wash off the insecticide. Very high temperatures may break down the chemical (this can occur when treated trees are near forest fires).
- Chemical shelf life/storage: Manufacturers guarantee stable chemical properties for at least two years after manufacturing date, if stored properly. Chemical properties of carbaryl may be altered if stored at very high or very low temperatures.
- Improper volume/formulation: Not enough spray is used to cover the bark area susceptible to beetle attack; lodgepole pine has "flaky" bark which may require more spray. The label on the chemical does not indicate bark beetle prevention (if using Sevin, SL or XLR is recommended).

Always carefully read and follow all label precautions before applying insecticides for MPB prevention.

Related Fact Sheets

5.543, *Western Spruce Budworms*

5.558, *Ips Beetles*

Contact the Colorado State Forest Service for additional information related to mountain pine beetles.

Colorado State Forest Service

This fact sheet was produced in cooperation with the Colorado State Forest Service.

[1]*D.A. Leatherman, Colorado State Forest Service entomologist (retired); I. Aguayo, Colorado State Forest Service entomologist; and T.M. Mehall, Colorado State Forest Service forester.*

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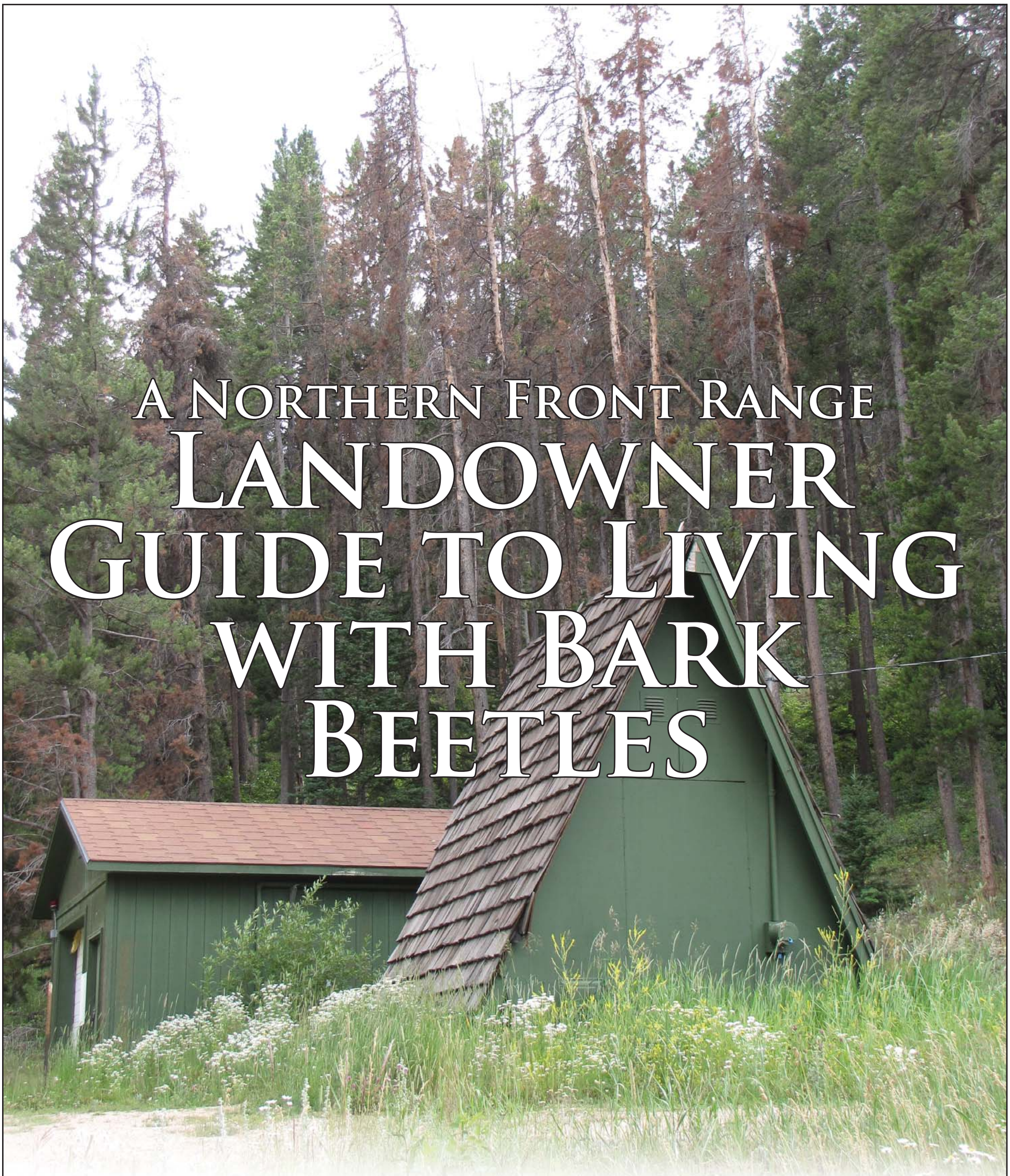


A Northern Front Range Landowner Guide to Living with Bark Beetles

You are the steward of your land!

Pine beetles are changing the look of forests throughout the West. Although the forests will recover, many property owners will see trees around them die. Each homeowner can take steps to minimize the impact on their land, speed the recovery of the forest around them, and minimize the danger of wildfire to their property.

The following pages contain information on the nature of the threat to property and the types of assistance available through federal, state, and county programs.

What's Inside

2 Meet the Beetles

3 What Can YOU Do?

5 Preventive Spray or Pheromone Pouches?

6 Mountain Pine Beetle in Lodgepole Pine

7 Mountain Pine Beetle in Ponderosa Pine

8 Neighbors Helping Neighbors

9 Fire Behavior in Beetle-Infested Forests

10 Defensible Space

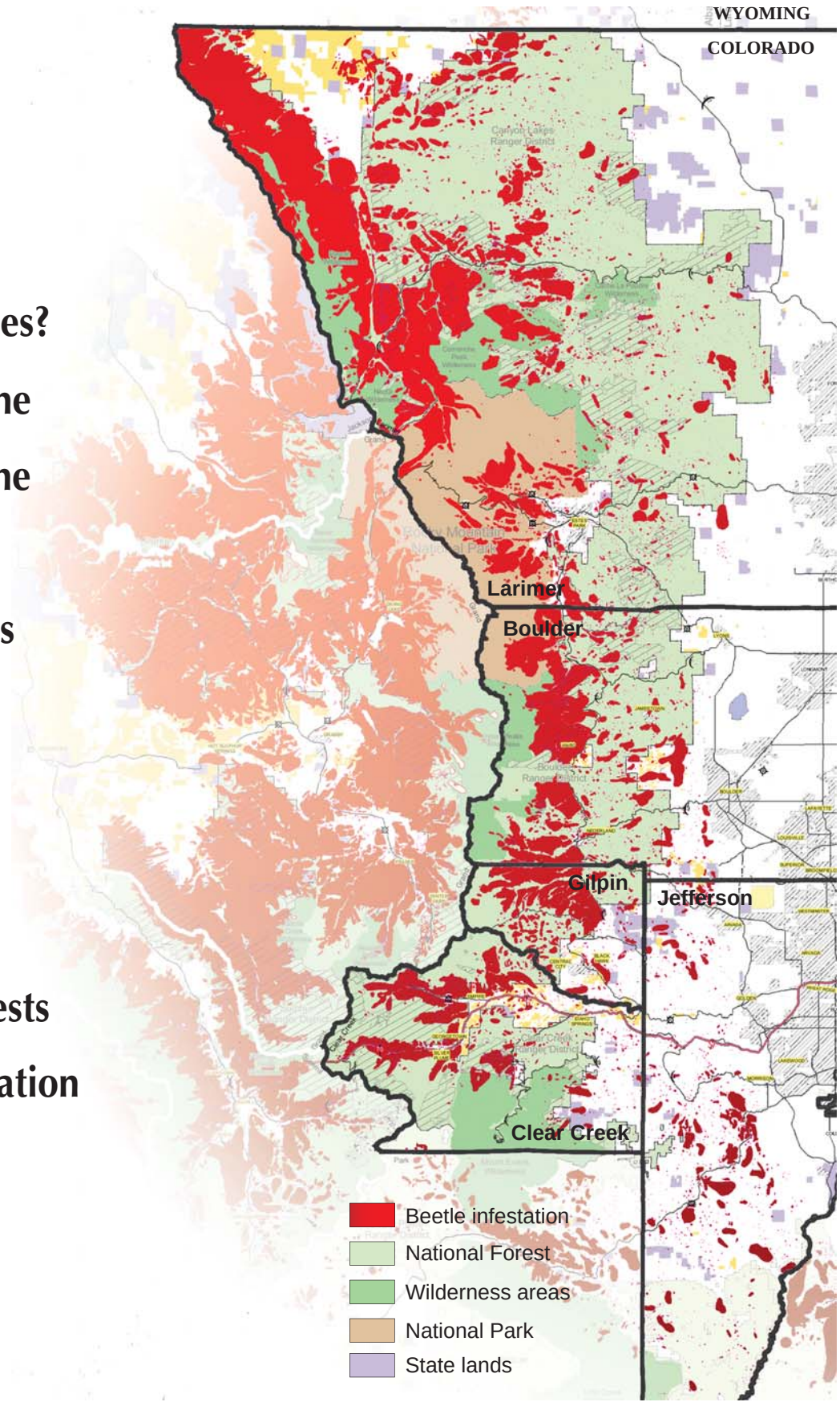
10 Community Wildfire Protection Plans

11 The Benefits of Fire

11 Beetles Also Like Urban Pine Trees

12 Using Wood From Beetle-Infested Forests

12 Online Resources and Contact Information



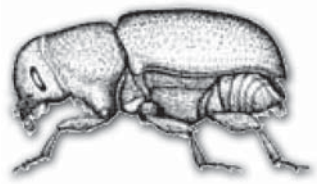
Small beetles, big impact.

Whitney Cranshaw, Colorado State University, Bugwood.org

Meet the Beetles: Two Species of Concern

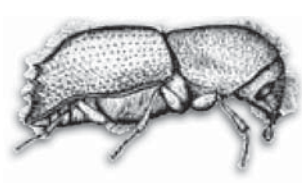
By Colorado State Forest Service Staff

Mountain Pine Beetle



The mountain pine beetle (MPB), *Dendroctonus ponderosae*, is a bark beetle native to western North America. Its range extends west from the Great Plains, from British Columbia to Mexico. The MPB usually takes 1 year to complete its lifecycle, developing through four stages: egg, larva, pupa, and adult. Except for a few days during the summer when adults emerge and fly to new trees, all development takes place under the bark of infested trees. Female beetles lay tiny, pearl-white eggs under the bark of pine trees in the late summer and early fall. The eggs hatch in 10 to 14 days. The white larvae overwinter in galleries under the bark and begin to mature the following spring. By July, most pupae have transformed into adults. Adults are black and 1/8- to 1/4-inch long.

Adults feed under the bark during the summer and emerge through an exit hole, with peak emergence occurring from mid-July to mid-August. Within a few days, the beetles enter other trees—there are usually enough insects emerging from one tree to attack several additional trees. In Colorado, MPB can attack all native species of pine, including lodgepole, ponderosa, limber, and bristlecone, and even some urban pines like Scotch and Austrian. Beetles carry the spores of blue-stain fungi on their bodies and introduce them into pine trees. The combination of the feeding beetles and spreading fungi kills the tree within a year.



Ips Beetles

Eleven species of Ips beetles are native to Colorado; *Ips pini*, the pine engraver beetle, is the most common. Its primary hosts are the same as MPB—lodgepole pine and ponderosa pine—but it can attack most other species of pine in its range, which extends across the United States and much of North America. Generally, Ips beetles attack stressed or dying pine trees and do not cause a lot of damage. But, Ips beetle populations have been increasing due to the effects of the MPB epidemic, drought, and the availability of wounded trees. In some counties, Ips beetles have recently killed dozens to hundreds of healthy trees in a single year. Like the MPB, Ips beetles introduce blue-stain fungi to trees; the fungi quicken tree death by blocking the flow of water up the tree.

Ips beetles complete their four-stage lifecycle in only 40 to 55 days, and can produce two to four generations of beetles per year. This makes them more challenging for the homeowner to control than MPB. In the spring, beetles begin to emerge as early as March, when consistent daytime temperatures reach 50 to 60°F, and flight can continue into November. Beetles can attack trees throughout the flight period; however, the first spring flight appears to be the most damaging. Ips beetles are about the size of a grain of rice (1/8- to 3/8-inch long), reddish-brown to black, and can be distinguished from MPB by the depressed cavity and spines at the rear end of the body.

You Are the Steward of Your Land! Here's What You Can Do as a Forest Landowner

By Irene Shonle, Director, CSU Extension, Gilpin County

Although this mountain pine beetle (MPB) epidemic is too big to stop, you might be able to slow the spread of both MPB and Ips beetles and reduce the level of tree mortality in your backyard forest. Be proactive! Look for new Ips beetle attacks throughout the warm months, and survey the trees on your property in the fall to look for new MPB attacks. Removing beetle-infested trees early will have a positive impact on forest health, reduce the number of hazard trees on your property, and decrease potential wildfire danger.

Is Your Tree, Slash Pile, or Firewood Still Infested?

You may already know which trees on your property have been attacked by beetles and whether slash and firewood came from beetle-infested trees, but determining if the wood is still infested by those beetles can be tricky. In general, infested wood should be free from MPB after about 1 year—adult MPB typically fly from infested trees anytime between July and September, a year after their eggs were laid. Ips beetles have a much shorter life cycle, and they may live in a tree or slash pile for as little as 6 weeks before emerging. Take time to look carefully at your trees, wood, and slash before transporting them to other locations.

To determine whether a tree is still infested, look for pitch tubes or small mounds of reddish-orange boring dust on the main tree trunk. Peel back an area of bark the size of a deck of cards just above the tubes or dust. A wound like this will not hurt a healthy tree, but don't cut into a tree more than once or twice if you don't find signs of beetles. If you see live adult insects, eggs, or larvae in breeding galleries, the tree is still infested and will need to be treated to kill the beetles before moving the wood.

Peel back bark to check for insects, eggs, or larvae in beetle galleries.

If you see blue staining and breeding galleries but no insects, and you also find small, circular exit holes about the size of a BB gun pellet on the outer surface of the bark, then the insects have already flown from the tree. The wood is no longer infested, and it is safe to be used as firewood. If tree needles have been red and dead for at least 1 year, then the tree is no longer infested. You can examine firewood and slash using these same techniques—with slash, peel back the bark on the largest branches.

Fall Is a Great Time to Survey Your Trees and Determine Treatment Options

In the fall, most new beetle attacks have already occurred, except for those by a few late-season Ips beetles. There is no snow on the ground, the days are beautiful, and there are many treatment options, including saving newly infested wood for firewood. As the flight time of the beetles approaches during the spring, the number of treatment options decreases.

Experts recommend that people carry out their forestry practices (cutting trees for beetle sanitation, fire mitigation, or forest health) during the fall and winter months. In addition to the reasons noted earlier, this is because Ips beetles are attracted to the smell of newly cut wood and slash. Restricting your cutting to the cooler season will help prevent new infestations. If it is not possible to perform your forestry work during this time, it is still better to cut infested trees or work on fire mitigation during the spring or summer than not to do it at all. Be sure to follow the slash management guidelines, and store any newly cut wood away from living trees.

continued on page 4

Was Your Tree Hit by Ips Beetles or MPB?

Beetle	Pitch Tubes	Time of Fading	Boring Dust at Base of Tree	Signs of Woodpecker Feeding	Blue-stain	Gallery Shape	Sawdust in Galleries?	Diameter of Attacked Tree
Ips	No	March–November	Yes: fine and reddish	Yes	Yes	Y, X, or H	No	Smaller than 8″
MPB	Yes	May–July	Yes: coarser and reddish-white	Yes	Yes	I or J	Yes	Usually bigger than 6″

MPB pitch tubes and boring dust (sawdust) are evident on infested trees.

Ips beetle galleries often form a Y, X, or H shape.

MPB galleries often form an I or J shape.

continued from page 3

Treating Infested Trees

Trees must be treated to destroy live beetles after they are cut down. Here are some options:

1. Take the entire tree to a sort yard for disposal. Visit *http://www.peaktopeakwood.org* for information on sort yard locations.

2. Chip the entire tree and/or slash pile to destroy the beetle. Spread the chips out in a thin layer so they will dry quickly and not attract Ips beetles.

3. Peel the bark from the trunk with a chain saw, draw knife, or Log Wizard® (a chainsaw attachment that peels logs). You can store peeled logs for firewood without a problem.

4. Use solar treatment: In the fall, lay logs in a single layer in a very sunny, south-facing location. Cover the logs with clear (not black), 6 mm plastic and leave the logs covered for at least 8 weeks. If you choose not to cover the logs with plastic, leave them for at least 3 months and partially roll the logs every few weeks to ensure all sides of the log are exposed to direct sunlight.

   This treatment often is not as effective at higher altitudes because it requires a lot of heat to kill the beetle. A common misconception is that the plastic is used to trap beetles, but in fact, the beetles can easily chew through it. Plastic is used to raise the temperature under the bark enough to "cook" the beetles to death.

5. Use infested wood for firewood. In the fall, cut wood to firewood length and split—this will allow the wood to dry out enough to burn in the spring. Mark your infested pile and ensure that the entire pile is burned before July, when remaining beetles could fly to live trees.

After cutting infested trees, choose from five treatment options: disposal, chipping, removing bark, using solar treatment, or burning the wood as firewood.

Slash Pile Management

Active slash pile management is a forestry tool for use primarily on large acreages. Ips beetles are attracted to freshly cut branches in slash piles, so if you don't intend to actively manage your slash, haul it away or chip it as soon as possible. Only if managed properly can slash piles be used to attract beetles *away* from living trees.

Check with your local sort yard for chipper availability.

If you plan to manage slash, pile it away from live trees and chip it every 4 to 6 weeks.

Continuously pile fresh slash away from living trees from July to September to avoid attracting emerging Ips adults. Haul off or chip the entire pile every 4 to 6 weeks and start a new pile in its place.

By using this method, you will provide the beetles with enough green material to breed, but you will treat the material before the beetles are able to fly to live trees. Be careful! If you don't haul off or chip the slash every 4 to 6 weeks, Ips beetles can complete their lifecycle and emerge from the pile to infest new trees.

Tips for Planning Your Future Forest

- Remember the three "Ds" of diversity: encourage diversity in *species*, diversity in *age*, and diversity in *spacing* of your forest. By encouraging diverse forests, you will make your forest healthier and less susceptible to future insect and disease outbreaks.
- Create defensible space by thinning forests around homes and communities. Fires are a natural component of our forests and are something to which we need to adapt. Thinning will help reduce the risk of severe fire and make your community a safer place. To learn how to create defensible space around your home, contact your local Colorado State Forest Service district office or visit the CSFS Web site at: *http://www.csfs.colostate.edu*.
- Remove conifers from aspen stands to improve wildlife habitat and help aspen regenerate.
- Create a long-term forest management plan to promote a healthier, more resilient forest that will be sustainable over time. Envision what you want your forest to look like in 20 years, then work with your local foresters to plan your future forest.

Maintain diversity in species, age, and spacing of your forest to promote forest health.

Preventive Spray or Pheromone Pouches—What's the Best Option?

By Ingrid Aguayo, Entomologist, Colorado State Forest Service

A burning question for many homeowners is whether to use preventive spray or pheromone pouches to protect their trees. My answer is always: "*It depends*." Depending on the tree species you want to protect, location of the trees, beetle population, or personal preference, you may choose to use one or the other, or both. But before you make a decision, it is important to know that whether you use a preventive spray, pheromone, or any other preventive treatment method, you will not eliminate MPB. These methods are intended only to minimize tree mortality.

Spraying trees to prevent attack from MPB is effective when protecting a small number of high-value pine trees, but it is not recommended on a large scale. If you live in an area faced with a high beetle population, it is only realistic to choose a few individual trees that you want to save. Always use a licensed pesticide applicator to spray your trees, and make sure trees are sprayed before the MPB fly in July.

Verbenone, the main anti-aggregant pheromone emitted by MPB and other western bark beetle species, is meant to be used as part of an integrated pest management strategy. Pheromone pouches can be placed throughout your forest and are an option in areas near waterways, where preventive spraying is usually not an option. So far, research on pheromone use has shown mixed results in a natural forest setting. Effectiveness appears to depend on tree species, beetle population levels, and many other environmental factors.

In reality, no single preventive method offers a comprehensive solution, and, many times, different management methods work best when used as part of an integrated pest management strategy. Such a strategy may include destroying currently infested trees, maintaining healthy forest conditions, and, in some cases, spraying trees or using pheromone pouches. The effectiveness of any strategy depends on many factors, including the level of beetle infestation.

Dead Trees = Hazard Trees

Bark beetles have the potential to kill millions of trees in Front Range communities. Over the next few decades, these dead trees will fall down and could pose a significant risk to your community.

By following these simple guidelines, you can make your community safer:

- Remove dead trees from around your home, garage, driveway, propane tank, utility lines, roads, and other areas people frequently visit.
- Be alert and keep an eye on your surroundings. Avoid walking through or stopping in dense patches of dead trees. They can fall without warning.
- Be extremely careful in strong winds. Lodgepole pines have shallow roots and easily blow over.
- Have an ax or chainsaw nearby to remove fallen trees from your driveway and roads, in case you become trapped by downed trees.
- Help spread the word about the dangers of dead trees. Educate your children, friends, visitors, and neighbors about the hazards.
- Remove standing dead trees. Doing so not only will make your home safer, it also will reduce risks associated with wildland fire.

Mountain Pine Beetle in Lodgepole Pine

By Irene Shonle, Director, CSU Extension, Gilpin County, and Taylor Stonehouse, Public Affairs Specialist, Arapaho-Roosevelt National Forest

Lodgepole pines (*Pinus contorta*) are one of the first trees to come in after a major disturbance such as a fire or insect outbreak, and they often grow as vast expanses of even-aged trees. Pure stands occur between 9,000 and 10,000 feet elevation, but the trees live anywhere between 6,000 and 11,000 feet. The average life span of a lodgepole pine tree is 250 years or less; after about 80 years, they become increasingly susceptible to stand-replacing disturbance events. In Colorado, the average age of lodgepole pine stands varies between 80 and 200 years, so it is easy to recognize that the stands are ripe for replacement.

Wanted: Stand Diversity

Under ideal conditions, fires help maintain a discontinuous landscape, with scattered stands of lodgepole pine at varying levels of maturity (seedlings, saplings, poles, and mature trees). But according to Arapaho-Roosevelt National Forest South Zone Silviculturist Kevin Zimlinghaus, the absence of fire and other factors has left current lodgepole pine populations with little variation in age or tree size, which has weakened the stands. The mountain pine beetle (MPB) has taken advantage of these more susceptible stand conditions, a major factor in the current infestation.

Most scientists agree that active vegetation management is unlikely to stop the spread of the current MPB outbreak in lodgepole pine, because the outbreak covers such a vast land area and is spreading so rapidly. Although the outbreak is unlikely to be stopped by removing infested trees, retaining large areas of standing dead timber near forested communitites is also not desirable. It is still a good idea to remove dead and newly infested trees, where possible. To promote maximum diversity for the future forest, save and replant with species other than lodgepole pine.

To Thin or Not to Thin?

Natural stands of lodgepole pine are typically very dense and self-thin only slowly with age—current stand densities are actually close to normal. It is possible to thin lodgepole pine forests, but the trees have shallow root systems and those remaining in stands that have been thinned too much could blow over when exposed to the high winds common along the Front Range. Give careful consideration to when and how you thin your lodgepole pine forest.

The best way to achieve a low-density lodgepole pine forest is to start to thin regularly when trees are small saplings, and then maintain appropriate densities as the trees mature. In the next few years, homeowners will have a chance to manage regenerating trees for optimal future forest health as mature trees die from pine beetle attacks.

Younger trees may improve their vigor and become more resistant to MPB infestation as a result of the less-crowded growing conditions that follow thinning. In order for trees to have time to respond to improved growing conditions, thinning must be done well in advance of beetle attacks—this may be a minimum of 5 years or more. In older stands, it may be too late to greatly improve a tree's chances at fending off the beetle. Older trees are less likely to "release" or start growing more vigorously unless competing trees around them are removed early.

Patch Cuts

A homeowner might want to consider using patch cuts rather than thinning in established lodgepole forests. Patch cuts are used to create "holes" in the landscape to allow regeneration of lodgepole pine and other species. Depending on property size and management objectives, one might accomplish this by clearing a full 5-acre area or by removing a small group of trees to improve defensible space. Patch cuts can be used as a tool to produce a mosaic of stand development stages and a diversity of trees, thereby creating diverse wildlife habitat and a healthier lodgepole pine ecosystem. Where aspen are present, patch cuts can promote aspen growth, as aspen trees share lodgepole pine's preference for full sun and thrive in disturbed, open areas. Flowers, grasses, and shrubs also will move into the open spaces.

A recent report titled "Lodgepole Pine Management Guidelines for Land Managers in the Wildland-Urban Interface" discusses management recommendations for this forest ecosystem. The document applies to lodgepole stands in the wildland-urban interface prior to, during, and after a MPB attack. The publication is available in the Colorado State Forest Service online library at *http://www.csfs.colostate.edu*.

Lodgepole Pine (*Pinus contorta*)

Bark	Light brown, thin, with many small scales
Needles	Yellow to dark-green evergreen needles 1 to 3 inches long Sharply pointed, stiff, stout, slightly flattened, often twisted Two needles in a bundle
Cones	Shiny, yellow-brown ¾ to 2 inches long Egg-shaped with raised, rounded cone scales and a tiny point Often remain closed on the branch; persistent
Elevation Range	6,000 to 11,000 feet
Tree Height	20 to 80 feet
Typical Habitat	Well-drained soils at high elevations, often in pure lodgepole stands

Mountain Pine Beetle in Ponderosa Pine

By Jeff Witcosky, Entomologist, U.S. Forest Service

Mountain pine beetles (MPB) are on the increase in Front Range forests. Many homeowners in forest settings have seen the severe mortality in high-country lodgepole pine forests and now wonder whether their lower-elevation ponderosa pine forests will face a similar fate.

Unfortunately, recommendations and suggestions for managing ponderosa pine may prove variable in their rate of success over the course of the current beetle epidemic. This epidemic has been extremely severe in its intensity (percentage of trees killed in a given area), extent (area impacted), and duration (in excess of 12 years and counting in lodgepole pine). Mountain pine beetle populations are at very high levels; each summer, beetles seek out living trees to attack and in which to produce their brood. At best, we can hope that the suggested treatments will reduce the losses from MPB, leaving more live trees when the epidemic subsides.

Forest Structure

The structure of ponderosa pine forests is different from lodgepole pine forests. Along the Front Range, ponderosa pine does not occur in vast expanses of continuous forests characteristic of the dense lodgepole pine forests found in the high country. Ponderosa pine stands tend to be patchy and open, and of variable age and size, and individual tree canopies tend to be separated from one another.

Ponderosa pines growing in open conditions create an environment that is less attractive to dispersing MPB. Entomologists believe that the elevated levels of sunlight and higher temperatures at the bark surface in an open forest stimulate beetles to continue their dispersal flight, rather than remain in the stand. In contrast, ponderosa pines growing in dense, overstocked stands provide more attractive environmental conditions for dispersing beetles.

Ponderosa pine restoration treatments, which return overstocked stands to more open and sustainable growing conditions using thinning and prescribed fire, should reduce losses of trees to the MPB under most conditions. If homeowners are considering restoration treatments, it is advisable that they act sooner rather than later, when beetle populations are likely to be much higher.

Managing for Beetles

Is it beneficial to identify and remove beetle-infested trees from a ponderosa pine stand each year? Entomologists are in general agreement that the routine removal of MPB-infested trees from a stand is valuable in reducing the overall impact from this bark beetle, even for ponderosa pine stands that have been opened up through a restoration treatment.

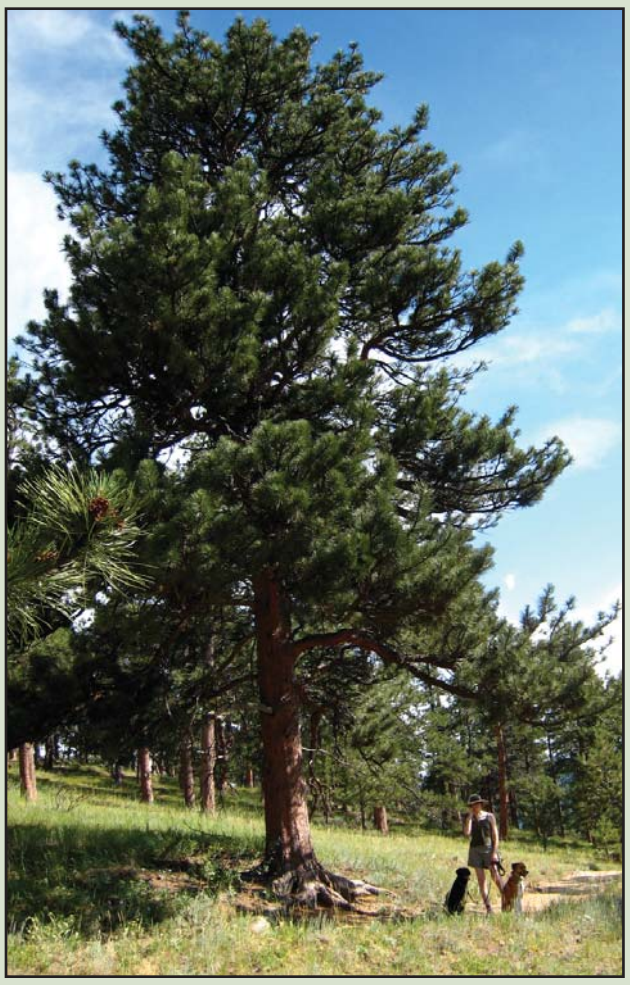
One final cautionary note: it appears that MPB are moving in large numbers from high-elevation forests into low-elevation ponderosa pine forests via upper-level air currents. This means that beetles may show up "out of nowhere" at any location along the northern Front Range ponderosa pine belt. This long-distance transport of beetles makes it imperative that forest landowners examine their trees each year during late summer and fall to look for and remove newly infested trees.

What Will Happen to Ponderosa Pine Forests?

When will the current MPB epidemic finally subside, and what will our ponderosa pine forests look like once the epidemic is over? Truthfully, no one can answer these questions with any degree of confidence. Barring an unusual event, such as very cold and prolonged winter temperatures (-30°F or colder) that kill beetle larvae under the bark, the epidemic is likely to continue for another 5 to 10 years. Regarding the cumulative impact of the MPB epidemic on Front Range ponderosa pine, the following generalizations appear to apply:

1. Ponderosa pine mortality is likely to be variable across the landscape, with areas of high mortality intermixed with areas of more moderate mortality.
2. Dense forests are likely to experience higher levels of mortality than open stands.
3. Larger-sized ponderosa pines (greater than 7 inches diameter at 4.5 feet above the ground) will experience the most severe losses, and smaller trees (trees 7 inches in diameter and smaller) will experience less severe losses.
4. Ponderosa pine stands adjacent to large-diameter lodgepole pine stands sustaining high levels of MPB-caused mortality are likely to experience higher losses than those at a distance from beetle-infested lodgepole pine stands.

Ponderosa Pine (*Pinus ponderosa*)



Bark	Young trees: Dark and thin Mature trees: Red-orange; nearly 3 inches thick; furrowed into large, flat, scaly plates; often smells like butterscotch
Needles	Dark yellow-green, stiff evergreen needles 3 to 7 inches long Two to three needles in a bundle, forming tufts near ends of branches
Cones	Light red-brown 3 to 4 inches long Egg-shaped, with scales that have a sharp point Contain small, long-winged seeds

Elevation Range	5,000 to 9,500 feet
Tree Height	40 to 160 feet
Typical Habitat	Dry, nutrient-poor soils in open, park-like stands *or* in mixed-conifer stands with Douglas-fir, Rocky Mountain juniper, and spruce

Neighbors Helping Neighbors: Community Organization Can Be Key to Your Success!

By Ryan Ludlow, Forestry Education and Outreach Coordinator, Boulder County Land Use

With each passing year, more and more trees in Front Range forests are succumbing to attack by bark beetles. This exponential increase in tree mortality is quickly becoming a bigger job to deal with than any individual can address on his/her own. Bark beetles don't care about property boundaries; they care about finding new suitable host trees. Now, neighbors need to work together to accomplish the shared goal of making safer, more livable communities.

Although the current bark beetle outbreak is more destructive than past outbreaks, we can still learn from outbreaks that took place in the 1970s and use past management strategies to fight the current infestation. In the 1970s, grassroots community groups developed strategies to fight the beetles. Neighbors worked with neighbors to remove thousands of infested trees from their private lands. Communities were able to accomplish significantly more while working in concert instead of in isolation. Many people believe this unified effort helped reduce some of the impacts of that beetle outbreak. The current outbreak is more intense, but the same basic strategies can be implemented. Communities working together can have a positive impact on the health of our forests.

Neighbors work together to identify and remove infested trees.

Tips for Organizing Your Community

1. **Use existing community networks –** Many communities already have established networks that can be a great starting point in creating your own bark beetle group. Regularly scheduled meetings, email distribution lists, and phone trees can be an extremely effective way to share current information about the beetle epidemic.

2. **Find individual talents –** Working with the entire community will allow you to capitalize on the group's collective skills. Everyone has something to offer—some individuals are great at organizing and planning, others are good at cutting trees, and others might be good at motivating neighbors.

3. **Seek power in numbers –** Cutting and hauling trees is demanding physical labor and can be overwhelming when working in isolation. Pool your resources and find equipment that your community already has available. Perhaps one neighbor has a tractor, another has a chainsaw, and yet another has teenage kids willing to haul slash. When communities work together, they can be a powerful force and accomplish much more work on the ground than any individual. In addition, neighbors working with neighbors might allow your community to get discounted rates on cutting, hauling, and chipping services. Forestry contractors might be able to offer discounted rates if they know they have an entire community to work with instead of just individual property owners.

4. **Make your community safer –** We may not be able to stop the current bark beetle outbreak, but we can have a positive impact on our forests and the safety of our communities. We know bark beetles will kill thousands of Front Range trees, and these trees will begin to fall down over the next few decades. As these trees fall, they will pose a significant risk to a community's infrastructure and homes. By working together to remove these hazardous trees, you will help protect your neighborhood from wildland fire and make it a safer place to live.

Cutting and hauling trees is demanding physical labor. Pool community resources to make the job easier and more enjoyable.

Fire Behavior in Beetle-Infested Forests

By Colorado State Forest Service Staff

Wildfires in Colorado are a natural element of our forest ecosystems and can help restore and maintain healthy forest stands. Although many forest lands historically and regularly experienced fire, the growing number of people, homes, and rural communities in the wildland-urban interface means that most fires now must be suppressed to protect lives and property.

For more than a decade, as we have continued to exclude fire from ecosystems, wildfire risk and severity in Colorado have increased. Wildfire behavior is always a complex process and varies depending on conditions such as wind, humidity, temperature, and vegetation (fuel) moisture at the time of the fire. Fire is always challenging to manage, and an even greater challenge exists now that mountain pine beetles (MPB) are part of the fire-behavior equation.

Severe drought during the past decade, accompanied by relatively warm temperatures in both summer and winter, has resulted in stressed trees and perfect conditions for MPB outbreak. The beetles prefer to feed on and breed in large trees with thick bark, and they have had an abundant food supply in Colorado's 1.5 million acres of aging lodgepole pine forests. The epidemic continues to impact Colorado's lodgepole and ponderosa pine forests and has resulted in high mortality in these stands, changes in forest structure and composition, and modification of fuels, which can affect fire behavior for decades.

Land managers are concerned about the probable impacts the MPB epidemic will have on fire behavior and fire hazard in infested stands. Even with information from beetle outbreaks in other locations, the science of fire ecology, and fire-behavior predictions, the degree of increased fire risk due to the epidemic has been a matter of debate. To protect lives and communities, public land managers and private landowners should prepare for the possibility of severe fire.

Fire severity depends on many factors—including wind, humidity, temperature, and fuel moisture.

Forest landowners can reduce hazardous fuels and snags by removing MPB-killed trees. As a first step to eliminate some of these hazards, landowners should establish defensible space around their homes.

For additional information about what you can do to actively manage your forest lands, reduce wildfire hazards, and restore forest health, visit the Colorado State Forest Service Web site at *http://www.csfs.colostate.edu* or contact your local CSFS district office.

Fuel Progression in Lodgepole Pine Forests

Experts agree that, during a dry season when needles, branches, and down wood are dry enough to catch fire, fire behavior in MPB-impacted lodgepole pine forests is likely to progress as follows:

Red Needle Stage

Within 8 to 10 months after a successful beetle attack, pine needles, which contain flammable chemicals, dry out and turn red to reddish brown. The needles can remain on trees for 3 to 5 years. With these dry fuels, if wind, low humidity, or high temperatures exist, relatively benign ground fires could transition into independent crown fires (fires in tops of trees).

Gray Tree Stage

Once the dry needles fall off the trees, it is hard for trees to ignite. Fire behavior is expected to be much more subdued and predictable for this period of time, and the stand will not sustain a crown fire. The increase in available large fuels could result in slower-moving but potentially more intense fires that are hard to control. The number of standing dead trees (snags) greatly increases during this stage, creating a hazard for firefighters.

Down-and-Dead Stage

As trees weaken and fall down, logs and large branches accumulate on the ground. These heavy fuels increase the risk of hot surface fires that are hard to control. The heavy fuels likely will be in contact with lighter, flashy fuels like grasses, flowers, and seedling trees that grow more vigorously as a result of the added sunlight and moisture available in dead stands. The combined increase in surface temperature and decrease in fuel moisture also may increase the probability of both human and natural fire ignitions. Wildfires can be intense, long, and difficult to suppress, and may cause severe soil damage.

Falling trees and large fuels on the ground threaten firefighter safety. These fuels also create special challenges for fireline construction and firefighter access.

During the down-and-dead stage, falling trees are a threat to firefighter safety.

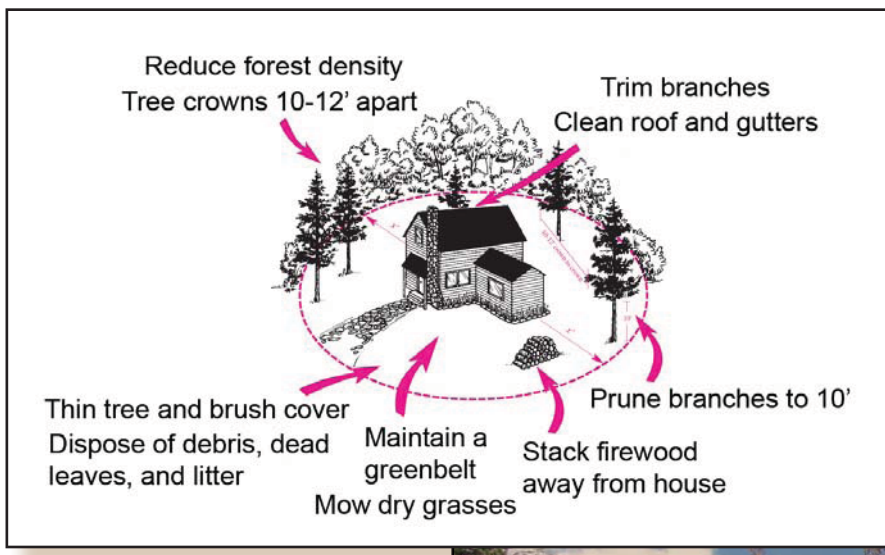
Defensible Space Can Always Be Improved

By Colorado State Forest Service Staff

Forest and fire management agencies encourage individuals and groups to be proactive in their efforts to create defensible space and reduce hazards from wildfire and falling trees around homes, businesses, utilities, infrastructure, and other high-value properties.

Defensible space is an area in which fuels and vegetation are treated, cleared, or reduced to slow the spread of wildfire toward a structure. Defensible space also can reduce the chance of a structure fire spreading to the surrounding forest and provides a safe area for firefighters to do their jobs. Your house is more likely to survive a wildfire if grasses, brush, trees, and other common forest fuels are managed to reduce a fire's intensity.

Defensible space can reduce wildfire hazard in all forest types, and does not mean that your landscape has to be barren. To learn how to create defensible space around your home, contact your local Colorado State Forest Service district office or visit the CSFS Web site at *http://www.csfs.colostate.edu*. Go to Resources for Homeowners & Landowners, then click on Protect your Home, Property & Forest from Wildfire.



Taking these actions...

...could save this home.

Community Wildfire Protection Plans—What do they Mean for You?

By Colorado State Forest Service Staff

Community Wildfire Protection Plans (CWPPs) offer one of the best opportunities to tackle threats to wildland-urban interface (WUI) communities. The plans identify and prioritize hazardous fuels reduction project areas; determine values at risk; rank priorities for management actions; and assess current levels of preparedness.

The process for developing CWPPs requires collaboration between community members, fire districts, and local, state, and federal government representatives. Community members are main contributors to the process, which helps build local relationships and capacity to better prepare individuals and communities to protect life, home, and property. The Colorado State Forest Service and federal agencies have grants and programs that support counties and communities in CWPP development and implementation.

Communities that work through the CWPP process realize many benefits. Communities can define their own WUI area based on what is important to them, and because CWPPs are developed on a landscape scale, the plans can include private, state, and federal lands. Federal agencies are directed to give priority to fuels reduction projects that are tied to CWPPs and the values they identify.

Defensible space is a key element to the success of any CWPP. Follow the standard FireWise guidelines (available at *http://www.csfs.colostate.edu/pages/wildfire.html*) to mitigate impacts to your property and home that could result from wildland fire. These actions give firefighters a safe area to fight a fire and give your home the best chance for survivability.

Communities should review and update CWPPs as they complete the action items and fuels treatments identified in the plan. Updated plans are an invaluable resource for firefighters when protecting a community involved in a wildland fire.

Visit the Rocky Mountain Wildland Fire Information Web site at *http://www.rockymountainwildlandfire.info* to search the grants database and access other wildland fire-related information. The site offers a calendar of events, training opportunities, fire management resources, media tools, featured news, and links to related Web sites.

Currently, more than 140 CWPPs have been completed in Colorado. Check with your local fire protection district or homeowners association to see if one has been developed for your area or to learn how you can participate in developing a plan. A list of all Colorado CWPPs by county can be found at *http://www.csfs.colostate.edu/pages/CommunityWildfireProtectionPlans.html*. If you have any questions about CWPPs, please call the Colorado State Forest Service at 970-491-6303.

Benefits of Fire to Forest Health

By Colorado State Forest Service Staff

Colorado is home to many species that rely on periodic fire to maintain their health and overall wellbeing. From tree species that depend on fire to release their seeds, to animals that depend on fire to open up habitat, fire plays many roles.

Fire can be both beneficial and destructive, depending on the severity of the disturbance. The short-term effects may seem negative—fire often appears destructive to habitat and causes injury or death to some living organisms. However, fire is nature's way of restoring ecosystem health. Its long-term benefits may not be visible for a few months or for several years, even as positive changes take place.

Above the ground, fire can have huge visible impacts. But, even when fire kills standing trees, it may benefit a site by thinning dense stands of timber to let the remaining trees thrive. Periodic surface fires limit the accumulation of fuel in some conifer stands, and fire can promote stand diversity, which may help deter outbreaks of insects and disease.

Many of the less-obvious benefits of fire occur at or below the soil surface. Some happen almost immediately—fire consumes dead and accumulating litter and releases essential nutrients to the soil. After the fire, the increased rate of nutrient cycling resulting from the disturbance stimulates new growth in grasses, flowers, and trees. Fire prepares seedbeds by exposing mineral soil and eliminates competition from shade-tolerant and fire-sensitive tree species. Fire helps regenerate stands by stimulating root growth and seed germination.

Firefighters monitor a prescribed fire on county open space land.

Over the last century, fire suppression in low-elevation forest types has resulted in dense forest stands and the accumulation of fallen timber and woody debris on the forest floor. Heavy fuel loads such as these can increase fire severity in a forest. Managed fire, used in conjunction with other forestry practices like thinning and pruning, can improve forest health and decrease the risk of severe fire.

Colorado's Fire-Dependent Ecosystems

Fire behavior changes based on many biological and physical variables. The effects of fire on an ecosystem largely depend on species composition, fuel availability, and fire frequency. Two of Colorado's most common forest types, lodgepole pine and ponderosa pine, are both fire-dependent ecosystems, but their fire regimes and species adaptations are vastly different.

Lodgepole pines grow in dense stands at high elevations, where plant growth is rarely limited by moisture. Fuels (both living and dead trees) are always available in these stands, and fires can spread because there is very little space between tree canopies. In these ecosystems, fire occurrence is limited by climate—only during very hot, dry years can the fuels dry out sufficiently to burn. When fires do occur in these systems, the dense stand structure and large amounts of fuel make it possible for entire forest stands to burn. Lodgepole pines are adapted to these infrequent, high-intensity fires by producing serotinous cones, specialized cones that remain closed on branches for many years. When exposed to the high heat of a fire, the resin on the cones melts, causing the cones to open. Seeds fall on the bare soil, where it is easy for them to germinate without competition.

Front Range ponderosa pine forests take many forms. At low elevations, frequent surface fires maintain low-density stands and remove fuels like grasses and dead wood from the understory. At higher elevations, fires burn less frequently, allowing more trees to grow and more fuel to build up between fire events. Fires in ponderosa pine forests at higher elevations naturally vary from low to high severity. Ponderosa pines have adapted to more frequent fires by shedding their lower branches and developing thick, cork-like bark that insulates the tree and allows mature trees to withstand all but the most severe fires.

Mountain Pine Beetles Also Like Urban Pine Trees

By Keith Wood, North Area Community Forester, Colorado State Forest Service

The native mountain pine beetle (MPB) currently is at epidemic levels from New Mexico into Canada. Over the past few years, it has also been found in urban areas along the northern Front Range. In 2006 and 2007, MPB sporadically attacked trees in Fort Collins. Most of the attacks were attributed to infested firewood that was transported from mountain areas. However, in late 2008, many northern Colorado communities—Denver, Boulder, Longmont, Berthoud, Loveland, Greeley, Windsor, Wellington, and especially the Fort Collins area—reported that multiple trees were attacked by MPB. Due to the sharp increase in the number of attacks in 2008, experts believe that a strong wind event carried the beetles from Colorado's high country to Front Range communities.

It appears that Scotch (Scots) pine is the preferred host tree for MPB in urban areas, but some attacks are occurring in ponderosa pine and other pine species that grow in northern Colorado communities. In August 2009, MPB was spotted in ponderosa pine as far east as Logan County.

To increase tree defenses against MPB, use good watering practices throughout the year—even during the winter months. This fall, help stop the transport of infested firewood. Let friends and neighbors know that transporting firewood from the mountains to the Front Range also brings the MPB into our communities.

What to do if Your Pine Tree is Infested

First, assess the pine tree in question. If the tree is completely dead, with red or no needles, it no longer is a threat because the MPB have already flown out of the tree. If the needles are green and the pine tree shows symptoms of heavy infestation—many pitch tubes and boring dust on the main trunk—then MPB larvae probably are developing under the bark.

Treatment options include cutting, debarking, and chipping the tree if it is heavily infested. The idea is to kill the larvae so the beetles do not develop to the adult stage and infest new pine trees next season.

No registered chemicals are available to treat trees that are heavily and successfully infested. If pine trees in your neighborhood are infested, but yours are only lightly infested or not yet infested at all, you can protect them from future infestation by using a chemical labeled for MPB. Such chemicals include carbaryl, permethrin, and bifenthrin. Spraying should be administered before July when the beetles emerge and begin to fly. The spray is effective for 1 year, and should only be applied by a certified, licensed applicator to a handful of your high-value trees. If you live by a stream or lake, or your neighbors are sensitive to chemicals, spraying may not be an option.

If you have questions or concerns about MPB in your trees, contact:

- Your local city or county forester,
- A local, licensed, ISA-certified arborist,
- Your local Colorado State Forest Service representative, or
- Your local CSU Extension office.

Using Wood From Beetle-Infested Forests

By Colorado State Forest Service Staff

The sale of wood products generates four billion dollars in revenue annually in Colorado. Yet 90 percent of those products, including blue-stain, do not originate in Colorado.

Now, as communities and forest land managers across the West remove dead trees from private and public forests impacted by MPB, efforts are underway to put this local wood to use. Local wood can be used as lumber or in community biomass and wood pellet heat generators. In addition, private forest landowners, local communities, state and local governments, and wood products businesses are exploring opportunities to manufacture, market, and sell wood products made of Colorado blue-stain wood.

About Blue-Stain Wood

Both MPB and Ips beetles introduce the spores of blue-stain fungi to pine trees when they attack. The fungi grow in the tree's moist outer wood, spreading and staining the wood an attractive faded-blue color.

Blue-stain fungi are not mold and do not cause wood to decay or rot. They are harmless to wood products and people, and the fungi usually are dead by the time wood leaves the manufacturer. The blue discoloration does not affect the wood's strength. Certain paints, stains, and wood preservatives can be used to either mask or enhance the blue coloring, depending on the user's personal preference.

What Can Be Produced From Beetle-Killed Trees?

In many wood markets, the presence of blue-stain is a valuable attribute to consumers. Blue-stain wood can be used for many of the same products as non-stained wood, and blue-stain can enhance products like furniture, wood cabinetry, flooring, wall paneling, and creative novelty or gift items. Fuelwood and biomass markets can also use beetle-killed wood.

Forest health and economic returns will increase with consumer knowledge about the benefits of buying local wood products. Awareness also will help overcome negative perceptions concerning the appearance, use, and durability of blue-stain wood products.

Promoting Use of Colorado-Grown Wood

A commitment to sustainable management of Colorado's forest land will foster the growth and development of an industry that utilizes more local wood. Businesses can turn Colorado's dead trees into useful forest products, helping to offset the costs of forest management and boosting our state's economy.

Colorado Wood Utilization and Marketing Program (CoWood)

CoWood facilitates the retention, expansion, and recruitment of forest and wood products businesses. Through applied research, technical and business assistance, and education and outreach to Coloradans, CoWood positively impacts Colorado's forest management, forest conditions, and forest and wood products economies.

For more information about CoWood, visit the CSFS Web site at *http://www.csfs.colostate.edu/cowood* or contact your local CSFS district office.

Colorado Forest Products™ Program

Colorado Forest Products (CFP™) is the only statewide program that campaigns on behalf of local, wood-based businesses. At least 50 percent of wood used to manufacture their products comes from public and private forests in Colorado. The program also informs consumers about how purchasing wood products from these CFP™ member businesses can benefit our local forests.

For more information about CFP™, visit *http://www.coloradoforestproducts.org*.

Peak to Peak Wood Program

Peak to Peak Wood is a collaborative effort between Boulder, Clear Creek, Gilpin, Jefferson, and Larimer counties to create markets for wood products that are generated from forest management projects on public and private lands. Peak to Peak helps operate public wood collection and sort yards in the five Front Range counties to reduce fuels treatment costs.

For more information about Peak to Peak Wood, visit *http://www.peaktopeakwood.org*.

Blue-stain logs are strong and sound and can be used for furniture, flooring, and cabinetry.

Businesses offer a variety of local wood products.

Online Resources and Contact Information

For frequently asked questions and additional information about bark beetles and bark beetle contacts please visit *http://www.FrontRangePineBeetle.org*

Boulder County
Colorado State Forest Service–Boulder District: 303-823-5774
Boulder County Land Use: 303-441-3930

Clear Creek and Jefferson County
Colorado State Forest Service–Golden District: 303-279-9757, 303-279-2011
Jefferson County Weed & Pest: 303-271-5989

Gilpin County
Colorado State Forest Service–Boulder District: 303-823-5774
CSU Extension, Gilpin County: 303-582-9106

Larimer County
Colorado State Forest Service–Fort Collins District: 970-491-8660
Larimer County Natural Resources: 970-498-5765

This publication represents a cooperative effort involving private landowners and:

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Beetle image: Maja Jurc, University of Lubljana, Bugwood.org.

Bark Beetles

They're Back!!

Are Your Trees at Risk?

Many species of bark beetles are causing widespread tree mortality throughout the Intermountain West. Although sometimes viewed by humans as catastrophic, outbreaks of native forest insects are natural events. Native insects and the plants they use for food and reproduction have evolved together. Unlike some introduced pests, native insects kill individual trees but do not threaten the existence of an entire plant species. Native insect outbreaks are only a problem when they conflict with values that humans have for an area (i.e., recreation, wildlife habitat, scenic beauty, wood production or property values). A tree in the wilderness is not subject to the same human values as a tree in your backyard.

FADING TREES ATTACKED BY BARK BEETLES

Bark beetle populations have been increasing in forested areas of the western U.S. The primary reason for this increase is the combination of large areas with susceptible stand conditions (mature trees in dense stands) and trees stressed by drought. High levels of forest insect activity will likely continue if current conditions do not improve.

The bark beetles causing widespread mortality in the forests of the Intermountain West are all native. The principal species include: mountain pine beetle, spruce beetle, Douglas-fir beetle, fir engraver beetle, western balsam bark beetle, and pinyon ips.

Forest Health Protection

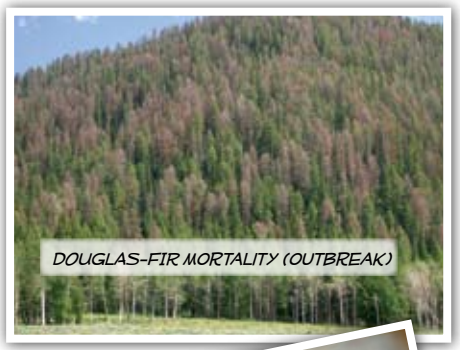
HOW CAN SOMETHING SO SMALL KILL SOMETHING SO BIG?

Individual beetles of these species are not much larger than a piece of cooked rice. Not only are they small, brown, and hard to see, but much of the time their activity is scattered and barely noticeable.

In low numbers (latent populations) these insects survive on newly dead, dying or stressed trees created by wind, snow, lightning, other biotic organisms, or by human activity. Occasionally, small pockets of standing trees may be killed but over the landscape these patches are often unnoticed.

However, beetle population levels can increase when sufficient food is available, allowing large numbers of these small beetles (outbreak populations) to attack large healthy trees *en mass*. Often many trees are killed over the landscape with results likened to that of wildfire. In recent years, more trees have been killed by bark beetles than by fire!

In the battle between trees and tree-killing beetles the two principle interacting factors are tree vigor and beetle numbers. When beetle populations are low, healthy trees often produce enough resinous pitch to drown and flush out the beetles that attempt to enter (pitchout). When trees are stressed they may be unable to produce sufficient amounts of defensive pitch. Yet, when beetle populations are high, even a healthy tree may not be able to produce enough pitch to ward off hundreds of simultaneous attacks (a mass attack). In addition, many beetles carry fungi that further damage the tree's defense system.



DOUGLAS-FIR MORTALITY (OUTBREAK)

A 'PITCHOUT'

A DOUGLAS-FIR BEETLE

The USDA Forest Health Protection offices in Ogden, UT and Boise, ID, in cooperation with the Caribou-Targhee and the Bridger-Teton National Forests have created this publication to educate the public regarding the principle tree-killing bark beetles in the Intermountain West. With this knowledge, you can make informed decisions concerning protection of your private property and provide meaningful input about proposed actions on public lands.

Representatives from the cooperating agencies are available to assist you with additional information. Please see page 12 for a list of contacts and additional information sources.

Does this affect you? Look inside

ARE MY TREES AT RISK?.....PAGE 2
HAVE MY TREES BEEN ATTACKED?.....PAGE 5
HOW TO PREVENT ATTACKS.....PAGE 6
WHAT IS A BARK BEETLE?.....PAGE 8
WHAT CAUSES SIMILAR ATTACKS?.....PAGE 9
WHAT ARE LAND MANAGERS DOING?.....PAGE 11
WHO SHOULD I CONTACT?.....PAGE 12

Are Your Trees at Risk to Bark Beetles? What Should You Do?

STEP 1: IDENTIFY YOUR TREES

The first step in determining whether or not your tree is susceptible to insect attack is to know what species of tree you have. The following lists are the principal evergreen species found in the Intermountain West.

PINES (NATIVE):

Most pines have more than one needle attached to the tree together in a 'bundle.' The number of needles per bundle is often important in determining the pine species.

PINYON (COLORADO AND SINGLELEAF)

Colorado pinyon, found mainly in Utah have two, 1-2" long needles per bundle. Singleleaf pinyon, found mainly in Nevada, have one sharp, rounded needle per bundle, >1" long. Cones are not spiny.

Natural Range: Colorado pinyon in UT; Singleleaf pinyon in NV, western edge of UT, scattered spots in southern ID.

COLORADO PINYON

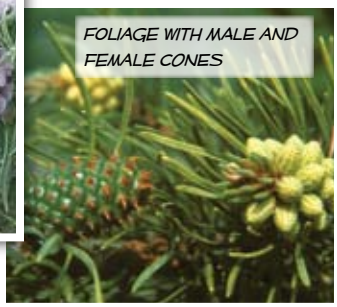
SINGLELEAF PINYON

LODGEPOLE

Needles are two per bundle, 1-3" long. The small ¾-2" long cones have very short stalks and stay attached to the tree for many years. Cones feel prickly.

Natural Range: ID, MT, WY, northern UT, spots along the Sierra Nevada Range in NV.

CLOSED AND OPEN CONES

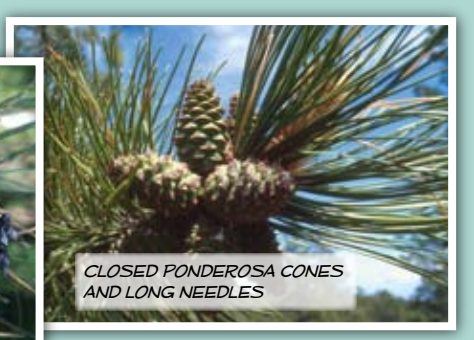

FOLIAGE WITH MALE AND FEMALE CONES

PONDEROSA (AND JEFFREY)

Ponderosa needles are 2-3 to a bundle, ranging from 3-10" in length. Cones are 2-6" long and prickled. Jeffrey pine (3-needles) is found along the Sierra Nevada's, overlapping with ponderosa pine's broad range. Jeffrey generally has larger, stouter cones (5-9") with incurved spines (pokey ponderosa; gentle Jeffrey).

Natural Range: ID, MT, UT, spots in eastern NV and the Sierra Nevadas, isolated spots in WY.

OPEN PONDEROSA CONES


CLOSED PONDEROSA CONES AND LONG NEEDLES

5-NEEDLED (E.G. LIMBER, WHITE BARK, AND WESTERN WHITE PINES)

Several pine species with 5-needle bundles are native to the Intermountain West, but Limber is the more commonly planted species around homes. Needle length ranges from 1.5-4". Cones vary.

Natural Range: various throughout Intermountain West.

LIMBER PINE NEEDLES AND CONES

PINES (EXOTIC):

SCOTCH AND AUSTRIAN PINES

These European pines have 2-needles per bundle, 1.5-3" and 3-6" longs, respectively. Scotch cones are smaller (1.5-2" long) than Austrian cones (2-3"). Cones of both species are not spiny (vs. ponderosa). Scotch pine is noted for the strong orange coloration of the bark.

Natural Range: As exotic species there is no native range but they can be found planted throughout the Intermountain West.

FIRS (NATIVE):

Firs and spruce have only one needle (no 'bundles') but the shape of that needle can differ by tree species.

WHITE FIR

The 2-3" long, single, flat needles narrow to a stalk at their base and have rounded tips (vs. sharp spruce or notched grand fir). The needles tend to curve upward, leaving few needles below the stem. The greenish purple or yellow cones (3-5"), found in the upper branches, point up and are not dropped. Rather, they fall apart on the tree (vs. Douglas-fir cones that drop off).

Natural Range: UT, eastern NV, southeast corner of ID.

DOUGLAS-FIR

Although not a true fir species, Douglas-fir is similar to other firs in having short (~1"), single, flat needles. Needles have rounded tips like white and subalpine fir, and are narrow at their base like white fir. However, the 3" long cones hang down. The cone scales have a distinct shape resembling the tail and back legs of a mouse.

Natural Range: ID, MT, WY, UT, and scattered spots in NV.

SUBALPINE FIR

The short (1-1.5"), single, flat needles also have rounded tips but are thick at their base (vs. white fir). The dark purple cones (2.25-4" long) are borne upright on the upper branches and are not dropped.

Natural Range: ID, western MT, western WY, UT, spots in northern NV.

GRAND FIR

The single, flat needles of grand fir are 1.25-2 inches long and distinguished by having a notched end. Needles tend to grow out to the sides giving the branchlets a flattened appearance. Cones are also 2-4" long, green-brown in color, and extend upward.

Natural Range: northern half of ID, northwest edge of MT.

SPRUCES (NATIVE):

ENGELMANN AND BLUE SPRUCE

Single needles are square and sharp, leaving 'bumps' on the small twigs when they fall off. Blue spruce needles tend to be stiffer and sharper than Engelmann needles. Cones hang down, measuring 1-2.5" in length for Engelmann and 2.5-4" for blue. In the wild, blue spruce prefers moist stream edges.

Natural Range: Engelmann spruce in ID, MT, WY, UT, and NV; blue spruce in UT and WY.

References:

- Kuhns, Michael. 1998. A guide to the trees of Utah and the Intermountain West. Utah State University Press, Logan, UT
- National Audubon Society. 1996. Field Guide to North American Trees. A. A. Knopf, NY
- Watts, Tom. 1985. Rocky Mountain Tree Finder. Nature Study Guild, Rochester, NY

STEP 2:
DETERMINE YOUR TREES' SUSCEPTIBILITY

The susceptibility of an individual tree is often described differently than the susceptibility of a stand of trees. When there is a group of trees (a stand), a tree may be killed yet the overall stand may look and function much as before. In an urban setting, however, an individual tree may be of high importance for aesthetic or other values.

A THINNED STAND WITH A DIVERSITY OF TREE AGES

A DENSE STAND WITH TREES COMPETING FOR RESOURCES

INDIVIDUAL TREE SUSCEPTIBILITY

Trees that are stressed are less able to produce the pitch used to counter bark beetle attacks. Damage to the bark, needles, or root system can occur through human activity (construction, paving, excavating, etc.) or by natural causes (drought, wind, lightning, other insect or disease agents, etc.). The more stressed the tree is the more susceptible it may be. Poor crown condition is often an indication of stress.

CROWN DIFFERENCES BETWEEN A HEALTHY (LEFT) AND STRESSED (RIGHT) TREE

Susceptible trees are not always attacked by bark beetles, especially if beetle numbers are low. Conversely, it is possible that when beetle populations are high, even healthy trees may be attacked.

STAND SUSCEPTIBILITY

Dense stands are more susceptible than open stands where trees do not have to compete with each other for limited water, light, and nutrients. Stands with a higher diversity of tree ages and tree species are also less susceptible. Some tree cover will likely remain if a bark beetle outbreak does remove the most susceptible trees.

Stands that have trees stressed by drought, defoliation, disease, or other damage are especially susceptible to bark beetle attacks.

SPECIFIC TREE SUSCEPTIBILITIES

Tree-killing bark beetles often have a preference for specific tree species. In some cases, a beetle species will attack only one tree type. In other cases the beetle may be able to use a number of similar tree species.

Lodgepole, ponderosa, '5-needled' pines, and other introduced and native pines: All native and introduced pines, except for Jeffrey pine, are susceptible to the mountain pine beetle. **Jeffrey pine** is susceptible to the Jeffrey pine beetle which is very similar to the mountain pine beetle. The most susceptible pine trees are older than 80 years; greater than 8 inches in diameter at breast height; weakened by drought, disease or damage (e.g. lightning or windthrow); or located near existing beetle-infested trees. Recently dead or downed pines are rarely infested by mountain pine beetle. However, there are other beetles that will use this material and can cause small clusters of tree mortality if conditions are right (especially *Ips* species).

Singleleaf and Colorado pinyons: Although several bark beetles can utilize pinyon pine, the landscape level mortality noted in recent years has been caused by pinyon ips. Trees stressed by drought, defoliation, pruning, or other damage are highly susceptible, especially if the trees are stressed in the spring or early summer. Drought is the principle instigator of outbreaks.

Engelmann and blue spruce: Engelmann is the preferred host tree species for spruce beetle with blue spruce occasionally attacked and successfully infested. Engelmann spruce trees over 16 inches in diameter are most susceptible to spruce beetle; trees less than 5 inches in diameter are seldom attacked. Freshly killed or damaged trees (e.g. from windthrow or avalanches) are preferred habitat. In this material beetles may be able to build a large population that can overcome the defenses of healthy host trees.

Douglas-fir: Douglas-fir trees can be killed by the Douglas-fir beetle. The most susceptible trees are larger than 14 inches in diameter; older than 120 years; growing in dense stands; weakened by drought, root disease, or defoliation; or are located near existing beetle-infested trees. The Douglas-fir beetle will readily use recently downed or damaged material and has shown a strong preference for fire-scorched trees.

White fir: The principle bark beetle in white fir is the fir engraver beetle. Large diameter trees weakened by drought, defoliation, or other stressors are most susceptible. Root disease is often associated with white fir and serves as a weakening agent. In some cases, only parts of trees are killed (especially tops).

Grand fir: Stressed trees over 5 inches in diameter are particularly susceptible to fir engraver. Odors emitted from stressed trees appear to be the principal attraction for attack. Overcrowding, disease, defoliation, and drought often cause stress. In grand fir forests, pure, dense stands are most susceptible. Because fir engraver may only kill a portion of the tree, a tree may sustain attacks over several years before tree mortality occurs.

Subalpine fir: Subalpine fir trees are also susceptible to the fir engraver beetle. However, western balsam bark beetle is the more common bark beetle in subalpine fir, and prefers highly stressed trees, especially those infected with root disease or weakened by drought. Windthrow events can also cause western balsam bark beetle outbreaks. Often a complex of factors including root disease, drought and bark beetles together cause widespread or pockets of subalpine fir mortality.

STEP 3:
DETERMINE IF YOUR TREES HAVE BEEN ATTACKED

Many symptoms of bark beetle attack are similar regardless of the tree or beetle species involved. However, some are more prevalent with certain bark beetles than others. Some of the most common signs are described below.

MOUNTAIN (AND JEFFREY) PINE BEETLES

HOSTS: Most native and introduced pine species, except Jeffrey pine which is attacked by the very similar Jeffrey pine beetle. Pinyon pines are not commonly attacked.

PITCH TUBES

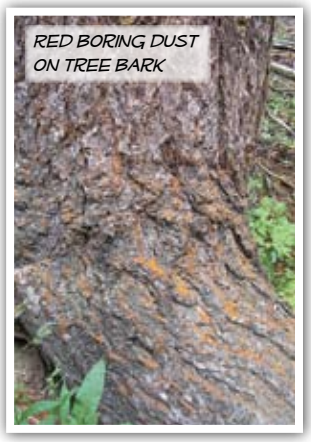
Pine trees infested with mountain pine beetle (or Jeffrey pine beetle) become next year's infection source, so it is important to identify freshly attacked trees. Signs of beetle infestation are pitch tubes or small holes and boring dust. Most beetle-attacked trees will have pitch tubes scattered over the bole of the tree. These popcorn-shaped masses of pitch and boring dust may be brown, pink, yellow or white. If the tree is extremely water stressed and cannot produce pitch, only small holes and boring dust are visible. Removing a section of the bark should show tunnels created by beetles in their reproduction (see page 8) if the attacks were successful. Downed host trees are rarely attacked by mountain pine beetle but may be attacked by another bark beetle group called 'ips'. The ips do not typically kill healthy live trees. Gallery patterns of all ips species are similar (see pinyon ips on page 9) and differ from that of mountain pine beetle.

DOUGLAS-FIR BEETLE

HOSTS: Douglas-fir.

Trees that have been infested will generally remain green until the following spring, so you must look for "clues" other than dead foliage. These trees become next spring's infection source, so it is important to identify them. Fresh-down trees and fire scorched trees are highly susceptible.

The most reliable external sign that your tree has been attacked is the presence of boring dust (reddish-brown sawdust) in bark crevices or around the base of the tree from April to August. Boring dust is created when the insects bore through the bark of the tree. Multiple pitch streams about 20 feet up on the tree bole may also be an indicator. However, not all pitching means bark beetles are present. Removing a section of the bark may show tunnels created by beetles in their reproduction process (see page 8). Unfortunately, sometimes the tunnels are made at heights on the tree that are beyond your reach.


RED BORING DUST ON TREE BARK

SPRUCE BEETLE

HOSTS: Principally Engelmann spruce although blue spruce may be occasionally attacked.

Signs of attack are boring dust (see photo under Douglas-fir beetle) in bark crevices or around the base of the tree from mid-May to July. Pitch tubes may accumulate around the insect boring holes. Also, look for pieces of bark around the base of the tree. Woodpeckers will often flake off pieces of this thin barked tree in order to feed on the beetles and their larvae. Removing a section of the bark should show tunnels created by beetles in their reproduction process (see page 8) if the attacks were successful.

WOODPECKER FEEDING

PINYON IPS

HOSTS: Singleleaf pinyon, common pinyon, other pinyon species, and occasionally other pines.

Pinyon ips attack all species of pinyon and occasionally other types of pines if they occur around the pinyon trees. Crown fading is often the first noticeable sign of attack. Small pitch tubes and boring dust may be present but are not easily noticed on bushy trees. Attacks can occur from early spring through late summer since this bark beetle can have several generations in a year. Woodborers also will quickly infest dead or dying trees, but can be differentiated by their larger size and a lack of distinct 'ips' gallery pattern (see page 9).

FIR ENGRAVER

HOSTS: White fir, grand fir, and occasionally subalpine fir.

Fir trees are often attacked in groups with attacked trees usually 5 inches in diameter or greater. Trees generally turn yellow-red within 3-6 months. Evidence of attack before trees fade is often hard to detect; entrance holes are without pitch tubes and in the Intermountain West pitch streamers are rare. Boring dust in bark crevices and color fading are most noticeable. This beetle may attack only strips or portions of the tree which will not cause mortality of the entire tree. These partial attacks may result in dead branches or tree tops. If your tree is fading and you think it might be caused by fir engraver beetle, check for the distinct gallery pattern the beetle creates under the bark (see page 9).

PITCH STREAMING

TOP KILL AND TREE MORTALITY CAUSED BY FIR ENGRAVER

WESTERN BALSAM BARK BEETLE

HOSTS: Subalpine fir.

External evidence of successful attacks by western balsam bark beetle can be hard to detect. Entrance holes and boring dust may be visible in late summer. Pitch flow may be found, especially when attacks have not been successful. Successfully attacked trees turn yellowish-red within a year and can stay bright red for several years after death.

STEP 4: HOW TO TREAT TREES THAT HAVE BEEN ATTACKED

Once bark beetles have attacked a tree around more than half of its circumference, there is generally nothing you can do to save it. There are no chemical insecticides registered or recommended for killing bark beetles under the bark of infested trees. While some trees do survive bark beetle attack, the vast majority are killed once infested.

To kill the beetles, cut down the infested trees and debark or burn all material greater than 4 inches in diameter. Burying trees is another option. Bucking and splitting infested trees for firewood may kill some beetles if done in the summer and if the wood is located where it can dry out quickly. However, if firewood is stacked or placed in the shade before it dries, most of the beetles will survive.

If infested trees or slash are not treated, removed, or burned, adult insects will emerge the following spring and attack standing trees nearby. Pinyon ips (and other ips) may emerge in as little as 35 days to repeat another reproductive cycle (2-4 cycles per year). In the case of spruce beetle, adult beetles will also emerge during the second spring.

By the time trees have red-brown needles, most bark beetles have left the tree; however, spruce beetles can emerge from trees with practically no needles. Other beetles and larvae may be observed, but they are of little concern in causing further tree mortality. Most are beneficial wood decomposers – not tree killers. The tree may be cut down for firewood or left standing for wildlife habitat (see below). The tree should be removed, however, if it has the potential to endanger persons or property.

DEAD TREES ARE "HOME" TO MANY FOREST CREATURES

If enhancing wildlife habitat interests you, consider keeping dead trees on your forested lands. Standing dead trees in a forest are called "snags" and many species of wildlife depend on snags for their survival.

Owls, hawks, and eagles use snags to perch and to support their nests. Cavity nesters such as woodpeckers, mountain bluebirds, and chickadees nest in the snag cavities.

Chipmunks, squirrels, and other mammals use snags as homes. Bats use areas under loose bark for roosting. Fungi, mosses, and lichens commonly grow in the decaying wood of a snag.

Insects chew through the decaying wood, creating tunnels and chambers. Moths and ladybird beetles, and many species of reptiles and amphibians, hide under the bark of snags.

With so many animals and plants living on and in a dead tree, other animals frequently come there to feed. For example, many species of woodpeckers depend on snags to provide insect larvae for food.

If a tree on your private land does not have the potential to endanger persons or property, please consider leaving it standing for our animal friends!

STEP 5: HOW TO PREVENT BARK BEETLE ATTACKS

There are several things you can do to protect your trees from bark beetles. Preventing attack is key because you cannot do anything to save a tree once it has been successfully attacked.

1. Remove all trees that currently contain beetles as described in Step 4.
2. Always clean up any recently blown down trees or fresh slash over 4 inches in diameter. Beetles are more attracted to and reproduce better in large diameter slash material.

3. Avoid tree damage such as knocking off bark, or compacting/excavating soil near trees. Injured trees attract bark beetles.
4. Thin out dense stands of trees, leaving the healthiest, most vigorous ones. Contact your state forester (see page 12) for details on proper thinning methods. Trees that have less competition for water, light, and nutrients more effectively repel bark beetle attacks. Thinning can also hamper the bark beetle pheromone communication system that facilitate mass attacks.

5. Increase age and species diversity to enhance stand resistance to bark beetle attacks and reduce the effects of tree mortality when attacks occur.
6. Use commercially produced beetle pheromones to inhibit attraction to an individual tree or a stand. Presently, this method is only available for deterring mountain pine beetle and Douglas-fir beetle under some situations.
7. Use insecticides to protect unattacked trees. Carbaryl spray applied as a preventative treatment is effective for most bark beetles, but is not registered for use against fir engraver or western balsam bark beetle.

Chemical Treatments

PHEROMONES

- **MCH for Douglas-fir beetle:** MCH (one-methy-cyclo-hex-3-one) is a chemical used by Douglas-fir beetle to communicate (a 'pheromone'). This pheromone tells the beetle that the tree is already fully occupied and they should look elsewhere for a tree to lay their eggs in. The chemical has been commercially synthesized and is available in small bubble caps that are easily stapled to tree boles just prior to beetle flight in mid-May. Application rates should be 30-40 bubble caps per acre for area protection or 2-4 caps per tree for individual tree protection. The cap slowly releases the pheromone and is generally effective for one season if properly applied. Current cost per cap is under $2. See 'Using MCH to Protect Tees and Stands from Douglas-fir beetle Infestation' at http://www.fs.fed.us/r1-r4/spf/fhp/publications/MCH_brochure/MCH_online.pdf for more information.

- **VERBENONE for mountain pine beetle:** Verbenone (4,6,6-trimethylbicyclo[3.1.1]-hept-3-en-2-one) is considered the principal pheromone used by mountain pine beetle to tell other beetles that the tree is fully occupied and to move on. As with MCH, this chemical has been commercially synthesized, however the cost is closer to $8 a pouch. Recommended dosage is 40 pouches per acre (area protection) or 2+ pouches per tree for individual tree protection; applied around mid-June. Verbenone pouches have shown mixed results in repelling mountain pine beetle attacks. In some previously treated sites where population pressures were high, the verbenone applications have had only limited success. Research studies in Idaho and Montana are currently being conducted to determine if population densities affect the performance of verbenone treatments. It is also critical that currently infested trees be removed from the area before the pouches are deployed or efficacy is greatly reduced. Generally, use of verbenone is limited to areas where insecticide application (see section below on Carbaryl) is not feasible.

- CONTACT YOUR STATE FOREST HEALTH SPECIALIST (see page 12) for assistance to determine if these treatments will be effective and if financial assistance is available to help defray your costs.

INSECTICIDES

- **Carbaryl for mountain pine beetle, Jeffrey pine beetle, spruce beetle, Douglas-fir beetle, and pinyon ips:** Application of this insecticide prior to beetle flight will protect pines, spruces, and Douglas-fir from the beetles described in this pamphlet. However, carbaryl is not approved for use against fir engraver or western balsam bark beetle on true firs. Due to the cost and the need for special equipment, this treatment is generally used only on individual, high value trees, and is generally applied by certified applicators. All tree bole surfaces must be completely soaked up to a height where the tree is too small in diameter to be useful habitat. While labeled as being an annual treatment, research has shown that the effectiveness generally lasts 18-24+ months. Contact your state's forest health specialist (see page 12) to determine if this is an appropriate treatment for your trees. Contact your state's agriculture department (see page 12), division of pesticides, for assistance finding qualified applicators.

- **Other insecticides for bark beetles:** Other insecticides such as pyrethroids are registered for use against some bark beetles. Research has shown some success with pyrethroids but they do not last as long or work as effectively as Carbaryl.

- **Systemic treatments** applied to the soil around the tree or inserted into holes drilled in the tree have not been shown to be effective although new injection systems and insecticides are currently being tested.

- **PESTICIDE PRECAUTIONS**
  Pesticides used improperly can be injurious to humans, animals, and plants. Follow directions and read all precautions on the label. Consult your local county agriculture agent or State extension agent about restrictions and registered uses of particular pesticides.

What is a Bark Beetle?

FEEDING LARVAE GIRDLING TREE

Bark beetles are small (<1/4"), hard bodied beetles that bore through the protective bark of a tree to lay their eggs in the moist, living tissues. These beetles and the larvae they produce feed on this living tissue, cutting off the tree's ability to transport water and nutrients. The shape of the tunnels created by adult beetles and their larvae as they feed are unique for each species of beetle. The principle gallery is created by the female who lays eggs along the gallery walls (egg gallery). The eggs hatch and the larva create 'larval galleries' that tend to increase in width as the larva increases in size. (Also see the beetle-specific information on page 5.)

MOUNTAIN (AND JEFFREY) PINE BEETLES

MOUNTAIN PINE BEETLE

Mountain pine beetle is a native to forests of western North America and attacks all species of pine except Jeffrey pine; Jeffrey pine is attacked by the similar Jeffrey pine beetle. Periodic outbreaks of these beetles, especially of mountain pine beetle, can result in the loss of millions of trees.

During low population levels, attacks are primarily on trees under stress from injury, poor site conditions, overcrowding, root disease, or old age. As the beetle populations increase, attacks may involve most trees 8 inches in diameter or greater in the outbreak area, regardless of their apparent health.

Adults are brown to black in color and about 3/16 inch long with a rounded back end. The larvae are yellowish white, legless grubs with dark heads, found within tunnels under the bark.

Successfully attacked trees normally do not show red, faded foliage until 8 to 10 months after attacked. However, drought stress will cause some trees to start "fading" as early as 4 to 5 months after attack.

MOUNTAIN PINE BEETLE GALLERIES

Mountain pine beetle adults leave the dead, yellow- to red-needled trees and attack green trees from July through September with the majority flying in mid to late July.

The female mountain pine and Jeffrey pine beetles create straight, vertical (with grain of wood) egg galleries that can extend up to 3 feet in length or more. At the bottom of this gallery where the attack was initiated is a distinctive J-shaped crook. Eggs are laid alternately along the walls of the egg gallery.

DOUGLAS-FIR BEETLE

This beetle is a native to forests of western North America and only attacks Douglas-fir trees. Outbreaks typically occur in areas of wind-thrown trees or trees damaged by fire or spruce budworm defoliation. The Douglas-fir beetle generally does not cause widespread mortality like mountain pine beetle. Groups of trees ranging from a few to several hundred trees may be killed. Although large outbreaks sometimes occur due to drought stress and dense stand conditions.

DOUGLAS-FIR BEETLE

The Douglas-fir beetle prefers large trees, but will attack trees as small as 6 inches in diameter. Depending on weather and elevation, attacks occur from late April through August, with peak flights occurring from early June to early July.

While physiologically dead within a few weeks, trees typically do not show yellow-green ("fading") or red foliage until 10 months or more after being attacked. With trees that are drought stressed, "fading" may occur by the fall following the attack (4 to 5 months).

DOUGLAS-FIR BEETLE GALLERIES

Adult beetles are brown to black in color and about 3/16-inch long. The larvae are whitish, legless grubs with brown heads found within tunnels under the bark. Eggs are laid in groups on alternative sides of the female's gallery, creating a unique pattern. The female's gallery may be 8x10 inches long starting at the bottom with a small angled 'J'.

SPRUCE BEETLE

This beetle is a native to forests of western North America and attacks all species of spruce, although Engelmann is preferred; blue spruce is seldom attacked. Outbreaks typically begin in areas of wind-thrown trees, then move into standing trees. In landscapes dominated by Engelmann spruce, extensive mortality can occur.

Adult beetles are ¼ inch long, brown to black in color with reddish-brown or black wing covers. The larvae are yellowish white, legless grubs found within tunnels under the bark.

Unlike the previous two bark beetles, spruce beetle can have a one- or two-year life cycle. Infested trees usually do not "fade" (turn yellow-green or reddish) until one or sometimes two years after attack.

SPRUCE BEETLE

The spruce beetle egg galleries average 3-12 inches in length with a slight crook at the start. Eggs are laid alternately along the gallery with larva feeding gregariously outward in all directions.

SPRUCE BEETLE GALLERY

PINYON IPS

Most native bark beetles in the 'ips' group are not very aggressive tree killers. Rather they tend to rely on recently dead, damaged or stressed trees for food and reproduction. Pinyon ips, a native ips, is no exception. However, their host trees are often found in areas prone to water and heat stress (droughts) which makes them susceptible to attack. During drought periods, pinyon ips is able to overcome the weakened defenses of trees, affecting broad landscapes. Because this beetle can have two or more generations in a year it is able to spread quite rapidly when conditions are favorable.

PINYON IPS

Attacks begin early in the spring, and attacks can continue through early fall.

TYPICAL IPS GALLERY

Pinyon ips are about 1/5 inch long, and have a spiny back end typical of all "ips' species (versus a rounded back end). Gallery patterns of most ips are similar; often a Y or H shape, with a larger 'mating' gallery from which the separate egg galleries radiate. Larva and beetles overwinter under the bark, consuming large patches of inner bark and lacking specific galleries. Wood borers (see side panel) are quick to infest attacked trees after pinyon ips have attacked.

FIR ENGRAVER

Also a native bark beetle, this species attacks true firs. It does not attack Douglas-fir which is not a true fir.

Measuring only about 1/8 inch, these small, shiny, black beetles are distinguished by having a truncated, spineless, back end. The gallery pattern is also unusual in that the egg gallery runs across the grain of the wood (horizontally) for 4 to 12 inches with the larval galleries extending up and down with the wood grain. Shortly after attack, a fungus that travels with the beetle starts to stain the area a yellow-brown color.

FIR ENGRAVER

FIR ENGRAVER GALLERY

The larva overwinter under the bark with the adult beetles emerging around June, and dispersing from June through September. Most populations have a one-year life cycle, occasionally two years at higher elevations. Larva and pupae are similar to those of other bark beetles.

WESTERN BALSAM BARK BEETLE

Only about 1/8th to 1/6th of an inch long, a magnifying glass may be needed to see the distinctive hairy patch (toupee) on the head of this beetle. The gallery pattern is star shaped, and often accompanied by a lesion caused by fungi that assist in killing the tree.

WESTERN BALSAM BARK BEETLE

The beetle is the most conspicuous agent in a complex that is responsible for killing large numbers of subalpine fir throughout the Intermountain West. Other agents in the complex include root disease and balsam woolly adelgid. In addition to drought, windthrow has been known to initiate large scale outbreaks of this insect.

WESTERN BALSAM BARK BEETLE GALLERY

Western balsam bark beetle normally needs two years to develop. However, a one year life cycle is possible under the right weather conditions. Two peak flights of this beetle occur in late June/ early July and again in late July / early August.

OTHER AGENTS . . .

THAT CAUSE DAMAGE SIMILAR TO THAT OF BARK BEETLES

Other insects or animals can cause damage to trees that may resemble bark beetle activity. We have listed a few of these to help you discern between bark beetles and activity from other agents.

OTHER WOOD DAMAGING AGENTS:

Because bark beetles have often left the tree by the time you see red needles, your inspection of a dead tree may find insects that were not directly responsible for the tree's death. Many of these insects live under the bark of dead and dying trees and are important in recycling the nutrients back into the ground.

A BARK BEETLE (LEFT) AND WOOD BORER (RIGHT)

Most often confused with bark beetles are the metallic and longhorn **WOOD BORERS**. Wood borers are much larger than bark beetles. These borers feed on the phloem just as bark beetles do; however, their galleries lack a distinct shape. While developing, the larva may drill large oval or round holes into the wood. Their life cycle may take from one to over 10 years to complete.

LONGHORN WOOD BORER

METALLIC WOOD BORER

AMBROSIA BEETLES are very small, creating multiple pin holes in wood where they cultivate a fungi (ambrosia) that they feed on.

WOOD WASP larva make large holes in dead wood similar to wood borers but the larva do not feed in the phloem.

Even woodpeckers (**SAPSUCKERS**) can make holes in the bark that may look like a bark beetle entrance/exit hole.

DEFOLIATING INSECTS:

Other insects and diseases can cause damage to the needles of trees by either consuming the needles or causing the trees to drop their needles. The 'defoliating' agents can cause trees to die if they remove most of the needles over a several year period. Most conspicuous are several moth larvae that eat foliage, especially the western spruce budworm and the Douglas-fir tussock moth.

WESTERN SPRUCE BUDWORM

HOSTS: Douglas-fir, all true firs, spruce, and larch.

Western spruce budworm is a small moth. In the caterpillar stage, it feeds on the needles of trees. Populations of this defoliating insect periodically rise to outbreak levels.

The weather naturally regulates this insect's population. During recent years, drought conditions have left trees severely water stressed and susceptible to insect infestations. Budworms grow more vigorously in stressed trees. If drought conditions continue, budworm populations can increase dramatically where there is an abundance of susceptible tree species. Forested stands, which are densely stocked with predominantly Douglas-fir or subalpine fir and are multi-storied, are at high risk to infestation.

Tree damage is caused by the budworm caterpillars (larvae) feeding on needles in the early spring through summer. Larvae primarily consume current-year foliage, but can move to older needles in extreme cases. Infested trees will appear to have a red luster when observed from a distance. Upon closer inspection, branch tips will be bare or covered with nests of silk webbing and dead needles. Several years of continued defoliation will reduce tree growth and development, and sometimes cause death. In addition, budworm defoliation stresses the trees and makes them more susceptible to bark beetle attack.

WESTERN SPRUCE BUDWORM ADULT AND PUPAL CASE

FEEDING LARVAE

Western spruce budworm populations can be reduced with insecticides. If you feel spraying is needed, contact your local State Forester (see page 12) for treatment recommendations. You may also contact a licensed, professional pesticide applicator. Promoting non-host species such as aspen or pines will reduce overall stand susceptibility.

TREE CROWN DAMAGE FROM FEEDING LARVAE

DOUGLAS-FIR TUSSOCK MOTH

HOSTS: Douglas-fir, all true firs, and spruce.

Feeding damage and light webbing from Douglas-fir tussock moth is similar to that of western spruce budworm, but the larva, egg masses, and cocoons are distinctly different. Most identifiable are the oldest larva which have four dense patches of yellowish brown hair (tussocks) and two hair 'horns' at the back and two at the front. Younger larva lack these long 'horn' tufts but will have the four tussocks. The youngest larva are a plain gray with long hairs. The adult male is a non-descript brown moth. The female does not have wings and is usually found near her cocoon.

In the fall, females lay egg masses in a gelatinous substance and attached to foliage, twigs, trunks, under limbs, or other objects near the tree. These eggs hatch in the spring when the buds on their host trees start to open. The early larva feed on this new foliage, often stringing a loose webbing from branch to branch. In late July-early August the larvae pupate and the new moths emerge about two weeks later to mate and start the process over.

DOUGLAS-FIR TUSSOCK MOTH DAMAGE TO TWIGS AND OVER LANDSCAPE

The most visible defoliation occurs in the later larval stages in July. Mature, dense stands with trees of different ages, especially in dry sites, are most often affected. High population levels (outbreaks) can last for 2-3 years; long enough to kill entire stands of host trees. Top kill and some tree mortality can occur in only one year of heavy defoliation. Non-fatal defoliation or continual low-level defoliation can also cause decreased growth and vigor, often making the trees more susceptible to bark beetle attacks (e.g. Douglas-fir beetle, spruce beetle, and fir engraver).

DOUGLAS-FIR TUSSOCK MOTH MALE AND FEMALE; EARLY STAGE LARVA; LATE STAGE LARVA WITH 'TUSSOCKS'

Challenges of a Bark Beetle Outbreak – What are Land Managers Doing?

FEDERAL AND STATE LAND MANAGERS

Effective management of bark beetle populations is a difficult challenge. Federal and State land managers know a great deal regarding characteristics that make stands susceptible to bark beetles and defoliators. Unfortunately, having this knowledge does not mean that they are able to prevent outbreaks.

The most effective way of dealing with bark beetle outbreaks over large, forested areas is through preventative vegetation management practices. Treating vast areas such as entire National Forests with chemicals to reduce bark beetle populations is not practical or feasible.

Land management planning is a required process for all Federal and State administered lands. Public involvement is a required – and encouraged – part of Federal planning efforts. During the Federal planning process, some areas are excluded from vegetation management (i.e. wilderness areas, roadless areas). Within these areas, treatments to manage an insect outbreak are often not available.

Where vegetation management activities are permitted, Federal and State land managers can reduce insect-related tree mortality. Examples of management activities that can reduce forest susceptibility to insect damage include:

- Remove some of the trees in dense stands through thinning to improve tree vigor and reduce susceptibility to bark beetles.
- Promote a diversity of tree species, which also reduces stand susceptibility to bark beetles.
- Promote a diversity of age classes (not always recommended for defoliators).
- Remove small pockets of bark beetle infested trees when they first appear in an area. This can be an effective way of suppressing populations. This method may not be effective in eliminating all beetles in an area if infested trees remain in susceptible sites.

Recent changes through the Healthy Forests Restoration Act of 2003 and the President's Healthy Forests Initiative, have given Federal land managers tools that will reduce delays and statutory barriers for projects which target improving forest health and reducing hazardous fuels. Federal land managers have used these tools to expedite projects aimed at reducing insect related mortality and thus decreasing hazardous fuels for wild fires.

PRIVATE LANDOWNERS

Each private landowner has different objectives for their property and trees. Each will have their own opinion about possible management techniques. Some will choose to do nothing; others will adopt aggressive bark beetle suppression strategies.

A neighbor who chooses not to remove beetle-infested trees will increase the probability that susceptible trees on adjacent property could be attacked. Obviously, these situations can become complicated. Tree removal options are not equally available to all landowners. Economics of the treatment may be a factor, especially for large properties. Site conditions, such as steep slopes, may make tree removal difficult.

Fortunately, using MCH caps for Douglas-fir beetle or Carbaryl insecticide for mountain pine beetle, Jeffrey pine beetle, spruce beetle, and pinyon ips, can be effective, preventative treatments for trees on your property; irregardless of what your neighbor chooses to do. However, treatments need to continue until the outbreak in your area collapses.

WHERE TO GO FOR HELP OR ADDITIONAL INFORMATION

ORGANIZATIONS

- For on-the-ground technical assistance with insect and forest management on private lands:
  - In Idaho, contact Jeff Fidgen, Idaho Department of Lands, (208) 666-8624, jfidgen@idl.idaho.gov, (http://www.idl.idaho.gov/Bureau/forasst.htm)
  - In Montana, contact Amy Kearney, Montana Department of Natural Resources, (406) 542-4283, (http://dnrc.mt.gov/forestry/assistance/pests/default.asp)
  - In Nevada, contact Gail Durham, Nevada Division of Forestry, (775) 684-2513 or 687-0431, gdurham@forestry.nv.gov, (http://agri.nv.gov/PLANT_Entomology_index.htm)
  - In North Dakota, contact Michael Kangas, North Dakota Forest Service, (701) 231-5936, Michael.Kangas@ndsu.nodak.edu
  - In Utah, contact Colleen Keyes, Department of Natural Resources Division of Forestry, Fire, and State Lands, (801) 538-5211, ColleenKeyes@utah.gov
  - In Wyoming, contact Les Koch, Wyoming State Forestry Division, (307) 777-5495, lkoch@state.wy.us

- For information on professional pesticide applicators and insecticide registration contact your local state Department of Agriculture, division of pesticide licensing. Web pages to assist you with the contacts are listed below:
  - Idaho: http://www.agri.idaho.gov (see noxious weed contacts)
  - Utah: http://ag.utah.gov/
  - Wyoming: http://wyagric.state.wy.us/techserv/tsindex.html
  - Montana: http://www.agr.state.mt.us/ (see pesticides, program contacts)
  - Nevada: http://agri.nv.gov/index_Plant2.htm or http://agri.nv.gov/PLANT_Chemistry_Index.htm
  - North Dakota: http://www.agdepartment.com/Programs/Plant/Pesticides.html (see laws and regulations for contacts)

- For general National Forest information, contact the National Forest directly
- For information on USDA FS Forest Health Protection for the Northern and Intermountain Region, visit http://www.fs.fed.us/r1-r4/spf/fhp/index.html
- Visit the FIREWISE™ program at www.firewise.org
- Additional pictures of the various trees and insects mentioned in this pamphlet can be found at www.bugwood.com

PUBLICATIONS

- A Field Guide to Diseases and Insect Pests of Northern & Central Rocky Mountain Conifers (http://www.fs.fed.us/r1-r4/spf/fhp/field_guide/index.htm)
- Forest Insect and Disease Management Guide (http://www.fs.fed.us/r1-r4/spf/fhp/mgt_guide/index.htm)
- Forest Insect and Disease Leaflets (FIDLs) are available for a variety of forest pests (http://www.na.fs.fed.us/spfo/pubs/fidl.htm)
- Using MCH to protect trees and stands from Douglas-fir beetle infestation (http://www.fs.fed.us/r1-r4/spf/fhp/publications/MCH_brochure/MCH_online.pdf)

The use of trade or firm names in this publication is for reader information and does not imply endorsement by the U.S. Department of Agriculture of any product or service.

THE ROLE OF FIRE

Dead trees with red needles, whether killed by bark beetles or other agents, are more flammable than live trees. However, once the needles are gone, the standing dead trees generally do not pose an increased risk of wildfire. As the trees eventually fall to the ground, increasing downed fuel loads have the potential to again increase fire severity.

Fire is a fundamental part of the natural ecosystem. The vegetation in the Intermountain West has evolved with fire and, in many cases, relies on fire to sustain its health and its presence on the landscape. However, fire around your home or other infrastructure is usually not desirable.

Research has shown that the most critical factors for a home surviving a wildfire are the construction of the home and the vegetation near the home.

FIREWISE™ is a multi-agency, non-profit program devoted to helping people and their property survive a wildfire. The program encourages developing a "defensible space" around your home. Information on how to improve the survivability of your home from wildfire can be found on a variety of *FIREWISE*™ websites.

Some general recommendations are:

1. Roofs should be made of non-flammable material.
2. Enclose places where fire embers could accumulate such as soffits and underneath porches.
3. Thin out dense trees or shrubs.
4. Remove brush or dried grasses close to your home.
5. Landscape with fire resistant plants.
6. Do not place flammable material such as firewood or above ground propane tanks near your home.

Firefighter safety is a primary consideration in any fire incident. Creating a "defensible space" will increase the chance that firefighters can safely protect your home.

For more information regarding protecting your home from wildfire, visit the FIREWISE™ website (see box at left) or contact your local fire department.

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Sudden Aspen Decline in Colorado

Forest Health Protection
Rocky Mountain Region
USDA Forest Service

2011 Feb. 1

What happened to aspen in the southern Rockies?

Aspen forests in many areas of western Colorado and adjoining states experienced widespread, severe, rapid branch dieback and mortality (Fig. 2). This phenomenon, termed "sudden aspen decline" (SAD), was first noticed in 2004 and increased rapidly through 2008 (Fig. 3). There was no notable increase in size of the affected area after 2008.

Is this any different from change that has always happened to forests?

Aspen forests are dynamic, and have always changed in response to climate, disturbance, and succession. However, the recent event is different from the usual changes that have been seen during the last hundred years for a number of reasons:

Landscape scale. The change occurred on a landscape scale, as opposed to the individual stand-level changes we have typically seen in the past.

Rapidity of mortality. The damage increased dramatically over a few years, as opposed to the typical changes that we see over decades.

Mortality agents. The relative importance of pathogens and insects associated with SAD are different from those typically associated with aspen mortality in Colorado.

What causes SAD?

Three interacting groups of factors are involved:

Predisposing factors. Low elevations, upper slope positions, south to west aspects, and open stands are vulnerable to warm drought.

Inciting factors. Hot, dry conditions of 2000-2003 weakened vulnerable stands.

Contributing factors. Secondary insects and diseases can kill trees under stress. These include Cytospora canker, poplar borer, bronze poplar borer, and two aspen bark beetle species.

How do tree age and prior management affect SAD?

In southwestern Colorado, among overstory trees (> 12 cm DBH), there was no correlation between SAD and tree age or size. However, stems < 12 cm DBH were unaffected. Where aspen was cut in the past, healthy green regenerated patches remained beside dying, unmanaged stands (Fig. 1). Diversification of age structure through management increased the resilience of the landscape to SAD.

What happened to roots and vegetative regeneration?

Roots in many affected stands were in poor condition (Fig. 4) and, probably as a consequence, there was no significant regeneration response to overstory loss from SAD (Fig. 5). Future stands may be more open than the ones that existed prior to SAD. Where sprouting is poor and ungulate browsing or other factors suppress sprouts, other vegetation types may dominate the site and the aspen clone may die.

Is SAD related to climate change?

The impacts of SAD are consistent with projected effects of climate change on aspen. The inciting drought was called a "global-change-type drought" because it was both unusually hot and dry. SAD occurred mostly in areas projected to become climatically unsuitable for aspen early in the 21st century (Fig. 2), in areas with the most severe moisture deficits. In Colorado, 2/3 of the aspen-suitable area is projected to become unsuitable by 2060, and the lower elevation of suitable climate is projected to rise nearly 2,500 feet by 2090.

Is there anything we can do to stop it, or to help stands recover?

In stands with active mortality, SAD may continue, and practical methods to protect the overstory are not available. Where clones still retain some vigor and energy, but are deteriorating, regeneration may be stimulated by burning, cutting or other stand manipulation before root systems are too weak to respond. Work in Utah suggests that stands with less than 50% mortality may be vigorous enough to respond to such disturbance. Preliminary results of treatments in Colorado generally support this. In the long run, more young stands on the landscape will increase the likelihood of aspen presence following future warm droughts of this sort.

Figure 1. The healthy, fine-grained canopy in the center of the picture is aspen that sprouted after harvest in 1984. Surrounding, older aspen is dead or dying. (Terror Creek, Gunnison NF, 2007)

What is being done?

Aerial survey. Aerial survey of forested land is conducted annually in the Rocky Mountain Region by Forest Health Protection and cooperators. We continue to monitor aspen conditions annually.

Analysis of landscape and survey data. Papers published in the journal FOREST ECOLOGY AND MANAGEMENT document the state of knowledge in 2008 and 2010, based largely on southwestern Colorado. Colorado State University and the Forest Service are studying plots in the rest of Colorado, Wyoming, and South Dakota.

Cooperation. The USDA Forest Service cooperates with other federal agencies, Colorado State Forest Service, legislators, and local governments to share information on forest health issues like SAD and their management implications, and to look for opportunities for partnerships, collaboration, and funding.

Management activities. National forests are actively addressing this issue. An Applied Silvicultural Assessment at Terror Creek, Paonia District, Gunnison National Forest, is being conducted in cooperation with Colorado State University and USFS Rocky Mountain Research Station.

Why is aspen so important?

Water. Aspen forests often yield more and higher-quality water than conifer forests. They favor riparian and aquatic habitats, reduce erosion, and moderate streamflows.

Biodiversity and wildlife habitat. Aspen forests are very diverse. Many species are specifically associated with aspen. Aspen provides unique wildlife habitat and good forage for elk and other ungulates.

Beauty and Tourism. Esthetically, aspen contribute a major share of Colorado's scenic beauty. Tourism contributed $7.3 billion and 200,000 jobs to Colorado's economy in 2004 (Colorado Tourism Office).

Wood products. Several communities have industries that depend on aspen wood, with products such as paneling and excelsior.

Contacts

Susan Gray, Group Leader, Forest Health Protection, Rocky Mountain Region; susangray@fs.fed.us, 303-275-5061

Roy Mask, Supervisor, Gunnison Service Center, Forest Health Protection, Rocky Mountain Region; rmask@fs.fed.us, 970-642-1133

Rehfeldt GE, Ferguson DE, Crookston NL. 2009. Aspen, climate, and sudden decline in western USA. Forest Ecology and Management 258:2353-2364.

Worrall JJ, Egeland L, Eager T, Mask RA, Johnson EW, Kemp PA, Shepperd WD. 2008. Rapid mortality of *Populus tremuloides* in southwestern Colorado, USA. Forest Ecology and Management 255:686-696.

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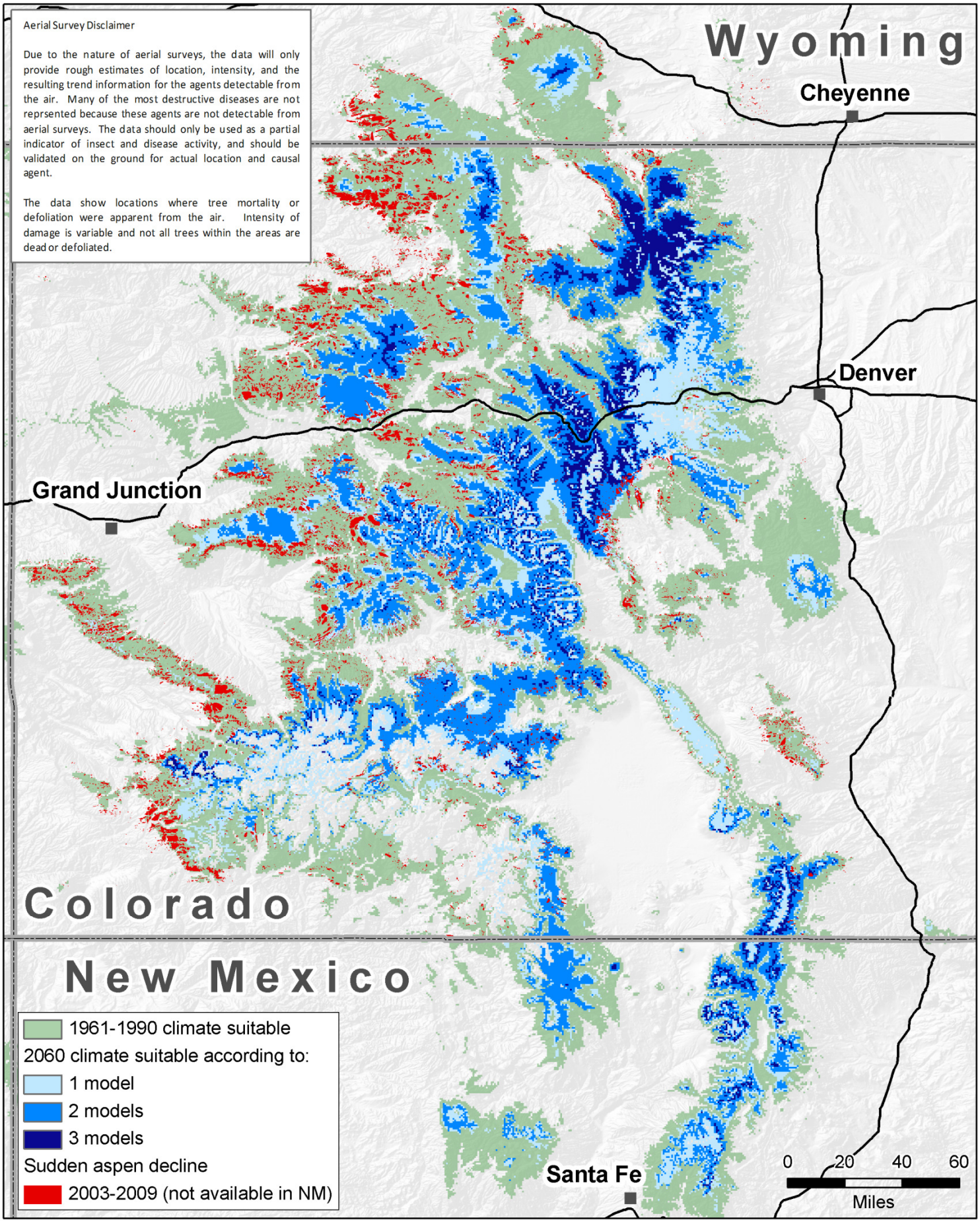

Figure 2. Of the area with climate suitable for aspen, ⅔ is projected to be lost by 2060. SAD occurred largely in those areas. Suitable climate areas based on model data of Rehfeldt et al. 2009.

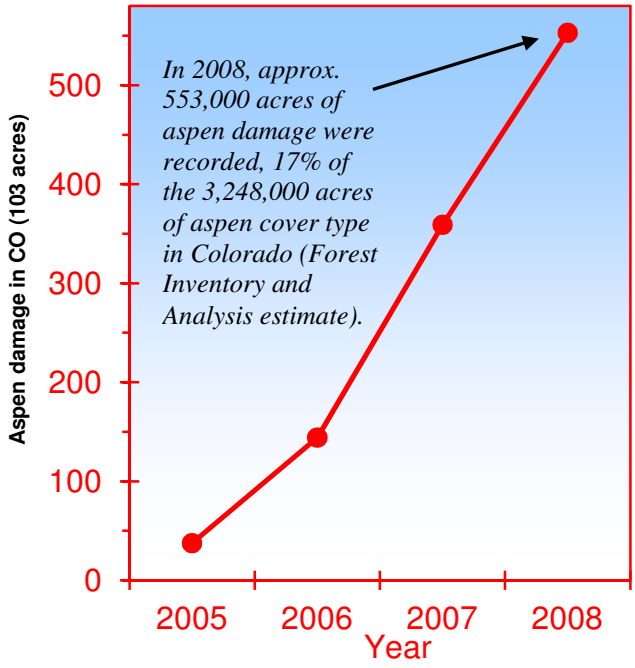

Figure 3. Aspen damage increased rapidly in Colorado from 2004-2008.

The 2008 aerial survey used different procedures to record aspen damage, so trends including 2008 should be interpreted cautiously. Due to the nature of aerial surveys, the data provide only rough estimates of intensity and the resulting trend information. Not all aspen acreage was surveyed every year, so the figures are underestimates.

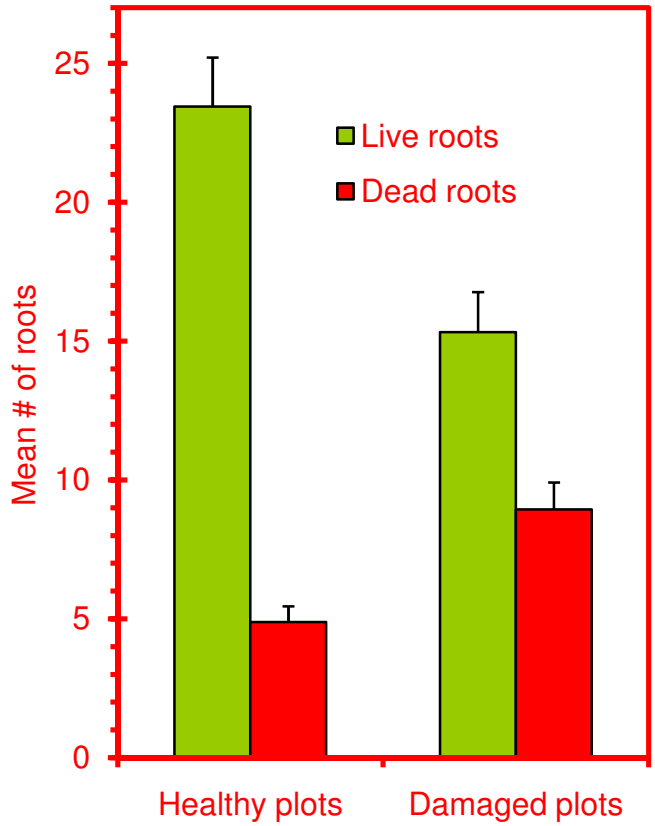

Figure 4. Compared to healthy plots, damaged plots had significantly fewer live roots and significantly more dead roots.

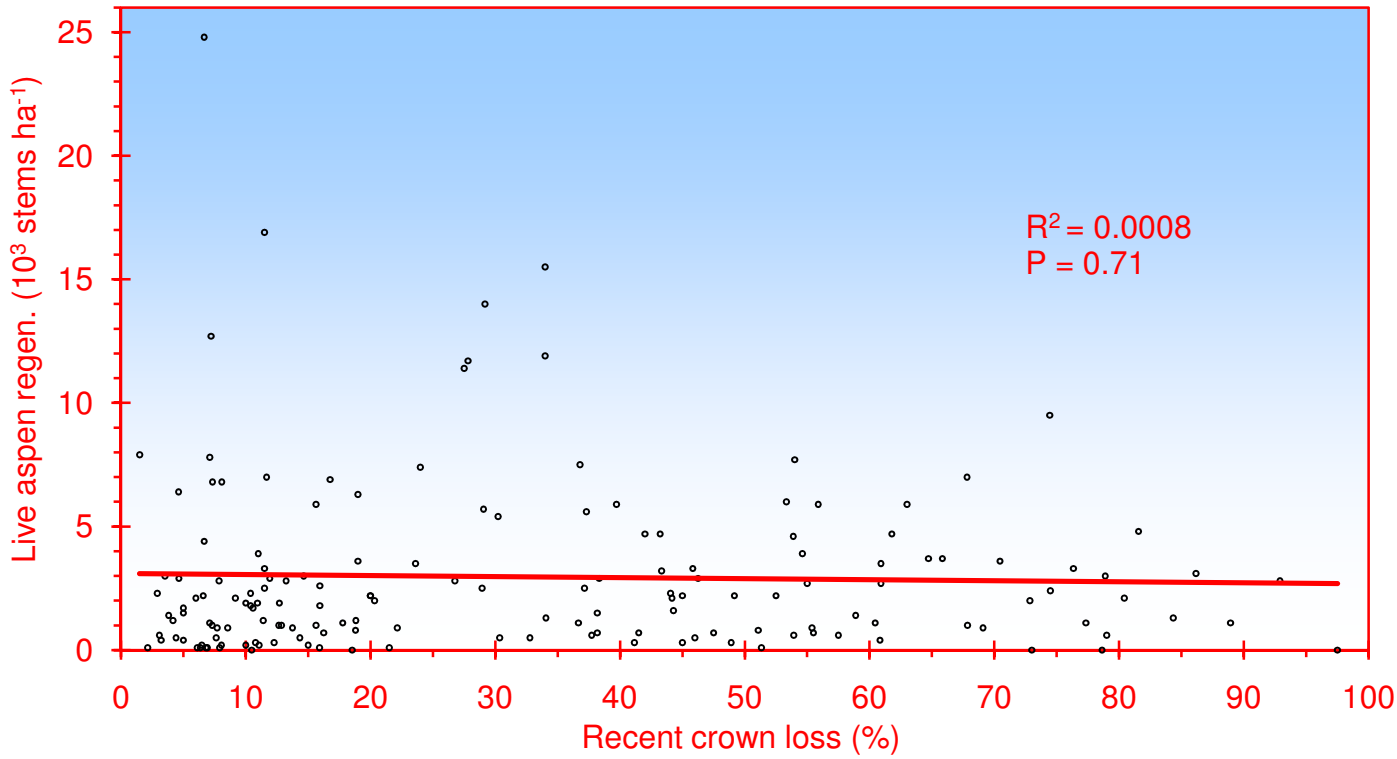

Figure 5. No significant regeneration response to crown loss (including mortality) associated with SAD in 160 plots.

FORESTRY

Insects and Diseases Associated with Forest Fires

no. 6.309

by D. Leatherman and I. Aguayo[1]

Quick Facts...

Wood borers are instrumental in beginning the breakdown processes that prepare nutrients for reuse by subsequent plants.

The presence of bark beetles, including Ips, is indicated by a brown boring dust located at the base of the tree or masses of resin (pitch tubes) on the trunk.

Bark beetle activity in burn areas should be monitored and managed to keep losses within acceptable limits.

Wood borers only attack highly-stressed trees or wood pieces with the bark still attached. The presence of wood borers is not a major concern to healthy trees or other wood (such as furniture).

This fact sheet discusses: organisms and damage commonly seen during or immediately after a fire; and organisms and damage associated with fire-affected trees (including salvaged logs and firewood) within the first few years after a fire event.

Adult longhorned beetle.

During the fire and "mop-up" operations, many firefighters report swarming insects. Collectively termed "fire bugs," these insects are harmless to people and are most often some type of wood borer. The most common wood borers are longhorned beetles (Family Cerambycidae), metallic wood boring beetles (Family Buprestidae, with members of the genus *Melanophila* being *the* "fire bug"), and wood wasps (also called horntails, Family Siricidae). Many wood borers use smoke as a pathway to the recently-damaged or killed trees which they favor. This is their ecological role and they are instrumental in beginning the breakdown processes that prepare nutrients for reuse by subsequent plants.

Bark Beetles

Within a year or two following the fire, many other organisms respond to the fire-induced changes. Insects such as bark beetles colonize burned trees that still have a viable inner bark. These beetles, including those in the genera *Ips* ("engraver beetles") and *Dendroctonus* (including Douglas-fir beetle, red turpentine beetle, and mountain pine beetle), can kill trees that otherwise would not have died from the fire affects alone. A brown boring dust located at the base of the tree or masses of resin (pitch tubes) on the trunk indicates the presence of these insects. Homeowners may want to

Adult metallic wood borer.

Adult wood wasp (or horntail).

Colorado State University Cooperative Extension

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www.ext.colosate.edu

Ips boring dust.

Adult wood borer (*Monochamus scutellatus*).

Cerambycid boring dust.

Decay fungus conks.

Dendroctonus pitch tubes.

Larval cerambycids.

preventively spray high-value conifers damaged – but not killed – by fire to prevent bark beetle attack. Also, bark beetles can accumulate in burned trees and then spread to nearby healthy trees causing even more damage. Therefore, bark beetle activity in burns should be monitored and managed to keep losses within acceptable limits.

Wood Borers

Wood borers develop inside damaged trees and emerge one to several years after the initial egg-laying. The large, white, segmented wood borer larvae are responsible for the munching sounds often reported by visitors to burned areas or by owners of salvaged logs and firewood. Sometimes the noise caused by their jaws scraping on wood under the bark can be heard up to several yards away! In addition to these tell-tale sounds, wood borer activity within snags or cut wood may be indicated by whitish, powdered or granular, boring dust accumulating in bark crevices and at the tree base. Wood borers only attack highly-stressed trees or wood pieces with the bark still attached, so the presence and emergence of wood borers is not a major concern to healthy trees or other wood (such as furniture). Their only negative impacts are lumber degrade in special situations and misunderstandings about their somewhat ominous appearance.

Other Insects and Fungi

Insects to expect in fire-killed trees following bark beetles and borers are carpenter ants. Unlike termites, they do not eat the wood but use semi-rotten areas for colony nests.

Many fungi also respond after wildfires. Taking up residence in wounds directly induced by the fire or created by wood borers, decay fungi quickly colonize fire trees. The spore-producing bodies of these fungi (conks) appear as woody projections or “shelves.” Mushrooms or conks on the bark of a standing snag or downed log indicates rotten wood for one to several feet above and below it.

Many conifer forest burns experience the widespread appearance of pine fire fungus (*Rhizina undulata*). This fungus forms irregular, oval, brown fruiting bodies on the charred soil. It may be abundant but not very easy to see. Its purpose is to help process the duff and upper soil layers, but it also can cause a root disease of conifer seedlings trying to form the next forest.

Mushroom found in openings.

Internal decay.

Pine fire fungus on forest floor.

Also, other fungi and mushrooms typical of so-called disturbed or "early succession" sites may appear. Collectors of edible fungi should practice caution and normal identification standards before eating anything found at fire sites.

Of course, many other organisms can be associated with fire – this publication gives just the highlights. Please direct further questions to your local Colorado State Forest Service office.

References

USDA Natural Resources Conservation Service, New Mexico State Office, 6200 Jefferson NE, Albuquerque, NM 87109; (800) 410-2067; www.nm.nrcs.usda.gov:

- USDA NRCS fact sheet, Vegetation Establishment for Soil Protection
- USDA NRCS fact sheet, Temporary Erosion Control Around the Home Following a Fire
- USDA NRCS fact sheet, Straw Mulching
- USDA NRCS fact sheet, Contour Log Terraces
- USDA NRCS fact sheet, Straw Bale Check Dam
- USDA NRCS fact sheet, Silt Fence
- USDA NRCS fact sheet, Drainage Tips

From Colorado State Forest Service, Colorado State University, Fort Collins, CO 80523-5060; (970) 491-6303; Fax (970) 491-7736; www.colostate.edu/Depts/CSFS:

- 6.302, *Creating Wildfire Defensible Zones*
- 6.303, *Fire-Resistant Landscaping*
- 6.304, *Forest Home Fire Safety*
- 6.305, *FireWise Plant Materials*
- 6.306, *Grass Seed Mixes to Reduce Wildfire Hazard*
- 6.307, *Vegetative Recovery after Wildfire*
- 6.308, *Soil Erosion Control after Wildfire*

FIREWISE is a multi-agency program that encourages the development of defensible space and the prevention of catastrophic wildfire.

This fact sheet was produced in cooperation with the Colorado State Forest Service.

[1]*Written by D. Leatherman, Colorado State Forest Service entomologist (retired). Reviewed by I. Aguayo, Colorado State Forest Service entomologist.*

Colorado State University, U.S. Department of Agriculture and Colorado counties cooperating. Cooperative Extension programs are available to all without discrimination. No endorsement of products mentioned is intended nor is criticism implied of products not mentioned.

What is prescribed fire?

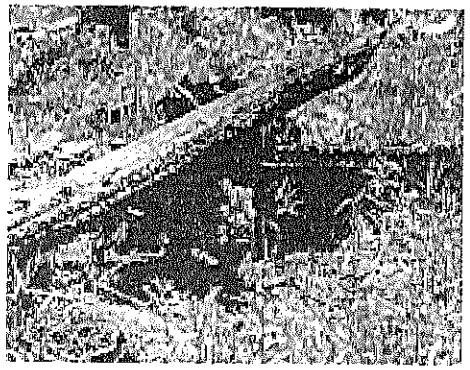
Prescribed fire is the controlled application of fire to the land to accomplish specific land management goals. Ignitions may be either human- or naturally caused. Benefits include:

- **Reducing fuel build-up**

Dead wood, overcrowded, unhealthy trees, and thick layers of pine needles can all contribute to catastrophic wildfires.

- **Prepares the land for new growth**

When excess vegetation or needle layers are burned off, nitrogen and other nutrients are released into the soil and become available for new plants to grow.



- **Helps certain plants/trees germinate**

Many native plant and forest communities have adapted to fire for their germination and growth. Seed contact with bare soil (such as that exposed by a fire) is necessary for some species to naturally regenerate. (Lodgepole pine is one such example.)

- **Naturally thins overcrowded forests**

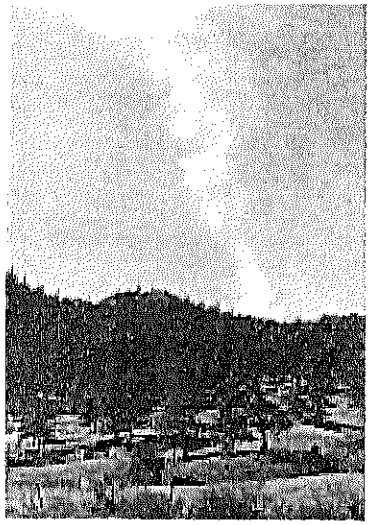
Historically, natural fire thinned Colorado's forests. Thinned forests can recover faster and are more resistant to insect and disease attacks. Currently, most of Colorado's mature forests are overcrowded, resulting in a lack of vigor and health.

- **Creates diversity needed by wildlife**

Fire creates a varied land and vegetation pattern that provides diverse habitat for plants and animals. Grazing wildlife benefit from new growth as shrubs produce succulent edible leaves when resprouting after a fire.

What about the smoke?

Controlling where the smoke will go is an important part of every prescribed burn. Before each burn, land managers look carefully at what they plan to burn and the proximity of houses, roads, and other smoke sensitive sites to the planned burn area. The burn prescription is then written to mitigate negative impacts of smoke, especially to



individuals who may be smoke-sensitive. Smoke, however, is a natural byproduct of fire and some amounts are unavoidable.

Periodic prescribed burns prevent heavy fuel accumulation that would send a larger amount of smoke into the air should an uncontrolled wildfire occur.

What is a burn prescription?

A burn prescription helps ensure that the objectives of the burn are met, as well as addressing safety issues. Land managers determine if the resource would benefit from a slow, consuming fire versus a hotter fire. The burn prescription determines the environmental conditions necessary for meeting resource objectives in a safe, effective manner.

The prescription includes how the fire will be ignited and contained and what resources, such as fire trucks and personnel, must be on site before burning may begin. Burning permits are completed when required.

Who does the burning?

Prescribed burns are conducted by trained fire management professionals who have studied fire behavior and fire control techniques. These prescribed burn professionals help ensure the safety of the burn crew, nearby residents, and property.

What can a homeowner expect?

Prescribed fire provides many important benefits, but some short-term undesirable aspects may also exist.

- **Smoke:** Fire management professionals make great efforts to reduce smoke impacts; however, some smoke will be unavoidable.
- **Smell:** A campfire smell may be present for several days after the burn.
- **Scorching:** Some scorching of lower tree branches (or even the entire tree) is to be expected. After the fire some needles will turn orange and eventually drop from the tree.

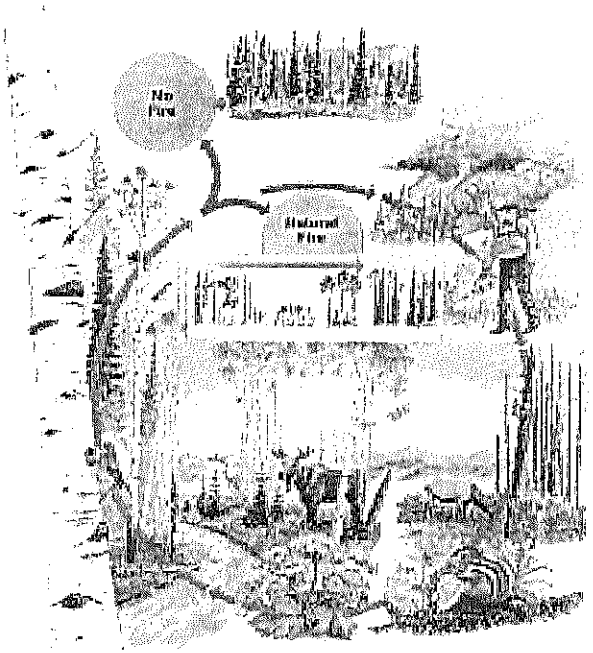
- **Weeds:** Weeds commonly invade disturbed areas and can be expected at burned sites.

Barren look: Immediately after a burn, the treated site may appear charred and lifeless. This temporary condition will be replaced by the resprouting of grasses, forbs, shrubs, and seedling trees.

For more information contact your local Colorado State Forest Service office or local fire department.

Prescribed Fire in Colorado

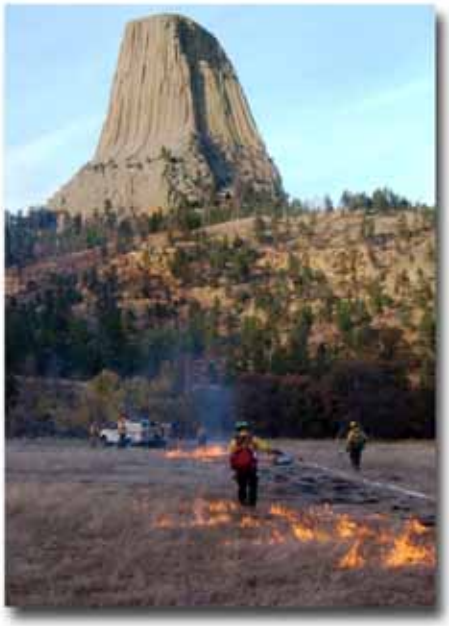
Fire plays an important role in the natural cycle of life in the west. A non-catastrophic fire, whether prescribed or natural, has many benefits.



Fire's Role in Nature

Interagency Prescribed Fire

Planning and Implementation Procedures Guide



PRESCRIBED FIRE PLAN

ADMINISTRATIVE UNIT(S): _____

PRESCRIBED FIRE NAME: _____

PREPARED BY: _____ DATE: _____
Name & Qualification Currency

TECHNICAL REVIEW BY: _____ DATE: _____
Name & Qualification Currency

COMPLEXITY RATING: _____

MINIMUM RXB REQUIREMENT: _____

APPROVED BY: _____ DATE: _____
Agency Administrator

July 2008

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Foreword

Interagency Prescribed Fire Planning and Implementation Procedures Guide (2008 Guide) provides standardized procedures, specifically associated with the planning and implementation of prescribed fire. These procedures meet all policy requirements described in the 2003 ***Interagency Strategy for the Implementation of Federal Wildland Fire Management Policy.*** The 2008 Guide provides unified direction and guidance for prescribed fire planning and implementation for the Department of the Interior's Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), the National Park Service (NPS), the United States Fish and Wildlife Service (USFWS) and the United States Department of Agriculture Forest Service (USDA FS) as well as National Wildfire Coordinating Group (NWCG) partners the National Association of State Foresters (NASF) and the United States Fire Administration (USFA).

Prior to implementing Prescribed Fire under the standards in the 2008 Guide, local units must have ensured compliance with National Environmental Policy Act (NEPA), National Historical Preservation Act (NHPA) and Endangered Species Act (ESA) requirements.

This 2008 Guide meets requirements of Interagency Fire Directorate task to develop common language and unified direction or guidance for agency/bureau manuals, directive handbooks, and guidelines to complete final implementation of this policy.

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Executive Summary

Fire is an essential ecological process in many fire dependent ecosystems. In large areas of the country, fire exclusion from these ecosystems has led to unhealthy forest, woodland and rangeland conditions. These areas are at risk of intense, severe wildfires that threaten communities and cause significant damage to key ecological components.

As one component of fire management, prescribed fire is used to alter, maintain, or restore vegetative communities; achieve desired resource conditions; and to protect life, property, and values that would be degraded and/or destroyed by wildfire.

Federal Prescribed Fire Programs are guided by the principles of the 1995 Federal Wildland Fire Management Policy and Program Review and the 2001 update. Collectively these principles establish that wildfire suppression, wildland fire use, and prescribed fire programs be implemented equally, consistently and concurrently, as a means to avoid fire risks. The policy emphasizes firefighter safety as a consideration in planning and a priority in operations (Wildland Fire Management Policy, June, 2003).

This guide supports the Interagency Strategy for the Implementation of Federal Wildland Fire Management Policy. It provides unified direction and guidance for prescribed fire planning and implementation for the Department of the Interior's Bureau of Indian Affairs (BIA), Bureau of Land Management (BLM), the National Park Service (NPS), the United States Fish and Wildlife Service (USFWS) and the United States Department of Agriculture Forest Service (USDA FS).

This guide partially replaces the original Wildland and Prescribed Fire Management Policy Implementation Procedures and Reference Guide (USDI/ USDA 1998)[1] which established consistent agreement between agencies regarding federal policy direction related to prescribed fire planning and implementation.

[1] Other documents that replace this 1998 document are the *Interagency Strategy for the Implementation of Federal Wildland Fire Management Policy*, June 20, 2003 and *Wildland Fire Use Implementation Procedures Reference Guide, May 2005*

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Introduction

Purpose

The purpose of this guide is to provide consistent interagency policy, establish common terms and definitions and identify planning and implementation processes for prescribed fire.

The guide describes what is **minimally** acceptable for prescribed fire planning and implementation. Agencies may choose to provide more restrictive standards and policy direction, but must adhere to these **minimums**.

Scope

This guide provides policy and direction to implement existing federal policy and has been developed with tribal, state, county, and local cooperators in mind. While some of these guidelines will not fit all non-federal cooperators, the intent is to include everyone by establishing a planning and implementation guide that might result in that outcome.

Prescribed Fire Program Goals

Interagency Prescribed Fire Program goals are to:

- Provide for firefighter and public safety as the first priority.
- Ensure that risk management is incorporated into all prescribed fire planning and implementation.
- Use prescribed fire in a safe, carefully planned, and cost-efficient manner.
- Reduce wildfire risk to communities, municipal watersheds and other values and to benefit, protect, maintain, sustain, and enhance natural and cultural resources.
- Utilize prescribed fire to restore natural ecological processes and functions, and to achieve land management objectives.

Authorities

All use of prescribed fire will be supported by a Land/Resource Management Plan (L/RMP) and/or Fire Management Plans (FMP). Prescribed fire projects can only be implemented through an approved Prescribed Fire Plan. Specific authorities exist for each agency to utilize prescribed fire (See Appendix A). All project decisions to use prescribed fire are subject to the agency's analysis, documentation, and disclosure requirements for complying with the National Environmental Policy Act (NEPA).

During prescribed fire planning and operations, all federal agencies will accept each other's standards for qualifications. The minimum qualifications standard is National Wildland Fire Coordinating Group (NWCG) Wildland and Prescribed Fire Qualifications System Guide, 2000 (PMS 310-1). State, local cooperators and contractors working on federal agency prescribed fires must meet the NWCG PMS 310-1 standards unless local agreements or contracts specify otherwise.

The main reference glossary for this guide is the NWCG glossary, which is updated periodically: http://www.nwcg.gov/.

This guide is not intended to address interagency business rules. Reference individual agency's business rules for direction.

Prescribed Fire Planning Process

Common planning documents to ensure quality prescribed fire plans include:

Land/Resource Management Plan (L/RMP)

Overall direction is provided to the Wildland Fire Management Program by Land/Resource Management Plans (L/RMP). These plans serve as the document to initiate, analyze, and provide the basis for using prescribed fire to meet resource management objectives.

Fire Management Plan (FMP)

All burnable acres will be covered by a Fire Management Plan (FMP). The FMP is the cornerstone plan for managing a Wildland Fire Management Program and should flow directly from the L/RMP. FMPs may be developed for a Fire Planning Unit (FPU) that crosses jurisdictional boundaries. Where the Wildland Fire Management Program crosses jurisdictional boundaries, or where

program coordination is essential, the FMP will require interagency coordination. Most FMPs are anticipated to fall into this category.

National Environmental Policy Act (NEPA)

Resource and prescribed fire objectives for specific prescribed fire projects are derived from the NEPA analysis. **The entire prescribed fire project area must be analyzed under NEPA.** NEPA documents that identify and analyze the effects of using or not using prescribed fire treatment projects may include Environmental Impact Statements (EIS), Environmental Assessments (EA), and Categorical Exclusion (CE).

Other authorities that may be utilized to guide analysis and determination of NEPA compliance are Healthy Forest Restoration Act (HFRA), Healthy Forest Initiative (HFI), and the Tribal Forest Protection Act (TFPA).

Prescribed fire planning and related NEPA analysis should always occur at the largest possible spatial and temporal scales.

Implementation Organization and Qualifications

During prescribed fire planning and operations, all federal agencies will accept each other's standards for qualifications. The minimum qualifications standard is National Wildland Fire Coordinating Group (NWCG) Wildland and Prescribed Fire Qualifications System Guide, (PMS 310-1). State, local cooperators and contractors working on federal agency prescribed fires must meet the NWCG PMS 310-1 standards unless local agreements specify otherwise. No less than the organization described in the approved Prescribed Fire Plan may be used for implementation. The complexity of each prescribed fire or phase of fire(s) determines the organization(s) needed to safely achieve the objectives specified in the Prescribed Fire Plan.

Minimum Supervisory Qualifications determined by prescribed fire complexity:

Table 1. Qualifications requirements related to Prescribed Fire Complexity.

	Complexity		
Position	**High**	**Moderate-Low**	**Low**
RXM1	Optional	Optional	Optional
RXM2	Not Allowed	Optional	Optional
RXB1	Required	Optional	Optional
RXB2	Not Allowed	Required	Optional
RXB3	Not Allowed	Not Allowed	Required
FIRB	Optional	Optional	Optional
Holding Specialist: Holding functions will be managed by personnel qualified at the appropriate ICS wildland fire operations position as required by complexity, assigned resources and operational span of control. For some projects, there may be no holding requirements or the holding duties are assumed by the Burn Boss.			

High, Moderate, and Low complexity prescribed fires are determined through the required NWCG Prescribed Fire Complexity Rating System Guide.

Prescribed Fire Burn Boss Type 3 (RXB3):

An RXB3 will only be allowed to implement low complexity prescribed fires where the final complexity is rated low.

The requirements for Prescribed Fire Burn Boss Type 3 are:

Table 2: Requirements for Prescribed Fire Burn Boss Type 3

Training:	Required: S-290 Intermediate Wildland Fire Behavior Suggested: S-234 Ignition Operations
Prerequisite Experience:	Incident Commander, Type 5 **OR** Advanced Firefighter/Squad Boss **AND** Satisfactory position performance as a Prescribed Fire Burn Boss Type 3
Physical Fitness:	Moderate
Other Position Assignments that will Maintain Currency:	Prescribed Fire Burn Boss Type 2 Prescribed Fire Burn Boss Type 1 Fire Use Manager Type 1 Fire Use Manager Type 2 Prescribed Fire Manager Type 1 Prescribed Fire Manager Type 2

Responsibilities

Prior to prescribed fire implementation, thorough planning and review processes must be conducted. All prescribed fire actions must be developed from resource/fire management objectives carried forward from FMP's and/or L/RMP's. A specific implementation plan for each prescribed fire must be completed, reviewed, and approved before ignition can begin.

The Agency Administrator has final approval authority for all Prescribed Fire Plans, unless special circumstances warrant higher review and concurrence (such as may occur during higher Preparedness Levels or for extremely large, complex projects). Although the Agency Administrator has final approval authority for the Prescribed Fire Plan and the Agency Administrator "GO/NO-GO" checklist, the Prescribed Fire Burn Boss has the responsibility to make the on-site tactical "GO/NO-GO" decision. The Prescribed Fire Burn Boss ensures that all prescription, staffing, equipment, and other plan specifications are met before, during, and after the prescribed fire.

Every Prescribed Fire Plan must receive a technical review. The Technical Reviewer and Prescribed Fire Plan Preparer must be qualified or have been previously qualified as a Prescribed Fire Burn Boss at an experience level equal to or higher than the complexity being reviewed. Either **the Prescribed Fire Plan Preparer or Technical Reviewer must be currently qualified, less physical fitness requirement.**

Only a RXB1 can review plans at high complexity. An RXB2 can review plans of moderate to low complexity. An RXB3 is allowed to function as a Prescribed Fire Plan Preparer for a low complexity plan, but not a Technical Reviewer.

Agency or individual unit policy may dictate additional reviews. Interagency Prescribed Fire Plans require approval from all appropriate Agency Administrators and a technical review. Listed below are the prescribed fire and implementation position roles and responsibilities:

Agency Administrator

For the purposes of this document, the Agency Administrator is defined as the Line Officer (or designee) of the agency or jurisdiction that has responsibility for the prescribed fire. These usually include the: NPS Park Superintendent, BIA Agency Superintendent, USFS Forest Supervisor/District Ranger, BLM District/Field Office Manager, FWS Project Leader and/or Refuge Manager, State Forest Officer, and/or Fire Chief.

The Agency Administrator is responsible to:

1. Approve Prescribed Fire Plans. When approving a plan, understand the risks associated with it. Ensure that the plan has been reviewed and recommended for approval by the Technical Reviewer who was not the primary preparer of the plan.
2. Ensure that only trained and qualified personnel participate in the implementation portion of the prescribed fire.
3. Ensure that projects are monitored, evaluated, and documented in the project file.
4. Sign, date, and provide an expiration date for the approval to burn on the Agency Administrator GO/NO-GO Checklist (Reference Burn Plan Template, Appendix B).
5. Understand and approve the Complexity Analysis (PMS 424).
6. Ensure that all prescribed fires are conducted in accordance with the approved implementation plan and established standards and guidelines.
7. Ensure that periodic reviews and inspections of the Prescribed Fire Program are completed.
8. Determine if and when the Agency Administrator is to be notified that contingency actions are being taken.
9. Report all wildfires resulting from prescribed fires through the chain of command.

10. Declare a prescribed fire a wildfire (if necessary and if responsibility is assigned in the plan).
11. Ensure that prescribed fires declared as wildfires are reviewed according to established guidelines.
12. Ensure that prescribed fires which receive a National Ambient Air Quality Standards (NAAQS) Notice of Violation (NOV) are reviewed according to established guidelines

Technical Reviewer

The Technical Reviewer is responsible for reviewing each Prescribed Fire Plan element for content as well as evaluating the risk and Complexity Analysis to ensure that the stated goals and objectives can be safely and successfully achieved when properly implemented. The Technical Reviewer shall be qualified or previously qualified as a Burn Boss at or above the level of project complexity. At a minimum, NWCG qualifications will be accepted. The Technical Reviewer should have local knowledge of the area, experience burning in similar fuel types, and/or conduct an on-site review. **The Technical Reviewer must be someone other than the primary preparer of the plan.** An off-unit technical review is encouraged to provide an additional independent perspective. It is acceptable for other specialists to review certain portions of the plan however; a primary Technical Reviewer must be designated as technical review signatory. For example, a fire behavior analyst may review the fire behavior calculations; the aviation manager may review the air operations plan; and/or a resource specialist may review impacts to their resource of interests. It is recommended that at least once every year, each unit should send a moderate or high complexity Prescribed Fire Plan off-unit for technical review.

The Technical Reviewer is responsible to:

1. Ensure that Prescribed Fire Plans meet agency policy and direction.
2. Ensure that the Complexity Analysis accurately represents the project, so the Agency Administrator understands the identified risks and the mitigating measures enacted. This may require on-site review in Wildland Urban Interface (WUI) or high complexity situations by the Technical Reviewer.
3. Check the prescription parameters against the fuel types to ensure that the project as planned has a reasonable chance of meeting the resource management objectives.
4. Ensure that the fire behavior calculations and/or prescription parameters are appropriate and within the acceptable range.
5. Ensure that the ignition, holding and contingency plans are consistent with the predicted fire behavior.
6. Complete and sign the Technical Review Checklist (See Burn Plan Template, Appendix B) and the Prescribed Fire Plan signature page.

Prescribed Fire Plan Preparer

For the purpose of this document, the Prescribed Fire Plan Preparer is defined as the individual responsible for the preparation of the Prescribed Fire Plan. Several people may be involved in the preparation of the Prescribed Fire Plan, but the Prescribed Fire Plan Preparer is responsible for the final plan content. The primary preparer of the Prescribed Fire Plan will sign the signature page.

The preparer is responsible to:

1. Prepare the Prescribed Fire Plan in accordance with this guide's policy and direction.
2. Coordinate with the resource management and/or technical specialists to ensure that the plan meets management and operational objectives.
3. Interact with the Technical Reviewer to ensure that all plan elements are adequately addressed.
4. Complete and sign the Complexity Analysis.

Prescribed Fire Burn Boss (RXB1/RXB2/RXB3)

The Prescribed Fire Burn Boss is responsible to the Agency Administrator, Prescribed Fire Manager, or FMO/local fire management

organization for implementing the Prescribed Fire Plan.

The Prescribed Fire Burn Boss is responsible to:

1. Review the Prescribed Fire Plan prior to implementation and ensure all required elements and objectives are addressed.
2. Inspect the burn unit to validate Prescribed Fire Plan elements including areas of special concern as well ensuring that holding/contingency plans adequately address expected fire behavior outside the unit(s).
3. Obtain current weather and smoke management forecasts, updates, and special advisories from a meteorologist.
4. Maintain communication with the Agency Administrator, Prescribed Fire Manager, or FMO/local fire management organization.
5. Ensure that the Agency Administrator GO/NO-GO Checklist is valid (See Burn Plan Template, Appendix B)
6. Take to the field those portions of the Prescribed Fire Plan necessary for completing the briefing and safe project implementation.
7. Complete and sign the Prescribed Fire GO/NO-GO Checklist (See Burn Plan Template, Appendix B).
8. Ensure availability of any contingency resources and management of those resources if deployed.
9. Ensure that all operations are conducted in a safe manner and in accordance with the approved plan and established standards and guidelines.
10. Verify qualifications of all assigned personnel. Conduct the personnel/safety briefing to ensure a safe operation.
11. Conduct the test fire and document the results.
12. Supervise assigned personnel and direct the ignition, holding and monitoring operations. The Prescribed Fire Burn Boss will be responsible for implementation including mop-up and patrol unless otherwise assigned to other qualified personnel.
13. Declare the prescribed fire out unless the responsibility for it is formally passed to another Prescribed Fire Burn Boss, Prescribed Fire Manager or the local fire management organization.
14. Determine when the prescribed fire is not within prescription parameters (both short and long term) or is not meeting objectives.
15. Declare a prescribed fire a wildfire (if necessary and if responsibility is assigned in the plan).
16. Manage the incident or oversee the transition to another Incident Commander if an escape occurs.
17. Ensure that reports are completed.
18. Coordinate with adjacent landowners, cooperators and permittees as designated in the Prescribed Fire Plan.

Fire Management Officer (FMO)/ Fire Program Manager

The Fire Management Officer (FMO)/Fire Program Manager is responsible to the Agency Administrator for planning, implementing and monitoring of the Prescribed Fire Program in accordance with policy and direction.

The FMO/Fire Program Manager is responsible to:

1. Ensure compliance with National, Regional, tribal and local fire policy and direction, as well as applicable state and local laws.
2. Ensure that Preparedness Level Restrictions are followed. At National Preparedness Levels Four and Five, prescribed fire implementation is restricted. See the National Interagency Mobilization Guide for details.
3. Ensure that both the Prescribed Fire Plan Preparer and the Technical Reviewer are qualified or qualified less currency at the level of complexity or higher.
4. Ensure that trained and qualified personnel are available to participate in the Prescribed Fire Program.
5. Assign the Prescribed Fire Burn Boss.
6. Ensure a Prescribed Fire Plan with written approval exists for each prescribed fire project.

7. Review the Prescribed Fire Plan to assess the impact of the project on the unit's workload; include the project in the unit's Annual Work Plan; assess the unit's ability to implement the project; and assess the need for additional implementation resources.
8. Ensure that all prescribed fires are conducted in accordance with the approved Prescribed Fire Plan and established standards and guidelines.
9. Declare a prescribed fire a wildfire (if necessary and if responsibility is assigned in the plan).
10. Act as liaison/coordinator to the Agency Administrator, Prescribed Fire Manager and/or Prescribed Fire Burn Boss, local dispatch office, other units, other agencies, air quality authorities, news media, transportation agencies, and safety officials.
11. Ensure that projects are reported through the local office and comply with national reporting guidelines.
12. Ensure that fuels management prescribed fire projects and interagency support actions are reported through the proper reporting systems.
13. Ensure that periodic reviews and inspections of the Prescribed Fire Program are completed.
14. Update Agency Administrator on the progress of the prescribed fire (as necessary).
15. Ensure that projects are monitored, evaluated and documented as a part of the project file.

Prescribed Fire Manager (RXM1/RXM2)

The Prescribed Fire Manager is responsible for implementing and coordinating assigned prescribed fire activities. A Prescribed Fire Manager may be assigned during periods when multiple simultaneous prescribed fires are being conducted; when multiple prescribed fires will be conducted within a short time frame; or where there is complex interagency involvement.

The Prescribed Fire Manager is responsible to:

1. Review Prescribed Fire Plans prior to implementation.
2. Monitor all prescribed fire operations.
3. Ensure that all operations are conducted in a safe manner and in accordance with the approved plan(s) and established standards and guidelines.
4. Act as coordinator/liaison between the burn organization(s) and other offices, agencies, air quality authorities, news media, transportation agencies, safety officials, and interested public.
5. Declare a prescribed fire a wildfire (if necessary and if responsibility is assigned in the plan).
6. Obtain and interpret long-term weather information.
7. Brief the Burn Bosses and direct operational assignments according to policies, priorities and standards.
8. Set priorities for allocation of resources.
9. Ensure the completion of all required documentation including the evaluation and documentation of accomplishments, fire behavior and fire effects, operation procedures, and cost summaries.

Firing Boss (FIRB)

The Firing Boss reports to the Prescribed Fire Burn Boss and is responsible for supervising and directing ground and/or aerial ignition operations according to established standards in the Prescribed Fire Plan.

The Firing Boss is responsible to:

1. Review the Prescribed Fire Plan and the burn unit prior to implementation.
2. Brief personnel on project objectives and ignition operations.
3. Complete the test fire according to the ignition plan at the direction of the Prescribed Fire Burn Boss.
4. Conduct ignition operations in a safe manner according to the ignition plan.
5. Identify the impacts of ignition on the control and desired fire effects.
6. Coordinate ignition operations with the Holding Specialist.

Firing Boss is not a mandatory position for any prescribed fire. Ignition operations may be managed by personnel qualified at the appropriate Incident Command System (ICS) wildland fire operations standard and as required by the prescribed fire complexity, assigned resources, and operational span of control.

Holding Specialist

The supervisory position in charge of the holding forces reports to the Prescribed Fire Burn Boss. There is no specific NWCG approved prescribed fire position for this function. This position is assigned by name and title using PMS 310-1 mnemonics. Holding functions will be managed by personnel qualified at the appropriate Incident Command System (ICS) wildland fire operations standard and as required by the prescribed fire complexity, assigned resources, and operational span of control.

The Holding Specialist is responsible to:

1. Review the Prescribed Fire Plan and the burn unit prior to implementation.
2. Brief holding personnel on project objectives and holding operations.
3. Conduct holding operations in a safe manner according to the holding plan.
4. Coordinate holding operations with the Firing Boss.
5. Confine the fire to a predetermined area, mop up, and patrol.
6. Maintain communication with Burn Boss on holding progress and/or problems.

For some prescribed fires, there may be no holding requirements or the holding duties are assumed by the Prescribed Fire Burn Boss.

Fire Effects Monitor (FEMO)

The Fire Effects Monitor (FEMO) is responsible for collecting the onsite weather, fire behavior, and fire effects information needed to assess whether the fire is achieving established resource management objectives.

The FEMO is responsible to:

1. Review the monitoring plan prior to implementation.
2. Monitor, obtain, and record weather data.
3. Monitor and record fire behavior data throughout the burn operations.
4. Recon the burn unit/area assigned.
5. Plot the burn area and perimeter on a map.
6. Monitor and record smoke management information.
7. Monitor first order fire effects.
8. Provide monitoring summary of the fire.
9. Provide fire behavior and weather information to burn personnel as appropriate.

Helitorch Manager (HTMG)

The Helitorch Manager is responsible to manage the helitorch operation, supervise the mixing operation, and provide technical assistance to the Prescribed Fire Burn Boss/Firing Boss (FIRB). The HTMG may also serve as Helicopter Manager and Helitorch Manager or Helicopter Parking Tender (but not both).

Plastic Sphere Dispenser Operator (PLDO)

The Plastic Sphere Dispenser Operator (PLDO) is responsible for the preparation, operation, maintenance, and care of the dispenser. The PLDO reports to the Firing Boss (FIRB).

Helitorch Mixmaster (HTMM)

The Helitorch Mixmaster (HTMM) is responsible for supervising the mixing/filling operations. The HTMM may also serve as Helitorch Manager or Helicopter Manager.

Resource Specialist or Resource Advisor (READ)

The Resource Specialist/READ is responsible for ensuring the prescribed fire project is planned and implemented in a manner supporting the unit's resource management goals and objectives. The Resource Specialist/READ is responsible to the Agency Administrator.

The Resource Specialist/READ is responsible to:

1. Ensure resource management representation in the preparation of the Prescribed Fire Plan.
2. Ensure a review of Prescribed Fire Plans is conducted before each plan is submitted for approval.
3. Evaluate the prescribed fire project in terms of meeting objectives.
4. Provide resource information and direction to the Prescribed Fire Burn Boss.
5. Present information at briefings on resources, priorities, and issues of concern.
6. Coordinate with adjacent landowners, cooperators and permittees as designated in Prescribed Fire plan or by Burn Boss.

Amendments

There may be a need to make amendments to the Prescribed Fire Plan. These are changes to the Prescribed Fire Plan that require Agency Administrator signature. When changes are necessary, plans must be amended to identify the affected sections; the reason for the change(s); and have the changes clearly identified. For amendments, the need for additional technical review will be determined and justified by the agency administrator.

Common reasons for amending the Prescribed Fire Plan may include:

- Changes to objectives.
- Changes to complexity.
- Changes to fire behavior prescription parameters.
- Changes to project area boundaries resulting in either an increase or decrease in area.
- Reduction in resource capabilities identified as required in the plan.
- Major changes to ignition methods including ground ignition to aerial ignition; aerial ignition to hand ignition; hand drip torch ignition to use of terra torch ignition (includes ATV mounted ignition devices); and/or hand ignition from roadways to hand ignition from boats or other watercraft.

To avoid having to amend the Prescribed Fire Plan, flexibility should be built into the plan that will allow for a range of adjustments during the prescribed fire. When building flexibility, the range of identified options must remain within the scope of the Complexity Analysis.

Examples of flexibility that can be built into a prescribed fire plan:

- The Prescribed Fire Plan may state that on burn day and subsequent days of the prescribed fire, a mix of the number and kinds of hand crews and engines may be modified as long as stated production capabilities are not compromised.
- As the prescribed fire progresses from ignition to holding to mop up and patrol, specified capabilities and/or types of resources may be adjusted. If these flexibilities are built into the Prescribed Fire Plan, there must be a clear statement as to the work capability requirements of the resources at the various stages of the prescribed fire.
- Minor changes in burn unit boundaries to facilitate holding and/or ignition, as long as the area in question has been in the NEPA document, requires no change in holding or ignition resources and is within the project boundaries.
- Additional resources may be assigned to the project without amending the burn plan if the addition of these resources does not change the complexity of the burn or require additional supervisory positions. These changes must be documented in the daily briefing.

Safety

The Federal Wildland Fire Policy states that firefighter and public safety is first priority. Prescribed Fire Plans and activities must reflect this commitment. Every person involved in a prescribed fire is responsible for identifying safety issues and concerns. It is the responsibility of each individual participating in prescribed fire activities to notify immediate supervisor of any possible misunderstanding of assigned tasks or safety concerns related to the assignment.

NWCG established Work/Rest Guidelines and span of control apply equally to wildland and prescribed fire operations. The management of crew, overhead, and support personnel rest to assure safe, productive fire operations is the responsibility of all supervisory fire management personnel (refer to *NWCG Interagency Incident Business Management Handbook*, PMS 902, NFES 3139).

Exposure to smoke during prescribed fire operations can be a significant safety concern. Research has shown that exposure to smoke on prescribed fires, especially in holding and ignition positions, often exceeds that on wildfire. At a minimum, smoke exposure must be addressed in a job hazard analysis or its equivalent and smoke management element. Public safety impacts from smoke should be addressed in the Smoke Management and Air Quality Element as well as the Public, Personnel Safety, Medical Element.

Transportation and use of any product containing chemicals (drip torch fuel, aviation gas, sphere dispensers, fusees, fuel thickener, etc.) must be in compliance with the Occupational Safety and Health Administration's (OSHA) Hazard Communication Standard (29 CFR 1910.1200) and Department of Transportation Regulations (49 CFR Part 171), and agency specific guidance. Material Safety Data Sheets (MSDS) for hazardous materials used on projects should be consulted in developing the job hazard analysis.

The SAFENET form and process is designed for reporting and correcting unsafe situations and is applicable to prescribed fire applications.

The risk management process identified in the NWCG Incident Response Pocket Guide (IRPG, PMS 410-1) helps ensure that critical factors and risks associated with prescribed fire operations are considered during decision making. This process should be applied to all prescribed fire planning and operations.

Consider using a Safety Officer on high complexity prescribed fires and others where the complexity analysis shows the need or indicates a higher than normal hazard.

A qualified Safety Officer is defined as a currently qualified Safety Officer, at any Type level (Types 1, 2 or 3), as defined by the NWCG, *Wildland and Prescribed Fire Qualification System Guide* (PMS 310-1).

Prescribed Fire Plan

The Prescribed Fire Plan is the site-specific implementation document. It is a legal document that provides the Agency Administrator the information needed to approve the plan and the Prescribed Fire Burn Boss with all the information needed to implement the prescribed fire. Prescribed fire projects must be implemented in compliance with the written plan.

Prescribed Fire Plans will vary in their degree of detail. The size and complexity of the prescribed fire project will determine the level of detail required. The Prescribed Fire Plan Template (Appendix B) must be utilized. Each element must be addressed and then assembled in the sequence identified in the template. Should an element not apply to a specific prescribed fire plan, not applicable (N/A) may be utilized. Programmatic plans for multiple units under like conditions may be appropriate. Additional information may be added as appendices.

If an interagency mixed ownership Prescribed Fire Plan is being prepared, the development of all appropriate elements within the plan will be conducted in an interagency setting. For cooperative burns implemented by non-federal entities involving federal and non-federal lands, where only a small amount of federal lands will be treated, the local agency administrator has discretion to use either a federal or non-federal Prescribed Fire Plan. Interagency agreements and Memorandums of Understanding (MOU) and/or private land owner agreements are required to implement prescribed fire on multiple ownerships.

Listed below are the planning explanations of each individual element required as part of a complete Prescribed Fire Plan and implementation policy related to the element.

Element 1. Signature Page

The following information must be included on the signature page:

1. Administrative unit name.
2. Prescribed Fire Unit (burn unit)/Project name.
3. At a minimum, three dated signatures are required: a Prescribed Fire Plan Preparer, a Technical Reviewer, and an Agency Administrator. Additional signatures may be included as required by the individual unit.
4. Final determined complexity rating(s).
5. If the plan needs to be amended, the signed and dated amendments must be attached to the Prescribed Fire Plan (see Amendments, page 17).

Element 2. GO/NO-GO Checklists

Agency Administrator GO/NO-GO Checklist

The Agency Administrator Pre-Ignition Checklist (Burn Plan Template, Appendix B) is required to be completed. The Agency Administrator's Pre-Ignition Checklist and Approval evaluates whether compliance requirements, Prescribed Fire Plan's elements, and internal and external notification(s) have been completed and expresses the Agency Administrator's intent to implement the Prescribed Fire Plan. The checklist establishes the expiration date for the implementation of the Prescribed Fire Plan. If ignition of the prescribed fire is not initiated prior to expiration date determined by the Agency Administrator, a new approval is required. An 'acting' Agency Administrator may sign the Agency Administrator GO/NO-GO checklist if authority to do so has been delegated. If the Prescribed Fire Plan is amended, a review and re-validation of the Agency Administrator GO/NO-GO Checklist would be required and included in the Project File.

Prescribed Fire GO/NO-GO Checklist

Prior to all ignition operations, the assigned Prescribed Fire Burn Boss will complete and sign the Prescribed Fire GO/NO-GO Checklist (Burn Plan Template, Appendix B). This checklist is a minimum standard and agencies may elect to add questions and/or approval signatures. For each day of active ignition on a prescribed fire, a separate daily GO/NO-GO Checklist is required.

Element 3. Complexity Analysis

Risk management is a foundation for all prescribed fire activities. Risks and uncertainties relating to prescribed fire activities must be understood, analyzed, communicated, and managed as they relate to the cost of either doing or not doing an activity. At a minimum, those risks from the Complexity Analysis that are rated high and cannot be mitigated will be identified with a discussion of the risks associated in the Summary Complexity Rating Rationale. This discussion will also be included in the Complexity Analysis Summary page (Appendix C of Prescribed Fire Plan Template).

The Prescribed Fire Complexity Rating must be completed utilizing the Prescribed Fire Complexity Rating System Guide.

The purpose of the complexity rating process is to provide:

- Assignment of a complexity rating of high, moderate, or low to the prescribed fire.
- Management and implementation personnel a relative ranking as to the overall complexity of a specific prescribed fire project.
- A process that can be used to identify Prescribed Fire Plan elements or characteristics that may pose special problems or concerns.
- A process that identifies mitigation activities needed to reduce the risk/hazard to the implementation personnel and public as well as mitigating potential resource damage.

A preliminary rating will be completed early in the Prescribed Fire Plan development stage. This will identify potential concerns that may be mitigated during the plan preparation process. Once the Prescribed Fire Plan is near completion, the final complexity rating is made. The final complexity rating will be used as a basis for determining prescribed fire organization, Prescribed Fire Burn Boss level, and mitigation measures.

The Summary Complexity Rating Rationale will clearly justify the summary rating for prescribed fire organization and Prescribed Fire Burn Boss level. It must also identify those risks from the Complexity Analysis that are rated high and cannot be mitigated and will provide a discussion of the risks associated. The Complexity Analysis must be signed by the Prescribed Fire Plan Preparer and the Agency Administrator and attached as an appendix to the Prescribed Fire Plan. The Complexity Analysis Summary will be attached to the Prescribed Fire Plan following the GO/NO-GO Checklists.

Separate prescriptions and/or burn organizations for different stages of implementation may result in multiple Complexity Analyses and ratings. For example, a plan may have separate prescriptions for spring and fall burning which may require different organizations and constitute the need for additional complexity analyses.

If a prescribed fire complexity changes which results in different Prescribed Fire Burn Boss qualifications, a separate complexity analysis is required. For example, for certain prescribed fires conducted over time, progressive or sequential actions may reduce complexity, organization and Prescribed Fire Burn Boss qualifications. (e.g. a large scale, high complexity prescribed fire has been black-lined, portions burned and operations suspended for a period of time then resumed to continue or finish the prescribed fire). In this case, a separate Complexity Analysis will be developed to reflect the reduced complexity rating and will be included in the appendix of the Prescribed Fire Plan.

Element 4. Description of the Prescribed Fire Area

A. Physical Description

This section of the plan will describe the physical features of the prescribed fire area.

- Location**:** Narrative description of the location of the prescribed fire project including a legal description, UTM and/or latitude/longitude (decimal degrees; NAD83 preferred), county, and state.

- Size: Area, in acres, of the prescribed fire project with a breakdown by prescribed fire unit and/or ownership if applicable.
- Topography: Identify the upper and lower range of elevation, slope(s) –maximum/minimum and average, and aspect(s) of the prescribed fire project.
- Project Boundary: **The project boundary defines that area where fire will be ignited and may be allowed to burn.** Describe the physical, natural and/or human made boundaries (including multiple units) of the prescribed fire project. This will be done through maps and may include narratives. The entire prescribed fire project area must be analyzed under NEPA.

B. Vegetation/Fuels Description

This is a description of current vegetation and fuels in the project area Identify any reference material used.

- Describe the structure and composition of the vegetation type(s) and fuel characteristics. This description may include natural or activity fuels, total fuel load (both live and dead) in tons/acre, dead fuel load by time-lag size classes, live fuel load (woody/herbaceous), fuel bed depth, and vertical and horizontal arrangement within the project boundary.
- Describe the percent of the unit composed of each vegetative type and the corresponding fuel model(s).
- Identify conditions (fuels, slope, and aspect) in and adjacent to boundaries that may be a potential threat for escaped fire.

C. Description of Unique Features and Resources:

List and discuss special features, hazards, regulations, issues, constraints, etc. Examples may include: fences to protect, power poles, historical/cultural sites, threatened and endangered species or habitat, etc.

D. Maps:

Maps will be developed and included in the Prescribed Fire Plan. At a minimum, the plan will include a vicinity and project map. The number of maps, map size and scale, legend and level of detail should be appropriate for the complexity of the project. All maps will include the standard mapping elements: title, name of preparer(s), date, north arrow, scale, and legend.

- Vicinity Map: Map scale will be such that the burn units can be located on the ground and in sufficient detail to guide implementation.
- Project Map(s): The project map(s) identify features in sufficient detail to guide and assist in operational implementation of the prescribed fire.

Element 5. Objectives

Describe in clear, concise statements the specific measurable resource and fire objectives for this prescribed fire. Objectives will be measurable and quantifiable so prescription elements can be developed to meet those objectives and the success of the project can be determined following implementation.

Element 6. Funding

Identify the funding source(s) and estimated cost(s) of the prescribed fire. Itemize by phase if desired.

Element 7. Prescription

Prescription is defined as the measurable criteria that define a range of conditions during which a prescribed fire may be ignited and held as a prescribed fire.

Parameters are quantitative variables expressed as a range that result in acceptable fire behavior and smoke management. The plan prescription will describe a range of low to high limits for the environmental (weather, topography, fuels, etc.) and fire behavior (flame lengths, rate of spread, spotting distance, etc.) parameters required to meet Prescribed Fire Plan objectives while meeting smoke management and control objectives.

In many cases, burning under the extremes of all prescriptive parameters would not meet or possibly exceed the desired prescribed fire behavior characteristics and are therefore out of prescription. Empirical evidence (historical evidence or researched data) and judgment may be utilized to identify or calibrate prescriptions. Weaknesses in modeling can be overridden, but must be justified with empirical evidence and/or verified actual fire behavior.

Separate prescriptions may be needed for multiple fuel model conditions to address seasonal differences and/or types of ignition (black lining, aerial ignition, etc). Separate prescriptions may result in multiple complexity ratings and burn organizations. For example, a separate prescription is needed for black-lining operations if conditions will be significantly different from the primary prescription or if the holding resources differ from those identified for ignition and holding phases. Separate prescriptions may result in the need to identify multiple levels of management, organizational structures, implementation measures, and pre-burn considerations.

If the prescription limits are exceeded, the Prescribed Fire Burn Boss must evaluate fire controllability and whether fire effects will meet objectives. The Prescribed Fire Burn Boss must take action to ensure objectives are being met, or take appropriate actions to maintain control of or secure the fire.

Holding and contingency plans must be developed with the consideration of the predicted fire behavior outside the project boundary(s). Fire behavior characteristics for fuel models within the maximum spotting distance and/or adjacent to the project boundaries must be considered and modeled. These predictions must be modeled using fire behavior model runs or empirical evidence of the hottest, driest, and windiest prescription limits identified in the Prescribed Fire Plan, along with the most extreme environmental conditions (slope, aspect) identified.

A short fire behavior narrative that summarizes the fire behavior identified in the prescription and discusses how it will achieve the desired treatment objectives may be included.

When used, fire behavior calculations must be developed using an appropriate fire behavior modeling program. Include modeling and/or empirical evidence documentation as an appendix or in the fire behavior narrative.

Element 8. Scheduling

Identify the general ignition time frame(s) (i.e. time of day, duration of ignition) or season(s) and note any dates when the project may not be conducted. For prescribed fires with multiple ignitions or burn days, estimate project duration.

At National Preparedness Levels Four and Five, see National Interagency Mobilization Guide for details.

Element 9. Pre-burn Considerations & Weather

Describe on and off-site actions to be conducted and considerations to be addressed prior to implementation. Examples include clearances; mitigation actions generated by the initial complexity analysis; line to be built; preparation of critical holding points; snags to be felled or protected; equipment to be pre-positioned; special features to be protected; warning signs to be placed; weather recording; fuels condition sampling; monitoring needs; responsibility; and timeframes.

Describe any fuel sampling and weather data that may need to be obtained (See Element 14: Test Fire). This data should be taken at the project site. If this is not possible, use the closest representative site.

The plan will include a list of organizations (including media) and individuals that are to be notified prior to ignition, with information necessary to make the contacts. Reasonable efforts will be made to notify adjacent land owners (or their agents) and other potentially

impacted publics. Attempts and/or actual notifications will be documented with date and method and placed in the Project File.

Identify in the burn plan the method and frequency for obtaining weather and smoke management forecast(s). Spot weather or local area forecasts are required prior to ignition, on all ignition days and any days the fire is actively spreading. A copy of the forecast will be included in the Project File. The Prescribed Fire Burn Boss or other person in charge of mop-up and patrol will also obtain and review the spot weather or area forecast to determine if mop up and patrol resources are adequate.

Element 10. Briefing

All assigned personnel must be briefed at the beginning of each operational period to ensure personnel safety considerations (including the job hazard analysis or other agency-specific risk analysis) and prescribed fire objectives and operations are clearly defined and understood. Briefing checklists are required to be included in the Prescribed Fire Plan and will include the following elements:

- Burn Organization and Assignments
- Burn Objectives and Prescription
- Description of the Prescribed Fire Area
- Expected Weather & Fire Behavior
- Communications
- Ignition Plan
- Holding Plan
- Contingency Plan and Assignments
- Wildfire Conversion
- Safety and Medical Plan
- If aerial ignition devices will be used, include an Aerial Ignition briefing.

The briefing checklist should list briefing topics only, not re-state what is listed in the Prescribed Fire Plan for that element.

The Prescribed Fire Burn Boss will ensure that any new personnel arriving to the prescribed fire receives a briefing prior to assignment.

An Incident Action Plan (IAP) is optional, it is recommended for large multi-day or high complexity prescribed fires.

Element 11. Organization & Equipment

The complexity of each prescribed fire determines the organization capabilities needed to safely achieve the objectives specified in the Prescribed Fire Plan. Specify the minimum required implementation organization to meet the capabilities (line production rates, etc.) by position, equipment, and the supplies needed for all phases of the prescribed fire until declared out. At a minimum, a Prescribed Fire Burn Boss will be assigned to every prescribed fire. Positions that may not be filled as collateral duty will be identified in the organization chart of the Prescribed Fire Plan.

Standard ICS fire management principles for span of control and length of assignments will be adhered to when developing burn implementation organization(s) and used in managing prescribed fires. On prescribed fires with large organizations, use the ICS organization and staffing commensurate with the level of complexity. Consider the use of a Prescribed Fire Manager in conducting multiple prescribed fires.

Before implementation (all phases) of the prescribed fire, documentation in the form of an organization chart must be completed. Any changes to the organization during implementation must be documented. Any changes that reduce capability or increase complexity will require an amendment. Different organizations may be identified for different phases of implementation (i.e. holding v. mop-up and patrol, different ignition operations, different prescriptions).

Multiple prescriptions for one Prescribed Fire Plan are permissible (Element 7). Multiple prescriptions may require identifying and developing multiple organizations.

The Prescribed Fire Burn Boss is responsible for implementation including mop-up and patrol until the responsibility is formally passed to a Prescribed Fire Burn Boss, Prescribed Fire Manager or the local fire management organization.

Element 12. Communication

Develop communications plan specific to the project's implementation to address safety and tactical resource management needs. Identify and assign command, tactical, and air operations frequencies as needed. Also include any required telephone numbers.

Element 13. Public & Personnel Safety, Medical

Describe provisions to be made for public and personnel safety. All personnel who are within the active burn area are required to wear personal protective equipment. Identify and analyze the safety hazards unique to the individual prescribed fire project and specify personnel safety and emergency procedures. Include safety hazards (including smoke exposure and impacts) and measures taken to reduce those hazards. Specify emergency medical procedures, evacuation methods, and emergency facilities to be used. A job hazard analysis or other agency-specific risk analysis is required for each prescribed fire.

Element 14. Test Fire

Provisions for a test fire are required and results must be recorded. The test fire must be ignited in a representative location and in an area that can be easily controlled. The purpose of the test fire is to verify that the prescribed fire behavior characteristics will meet management objectives and to verify predicted smoke dispersion. In many applications, analysis of the initial ignitions may provide adequate test fire results. On multiple-day projects, evaluation of current active fire behavior, in lieu of a test fire, may provide a comparative basis for continuing and must be documented. If in doubt however, initiate a separate test fire and evaluate results.

Prior to ignition of both the test fire and ignition operations, compare the Prescribed Fire Plan prescription elements, both individually and collectively, against local area or spot weather forecasts, other predicted conditions, and the actual conditions onsite (See element 9: Pre-Burn Considerations) to ensure that predicted fire behavior will take place and/or weather parameters will not change to the point of the burn going out of prescription.

Element 15. Ignition Plan

Describe planned ignition operations. Examples could include firing methods, devices, techniques, sequences, patterns, and ignition staffing for single or multiple unit operations. Maps showing proposed firing patterns may be included. If aerial ignition is planned, cover aviation operations, organization, and safety within the Prescribed Fire Plan, Aerial Ignition Plan, or in an agency specific Aviation Operating Plan (Refer to the Interagency Helicopter Operations Guide, {NFES #1885} and the Interagency Aerial Ignition Guide {NFES #1080}for more detailed information on this topic). Multiple prescriptions and ignition operations (blackline, primary, aerial, etc.) may require identifying and developing multiple ignition organizations.

Element 16. Holding Plan

Describe general procedures to be used for operations to maintain the fire within the project area and meet project objectives until the fire is declared out. This may include mop-up and/or patrol procedures. Describe critical holding points (if any) and mitigation actions. Critical holding points will be identified on the project map. Describe minimum capabilities needed for all phases of implementation (see Element 11: Organization and Equipment). If used, attach or reference modeling outputs or worksheets (i.e. Fireline Handbook production rates, BEHAVE, etc.) and/or documented empirical evidence to justify minimum holding resources required.

Different organizations may be identified for different phases of implementation (i.e. holding v. mop-up and patrol, different ignition operations, different prescriptions). Multiple prescriptions may require identifying multiple complexity ratings and developing multiple holding organizations.

If onsite resources are insufficient to meet the prescribed fire plan objectives, then the Burn Boss should implement the Contingency Plan or Wildfire Conversion.

Element 17. Contingency Plan

"…If the objectives are not being met the Contingency Plan, a required component of the Prescribed Fire Burn Plan, is implemented. If the Contingency Plan is successful at bringing the project back within the scope of the Prescribed Fire Burn Plan the project continues. If contingency objectives are not met the prescribed fire is converted to a wildfire and Extended Attack is undertaken."

Interagency Strategy for the Implementation of Federal Wildland Fire Management Policy, June 20, 2003, page 12.

The contingency plan is the portion of the Prescribed Fire Plan that considers possible but unlikely events and the actions needed to mitigate those events.

Contingency planning is the determination of initial actions and additional resources needed if the prescribed fire is not meeting, exceeds, or threatens to exceed:

- Project or unit boundary
- Objectives
- Prescription parameters
- Minimum implementation organization
- Smoke management objectives
- Other Prescribed Fire Plan elements

Contingency resources are those resources or capabilities required to meet contingency actions. These resources may be on or off site as required by the Prescribed Fire Plan. For purposes of this element, the terms *capabilities* and *resources* are interchangeable.

The contingency plan will establish trigger points or limits that indicate when additional actions and/or resources are needed. If additional resources will not be needed to implement the contingency plan, document the rationale in this section.

Contingency planning may include the additional resources required, and the maximum acceptable response time for those resources. Resource needs should be based on fire behavior outputs tied to the hottest, driest, windiest fire behavior scenario as identified in Element 7: Prescription. Separate contingency plans may be necessary and appropriate to address seasonal differences, types of ignitions or phases of the burn implementation as described in the prescriptions and ignition and holding plans developed for the burn.

Verify and document availability of identified contingency resources and response time throughout each phase of the burn. If contingency resources availability falls below plan levels, actions must be taken to secure operations until identified resources are replaced.

The same contingency resource can be identified for multiple prescribed fire projects. When specific contingency resources are identified for more than one prescribed fire, the local fire management organization(s) must evaluate and document adequacy of all contingency resources within the area. This evaluation must consider:

- Local, current, and predicted fire danger
- Local and regional wildland fire activities.

Once a contingency resource is committed to a specific wildland fire action (wildfire, wildland fire use or prescribed fire), it can no longer be considered a contingency resource for another prescribed fire project and a suitable replacement contingency resource must be identified or the ignition secured.

The Agency Administrator will determine if and when they are to be notified that contingency actions are being taken.

If the contingency actions are successful at bringing the project back within the scope of the Prescribed Fire Plan, the project may continue. If contingency actions are not successful by the end of the next burning period, then the prescribed fire will be converted to a wildfire.

Element 18. Wildfire Conversion

The Prescribed Fire Plan will specify who has the authority to declare a wildfire. A prescribed fire must be declared a wildfire by those identified in the plan when that person(s) determines that the contingency actions have failed or are likely to fail and cannot be mitigated by the end of the next burning period. A prescribed fire must be declared a wildfire when

the fire has spread outside the project boundary, or is likely to do so, and cannot be contained by the end of the next burning period. A prescribed fire can be converted to a wildfire for reasons other than an escape.

Describe the actions to be taken when a prescribed fire is declared a wildfire. Description will include:

- Wildfire declaration (by whom)
- IC assignment
- Notifications

A prescribed fire declared a wildfire cannot be returned to prescribed fire status.

Element 19. Smoke Management & Air Quality

Describe how the project will comply with local community, County, State, Tribal, and Federal air quality regulations. Identify what permits, if any, need to be obtained. Identify smoke sensitive receptors including population centers, recreation areas, hospitals, airports, transportation corridors, schools, non-attainment areas, Class I areas, and restricted areas that may be impacted. Include modeling outputs and mitigation strategies and techniques to reduce the impacts of smoke production, if required by State Implementation Plans (SIPs) and/or State or local regulations. Reference the Smoke Management Guide for Prescribed and Wildland Fire for other smoke management planning suggestions and smoke management techniques for reducing or redistributing emissions.

Special considerations must be taken to address smoke when the project is in a non-attainment area for a National Ambient Air Quality Standards including insuring compliance with SIP/TIP provisions and addressing Conformity. Projects which will potentially impact Class I areas should address any efforts to minimize smoke impacts on visibility. Comply with all local, State, Tribal and Federal pre-burn and post-burn data reporting requirements.

If a Notice of Violation (NOV) is issued by an air quality regulatory agency for a prescribed fire, a formal review of the incident must be conducted, following the guidance provided under the 'Reviews' chapter. If an air quality regulatory agency notifies a land management agency that their prescribed fire may have contributed to an exceedance of a NAAQS then a review is highly recommended. Use of *Guidance for After Action Review of Smoke Impacts*, available at http://www.nifc.gov/smoke or other review approaches are recommended to the extent feasible in order meet information needs stipulated by the Final Rule on the Treatment of Data Influenced by Exceptional Events (40 CFR Parts 50 1nd 51).

Element 20. Monitoring

Prescribed fire monitoring is defined as the collection and analysis of repeated observations or measurements to evaluate changes in condition and progress toward meeting a management objective. Describe the monitoring that will be required to ensure that Prescribed Fire Plan objectives are met. For the prescribed fire, at a minimum specify the weather (forecast and observed), fire behavior and fuels information and smoke dispersal monitoring required during all phases of the project and the procedures for acquiring it, including who and when.

Element 21. Post-burn Activities

Describe the post-burn activities that must be completed. This may include post-burn report, safety mitigation measures, and rehabilitation needs including those as a result of pre-burn activities undertaken.

Appendices

Include all the required appendices.

A. Maps

B. Technical Review Checklist

C. Complexity Analysis

D. A job hazard analysis or other agency specific risk analysis (may be included here or in Project File)

E. Fire Behavior Modeling Documentation or Empirical Documentation

Project File

All prescribed fire Project Files will contain the following information. Agencies and/or administrative units may require additional information.

1. Prescribed Fire Plan (and amendments)
2. Monitoring data including weather, fire behavior, fire effects and smoke dispersal observations
3. Weather forecasts
4. Notifications
5. Documented prescribed fire organization(s)
6. Any written agreements related to implementation
7. Multiple day GO/NO-GO checklist(s), if applicable
8. Re-validation of the agency administrator GO/NO-GO checklist (if applicable)

Depending on the scope and complexity of the prescribed fire, optional information and/or further documentation that may be included in the Project File include:

1. After Action Review (see Chapter 8)
2. Incident Action Plans, Unit Logs
3. Press releases, etc
4. Implementation costs
5. Actual ignition patterns and sequences used
6. Appropriate smoke management information
7. Agency individual fire occurrence form
8. Detailed Post Burn Report
9. NEPA documentation
10. Permits
11. Reference documents that helped in development of the plan.

Reviews

After Action Review (AAR)

Each operational shift on a prescribed fire should have an informal After Action Review (AAR). Certain events or a culmination of events that may affect future prescribed fire implementation and/or policy should be submitted via the Roll-up documentation (Found at http://www.wildfirelessons.net). The questions to answer in conducting an AAR are:

1. What did we set out to do (what was planned)?
2. What actually happened?
3. Why did it happen that way?
4. What should be sustained? What can be improved?

Declared Wildfire Reviews

The Agency Administrator will be notified of a declared wildfire. The Agency Administrator is required to make the proper notifications. All prescribed fires declared a wildfire will have a review initiated by the appropriate level Agency Administrator. The level and scope of the review will be determined by agency policy.

The goal of the declared wildfire review process is to guide future program actions by minimizing future resource damage and/or preventing future escapes from occurring by gathering knowledge and insight for incorporation into future resource management and prescribed fire planning. The objectives of the review are to:

- Determine if the Prescribed Fire Plan was adequate for the project and complied with policy and guidance related to prescribe fire planning and implementation.
- Determine if the prescription, actions, and procedures set forth in the Prescribed Fire Plan were followed.
- Describe and document factual information pertaining to the review.
- Determine if overall policy, guidance, and procedures relating to prescribed fire operations are adequate.
- Determine the level of awareness and the understanding of the personnel involved, in regard to procedures and guidance.

At a minimum, the declared wildfire review report will include the following elements:

1. An analysis of seasonal severity, weather events, and on-site conditions leading up to the wildfire declaration.
2. An analysis of the actions taken leading up to the wildfire declaration for consistency with the Prescribed Fire Plan.
3. An analysis of the Prescribed Fire Plan for consistency with policy.
4. An analysis of the prescribed fire prescription and associated environmental parameters.
5. A review of the approving line officer's qualifications, experience, and involvement.
6. A review of the qualifications and experience of key personnel involved.
7. A summary of causal agents contributing to the wildfire declaration.

Document the incident, including all actions prior to and after the declaration. Set up a file that includes all pertinent information, i.e., the Prescribed Fire Plan; a chronology of events including the prescribed fire report; unit logs and individual statements; weather forecasts including any spot forecasts; weather information taken on site and Remote Automated Weather Station (RAWS) and National Fire Danger Rating System (NFDRS) data for the day of the escape from the nearest station(s); photos; and all other pertinent information.

An independent review team is recommended for conducting declared wildfire reviews. The number of individuals assigned to the team and their functional expertise should be commensurate with the scope and focus of the review. Interagency participation is highly recommended for all declared wildfire reviews.

Air Quality Notice of Violation (NOV) Reviews

This review would follow direction in "Declared Wildfire Reviews" that support understanding of the planning, the decisions made, and actions taken that contributed to the NOV. In addition, the elements below which are unique to smoke incidents affecting air quality must be addressed.

The review may also utilize the *Guidance for After-Action-Review of Smoke Impacts* found at the http://www.nifc.gov/smoke website. At a minimum the NOV review will include:

- An analysis of the smoke sensitive receptors identified in the prescribed fire plan, estimated smoke effects including modeling and any smoke monitoring observations and effects related to the burn project.
- An analysis of predicted vs. actual ambient air quality using best on-site fuels information available (e.g. fuel conditions, fire behavior, fuel consumption), emissions production (quantity and duration) and weather.
- If needed to determine causes of impacts, a comparison between pre-burn smoke dispersion modeling and post-burn modeling using best on-site information available.
- Assess the smoke management training of personnel, policies for smoke management, and performance of the smoke management elements of the Prescribed Fire Plan for the prescribed fire under review.
- Assess the smoke management practices used for the prescribed fire and the role of cumulative smoke impacts from other burning activities for how they affected the issuance of the NOV.

References

NWCG Glossary of Wildland Fire Terminology PMS 205

Additional definitions found in the NWCG glossary of Project Management Terms (http://www.nwcg.gov/teams/pmo/products/glossaries.htm)

National Fire & Aviation Executive Board, Federal Fire Policy Directives Task Group – Common Policy Language, November 19, 2004

Interagency Strategy for the Implementation of Federal Wildland Fire Management policy, September 7, 2004

Smoke Management Guide for Prescribed and Wildland Fire 2001 Edition, December 2001

Restoring Fire Adapted Ecosystems on federal Lands - A Cohesive Fuel Treatment Strategy for Protecting People and Sustaining Natural resources. August 2, 2002

10-Year Comprehensive Strategy Implementation Plan, May 2002

Prescribed Fire Complexity Rating System Guide PMS 424, January 2002

Review and Update of the 1995 Federal Wildland Fire Management Policy, January 2001.

Cerro Grande Prescribed Fire Investigative Report - National Park Service, May 18, 2000

Sawtooth Mountain Prescribed Fire Burnover Fatality - Bureau of Indian Affairs Fort Apache Agency, Arizona May 14, 2003

Lowden Ranch Prescribed Fire Review Final Report - Bureau of Land Management, July 22, 1999

Wildland and Prescribed Fire Qualifications System Guide PMS 310-1 January 2002

Appendix A: Laws and Authorities

Organic Administration Act of June 4, 1897 (16 U. S. C. 551

Weeks Law, Act of March 1, 1911 (16 U. S. C. 563)

National Park Service Act of 1916 as amended (67 Stat. 495; 16 U.S.C. 1 et seq.)

Protection Act of September 20, 1922 (42 Stat. 857; 16 U.S.C. 594)

Clark-McNary Act of 1928 (45 Stat. 221; 16 U. S. C. 487)

McSweeney-McNary Act of 1928 (45 Stat. 221; 16 U.S.C. 487)

Economy Act of June 30, 1932 (47 Stat. 417; 31 U.S.C. 1535)

Taylor Grazing Act of June 28, 1934 (48 Stat. 1269; 43 U.S.C. 315)

Oregon and California Act of August 28, 1937 (50 Stat. 875; 43 U.S.C. 1181e)

Bankhead-Jones Farm Tenant Act of July 22, 1937 (7 U. S. C. 1010 - 1011)

Federal Property and Administrative Service Act of 1949 (40 U.S.C. 471; et seq.)

Reciprocal Fire Protection Act of May 27, 1955 (69 Stat. 66; 42 U.S.C. 1856a)

Clean Air Act of July 14, 1955, as amended (42 U. S. C. 7401 et seq.)

Multiple-Use Sustained Yield Act of 1960 (16 U. S. C. 528)

Wilderness Act of 1964 (16 U. S. C. 1131 - 1132)

National Wildlife Refuge System Administration Act of 1966 as amended (80 Stat. 927; 16 U.S.C. 668dd through 668ee)

National Environmental Policy Act of 1969 (42 U. S. C. 4321)

Alaska Native Claims Settlement Act of 1971 (85 Stat. 688; 43 U.S.C. 1601)

Endangered Species Act of 1973 (16 U. S. C. 1531 - 1544)

Disaster Relief Act of May 22, 1974 (88 Stat. 143; 42 U.S.C. 5121)

Federal Fire Prevention and Control Act of 1974 (88 Stat. 1535; 15 U.S.C. 2201)

National Forest Management Act of 1976 (16 U. S. C. 1600 et seq.)

Federal Land Policy and Management Act of 1976 (90 Stat. 2743)

Federal Grant and Cooperative Agreement Act of 1977 (P.L. 950224, as amended by P.L. 97-258, September 13, 1982 (96 Stat. 1003; 31 U.S.C. 6301 thru 6308)

Alaska National Interest Lands Conservation Act of 1980 (94 Stat. 2371)

Supplemental Appropriation Act of September 10, 1982 (96 Stat. 837)

Wildfire Suppression Assistance Act of 1989 (P.L. 100-428, as amended by P.L. 101-11, April 7, 1989), 42 U. S. C. 1856

Indian Self-Determination and Education Assistance Act (PL 93-638) as amended

National Indian Forest Resources Management Act (P. L. 101-630 November 28, 1990)

Tribal Self-Governance Act of 1994 (P.L. 103-413)

Department of the Interior and Related Agencies Appropriations Act, Fiscal Year 1995 (P.L. 103-332)

National Wildlife Refuge System Improvement Act of 1997 (P.L. 105-57)

Federal Financial Assistance Management Act of 1999 (P.L. 106-107)

Healthy Forest Restoration Act of 2003 (P.L. 108-18, 117 Stat. 1887)

Tribal Forest Protection Act of 2004 (P.L. 108-287)

Department of the Interior, Departmental Manual; Part 620: Wildland Fire Management; Chapter 4: Fuels Management and Wildland-Urban Interface Community Assistance

Department of Agriculture, US Forest Service Manual; FSM 5100: Fire Management; Chapter 5140: Fire Use

National Historic Preservation Act (1966 as amended)

Appendix B: Prescribed Fire Plan Template

A standardized, reproducible template form for the Prescribed Fire Plan development process is included in this appendix. A standardized format is provided for the Prescribed Fire Plan in PDF. An electronic version editable in Word is also available. Users should prepare the plan using the electronic version.

PRESCRIBED FIRE PLAN

ADMINISTRATIVE UNIT(S): _____

PRESCRIBED FIRE NAME: _____

PREPARED BY: _____ **DATE:** _____

Name & Qualification/Currency

TECHNICAL REVIEW BY: _____ **DATE:** _____

Name & Qualification/Currency

COMPLEXITY RATING: _____

MINIMUM RXB REQUIREMENT: _____

APPROVED BY: _____ **DATE:** _____

Agency Administrator

ELEMENT 2: AGENCY ADMINISTRATOR GO/NO-GO PRE-IGNITION APPROVAL CHECKLIST

Instructions: The Agency Administrator's GO/NO-GO Pre-Ignition Approval is the intermediate planning review process (i.e. between the Prescribed Fire Complexity Rating System Guide and Go/No-Go Checklist) that should be completed before a prescribed fire can be implemented. The Agency Administrator's Go/No-Go Pre-Ignition Approval evaluates whether compliance requirements, Prescribed Fire Plan elements, and internal and external notifications have been or will be completed and expresses the Agency Administrator's intent to implement the Prescribed Fire Plan. If ignition of the prescribed fire is not initiated prior to expiration date determined by the Agency Administrator, a new approval will be required.

YES	NO	KEY ELEMENT QUESTIONS
		Is the Prescribed Fire Plan up to date? *Hints: amendments, seasonality.*
		Will all compliance requirements be completed? *Hints: cultural, threatened and endangered species, smoke management, NEPA.*
		Is risk management in place and the residual risk acceptable? *Hints: Prescribed Fire Complexity Rating Guide completed with rational and mitigation measures identified and documented?*
		Will all elements of the Prescribed Fire Plan be met? *Hints: Preparation work, mitigation, weather, organization, prescription, contingency resources*
		Will all internal and external notifications and media releases be completed? *Hints: Preparedness level restrictions*
		Will key agency staff be fully briefed and understand prescribed fire implementation?
		Are there any other extenuating circumstances that would preclude the successful implementation of the plan?
		Have you determined if and when you are to be notified that contingency actions are being taken? Will this be communicated to the Burn Boss?
		Other:

Recommended by: _____ Date: _____
FMO/Prescribed Fire Burn Boss

Approved by: _____ Date: _____
Agency Administrator

Approval expires (date): _____

ELEMENT 2: PRESCRIBED FIRE GO/NO-GO CHECKLIST

	YES	NO
A. Has the burn unit experienced unusual drought conditions or does it contain above normal fuel loadings which were not considered in the prescription development? If NO proceed with checklist below, if YES go to item B.		
B. Has the prescribed fire plan been reviewed and an amendment and technical review been completed; or has it been determined that no amendment is necessary? If YES to any, proceed with checklist below, if NO, STOP.		

YES	NO	QUESTIONS
		Are ALL pre-burn prescription parameters met?
		Are ALL smoke management specifications met?
		Has ALL required current and projected fire weather forecast been obtained and are they favorable?
		Are ALL planned operations personnel and equipment on-site, available, and operational?
		Has the availability of ALL contingency resources been checked and are they available?
		Have ALL personnel been briefed on the project objectives, their assignment, safety hazards, escape routes, and safety zones?
		Have all the pre-burn considerations identified in the Prescribed Fire Plan been completed or addressed?
		Have ALL the required notifications been made?
		Are ALL permits and clearances obtained?
		In your opinion, can the burn be carried out according to the Prescribed Fire Plan and will it meet the planned objective?

If all the questions were answered "YES" proceed with a test fire. Document the current conditions, location, and results

_____ _____

Burn Boss Date

ELEMENT 3 COMPLEXITY ANALYSIS SUMMARY

PRESCRIBED FIRE NAME			
ELEMENT	**RISK**	**POTENTIAL CONSEQUENCE**	**TECHNICAL DIFFICULTY**
1. Potential for escape			
2. The number and dependence of activities			
3. Off-site Values			
4 On-Site Values			
5. Fire Behavior			
6. Management organization			
7. Public and political interest			
8. Fire Treatment objectives			
9 Constraints			
10 Safety			
11. Ignition procedures/ methods			
12. Interagency coordination			
13. Project logistics			
14 Smoke management			

COMPLEXITY RATING SUMMARY	
	OVERALL RATING
RISK	
CONSEQUENCES	
TECHNICAL DIFFICULTY	
SUMMARY COMPLEXITY DETERMINATION	
RATIONALE:	

ELEMENT 4: DESCRIPTION OF PRESCRIBED FIRE AREA

A. Physical Description

1. Location**:**
2. Size:
3. Topography:
4. Project Boundary:

B. Vegetation/Fuels Description:

1. On-site fuels data
2. Adjacent fuels data

C. Description of Unique Features:

ELEMENT 5: OBJECTIVES

A. Objectives:

1. Resource objectives:
2. Prescribed fire objectives:

ELEMENT 6: FUNDING:

A. Cost:

B. Funding source:

ELEMENT 7: PRESCRIPTION

A. Environmental Prescription:

B. Fire Behavior Prescription:

ELEMENT 8: SCHEDULING

A. Ignition Time Frames/Season(s):

B. Projected Duration:

C. Constraints:

ELEMENT 9: PRE-BURN CONSIDERATIONS AND WEATHER

A. Considerations:

1. On Site:

2. Off Site

B. Method and Frequency for Obtaining Weather and Smoke Management Forecast(s):

C. Notifications:

ELEMENT 10: BRIEFING

Briefing Checklist:

- ☐ Burn Organization
- ☐ Prescribed Fire Objectives
- ☐ Description of Prescribed Fire Area
- ☐ Expected Weather & Fire Behavior
- ☐ Communications
- ☐ Ignition plan
- ☐ Holding Plan
- ☐ Contingency Plan

- ☐ Wildfire Conversion
- ☐ Safety and Medical Plan
- ☐ Aerial Ignition Briefing (if Required)

ELEMENT 11: ORGANIZATION AND EQUIPMENT

A. Positions:

B. Equipment:

C. Supplies:

ELEMENT 12: COMMUNICATION

A. Radio Frequencies

1. Command Frequency(s):
2. Tactical Frequency(s):
3. Air Operations Frequency(s):

B. Telephone Numbers:

ELEMENT 13: PUBLIC AND PERSONNEL SAFETY, MEDICAL

A. Safety Hazards:

B. Measures Taken to Reduce the Hazards:

C. Emergency Medical Procedures:

D. Emergency Evacuation Methods:

E. Emergency facilities:

ELEMENT 14 TEST FIRE

A. Planned location:

B. Test Fire Documentation:

1. Weather conditions On-Site:

2. Test Fire Results:

ELEMENT 15: IGNITION PLAN

A. Firing Methods (including Techniques, Sequences and Patterns):

B. Devices:

C. Ignition Staffing:

ELEMENT 16: HOLDING PLAN

A. General Procedures for Holding:

B. Critical Holding Points and Actions:

C. Minimum Organization or Capabilities Needed:

ELEMENT 17: CONTINGENCY PLAN

A. Trigger Points:

B. Actions Needed:

C. Additional Resources and Maximum Response Time(s):

ELEMENT 18: WILDFIRE CONVERSION

A. Wildfire Declared By:

B. IC Assignment:

C. Notifications:

D. Extended Attack Actions and Opportunities to Aid in Fire Suppression:

ELEMENT 19: SMOKE MANAGEMENT AND AIR QUALITY

A. Compliance:

B. Permits to be Obtained:

C. Smoke Sensitive Receptors:

D. Potential Impacted Areas:

E. Mitigation Strategies and Techniques to Reduce Smoke Impacts:

ELEMENT 20: MONITORING

A. Fuels Information Required and Procedures:

B. Weather Monitoring (Forecasted and Observed) Required and Procedures:

C. Fire Behavior Monitoring Required and Procedures:

D. Monitoring Required To Ensure That Prescribed Fire Plan Objectives Are Met:

E. Smoke Dispersal Monitoring Required and Procedures:

ELEMENT 21: POST-BURN ACTIVITIES

Post-Burn Activities That Must Be Completed:

APPENDICES

A. Maps: Vicinity and Project

B. Technical Review Checklist

C. Complexity Analysis

D. Agency Specific Job Hazard Analysis

E. Fire Behavior Modeling Documentation or Empirical Documentation (unless it is included in the fire behavior narrative in Element 7; Prescription)

A: MAPS

1. Vicinity Map:

2. Project Map:

B: TECHNICAL REVIEWER CHECKLIST

PRESCRIBED FIRE PLAN ELEMENTS:	S /U	COMMENTS
1. Signature page		
2. GO/NO-GO Checklists		
3. Complexity Analysis Summary		
4. Description of the Prescribed Fire Area		
5. Objectives		
6. Funding		
7. Prescription		
8. Scheduling		
9. Pre-burn Considerations and Weather		
10. Briefing		
11. Organization and Equipment		
12. Communication		
13. Public and Personnel Safety, Medical		
14. Test Fire		
15. Ignition Plan		
16. Holding Plan		
17. Contingency Plan		
18. Wildfire Conversion		
19. Smoke Management and Air Quality		
20. Monitoring		
21. Post-burn Activities		
Appendix A: Maps		
Appendix C: Complexity Analysis		
Appendix D: Agency specific job hazard analysis		
Appendix E: Fire Prediction Modeling Runs or Empirical Evidence		
Other		

S = Satisfactory **U = Unsatisfactory**

Recommended for Approval: _____ Not Recommended for Approval: _____

_____ _____ _____

Technical Reviewer Qualification and currency (Y/N) Date

☐ **Approval is recommended subject to the completion of all requirements listed in the comments section, or on the Prescribed Fire Plan.**

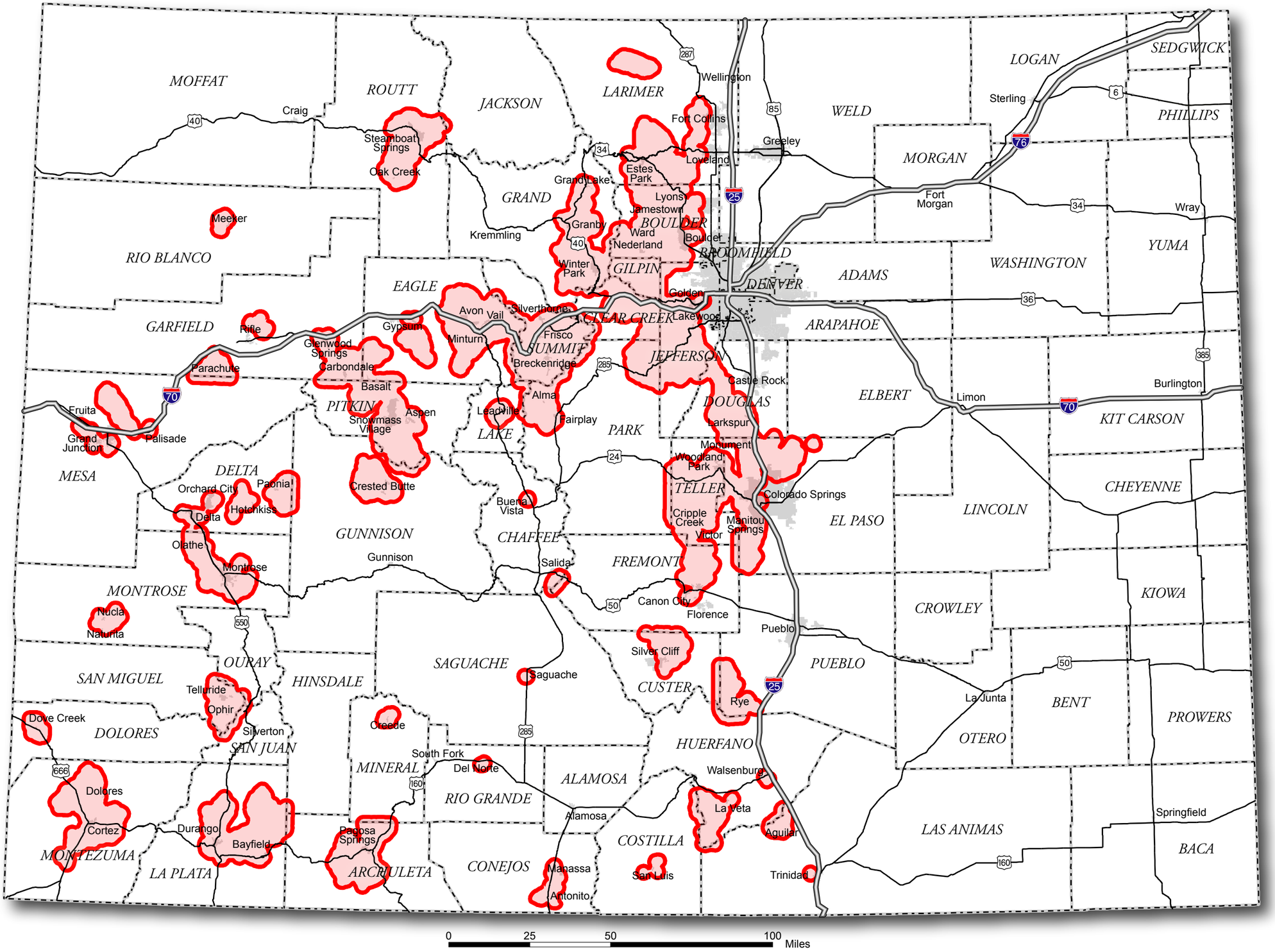
C: COMPLEXITY ANALYSIS

D: AGENCY SPECIFIC JOB HAZARD ANALYSIS

E: FIRE BEHAVIOR MODELING DOCUMENTATION OR EMPIRICAL DOCUMENTATION

3 - Wildland-Urban Interface

Interface Areas of High Wildfire Risk in Colorado



Red Zone Population:
748,350 (1990 Census)
979,851 (2000 Census)

Homes in Red Zone:
370,000 (1990 Census)
474,000 (2000 Census)

Red Zone Acres:
6,300,000 (2000)

Colorado State Forest Service

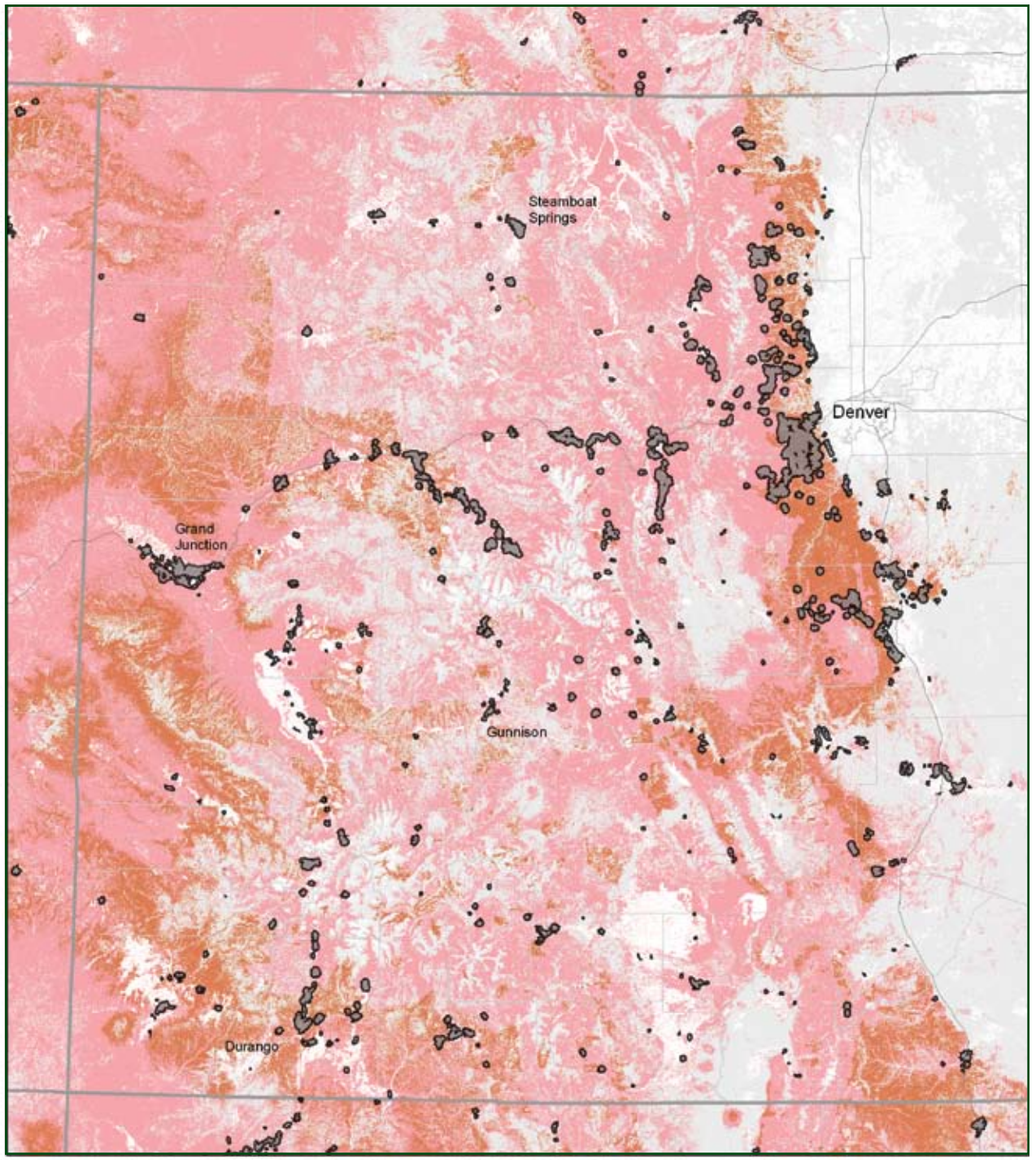
Map Created September 2004
Colorado State Forest Service

Colorado State University

From the *2007 Report on the Health of Colorado's Forests*

Colorado's Wildland-Urban Interface, Current and Projected

Development of natural areas, as is occurring in Colorado, increases demand for and costs of wildfire protection. A Colorado State University analysis (D. Theobald and W. Romme, 2007) projects that the state's wildland-urban interface (WUI) areas will increase from 715,500 acres in 2000 to 2,161,400 acres in 2030, a 300-percent increase. These maps depict Colorado's WUI in 2000 (left) and the likely expansion of WUI in 2030 based on housing development forecasts (right).

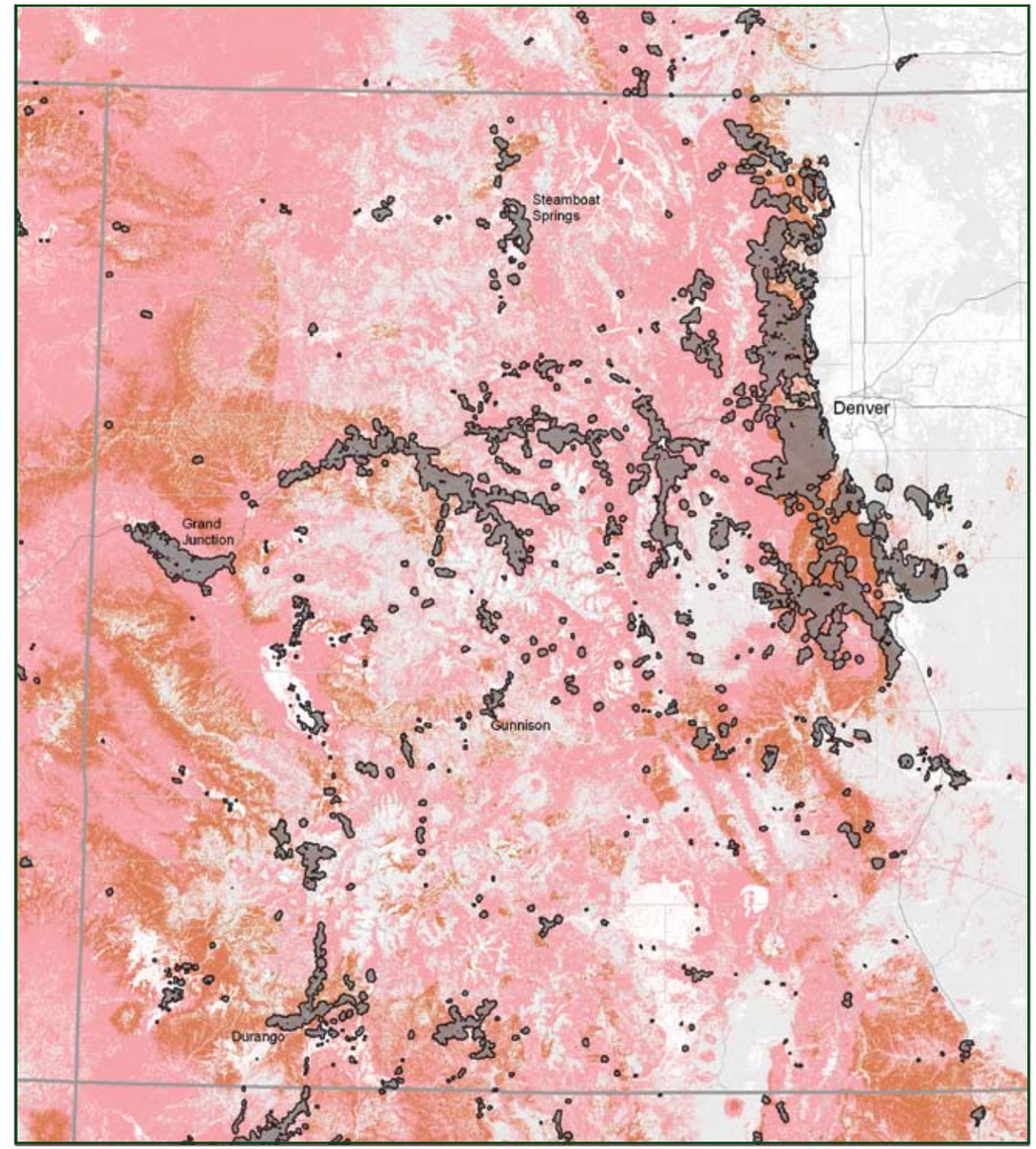


WUI + 1 mi CPZ in 2000

Low hazard | High hazard | High (variable) | None

50 Miles

Map created 23 October 2007 by D. Theobald, Colorado State University.



WUI + 1 mi CPZ in 2030

Low hazard | High hazard | High (variable) | None

50 Miles

Map created 23 October 2007 by D. Theobald, Colorado State University.

Definitions

WUI is the wildland-urban interface. It is the area where homes and urban sprawl press against the wildland, and includes both interface and intermix communities.

CPZ is the community protection zone surrounding the WUI. The analysis shows that there were more than 300,000 homes in the CPZ in 2000, and more than 720,000 homes are projected for 2030.

Low hazard means that most fires burn at relatively low intensity through surface fuels, with little potential for spread into tree or shrub crowns, and would be relatively easy to contain or suppress.

High hazard means that many or most fires burn at high intensity, often through crowns, and would be difficult to contain or suppress.

High (variable) applies to vegetation types in which fires historically were of low or variable intensity, but recently have often burned at high intensity due to a century of fire exclusion, e.g., southwestern ponderosa pine forests.

Firebreak Helps Firefighters Save YMCA Camp and Subdivision

On June 25, 2007, a human-caused fire broke out at the YMCA Snow Mountain Ranch near Winter Park. Although burning conditions were only moderate, the fire grew and spread rapidly, partly due to the dry beetle-killed trees. Recent tree cutting to reduce forest fuels at the ranch and a fast, coordinated response by firefighters kept people and buildings safe.

The Colorado State Forest Service advised ranch managers to protect their cabins from wildfire, and ranch managers did just that. A month prior to the Y Fire, they established a 150- to 200-foot firebreak around several buildings that previously were nestled in a thicket of timber.

"When the fire hit the firebreak, it literally dropped to the ground, and between the weather, a logger who was putting in dozer line, and the rest of our efforts, we were able to get a handle on it," said Ron Cousineau, Colorado State Forest Service firefighter and Granby District forester. "The firebreak did exactly what we wanted it to."

A firebreak at YMCA Snow Mountain Ranch not only protected the YMCA cabins, it also kept the fire from spreading into the neighboring Fairways at Pole Creek subdivision, which has about 100 homes.

Grand County Sheriff and Emergency Medical Services, every fire department in the county, the Colorado State Forest Service, the U.S. Forest Service, and Summit County fire departments all helped with the firefighting efforts.

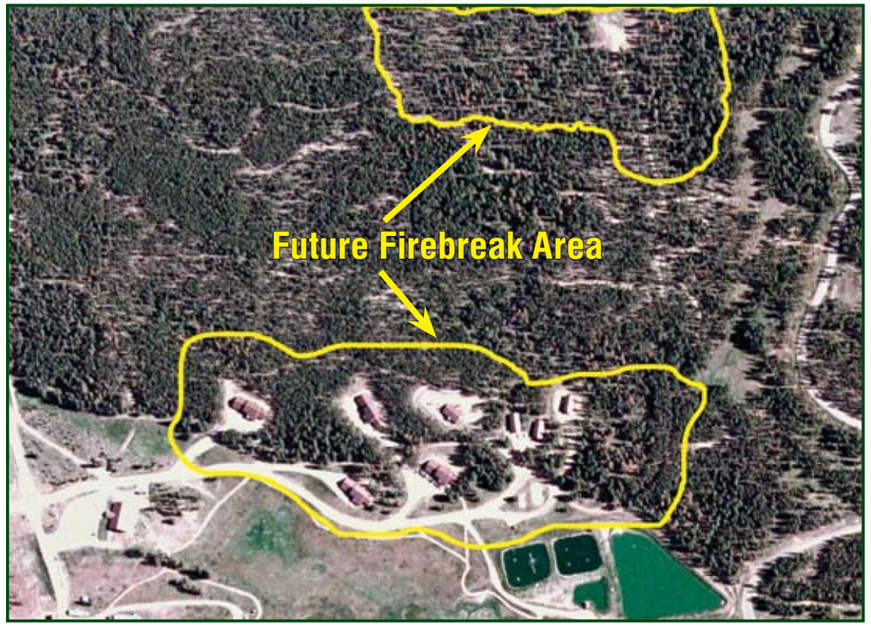
Deborah Carr

Forest thinning work reduced fire behavior in other parts of the fire.

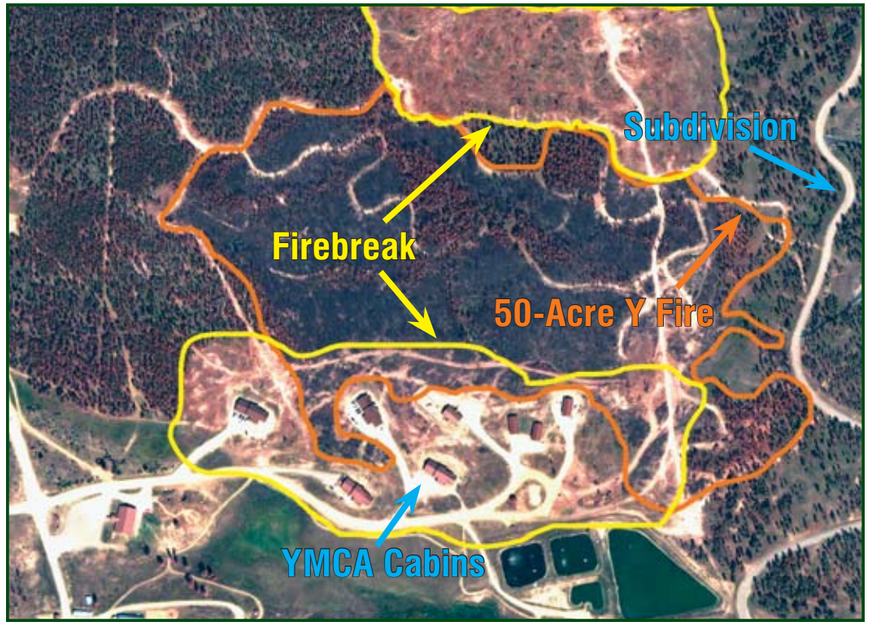
Paul Mintier

Firefighters attribute the fire's unusual intensity for the early time of year and moderate weather to beetle-infested trees.

Aerial imagery of the YMCA camp shows the firebreak location (outlined in yellow) and the extent of the Y Fire (outlined in orange). A firebreak is an area where trees and shrubs are removed so that a wildfire drops to the ground, allowing firefighters a better chance to extinguish the fire. Firebreaks can involve a significant amount of work and hazardous fuel removal, but, as seen in the lower image, can be successful in protecting homes from wildfire.



Before the Firebreak and the Y Fire, 2005



After the Firebreak and the Y Fire, 2007

© 2007
QuickBird Satellite Imagery
Courtesy DigitalGlobe, Inc.
and NCDC Imaging & Mapping

Colorado State Forest Service

From the *2007 Report on the Health of Colorado's Forests*

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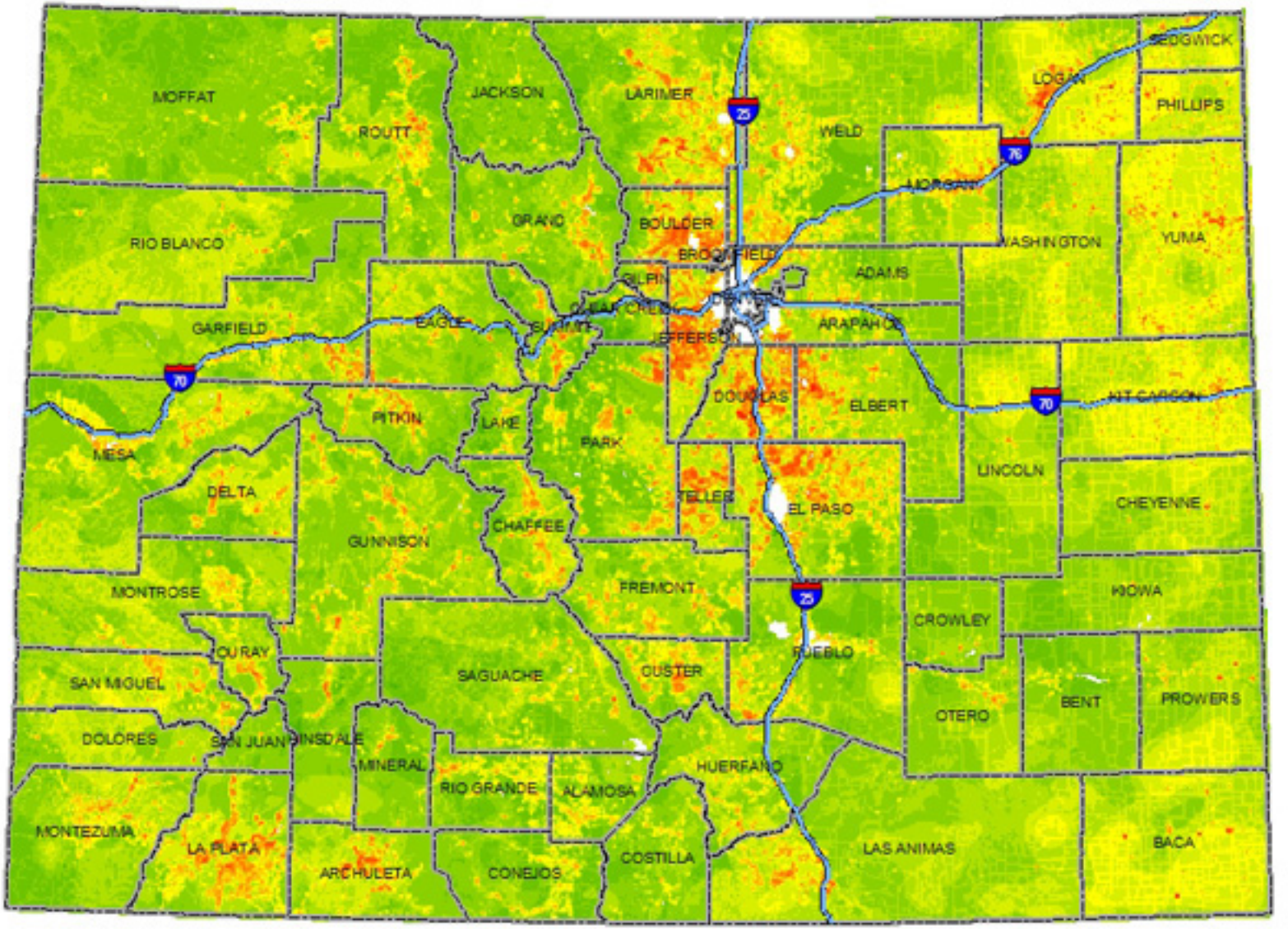
Colorado Wildland Urban Interface Hazard Assessment



Hazard Values - Aggregate of Hazard Risk and Values Layers

0 2 3 4 5 6 7 8 9 10 11 12 13 14

None Low Moderate High

Colorado State

0 10 20 40 Miles

QUICK GUIDE SERIES FIRE 2012-1

Protecting Your Home from Wildfire:

Creating Wildfire-Defensible Zones

Formerly CSU Extension Factsheet 6.302

If your home is located in the natural vegetation of Colorado's grasslands, shrublands, foothills or mountains, you live in the **wildland-urban interface** (WUI) and are inherently at risk from a wildfire. The WUI is any area where structures and other human developments meet or intermingle with wildland vegetative fuels. In many vegetation types, it is not a matter of ***if*** a wildfire will impact your home, but ***when***.

Figure 1: ***Firefighters will do their best to protect homes, but ultimately it is the homeowner's responsibility to plan ahead and take actions to reduce fire hazards around structures. Photo: National Interagency Fire Center***

Wildfires are a natural part of Colorado's varied forest ecosystems. Many rural communities are located in areas historically prone to frequent natural wildfires. Living in the wildland requires more self-reliance than living in urban areas. It may take longer for a fire engine to reach your area, and a small fire department can easily become overwhelmed during an escalating wildfire. Planning ahead and taking actions to reduce fire hazards can increase your safety and help protect your property. As more people choose to live in areas prone to wildfire, additional homes and lives are potentially threatened every year. Firefighters always do their best to protect rural residents, but ultimately, **it is YOUR responsibility to protect your life, family, animals and property from wildfire.**

The information contained in this document is for use by individual landowners to help reduce wildfire risk on their property. In order to effectively protect subdivisions and communities, all landowners must work together to reduce fire hazards within and adjacent to communities. This includes treating individual home sites and common areas within communities, and creating fuelbreaks within and adjoining the community where feasible. This document will focus on actions individual landowners can take to reduce wildfire hazards on their property. For additional information on broader community protection, go to www.csfs.colostate.edu.

Figure 2: *Colorado's grasslands, shrublands, foothills and mountains all have areas in the wildland-urban interface where human development meets wildland vegetative fuels. Photo: CSFS*

In this guide, you'll read about steps you can take to protect your property from wildfire. These steps focus on beginning work closest to your house and moving outward. Also, remember that keeping your home safe is not a one-time effort – it requires ongoing maintenance. It may be necessary to perform some actions, such as removing pine needles from gutters and mowing grasses and weeds several times a year, while other actions may only need to be addressed once a year. While

This quick guide was produced by the Colorado State Forest Service to promote knowledge transfer.

October 2012
www.csfs.colostate.edu

you may not be able to accomplish ALL of the actions described in this document to prepare your home for wildfire, each completed activity will increase the safety of your home, and possibly your family, during a wildfire.

(Note: These guidelines are adapted for ponderosa pine, Douglas-fir and mixed-conifer ecosystems below 9,500 feet. See page 9 for guidelines adapted to other forest ecosystems.)

Figure 3: ***Burning embers can be carried long distances by wind. Embers ignite structures when they land in gaps, crevices and other combustible places around the home. Photo: CSFS***

This guide primarily will help design your defensible space. **Defensible space** is the natural and landscaped area around a home or other structure that has been modified to reduce fire hazard. Defensible space gives your home a fighting chance against an approaching wildfire. Creating defensible space also reduces the chance of a structure fire spreading to the surrounding forest and other homes.

Three factors determine wildfire behavior: **fuels, weather** and **topography**. We cannot alter weather or topography, so we must concentrate on altering fuels. Fuels include vegetation, such as trees, brush and grass; near homes, fuels also include such things as propane tanks, wood piles, sheds and even homes themselves. Some plant species are more flammable than others, and the flammability of vegetative fuels changes depending on the season, recent weather events, and other factors such as drought. Fuel continuity and density also play an important role in wildfire.

Wildfire often creates its own weather conditions. Hot rising air and associated winds can carry embers and other burning materials into the atmosphere for long distances, where they can ignite vegetation and structures up to several miles away. Embers have caused the loss of many homes during wildfires.

As you think about protecting your home and property from wildfire, consider how you can manage fuels on your property to prevent fire from spreading to your home and other structures.

For more information on wildfire behavior, please see *FireWise Construction: Site Design and Building Materials* at www.csfs.colostate.edu.

Remember...

- ***Reducing fuels around a home will increase the chances for survival in a wildfire, but there is no guarantee.***
- ***This quick guide provides minimum guidelines. The more fuels you remove, the greater the chance your home will survive.***
- ***Working with your neighbors and community will increase the effectiveness of your home's defensible space.***

Fuel Arrangement and Types

When fuels are abundant, a fire can be uncontrollable and destructive. But when fuels are scarce, a fire cannot build momentum and intensity, which makes it much easier to control and is more likely to be beneficial to the land.

The more dense and continuous the fuels, the bigger the threat they pose to your home. The measure of fuel hazard refers to its continuity, both horizontal and vertical. Horizontal continuity refers to fuels across the ground, while vertical continuity refers to fuels extending from the ground up into the crowns of trees and shrubs. Fuels with a high degree of both vertical and horizontal continuity are the most hazardous, particularly when they occur on slopes. Mitigation of wildfire hazards focuses on breaking up the continuity of horizontal and vertical fuels.

Heavier fuels, such as brush and trees, produce a more intense fire than light fuels, such as grass. However, grass-fueled fires travel much faster than heavy-fueled fires. Some heavier surface fuels, such as logs and wood chips, are potentially hazardous heavy fuels and also should be addressed.

Vertical/Ladder Fuels

Ladder fuels are defined as smaller trees and brush that provide vertical continuity, which allows a fire to burn from the ground level up into the branches and crowns of larger trees. Lower branches on large trees also can act as ladder fuels. These fuels are potentially very hazardous, but are easy to mitigate. The hazards from ladder fuels near homes are especially important to address. Prune all tree branches from ground level up to a height of 10 feet above ground or up to 1/3 the height of the tree, whichever is less. Do not prune further up because it could jeopardize the health of the tree. Shrubs should be pruned based on specifications recommended for the species. Dead branches should be removed whenever possible.

Figure 4: *Ladder fuels are shrubs and low branches that allow a wildfire to climb from the ground into the tree canopy. Photo: CSFS*

Surface Fuels

Logs/Branches/Slash/Wood Chips

Naturally occurring woody material on the ground and debris from cutting down trees (also known as slash) may increase the intensity of fires. Increased fire intensity makes a fire harder to control and increases the likelihood of surface fires transitioning to crown fires. Dispose of any heavy accumulation of logs, branches and slash by chipping, hauling to a disposal site or piling for burning later. Always contact your county sheriff's office or local fire department first for information about burning slash piles. Another alternative is to lop and scatter slash by cutting it into very small pieces and distributing it widely over the ground. If chipping logs and/or slash, it's essential to avoid creating continuous areas of wood chips on the ground. Break up the layer of wood chips by adding nonflammable material, or allow for wide gaps (at least 3 feet) between chip accumulations. Also, avoid heavy accumulation of slash by spreading it closer to the ground to speed decomposition. If desired, two or three small, widely spaced brush piles may be left for wildlife habitat. Locate these well away from your home (NOT in Zones 1 or 2; see page 5-8 for zone descriptions).

Figure 5: *Surface fuels include logs, branches, wood chips, pine needles, duff and grasses. Photo: CSFS*

Pine Needles/Duff Layers

Due to decades of fire suppression, decomposing layers of pine needles, twigs and other organic debris–called duff – is deeper under many large trees today than it would have been a century ago. This is especially true in ponderosa pine forests where frequent and naturally occurring fires have been absent. These large trees often are lost when fires occur, because flames burning in the duff layer can pre-heat live vegetation and ignite the trees, or the tree's roots can be damaged from the intense heat of the smoldering duff, killing the tree. It is important to rake needle or duff layers deeper than 2 inches at least 3 feet away from the base of large trees. This should be done annually, and the additional duff also should be removed from the area.

Grasses

Grasses are perhaps the most pervasive and abundant surface fuel in Colorado. Mow grasses and weeds as often as needed throughout the growing season to keep them shorter than 6 inches. This applies to irrigated lawns and wild or native grasses. This is critical in the fall, when grasses dry out, and in the spring, after the snow is gone but before plants green-up.

Be especially careful when mowing in areas with rocks. Mower blades can hit rocks and create sparks, causing fires in dry grass. Consider mowing only on days with high humidity or after recent moisture to reduce the risk of starting an unwanted fire.

When mowing around trees, be sure to avoid damaging the root system and tree trunk by using a higher blade setting on the mower and trimming grass that grows against the trunk only by hand.

Figure 6: *Tree canopies offer fuel for intense crown fires. Photo: Paul Mintier*

Crown Fuels

An intense fire burning in surface fuels can transition into the upper portion of the tree canopies and become a crown fire. Crown fires are dangerous because they are very intense and can burn large areas. Crown fire hazard can be reduced by thinning trees to decrease crown fuels, reducing surface fuels under the remaining trees, and eliminating vertical fuel continuity from the surface into the crowns. Specific recommendations are provided in the Defensible Space Management Zones, pages 5-8.

The Home Ignition Zone

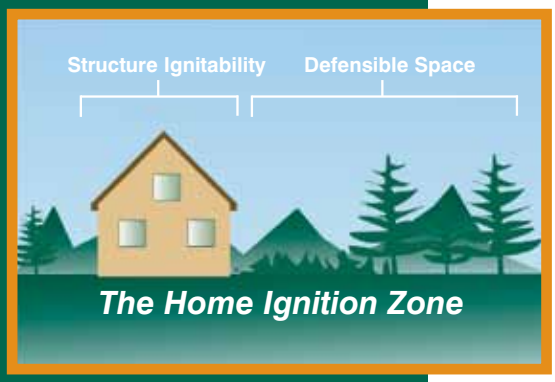


Figure 7: *Addressing both components of the Home Ignition Zone will provide the best protection for your home. Credit: CSFS*

Two factors have emerged as the primary determinants of a home's ability to survive a wildfire – the quality of the defensible space and a structure's ignitability. Together, these two factors create a concept called the **Home Ignition Zone** (HIZ), which includes the structure and the space immediately surrounding the structure. To protect a home from wildfire, the primary goal is to reduce or eliminate fuels and ignition sources within the HIZ.

Structural Ignitability

The ideal time to address home ignition risk is when the structure is in the design phase. However, you can still take steps to reduce ignitability to an existing home.

The **roof** has a significant impact on a structure's ignitability because of its extensive surface area. When your roof needs significant repairs or replacement, use only fire-resistant roofing materials. Also, check with your county building department – some counties now have restrictions against using wood shingles for roof replacement or require specific classifications of roofing material. Wood and shake-shingle roofs are discouraged because they are highly flammable, and are prohibited in some areas of the state. Asphalt shingles, metal sheets and shingles, tile, clay tile, concrete and slate shingles are all recommended roofing materials.

Figure 8: *(above) Wood shingle roofs are highly flammable and not recommended. Photo: CSFS*

Figure 9: *(above right) Class A roofing materials including tile, clay, concrete, slate and asphalt shingles are fire-resistant options. Photo: CSFS*

The extension of the roof beyond the exterior structure wall is the eave. This architectural feature is particularly prone to ignition. As fire approaches the building, the exterior wall deflects hot air and gasses up into the eave. If the exterior wall isn't ignition-resistant, this effect is amplified.

Most **decks** are highly combustible. Their shape traps hot gasses, making them the ultimate heat traps. Conventional wooden decks are so combustible that when a wildfire approaches, the deck often ignites before the fire reaches the house.

The **exterior walls** of a home or other structure are affected most by radiant heat from the fire and, if defensible space is not adequate, by direct contact with flames from the fire.

Figure 10: *Decks, exterior walls and windows are important areas to examine when addressing structure ignitability. Photo: CSFS*

Windows are one of the weakest parts of a building with regard to wildfire. They usually fail before the building ignites, providing a direct path for flames and airborne embers to reach the building's interior.

Burning embers are produced when trees and structures are consumed by wildfire. These embers sometimes can travel more than a mile. Flammable horizontal or nearly horizontal surfaces, such as wooden decks or shake-shingle roofs, are especially at risk for ignition from burning embers. Since airborne embers have caused the loss of many homes in the WUI, addressing structural ignitability is critical, even if the area surrounding a home is not conducive to fire spread.

This guide provides only basic information about structural ignitability. For more information on fire-resistant building designs and materials, refer to the CSFS *FireWise Construction: Site Design and Building Materials* publication at www.csfs.colostate.edu.

Defensible Space

Defensible space is the area around a home or other structure that has been modified to reduce fire hazard. In this area, natural and manmade fuels are treated, cleared or reduced to slow the spread of wildfire. Creating defensible space also works in the reverse, and reduces the chance of a structure fire spreading to neighboring homes or the surrounding forest. Defensible space gives your home a fighting chance against an approaching wildfire.

Figure 11: *Homesite before defensible space. Photo: CSFS*

Creating an effective defensible space involves a series of management zones in which different treatment techniques are used. Develop these zones around each building on your property, including detached garages, storage buildings, barns and other structures.

The actual design and development of your defensible space depends on several factors: size and shape of building(s), construction materials, slope of the ground, surrounding topography, and sizes and types of vegetation on your property. You may want to request additional guidance from your local Colorado State Forest Service forester, fire department or a consulting forester as you plan a defensible space for your property.

Figure 12: *Homesite after creating a defensible space. Photo: CSFS*

Defensible space provides another important advantage during a fire: increased firefighter safety. Firefighters are trained to protect structures only when the situation is relatively safe for them to do so. They use a process called "structural triage" to determine if it is safe to defend a home from an approaching wildfire. The presence or absence of defensible space around a structure is a significant determining factor used in the structural triage process, as defensible space gives firefighters an opportunity to do their job more safely. In turn, this increases their ability to protect your home.

If firefighters are unable to directly protect your home during a wildfire, having an effective defensible space will still increase your home's chance of survival. It is important to remember that with wildfire, there are no guarantees. Creating a proper defensible space does not mean that your home is guaranteed to survive a wildfire, but it does significantly improve the odds.

Defensible Space Management Zones

Three zones need to be addressed when creating defensible space:

Zone 1 is the area nearest the home and other structures. This zone requires maximum hazard reduction.

Zone 2 is a transitional area of fuels reduction between Zones 1 and 3.

Zone 3 is the area farthest from the home. It extends from the edge of Zone 2 to your property boundaries.

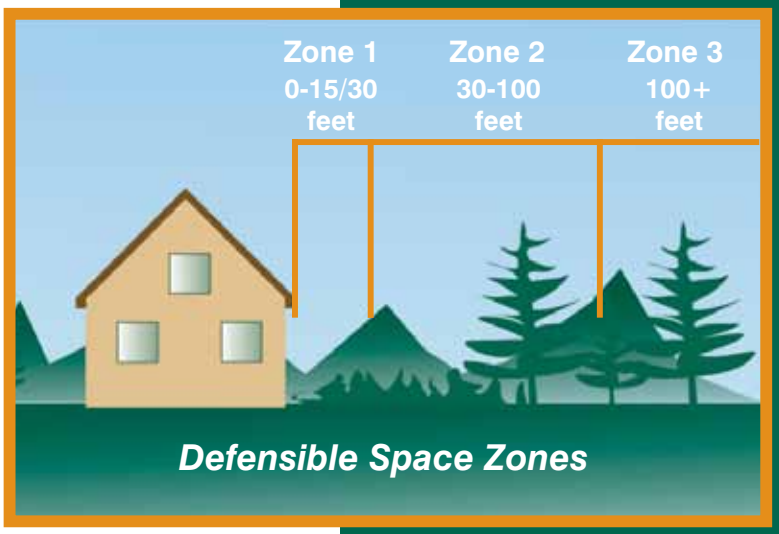


Figure 13: *Defensible space management zones. Credit: CSFS*

Figure 14: ***This homeowner worked hard to create a defensible space around the home. Notice that all fuel has been removed within the first 5 feet of the home, which survived the Waldo Canyon Fire in the summer of 2012. Photo: Christina Randall, Colorado Springs Fire Department***

Figure 15: ***Clearing pine needles and other debris from the roof and gutters is an easy task that should be done at least once a year. Photo: CSFS***

Figure 16: ***Enclosing decks with metal screens can prevent embers from igniting a house. Photo: Marilyn Brown, La Plata County***

Zone 1

The width of Zone 1 extends a minimum distance of 15-30 feet outward from a structure, depending on property size. Most flammable vegetation is removed in this zone, with the possible exception of a few low-growing shrubs or fire-resistant plants. Avoid landscaping with common ground junipers, which are highly flammable.

Increasing the width of Zone 1 will increase the structure's survivability. This distance should be increased 5 feet or more in areas downhill from a structure. The distance should be measured from the outside edge of the home's eaves and any attached structures, such as decks. Several specific treatments are recommended within this zone:

- Install nonflammable ground cover and plant nothing within the first 5 feet of the house and deck. This critical step will help prevent flames from coming into direct contact with the structure. This is particularly important if a building is sided with wood, logs or other flammable materials. Decorative rock creates an attractive, easily maintained, nonflammable ground cover.
- If a structure has noncombustible siding (i.e., stucco, synthetic stucco, concrete, stone or brick), widely spaced foundation plantings of low-growing shrubs or other fire-resistant plant materials are acceptable. However, do not plant directly under windows or next to foundation vents, and be sure areas of continuous grass are not adjacent to plantings. Information on fire-resistant plants is available on the CSFS website at www.csfs.colostate.edu.
- Prune and maintain any plants in Zone 1 to prevent excessive growth. Also, remove all dead branches, stems and leaves within and below the plant.
- Irrigate grass and other vegetation during the growing season. Also, keep wild grasses mowed to a height of 6 inches or less.
- Do not store firewood or other combustible materials anywhere in this zone. Keep firewood at least 30 feet away from structures, and uphill if possible.
- Enclose or screen decks with $^1/_8$-inch or smaller metal mesh screening ($^1/_{16}$-inch mesh is preferable). Do not use areas under decks for storage.
- Ideally, remove all trees from Zone 1 to reduce fire hazards. The more trees you remove, the safer your home will be.
- If you do keep any trees in this zone, consider them part of the structure and extend the distance of the entire defensible space accordingly.
- Remove any branches that overhang or touch the roof, and remove all fuels within 10 feet of the chimney.
- Remove all pine needles and other debris from the roof, deck and gutters.
- Rake pine needles and other organic debris at least 10 feet away from all decks and structures.
- Remove slash, wood chips and other woody debris from Zone 1.

Zone 2

Zone 2 is an area of fuels reduction designed to diminish the intensity of a fire approaching your home. The width of Zone 2 depends on the slope of the ground where the structure is built. Typically, the defensible space in Zone 2 should extend at least 100 feet from all structures. If this distance stretches beyond your property lines, try to work with the adjoining property owners to complete an appropriate defensible space.

The following actions help reduce continuous fuels surrounding a structure, while enhancing home safety and the aesthetics of the property. They also will provide a safer environment for firefighters to protect your home.

Tree Thinning and Pruning

- Remove stressed, diseased, dead or dying trees and shrubs. This reduces the amount of vegetation available to burn, and makes the forest healthier.
- Remove enough trees and large shrubs to create at least 10 feet between crowns. Crown separation is measured from the outermost branch of one tree to the nearest branch on the next tree. On steep slopes, increase the distance between tree crowns even more.
- Remove all ladder fuels from under remaining trees. Prune tree branches off the trunk to a height of 10 feet from the ground or 1/3 the height of the tree, whichever is less.

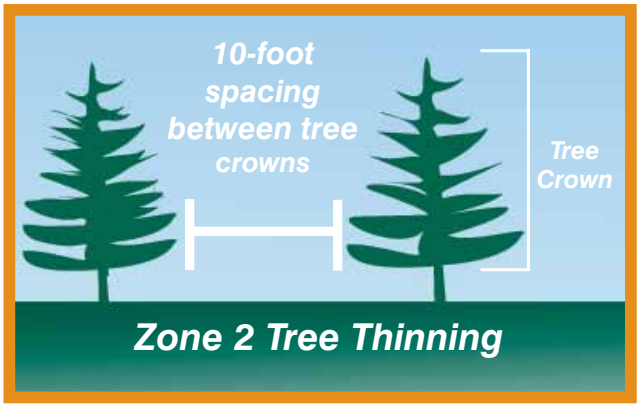


Figure 17: *In Zone 2, make sure there is at least a 10-foot spacing between tree crowns. Credit: CSFS*

- If your driveway extends more than 100 feet from your home, thin out trees within a 30 foot buffer along both sides of your driveway, all the way to the main access road. Again, thin all trees to create 10-foot spacing between tree crowns.
- Small groups of two or three trees may be left in some areas of Zone 2, but leave a minimum of 30 feet between the crowns of these clumps and surrounding trees.
- Because Zone 2 forms an aesthetic buffer and provides a transition between zones, it is necessary to blend the requirements for Zones 1 and 3. For example, if you have a tree in Zone 2 with branches extending into Zone 1, the tree can be retained if there is proper crown spacing.
- Limit the number of dead trees (snags) to one or two per acre. Be sure snags cannot fall onto the house, power lines, roads or driveways.
- As in Zone 1, the more trees and shrubs removed, the more likely your house will survive a wildfire.

Shrub Thinning/Pruning and Surface Fuels

- Isolated shrubs may be retained in Zone 2, provided they are not growing under trees.
- Keep shrubs at least 10 feet away from the edge of tree branches. This will prevent the shrubs from becoming ladder fuels.
- Minimum spacing recommendations between clumps of shrubs is 2 1/2 times the mature height of the vegetation. The maximum diameter of the clumps themselves should be twice the mature height of the vegetation. As with tree-crown spacing, all measurements are made from the edge of vegetation crowns.

Figure 18: *Pruning trees will help prevent a wildfire from climbing from the ground to the tree crowns. Credit: CSFS*

- Example – For shrubs 6 feet high, spacing between shrub clumps should be 15 feet or more (measured from the edge of the crowns of vegetation clumps). The diameter of these shrub clumps should not exceed 12 feet.
- Periodically prune and maintain shrubs to prevent excessive growth, and remove dead stems from shrubs annually. Common ground junipers should be removed whenever possible because they are highly flammable and tend to hold a layer of duff beneath them.
- Mow or trim wild grasses to a maximum height of 6 inches. This is especially critical in the fall, when grasses dry out.
- Avoid accumulations of surface fuels, such as logs, branches, slash and wood chips greater than 4 inches deep.

Firewood

- Stack firewood uphill from or on the same elevation as any structures, and at least 30 feet away.
- Clear all flammable vegetation within 10 feet of woodpiles.
- Do not stack wood against your home or on/under your deck, even in the winter. Many homes have burned as a result of a woodpile that ignited first.

Figure 19: *Keep firewood, propane tanks and natural gas meters at least 30 feet away from structures. Photo: CSFS*

Propane Tanks and Natural Gas Meters

- Locate propane tanks and natural gas meters at least 30 feet from any structures, preferably on the same elevation as the house.
- The tank should not be located below your house because if it ignites, the fire would tend to burn uphill. Conversely, if the tank or meter is located above your house and it develops a leak, gas will flow downhill into your home.
- Clear all flammable vegetation within 10 feet of all tanks and meters.
- Do not visibly screen propane tanks or natural gas meters with shrubs, vegetation or flammable fencing. Instead, install 5 feet of nonflammable ground cover around the tank or meter.

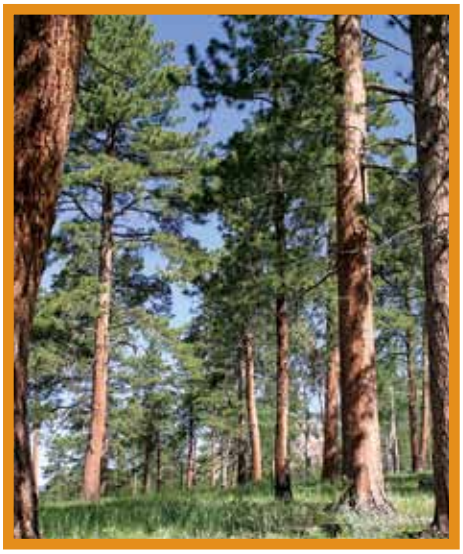


Figure 20: *This ponderosa pine forest has been thinned, which will not only help reduce the wildfire hazard, but also increase tree health and vigor. Photo: CSFS*

Zone 3

Zone 3 has no specified width. It should provide a gradual transition from Zone 2 to areas farther from the home that have other forest management objectives. Your local Colorado State Forest Service forester can help you with this zone.

This zone provides an opportunity for you to improve the health of the forest through proper management. With an assortment of stewardship options, you can proactively manage your forest to reduce wildfire intensity, protect water quality, improve wildlife habitat, boost the health and growth rate of your trees, and increase tree survivability during a wildfire.

In addition, properly managed forests can provide income, help protect trees against insects and diseases, and even increase the value of your property. Typical forest management objectives for areas surrounding home sites or subdivisions provide optimum recreational opportunities; enhance aesthetics; improve tree health and vigor; provide barriers against wind, noise, dust and visual intrusions; support production of firewood, fence posts and other forest commodities; or cultivate Christmas trees or trees for transplanting.

Consider the following when deciding forest management objectives in Zone 3:

- The healthiest forest is one that includes trees of multiple ages, sizes and species, and where adequate growing room is maintained over time.
- Remember to consider the hazards associated with ladder fuels. A forest with a higher canopy reduces the chance of a surface fire climbing into the tops of the trees, and might be a priority if this zone has steep slopes.
- A greater number of snags – two or three per acre, standing or fallen – can be retained in Zone 3 to provide wildlife habitat. These trees should have a minimum diameter of 8 inches. Make sure that snags pose no threat to power lines or firefighter access roads.
- While tree pruning generally is not necessary in Zone 3, it may be a good idea from the standpoint of personal safety to prune trees along trails and firefighter access roads. Or, if you prefer the aesthetics of a well-manicured forest, you might prune the entire area. In any case, pruning helps reduce ladder fuels within tree stands, thus reducing the risk of crown fire.
- Mowing grasses is not necessary in Zone 3.
- Any approved method of slash treatment is acceptable, including piling and burning, chipping or lop-and-scatter.

Other Recommendations

Windthrow

In Colorado, some tree species, including lodgepole pine, Engelmann spruce and Douglas-fir, are especially susceptible to damage and uprooting by high winds or windthrow. If you see evidence of this problem in or near your home, consider making adjustments to the defensible space guidelines. It is highly recommended that you contact a professional forester to help design your defensible space, especially if you have windthrow concerns.

Figure 21: ***During high winds, these lodgepole pine trees fell onto the house. Lodgepole pine is highly susceptible to windthrow. Photo: CSFS***

Water Supply

If possible, make sure that an on-site water source is readily available for firefighters to use, or that other water sources are close by. Lakes, ponds, swimming pools and hot tubs are all possible options. If there are no nearby water sources, consider installing a well-marked dry hydrant or cistern. If your primary water source operates on electricity, be sure to plan for a secondary water source. During wildfires, structures often are cut off from electricity. For more information on how to improve the accessibility of your water source, contact your local fire department.

Recommendations for Specific Forest Types

The above recommendations refer primarily to ponderosa pine, Douglas-fir and mixed-conifer ecosystems. For other forest types, please refer to the additional recommendations below:

Aspen

Tree spacing and ladder fuel guidelines do not apply to mature stands of aspen trees. Generally, no thinning is recommended in aspen forests, regardless of tree size, because the thin bark is easily damaged, making the tree easily susceptible to fungal infections. However, in older stands, numerous dead trees may be on the ground and require removal. Conifer trees often start growing in older aspen stands. A buildup of these trees eventually will increase the fire hazard of the stand, so you should remove the young conifers. Brush also can increase the fire hazard and should be thinned to reduce flammability.

Figure 22: ***Mature aspen stands can contain many young conifers, dead trees and other organic debris. This can become a fire hazard. Photo: CSFS***

Lodgepole Pine

Lodgepole pine management in the WUI is much different than that for lodgepole pine forests located away from homes, communities and other developments. Normally, it is best to develop fuels management and wildfire mitigation strategies that are informed and guided by the ecology of the tree species. This is not the case with lodgepole pine.

Older lodgepole pine stands generally do not respond well to selective thinning, but instead respond better to the removal of all trees over a defined area to allow healthy forest regeneration. Selectively thinning lodgepole can open the stand to severe windthrow and stem breakage. However, if your home is located within a lodgepole pine forest, you may prefer selective thinning to the removal of all standing trees.

Figure 23: ***A young lodgepole pine stand. Thinning lodgepole pines early on in their lives will help reduce the wildfire hazard in the future. Photo: CSFS***

To ensure a positive response to thinning throughout the life of a lodgepole pine stand, trees must be thinned early in their lives – no later than 20 to 30 years after germination. Thinning lodgepole pine forests to achieve low densities can best be

The defensible space guidelines in this quick guide are predominantly for ponderosa pine and mixed-conifer forests. These guidelines will vary with other forest types.

accomplished by beginning when trees are small saplings, and maintaining those densities through time as the trees mature.

Thinning older stands of lodgepole pine to the extent recommended for defensible space may take several thinning operations spaced over a decade or more. When thinning mature stands of lodgepole pine, do not remove more than 30 percent of the trees in each thinning operation. Extensive thinning of dense, pole-sized and larger lodgepole pine often results in windthrow of the remaining trees. Focus on removing trees that are obviously lower in height or suppressed in the forest canopy. Leaving the tallest trees will make the remaining trees less susceptible to windthrow.

Another option is leaving clumps of 30-50 trees. Clumps are less susceptible to windthrow than solitary trees. Allow a minimum of 30-50 feet between tree crowns on the clump perimeter and any adjacent trees or clumps of trees. Wildfire tends to travel in the crowns of lodgepole pine. By separating clumps of trees with large spaces between crowns, the fire is less likely to sustain a crown fire.

Figure 24: ***Piñon-juniper forests are often composed of continuous fuels. Creating clumps of trees with large spaces in between clumps will break up the continuity. Photo: CSFS***

Piñon-Juniper

Many piñon-juniper (PJ) forests are composed of continuous fuel that is highly flammable. Fire in PJ forests tend to burn intensely in the crowns of trees. Try to create a mosaic pattern when you thin these trees, with a mixture of individual trees and clumps of three to five trees. The size of each clump will depend on the size, health and location of the trees. The minimum spacing between individual trees should be 10 feet between tree crowns, with increasing space for larger trees, clumps, and stands on steeper slopes.

Tree pruning for defensible space is not as critical in PJ forests as in pine or fir forests. Instead, it is more important to space the trees so that it is difficult for the fire to move from one tree clump to the next. Trees should only be pruned to remove dead branches or branches that are touching the ground. However, if desired, live branches can be pruned to a height of 3 feet above the ground. Removing shrubs that are growing beneath PJ canopies is recommended to reduce the overall fuel load that is available to a fire.

It is NOT recommended to prune live branches or remove PJ trees between April and October, when the piñon ips beetle is active in western Colorado. Any thinning activity that creates the flow of sap in the summer months can attract these beetles to healthy trees on your property. However, it is acceptable to remove dead trees and dead branches during the summer months.

For more information, please refer to the CSFS *Piñon-Juniper Management Quick Guide* at www.csfs.colostate.edu.

Figure 25: ***Gambel oak needs to be treated in a defensible space at least every 5-7 years because of its vigorous growing habits. Photo: CSFS***

Gambel Oak

Maintaining Gambel oak forests that remain resistant to the spread of wildfire can be a challenge because of their vigorous growing habits. Gambel oak trees grow in clumps or groves, and the stems in each clump originate from the same root system. Most reproduction occurs through vegetative sprouts from this deep, extensive root system. You may need to treat Gambel oak near your home every five to seven years. Sprouts also should be mowed at least once every year in Zones 1 and 2. Herbicides can be used to supplement mowing efforts for controlling regrowth.

For more information, please refer to the CSFS *Gambel Oak Management* publication at www.csfs.colostate.edu.

Note: This publication does not address high-elevation spruce-fir forests. For information on this forest type, please contact your local CSFS district office.

Maintaining Your Defensible Space

Your home is located in a dynamic environment that is always changing. Trees, grasses and shrubs continue to grow, die or are damaged, and drop their leaves and needles each season. Just like your home, the defensible space around it requires regular, ongoing maintenance to be effective. Use the following checklists to build and maintain your defensible space.

Defensible Space: Initial Projects

Figure 26: *Keeping the forest properly thinned and pruned in a defensible space will reduce the chances of a home burning during a wildfire. Photo: CSFS*

- ☐ Properly thin and prune trees and shrubs within Zones 1 and 2.
- ☐ Dispose of slash from tree/shrub thinning.
- ☐ Screen attic, roof, eaves and foundation vents, and periodically check them to ensure that they are in good condition.
- ☐ Screen or wall-in stilt foundations and decks; screens should be 1/8-inch or smaller metal mesh (1/16-inch mesh is best).
- ☐ Post signs at the end of the driveway with your last name and house number that are noncombustible, reflective and easily visible to emergency responders.
- ☐ Make sure that the driveway is wide enough for fire trucks to enter and exit, and that trees and branches are adequately cleared for access by fire and emergency equipment. Contact your local fire department or check the CSFS website for information specific to access.
- ☐ Take pictures of your completed defensible space for comparison of forest growth over time.

Defensible Space Tasks: Annual Requirements

Figure 27: *Sharing information and working with your neighbors and community will give your home and surrounding areas a better chance of surviving a wildfire. Photo: CSFS*

- ☐ Clear roof, deck and gutters of pine needles and other debris. *
- ☐ Mow grass and weeds to a height of 6 inches or less. *
- ☐ Rake all pine needles and other flammable debris away from the foundation of your home and deck. *
- ☐ Remove trash and debris accumulations from the defensible space.*
- ☐ Check fire extinguishers to ensure that they have not expired and are in good working condition.
- ☐ Check chimney screens to make sure they are in place and in good condition.
- ☐ Remove branches that overhang the roof and chimney.
- ☐ Check regrowth of trees and shrubs by reviewing photos of your original defensible space; properly thin and prune trees and shrubs within Zones 1 and 2.
- ☐ Dispose of slash from tree/shrub thinning. *

**Address more than once per year, as needed.*

Be Prepared

- ☐ Complete a checklist of fire safety needs inside your home (these should be available at your local fire department). Examples include having an evacuation plan and maintaining smoke detectors and fire extinguishers.
- ☐ Develop your fire evacuation plan and practice family fire drills. Ensure that all family members are aware of and understand escape routes, meeting points and other emergency details.
- ☐ Contact your county sheriff's office and ensure that your home telephone number and any other important phone numbers appear in the county's Reverse 911 or other emergency notification database.
- ☐ Prepare a "grab and go" disaster supply kit that will last at least three days, containing your family's and pets' necessary items, such as cash, water, clothing, food, first aid and prescription medicines.
- ☐ Ensure that an outdoor water supply is available. If it is safe to do so, make a hose and nozzle available for responding firefighters. The hose should be long enough to reach all parts of the house.

Preparing your home and property from wildfire is a necessity if you live in the wildland-urban interface. It is important to adequately modify the fuels in your home ignition zone. Remember, every task you complete around your home and property will make your home more defensible during a wildfire.

Always remember that creating and maintaining an effective defensible space in the home ignition zone is not a one-time endeavor – it requires an ongoing, long-term commitment.

If you have questions, please contact your local CSFS district office. Contact information can be found at www.csfs.colostate.edu.

Figure 28: *This house has a high risk of burning during an approaching wildfire. Modifying the fuels around a home is critical to reduce the risk of losing structures during a wildfire. Photo: CSFS*

List of Additional Resources

- The Colorado State Forest Service, http://www.csfs.colostate.edu
- CSFS wildfire-related publications, http://csfs.colostate.edu/pages/wf-publications.html
- Community Wildfire Protection Planning, http://csfs.colostate.edu/pages/community-wf-protection-planning.html
- Colorado's "Are You FireWise?" information, http://csfs.colostate.edu/pages/wf-protection.html
- National Fire Protection Association's Firewise Communities USA, http://www.firewise.org
- Fire Adapted Communities, http://fireadapted.org/
- Ready, Set, Go!, http://wildlandfirersg.org/

Figure 29: *This house survived the Fourmile Canyon Fire in 2010. Photo: CSFS*

Figure 30: *Firefighters were able to save this house during the 2012 Weber Fire because the homeowners had a good defensible space. Photo: Dan Bender, La Plata County*

Colorado State Forest Service

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Wildfire, Wildlands, and People: Understanding and Preparing for Wildfire in the Wildland-Urban Interface

A Forests on the Edge Report

ABSTRACT

Stein, S.M.; Menakis, J.; Carr, M.A.; Comas, S.J.; Stewart, S.I.; Cleveland, H.; Bramwell, L.; Radeloff, V.C. 2013. **Wildfire, wildlands, and people: understanding and preparing for wildfire in the wildland-urban interface—a Forests on the Edge report.** Gen. Tech. Rep. RMRS-GTR-299. Fort Collins, CO. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 36 p.

Fire has historically played a fundamental ecological role in many of America's wildland areas. However, the rising number of homes in the wildland-urban interface (WUI), associated impacts on lives and property from wildfire, and escalating costs of wildfire management have led to an urgent need for communities to become "fire-adapted." We present maps of the conterminous United States that illustrate historical natural fire regimes, the wildland-urban interface, and the number and location of structures burned since 1999. We outline a sampler of actions, programs, and community planning and development options to help decrease the risks of and damages from wildfire.

Key Words: wildfire, community planning, fire-adapted, wildland-urban interface, defensible space

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US Fish and Wildlife Service Southeast Region

Brett Van Paepeghem

Curtis Lee Jones / Flickr

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INTRODUCTION

Wildfire! It's been the subject of legends; the source and sustenance of many of America's forests, shrub lands, grasslands, and other wildlands; and a central theme in forest management in the United States during the 20th century (Agee 1998). Fire plays a vital role in the maintenance of the health of many ecosystems (Hutto 2008, Pollet and Omi 2002), in part by promoting a mosaic of vegetation and by stimulating the establishment and growth of particular trees and other plants (Brown 2000); indeed, many wildland species, such as the lodgepole pine found in the West, require fire to regenerate (Brown and Smith 2000). However, wildfire can also be the cause of economic and ecological losses and can pose threats to people, property, and communities.

As more and more people live in and around forests, grasslands, shrub lands, and other natural areas—places referred to the wildland-urban interface, or WUI—the fire-related challenges of managing wildlands are on the increase (Hammer and others 2009, NASF 2009). The number of wildfires exceeding 50,000 acres has increased over the past 30 years, with most of that change occurring over the past 10 years (NASF 2009); many of these large wildfires are more intense than they were in the past[1] (Hardy and others 2001, Schmidt and others 2002). As more people live or work in the WUI, fire management becomes more complex. In addition, the costs to reduce fire risk, fight wildfires, and protect homes and human lives have risen sharply in recent decades (Abt and others 2009, NASF 2009). Climate change, insect pests, and diseases, among other influences, are also contributing to vast changes in wildland vegetation that in many areas result in landscapes that are drier, less resilient, and more likely to burn once ignited (Keane and others 2008a, 2008b).

Some 32 percent of U.S. housing units[2] and one-tenth of all land with housing are situated in the wildland-urban interface (Radeloff and others 2005), and WUI growth is expected to continue (Hammer and others 2009). While the degree of risk may vary from one place to another, given the right conditions, wildfire can affect people and their homes in almost any location where wildland vegetation is found[3]. Even structures not immediately adjacent to wildland vegetation are at risk of damage from wildfire, because embers can be transported by wind and ignite vulnerable homes a mile or more away from the flame front (Cohen 2000).

Reducing the loss of lives, property, infrastructure, and natural resources from wildfires depends on long-term community action (NFPA 2006). Land use decisions, building codes and standards, and other planning and landscaping choices all influence a community's vulnerability to damage from wildfire (Blonski and others 2010). Communities can reduce the risk of such damage by becoming knowledgeable about and engaged in actions to plan and protect their homes and neighborhoods from wildfire. Such "fire-adapted" communities will be better prepared to safely accept wildfire as a part of their surrounding landscape (Leschak 2010, NASF 2009, NFPA 2006).

Terry DeWan and Associates

As houses are added to the landscape, fire-management challenges increase.

[1] The range of ecological processes and conditions that characterized various ecosystems in the United States prior to European settlement, referred to as "historical range of variability (HRV)," has been a subject of much research (Keane and others 2009). HRV is used by scientists and managers as a reference point to assess current conditions. For fire, HRV refers to the fire regimes that existed prior to European settlement.

[2] For the cited study, "housing units" were defined as homes, apartment buildings, and other human dwellings.

[3] Of course, vegetation outside of wildland areas can also burn.

This report by the Forests on the Edge project, sponsored by the U.S. Department of Agriculture, Forest Service (see box), is intended to heighten awareness of the ecological role and societal costs of wildfire, the causes and impacts of wildfire on human communities, and the relationship between increases in housing development and wildfire risk. While our target audience is planners and developers, many other entities—such as extension agencies, conservation districts, landscape designers, communities, and homeowners—can also benefit from the information and materials provided here. The report includes maps identifying areas in the conterminous United States where the wildland-urban interface is located and where structures have already been lost to wildfire. A sampler of resources and programs is provided to call attention to a few of the many options for reducing the risk of wildfire and its impacts, and to highlight the numerous organizations, Websites, and resources that can provide specific guidance relevant to individual regions, communities, and situations. Case studies focus on fire prevention and mitigation tools currently being used in a number of communities in the United States.

Key Terms

Wildlands—forests, shrub lands, grasslands, and other vegetation communities that have not been significantly modified by agriculture or human development*. A more specific meaning for fire managers, used by the National Wildfire Coordinating Group (which coordinates programs of participating wildfire management agencies nationwide), refers to an area in which development is essentially non-existent (except for roads, railroads, power lines, and similar transportation facilities); structures, if any, are widely scattered.

Wildfire—unplanned fire burning in natural (wildland) areas such as forests, shrub lands, grasslands, or prairies**.

Prescribed fire (or controlled burn)—the intentional application of fire by management under an approved plan to meet specific ("prescribed") objectives.

Mechanical treatments—the use of people or machines to thin or reduce the density of live and dead trees and plants.

* By "human development" is meant the construction of homes or other structures; we are not referring to forest management.

** The complete definition of wildfire from the National Wildfire Coordinating Group glossary is "an unplanned ignition caused by lightning, volcanoes, unauthorized, and accidental human-caused actions and escaped prescribed fires" (NWCG 2010).

Forests on the Edge

Forests on the Edge (FOTE) is a project developed by the U.S. Forest Service in conjunction with universities and other partners. The project aims to increase public understanding of the contributions of and pressures on America's forests, and to create new tools for strategic planning. This report, one of several FOTE reports to date, provides an overview of the relationship between housing in the wildland-urban interface and wildfire. Unlike other FOTE reports, which focus primarily on private forests, this one examines the relationship between wildfire and all wildlands, including public and private forests, as well as grasslands and shrub lands. It also emphasizes the impacts of wildfires on people and their homes, and presents a sampler of some preventative measures that can be taken to create fire-adapted homes and communities.

WILDFIRE—A FUNDAMENTAL, COMPLEX, AND COSTLY FORCE

The Ecological Role of Wildfire

While many people experience and interpret wildfire in terms of the damages caused to human lives, structures, and communities, it is important to recognize the ecological role that fire plays across landscapes. Wildfire is a fundamental ecological component for 94 percent of wildlands across the conterminous United States (USDA Forest Service 2012). Fire-adapted[4] ecosystems and species are found in every region of the United States, from the ponderosa pine forests of the Northwest and the Rocky Mountain West, to the Southwest's chaparral, the Midwest's tall grass prairies, the pine barrens of New Jersey, and the South's longleaf pine forests.

The relationship between wildlands and wildfire is complex, and it varies considerably depending on the location, size, and intensity of the fire; the season; the weather; the ecological characteristics of the land; and the type and amount of human influence (Anderson 2001, Greswell 1999, Martin and Sapsis 1992, Rieman and others 2005). Typical long-term patterns of fire size, intensity, frequency, and other characteristics occurring naturally over time and across the landscape are known as "natural fire regimes." Fire regimes have been assigned to wildlands based on fire severity (how damaging a fire is to vegetation and soils of a certain site), fire intensity (the rate of heat released by a fire and prominent immediate effects), and fire frequency (how often the site burns)(Morgan and

[4] "Adapted" in this sense means an ability to adjust to the intensity or quality of a disturbance; qualities that make an organism or its parts fit for existence under the conditions of its environment (Merriam-Webster 2011).

Table 1. Historical natural fire regimes, with examples

Fire regime group	Percent of wildland in this group[a]	Fire frequency[b] (years)	Fire severity[c]	Description/ definition	Examples
I	25	0–35	Low to mixed	Low-severity fires that leave most dominant overstoryd vegetation intact; can include mixed-severity fires replacing up to 75 percent of overstory	Lower elevation Ponderosa pine forests in the West; Pine and oak forests in the Southeast
II	19	0–35	High	High-severity fires that consume at least 75 percent of overstory vegetation	Grassland areas across the central United States; Chaparral stands throughout the West
III	22	35–200	Mixed to low	Generally mixed-severity fires; can also include low-severity fires	Mixed deciduous-conifer forests of the upper Midwest and Northeast; Western Douglas-fir forests
IV	12	35–200+	High	High-severity fires that consume or kill most of the aboveground vegetation	Lodgepole pine in the Northern Rockies; Isolated areas of the Great Lakes and New England regions
V	16	200+	Any severity	Infrequent fires that consume or kill most of the aboveground vegetation	Wetter forests in much of Maine, northern Pennsylvania, and parts of the West

[a] The column does not add up to 100 percent because 6 percent of all wildlands do not fall into any of these categories.
[b] Historical average number of years between fires (prior to European settlement).
[c] Historical effect on the trees and plants most commonly found in each wildland type (prior to European settlement).
[d] The term overstory refers to all above-ground vegetation.

Sources: Barrett and others 2010, Brown 2000, Hardy and others 2001, Rieman and others 2005, Schmidt and others 2002, USDA Forest Service 2012.

others 2001). Understanding these regimes can help to communicate the ecological role of fire in America's wildlands and can be used to identify significant changes resulting from management actions or possible shifts in climate (Brown 2000). Table 1 describes and provides examples of wildland fire regimes found in the United States[5]; see also the Historical Natural Fire Regimes box[6], and Figure 1.

Many plant and animal species depend or thrive on the structure and conditions resulting from the natural fire

Kelly Stover/US Forest Service

[5] The information displayed in Table 1 and Figure 1 is derived from an analysis (USDA Forest Service 2012) based on the following data sources: Fire Regime Group and Mean Fire Return Interval data come from LANDFIRE Refresh 2001 v1.0.5 (http://www.landfire.org). Developed and agricultural lands data come from LANDFIRE Refresh 2008 v.1.1.0 Existing Vegetation Type. State boundaries are from publicly available 1:2,000,000-scale polygon spatial data of U.S. States. All spatial data were converted to rasters with 270-meter (~82-feet) resolution for this summary.

[6] It is important to note that some U.S. wildlands no longer experience these fire regimes, owing to fire suppression, invasive species, and other factors.

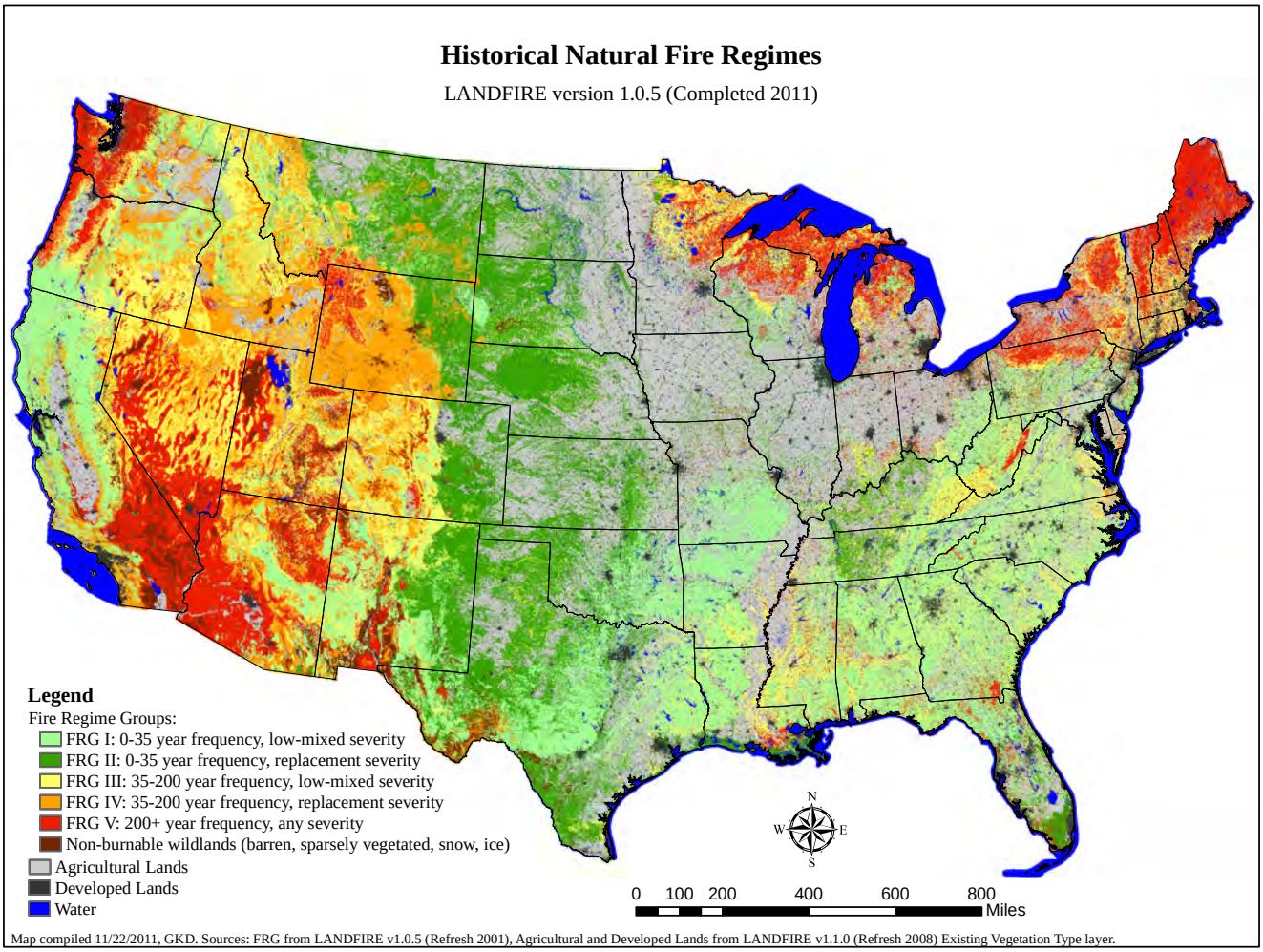


Figure 1. Historical natural fire regimes. Source: FRG from LANDFIRE v. 1.0/5 (Refresh 2001), Agricultural and Developed Lands from LANDFIRE v1.1.0 (Refresh 2008) Existing Vegetation layer.

Historical Fire Regimes: What's 'Natural' for Wildfire?

What determines whether a fire is unusual or just part of a typical fire pattern for a particular place? Fire specialists have looked at fires that occurred in various ecosystems prior to European settlement. In studying these fires, scientists categorized broad areas across the country that have similar patterns of fire frequency and severity (see Table 1 footnote for definitions) that have occurred over extended periods of time. Historical patterns of fire *frequencies* were typically caused by lightning and by burning by Native Americans; patterns of fire *severity* were mostly caused by climate, topography, and vegetation dynamics. The grouping of such patterns into categories (Table 1) is referred to as historical fire regimes, and provides a framework for what to expect in the way of fire in different locations based on historical conditions (Fig. 1).

In many areas, fire still plays a vital role and is key to maintaining those ecosystems; some fire-dependent forest types, such as the lodgepole pine in Yellowstone National Park, continue to function within their historical range (Hardy and others 2001, Schmidt and others 2002). However, in many areas, especially in lower elevation areas characterized by fire regimes I and II, current fire regimes are different than they were historically—in part because of fire exclusion, human disturbance, exotic species, and changes in climatic patterns. In some areas, fires that once burned often but with low severity may now burn less frequently, hotter, and larger; other places may now have numerous fires where once they had few (Martin and Sapsis 1992, Rieman and others 2005). Such "uncharacteristic" fires can challenge the ability of systems, wildland species, and people to respond to fire.

—Hardy and others (2001), Rieman and others (2005), Schmidt and others (2002)

Marc Barrison / Flickr

The gopher tortoise requires low-severity fires every 3 to 4 years.

regimes to which the species evolved or adapted (Kennedy and Fontaine 2009, Martin and Sapsis 1992). For example:

- The gopher tortoise (*Gopherus polyphemus*) and Bachman's sparrow (*Aimophila aestivalis*) found in longleaf pine forests require low-severity fires every 3 to 4 years to maintain bare ground and herbaceous habitat for nesting (Kennedy and Fontaine 2009).

- Black-backed and hairy woodpeckers make use of snags (standing dead trees) typically created by more intense fire (Kennedy and Fontaine 2009).

- Some fish and amphibians have complicated life cycles that benefit from fire because it can create the habitat diversity they require for long-term population stability (Rieman and others 2005, Skinner 2002). In some shallow wetlands and riparian areas, frequent fire can keep woody vegetation from being established, thus creating opportunities for amphibians that need sunny areas or open water (Pilliod and others 2003).

- Lodgepole pines in some areas of the Rocky Mountains require fire to open their sticky cones, and dense Douglas-fir forests in the Pacific Northwest benefit when fire creates sunny openings where shade-intolerant Douglas-fir seedlings can grow (Franklin and Van Pelt 2004, Rieman and others 2005).

- Whole suites of "fire-following" wildflowers produce profuse blooms of annuals or short-lived perennials, such as lupines and Indian paintbrush, with winter or spring rains following a wildfire; their seeds can lay dormant for decades until the right conditions trigger germination.

KevinCass / istockphoto.com

Many wildflowers germinate after fires.

Depending on the characteristics and scale of a particular fire, a patch of habitat or an entire watershed can undergo shifts in nutrients, energy cycles, and other ecological conditions that favor some species or communities while adversely affecting others (Agee 1998, Pickett and White 1985, Reeves and others 1995). Changes in characteristic fire patterns can have substantial consequences for ecosystems and the species they harbor, including wildlife and plant pollinators adapted to specific vegetation types. For example, the absence of typical fires from some vegetation types can lead to unusually large, intense wildfires that can extensively alter habitats or landscapes (Ice and others 2004, Smith 2000, Wilcove and others 1998), hasten soil erosion (Kocher and others 2001), increase stream temperature or sediments (Minshall and others 1989), and reduce the amount of carbon that is stored in the vegetation (Hurteau and others 2009).

Regardless of the fire regime, wildfires can kill individual plants, animals, fish, and aquatic organisms (Reiman and others 1997); degrade fish and wildlife habitat in the short term (Burton 2005); temporarily lower survival rates for larger animals and their young (Singer and others 1989); change the mix of birds and other species in an area (Tiedemann and Woodard 2002); and increase the susceptibility of trees to insect invasion (McCullough and others 1998). In many instances, such ecological impacts eventually disappear or create a net benefit for the ecosystem over time[7], but chronic damage can also occur (Gresswell 1999, Gruell 1983, Singer and others 1989, Neary and others 2005).

[7] Whether or when recovery occurs depends upon site conditions, fire severity, and species involved.

Complicating Factors: Climate Change, Insect Pests, and Diseases

On many landscapes across the country, climate change as well as insect pests and diseases are increasing the potential for wildfires by influencing changes in vegetation.

Climate Change

Increases in the number, size, intensity, and duration of wildfires across large areas of the United States are being attributed in part to climate change (Fried and others 2004, Westerling and others 2006). Climate change is predicted to lead to warmer temperatures and changes in rainfall patterns, as well as increased periods of drought in many locations (Dale and others 2001). By 2070, the length of the fire season in some Western U.S. regions could increase by 2 to 3 weeks (Brown and others 2004). Projections for the Greater Yellowstone ecosystem foresee a dramatic increase in fire frequency, which will lead to the replacement of many plant and animal communities with a different mix of species (Westerling and others 2011). However, changes in acreage burned and other fire characteristics are not likely to be uniform because of variations in precipitation, winds, temperature, vegetation types, and landscape conditions (California Climate Change Center 2006). Furthermore, water shortages as a result of drought and changes in snowpack[8] could also affect the availability of water to fight fires once they start (Knutson and others 1998; Barnett and others 2005).

Insect Pests and Diseases

Insect and disease outbreaks are an integral part of the life cycle of many forests. However, insect and disease outbreaks are increasing across the country—linked in part to climate change; to human activities that introduce and spread forest pests (Koch and Smith 2010, Logan and others 2003); and, in some areas, to fire suppression (Romme and others 2006). Insects and diseases caused the mortality of 5.3 million acres of U.S. forests in 2006 and nearly 6.8 million acres in 2007 (USDA Forest Service 2009). The large number of trees being killed by extreme insect or disease outbreaks contributes to increasing the potential for wildfires (Konkin and Hopkins 2009, Man 2009, McCullough and others 1998, Parker and others 2006).

Curtis Lee Jones / Flickr

Pine bark beetle kill.

Chris Evans/Bugwood.org

Cheat grass is an invasive, highly flammable non-native species that increases the risk of wildfire.

Non-native invasive plants are an additional complicating factor for fire in forest and grassland areas. The replacement of native grasses, shrubs, and trees with non-native species, which are often more flammable, has increased the potential for future wildfires (D'Antonio and Vitousek 1992).

[8] Earlier winter/spring snowmelt reduces streamflow during the summer and autumn, thus increasing vulnerability to wildfire damage.

Societal Costs of Wildfire

While the presence of fire on the landscape is inescapable and often desirable from an ecological standpoint, wildfires can have considerable social and economic costs. These costs have risen substantially in recent years and can be particularly high in the wildland-urban interface (Kent and others 2003), where considerable resources are spent on the protection of homes and other structures. Recent studies have found a positive correlation between firefighting expenditures and the presence of housing and private lands (Gebert and others 2007, Liang and others 2008)[9].

The most publicized costs associated with wildfire are those to fight, or suppress, large wildfires. Average annual fire suppression expenditures by the U.S. Forest Service alone totaled $580 million from 1991 to 2000, and more than doubled to $1.2 billion annually from 2001 to 2010 (USDA Forest Service 2011c). State expenditures related to wildfire have also increased substantially in recent years. According to a biannual survey conducted by National Association of State Foresters (NASF), more than $1.6 billion annually is spent by State forestry agencies on wildfire protection, prevention, and suppression (including Federal funding expended by State agencies)—and that number has more than doubled in the past 10 years (NASF 2010).These figures do not include the cost to local fire departments across the country, which, according to a survey by the National Fire Protection Association (NFPA), responded to an average of 36,700 fires annually in forests, woodlands, or other wildlands from 2004 to 2008[10] (Ahrens 2010).

Kari Greer / US Forest Service

Application of fire retardant is one of the most costly aspects of fire suppression.

However, fire suppression expenses represent only a fraction of the monetary value spent on or lost in damages due to wildfires (see box). Numerous other costs include: the costs of restoring burned areas[11], lost tax and business revenues, property damage and/or devaluation, and costs to human health and lives (Donovan and others 2007, Kent and others 2003, USDA Forest Service 2011b, WFLC 2010). As an example, soil erosion and flash flooding following Colorado's 1996 Buffalo Creek fire resulted in more than $2 million in flood damage as well as more than $20 million in damage to the Denver water supply system (Lynch 2004).

Human lives lost or injured in the course of a wildfire are an incalculable societal cost. In the most extreme case to date in North America, the 1871 Pestigo Fire killed more than 1,200 people, destroyed numerous settlements, and burned 2,400 square miles across Wisconsin and Michigan (Pernin 1971). But the loss of even one person is an immense cost.

Wildfires can damage human health and take human lives even when people do not come into direct contact with the fire itself. People living near or downwind of a wildfire, for example, can be exposed to a host of pollutants that, depending on the person and the level of exposure to smoke, can trigger allergies, bronchitis, impaired judgment, and respiratory irritation (Chepesiuk 2001). Such health costs are generally accompanied by increased

[9] Recent analyses indicate that fire suppression expenditures by the U.S. Forest Service are greatly influenced by the presence of private lands (Liang and others 2008) and that per-acre suppression costs are greater in areas with higher total housing values (Gebert and others 2007).

[10] Figures are based on data provided by fire departments and State fire authorities who participated in the National Fire Incident Reporting System (NFIRS) and the annual NFPA fire experience survey. Fires in forests, woodlands, or other wildlands accounted for about 10 percent of all fires to which local fire departments responded (estimated average of 356,800 brush, grass, and forest fires per year) during 2004–2008.

[11] The need for restoration after a wildfire varies considerably, depending upon the location and intensity of a fire. In some areas, such as remote areas, restoration may not be warranted.

Ric Francis / AP Photo

Bell Canyon area of southern Ventura County, CA.

How Much Money Does a Wildfire Cost?

Total monetary costs associated with any wildfire are difficult to estimate but even partial costs can be staggering, as shown in the following examples*:

Colorado's 2002 Hayman Fire, 138,000 acres (Kent and others 2003)*:*

- Total insured private property losses: $38.7 million
- Loans and grants from Small Business Administration and FEMA: $4.9 million
- Damage to transmission lines: $880 thousand
- Loss in recreation concessionaire revenue on two U.S. Forest Service ranger districts: $382 thousand
- Lost value of water storage capacity: $37 million
- Lost value from timber: $34 million

Total documented cost: $115.9 million

Six weeks of large wildfires (500,000 acres) occurring across 18 counties in northeastern Florida in 1998 (Butry and others 2001):

- Commercial timber (softwood) losses: $322 million to $509 million
- Suppression and disaster relief: $50 million to $100 million
- Property losses (including 340 homes): $10 million to $12 million
- Tourism and trade losses: $140 million
- Health care (asthma treatment): $325 thousand to $700 thousand

Total documented cost: $522 million to $762 million

* Not including suppression costs or costs to rehabilitate burned areas.

monetary expenses for medical treatment (Butry and others 2001).

Living in or near a wildland-urban interface area that is at high risk of wildfire also can reduce real estate values. A recent Colorado study showed that after the posting of fire risk maps and information on the Web, the values of homes located near areas of high wildfire risk experienced a temporary (2-year) decrease in value relative to homes farther away from high-risk areas (Donovan and others 2007). A Montana study concluded that sale prices of homes closer to areas previously burned by wildfires were lower than those for similar homes located farther away (Stettler and others 2010).

Over Time: Changes in U.S. Wildland Fire Management Policy

Fire and fire management have played a substantial role in the development and maintenance of America's wildlands. Long before European settlement, fire was used extensively by native inhabitants as an agricultural tool and to create hunting habitat (Pyne 1982), a practice that was continued by some European settlers. Until the early 1900s, fire also was used by settlers to reduce the amount of vegetation in order to decrease the potential "fuel" for future fires (Donovan and Brown 2007, Pyne 2010).

By the beginning of the 20th century, at a time when virtually every industry and convenience of life in America relied on wood (Williams 1989), America's professional foresters and others saw fire as a waste of valuable forest resources (Donovan and Brown 2007, Pyne 2010). Public support for fire suppression

F. E. Dunham / US Forest Service, National Archives and Records Administration

Malibu Fire, near Angeles National Forest, fall 1935.

Gary Chancey, Black Hills National Forest / forestphoto.com

increased after a series of large, intense fires burned vast stretches of U.S. wildlands (Pyne 2010), destroyed entire communities, and led to the loss of many lives. A tipping point came in 1910, when a wave of wildfires swept across the West, burning more than 3 million acres and leading to the loss of 78 firefighters (Pyne 2010).

In the years following the 1910 fires, Federal and State agencies strove to suppress all wildfires, but the lack of fire led to changes in the condition of some fire-dependent wildlands, and a build-up of flammable materials (Parsons 2000). Since the early 1900s, public wildfire management policy has evolved considerably. In the 1960s and 1970s, managers, scientists, and the public learned more about the fundamental role of fire in many forest and wildland ecosystems. Fire has been gradually reintroduced through carefully controlled and supervised burns referred to as prescribed burning (Parsons 2000, Pyne 2010, Stephens and Ruth 2005, vanWagtendonk 1995).

Larry Kohrnak / InterfaceSouthv

Close to 70 percent of the 9 million acres treated with prescribed fire from 2005 to 2010 were located in the Southeast (Gary Jarvis, U.S. Forest Service, Fire and Aviation Management, Fuels and Fire Ecology, personal communication).

A National Cohesive Wildland Fire Management Strategy

Under the guidance of the Wildland Fire Leadership Council, dozens of Federal, State, local, tribal, and non-governmental partners, as well as interested members of the public, are working on a strategy to guide the future of fire management across the United States. The council's vision is "to safely and effectively extinguish fire when needed; use fire where allowable; manage our natural resources; and as a nation, to live with wildland fire."

The strategy contains objectives and actions for each of three U.S. regions—Northeast, Southeast, and West. These include:

- efficiently reducing wildfire hazards on lands bordering communities;
- restoring and maintaining the structure, composition, and function of fire-dependent landscapes; and
- improving the overall effectiveness of the wildland fire management organization.

More information on this effort can be found at: http://www.forestsandrangelands.gov/strategy/.

Public wildfire policy continues to evolve, as managers advance their efforts to coordinate and improve wildfire response, prevention, and restoration of fire-adapted wildlands. Much work still remains to reduce fuels to those more closely matching the ecological fire loads of natural fire regimes depicted in Table 1, especially because biomass continues to accumulate (P. Langowski, personal communication).

WHERE WILDLANDS, HOUSING, AND FIRE CONVERGE

The Wildland-Urban Interface

The dynamic tension between the need for periodic fire to sustain wildland health in certain ecosystems and the need to minimize negative impacts to people and their homes from wildfire is most acute in the wildland-urban interface (WUI), where homes and wildlands meet or intermingle. Given that fire plays an ecological role in 94 percent of wildlands across the conterminous United States (USDA Forest Service 2012), we know that wildfire can and will eventually occur in most U.S.

Mark D. Roper / US Forest Service

Larry Kohrnak / InterfaceSouth

Kari Greer / US Forest Service

Examples of wildland-urban interface.

wildlands. Therefore, homes located anywhere in the WUI will eventually be exposed to wildfire, regardless of vegetation type or potential for large fires.

What is the WUI and where is it located? There are many ways to answer this question (Blonski and others 2010), depending in part on how specifically one defines WUI. One definition refers to the WUI as any area where "humans and their development meet or intermix with wildland fuel" (USDA Forest Service and others 2001). The map presented here (Fig. 2a) is based on a study (Radeloff and others 2005) that identified WUI more specifically as lands with more than one housing unit per 40 acres where wildlands dominate the landscape (referred to as intermix); and land with higher housing densities that are adjacent to natural areas (referred to as interface). In other words, homes in the intermix WUI are interspersed with vegetation, whereas homes in the interface WUI are grouped together and adjacent to areas with heavy vegetation (Fig. 2b). Figure 2a was built considering vegetation data, census data on housing[12], and updated land ownership data as initially described in Radeloff and others (2005)[13].

As depicted in Figure 2a, both intermix WUI (colored orange) and interface WUI (colored yellow), are found across the United States and are most prominent across much of the East, where most of the Nation's population is found. Under the right conditions, homes in any of these WUI areas could be exposed to wildfire. So too, could homes in more lightly settled rural areas with considerable wildland vegetation (colored lighter green on the map). Since housing in these lighter green areas is sparse and scattered, housing density is not yet high enough to be considered WUI. However, with additional housing growth and no change in vegetation, light green areas could become WUI communities. Because these isolated homes are near or within wildlands, their owners must also be ready to respond to the risk of wildfire.

According to the Radloff and others (2005) study, about one-tenth of the land area occupied by housing and about one-third of all housing units (homes, apartment houses, condominiums, etc.) in the conterminous United States are located in the WUI[14]; if past trends continue, the WUI will continue to increase. From 1990 to 2000 alone, the total WUI area in the United States increased by 18 percent, with the addition of more than 6 million

[12] Public lands are excluded from census blocks before housing and vegetation are assessed, to ensure that WUI classification captures even small human communities surrounded by public lands.

[13] We used the same methods as described in the Radeloff and others 2005 publication to produce Figure 2, but we updated the analysis based on the 2010 census data.

[14] The remaining nine-tenths of land area occupied by housing, and two-thirds of housing units, are located in areas that are urban, or are too sparsely populated to be identified as WUI.

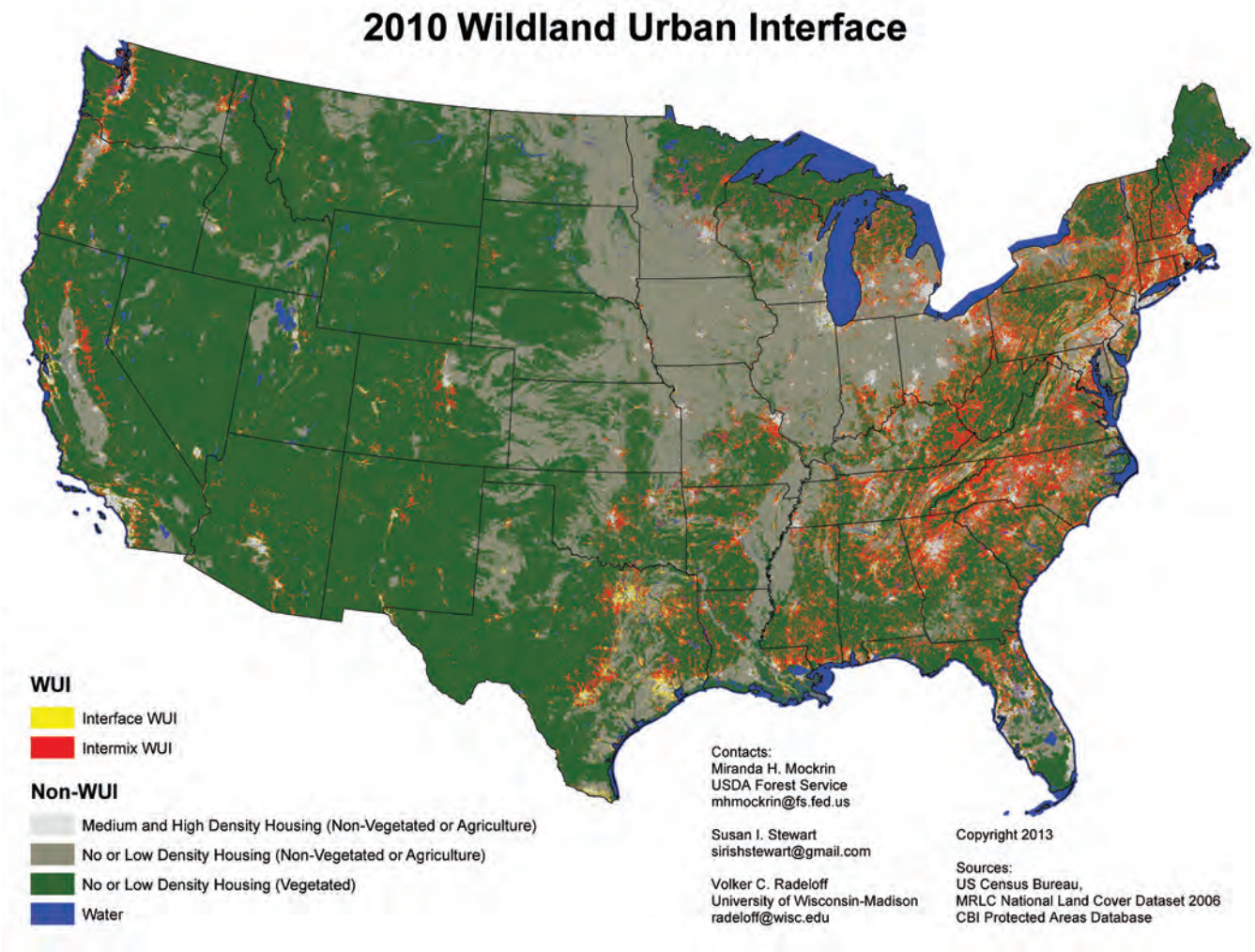


Figure 2a. Distribution of wildland-urban interface across the conterminous United States, 2010. Source: compiled by S.I. Stewart and V.C. Radeloff based on the 2010 census, the 2006 National Land Cover Dataset (NLCD), and the Protected Area Database v.1.1

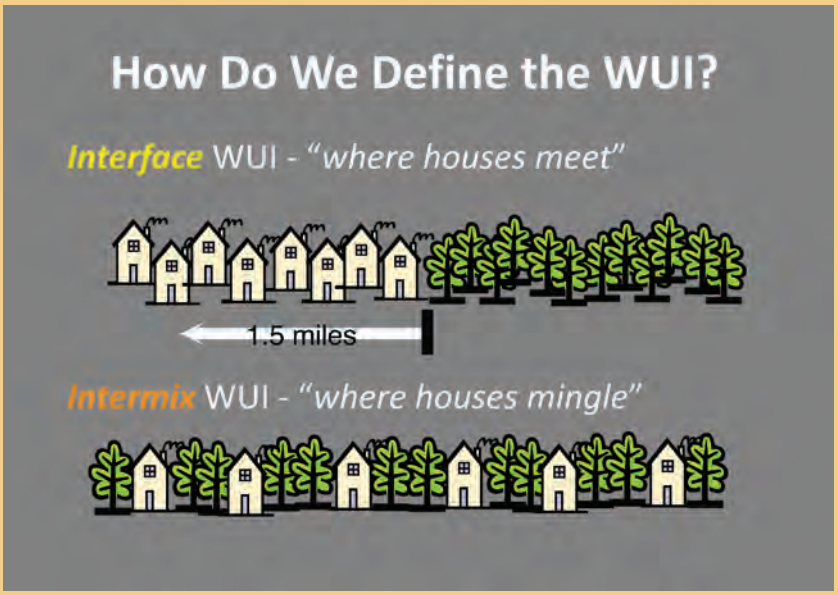


Figure 2b. How Do We Define the WUI? In *interface* WUI wildlands are adjacent to housing developments, while in *intermix* WUI, houses and wildlands intermingle. Source: Dr. Volker Radeloff, University of Wisconsin, used with permission.

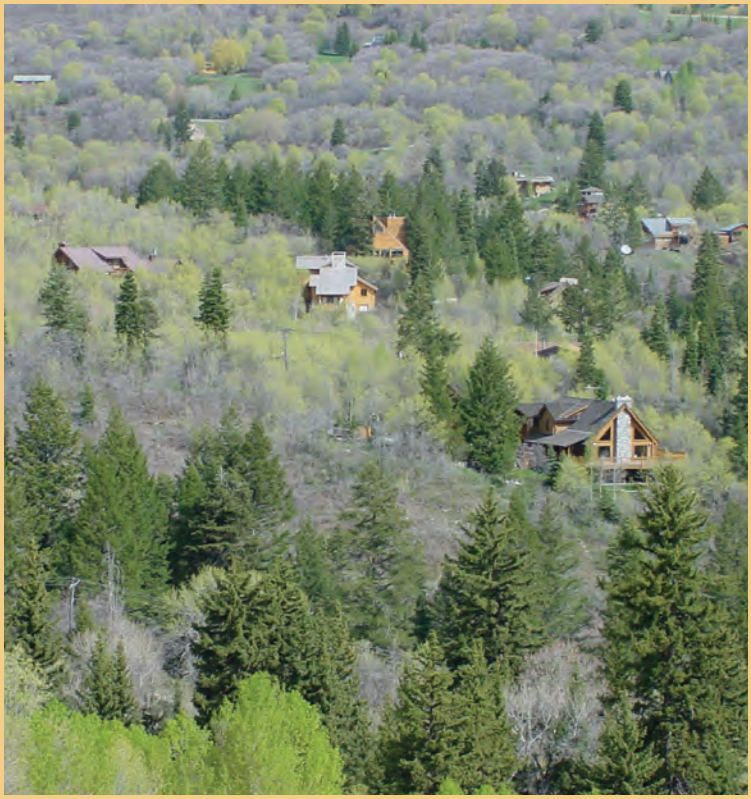
Paul Ryan/US Fish and Wildlife Service

Smoke from approaching fire, JN 'Ding' Darling National Wildlife Refuge, Florida.

Kari Greer/US Forest Service

Waldo Canyon Fire, Colorado Springs, CO, 2012, where wildfire caused extensive damage in and near WUI neighborhoods.

homes (Radeloff and others 2005). There are many factors behind WUI growth, including population growth; housing growth in areas with abundant natural amenities (such as forests, scenery, and wildlife); and population shifts from the long-developed Eastern United States to the still-growing West and South, where cities are expanding into their surrounding wildlands (Hammer and others 2009). "Baby-boom" retirement is just beginning and will likely reinforce the so-called amenity migration, as some retirees move to smaller, more rural communities close to scenic natural resources (Hammer and others 2009). Many Federal, State, and local agencies responsible for suppressing wildfires are concerned about such increases in the WUI because fire management and firefighting in these areas can be complicated and expensive, and resources for fire management are limited (NASF 2009).



NFPA Firewise Communities Program

WUI Facts and Figures

- In 2000, nearly a third of U.S. homes* (37 million) were located in the WUI (Radeloff and others 2005).
- More than two-thirds of all land in Connecticut is identified as WUI (Radeloff and others 2005).
- California has more homes in WUI than any other State—3.8 million (Radeloff and others 2005).
- Between 1990 and 2000, more than 1 million homes were added to WUI in California, Oregon, and Washington combined (Hammer and others 2007).
- WUI is especially prevalent in areas with natural amenities, such as the northern Great Lakes, the Missouri Ozarks, and northern Georgia (Stewart and others 2001).
- In the Rocky Mountains and the Southwest, virtually every urban area has a large ring of WUI, as a result of persistent population growth in the region that has generated medium and low-density housing in low-elevation forested areas (Hammer and others 2009).

* The research conducted for this and the other bullets in this box actually focused on "housing units," which include homes, apartment buildings, and other human dwellings.

Variations in Wildfire Risk Across the Wildland-Urban Interface

Many homes in the wildland-urban interface are at risk of wildfire. However, the potential for economic damage from wildfires is higher in some areas than in others. As described in previous sections, wildland areas with certain climates, seasonal weather patterns, and vegetation types are more susceptible to wildfires than others. Similarly, wildfires occurring in certain vegetation types are likely to be more intense than others. Lastly, the pattern and density of housing in a WUI area can influence the level of economic damage resulting from a wildfire.

Karl Anderson, The Courier/AP photo

Identifying areas where total wildfire damages to structures may be highest can help Federal, State, and local government agencies identify priorities for hazardous fuel treatments and wildfire mitigation. The Calkin (Calkin and others 2010, 2011) and Haas (Haas and others, in review) analyses identified areas across the country where wildfire poses the greatest risk to people, their homes, and other valuable resources (including energy and recreation infrastructure, fire-susceptible species, and municipal watersheds). Estimates of risk were based on the probability that large wildfires would occur, the estimated intensity of future wildfires, and the likelihood that future wildfires would cause damage to residential homes (based on population density, proximity to roads, and other factors (Haas and others, in review).

The approach by Haas and others (in review) is illustrated in Figure 3. As depicted in this example, wildfire risk to structures and populations can vary considerably across

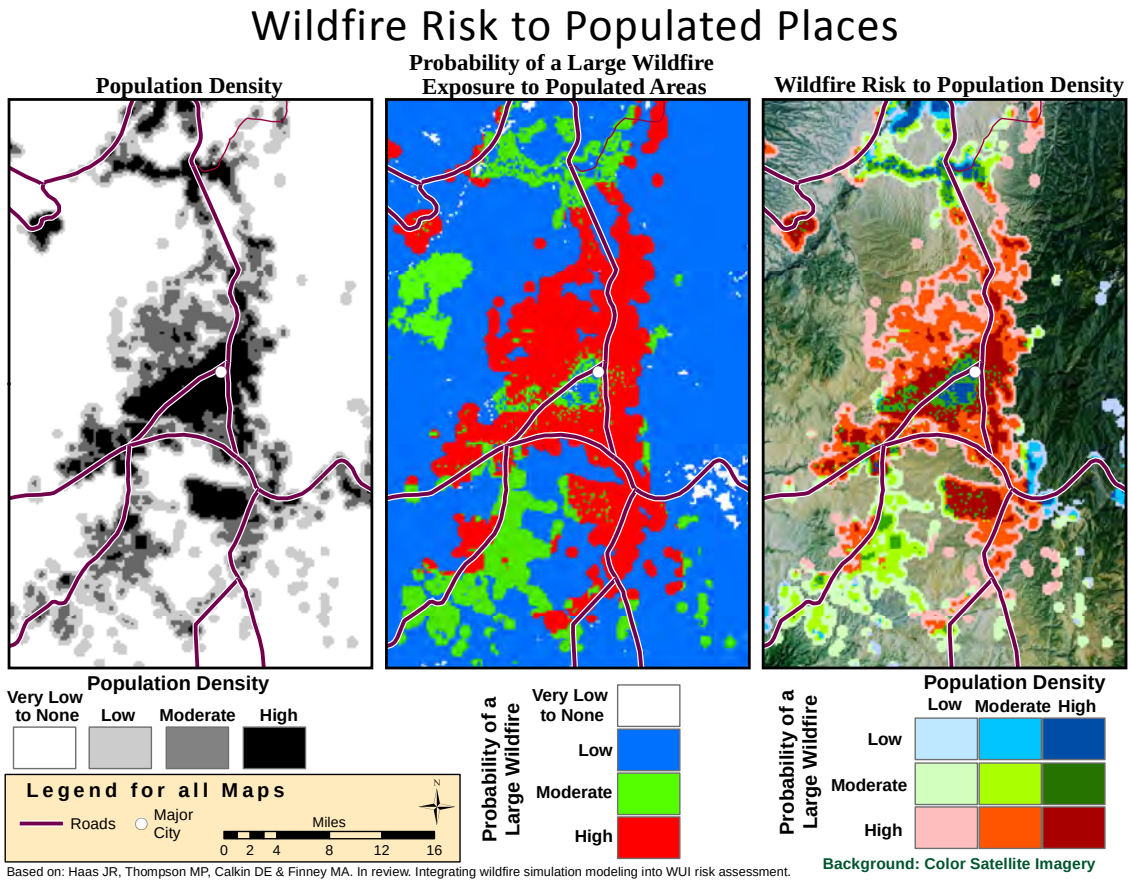


Figure 3. Example of how wildfire risk can be estimated for a wildland-urban interface area. One approach is to map an area's population density (left) and the probability of large wildfire exposure (center), and then overlay the two layers (right). Source: Based on Haas and others (in review).

a region and tends to be highest in areas where moderate population levels overlap with, or are close to, areas of wildland vegetation, and high potential wildfire exposure.

As will be discussed later in this report, potential wildfire damage to homes and other structures can be decreased by reducing wildland vegetation in and around high-risk areas, removing flammable vegetation directly around homes, and reducing the flammability of homes.

Structures Already Lost to Wildfire

Where in the WUI have homes and other structures already been destroyed? In order to answer this question, we analyzed data on structures burned that had been collected from 1999 to 2006 by an interagency group of Federal and State land management agencies for the purpose of emergency response management[15].

As depicted in Figure 4, during 1999–2011, wildfires destroyed homes and other structures across the conterminous United States. Structures destroyed were located in or near a range of wildland vegetation types, from chaparral shrub lands of southern California, to grasslands of central Oklahoma, to the forests of Pennsylvania and Georgia, and the scrub lands of central Florida[16].

15 The data were collected by the Geographic Area Coordination Centers (GACC), an interagency group of Federal and State land management agencies created for the purpose of management and mobilization of resources to respond to emergency incidents such as wildfires, earthquakes, floods, hurricanes, and tornadoes (http://gacc.nifc.gov/admin/about_us/about_us.htm). Data on structures burned and on latitude and longitude of the fire start are among the many types of information collected by GACC. The map itself was created by the U.S. Forest Service Fire Modeling Institute, in the Fire, Fuels, and Smoke Program of the Rocky Mountain Research Station.

16 The map depicted here only includes data collected by the GACC and does not include areas outside of the conterminous United States. Although wildfires do occur in U.S. States and territories outside the continental United States, few structures are lost compared to the conterminous United States.

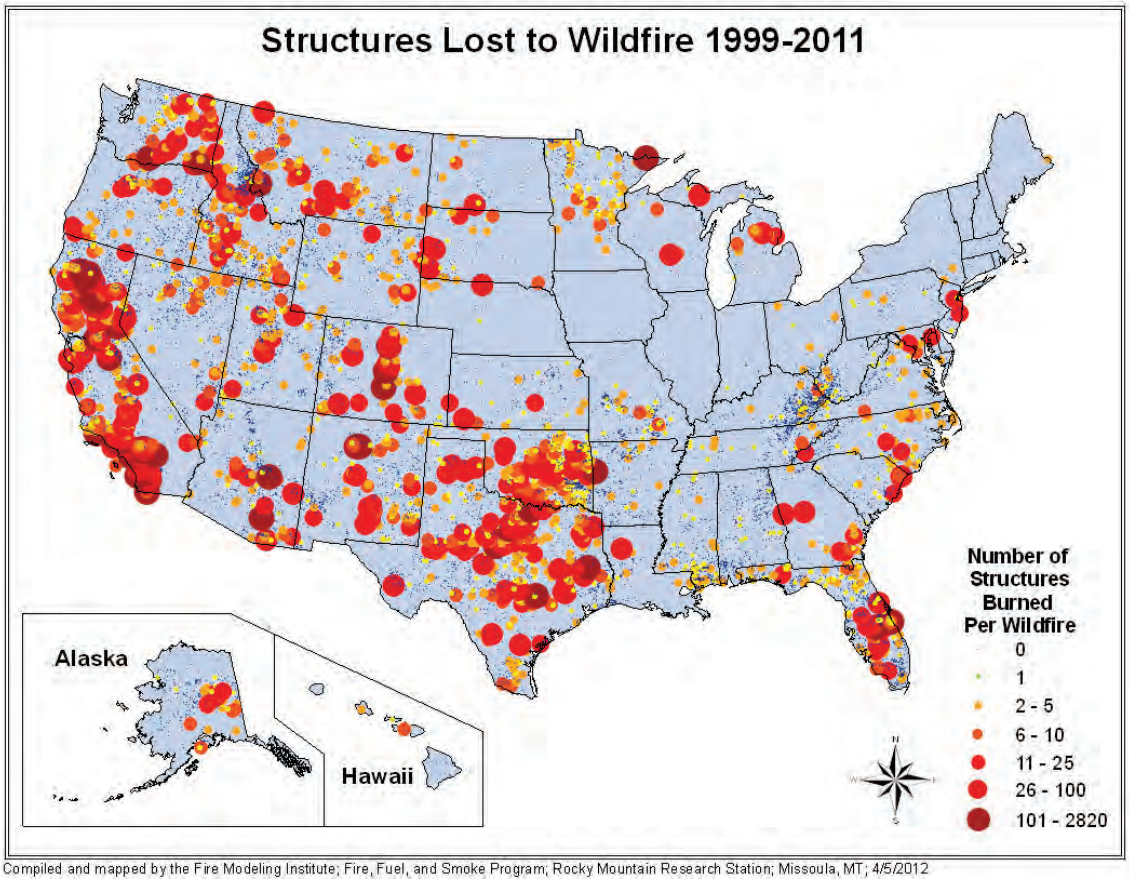


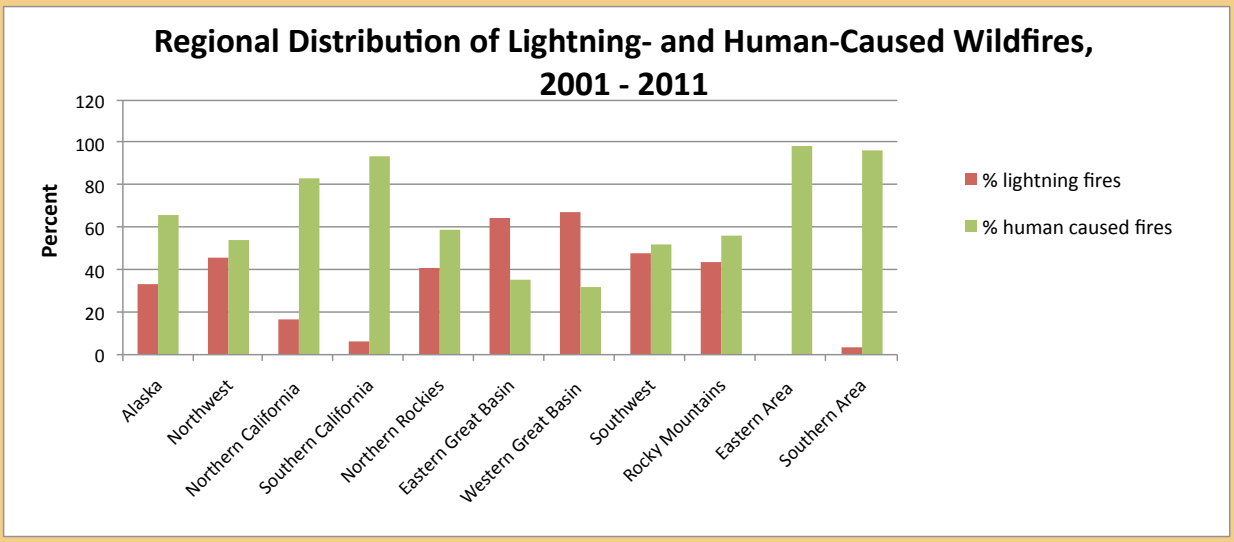
Figure 4: Structures lost to wildfire 1999–2011. Data are limited to burned structures reported through the National Interagency Coordination Center database. Data source(s): Situation Report (SIT/209) (http://famtest.nwcg.gov/fam-web/help/famweb_data_warehouse/fdw_topic_areas/situation_report_incident_status_summary_(sit_209).htm). Compiled and mapped by the Fire Modeling Institute, Fire, Fuel, and Smoke Program, U.S. Forest Service, Rocky Mountain Research Station, Missoula, MT, April 2012.

Connecting the Dots: How Housing Can Influence Wildfire Activity

Although vegetation type, climate, and other ecological factors have a strong influence over wildfire potential, people and their homes can also affect wildfire frequency, distribution, and suppression (Syphard and others 2007).

In general, the more houses and people, the more human-caused fire ignitions occur (Blonski and others 2010, Hammer and others 2007). From 2001 through 2011, an average of 85 percent of wildfires in the United States as recorded by the National Interagency Fire Center (NIFC) were caused by people (121,849 lightning-caused and 717,527 human-caused) (Fig. 5). The two areas with the highest percentage of wildfires caused by humans are the Eastern (99 percent) and Southern (96 percent) areas. However, in terms of average annual number of acres burned by human-caused wildfires in 2001–2011, the Southern area is highest nationwide, with more than

Karl Greer / US Forest Service



Percentage of lightning fires in the Eastern Area is too low (1.4%) to show up on this graph.

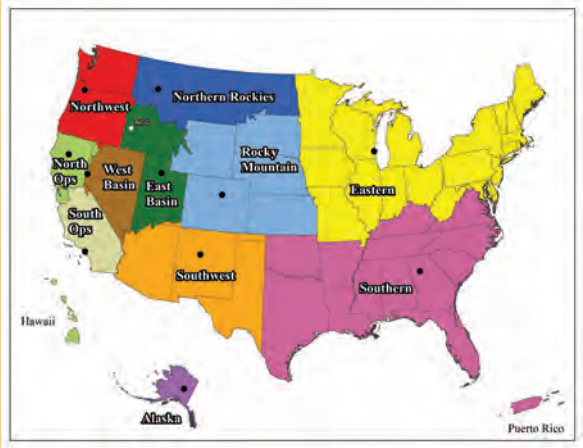


Figure 5. Regional distribution of lightning- and human-caused wildfires, 2001–2011. In every region of the United States except the Eastern Great Basin and Western Great Basin, most wildfires are started by people. Source: National Interagency Coordination Center <http://www.nifc.gov/nicc/>

1 million acres, followed by the Southwest region, with about 380,000 acres of human-caused wildfires annually. Such findings are consistent with a recent report linking high population growth with the prevalence of human-caused fires in the South (Andreu and Hermansen-Baez 2008).

The presence of homes can also increase the spread of a wildfire once it has started, in part because housing materials, such as wood shakes, can be highly flammable (Cohen 1999). A burning home is a major source for hot embers, which can travel through the air and help spread wildfires. The pattern of housing development also influences the spread and intensity of fire (Blonski and others 2010, ISO 1997).

NFPA Firewise Communities Program

CREATING FIRE-ADAPTED COMMUNITIES

Given that wildfires can occur in any wildland area; that the number of acres burned has been increasing; that the number of houses in the WUI is increasing; and that Federal, State, and local government fire suppression budgets are already strained—agencies are focusing more and more on promoting the concept of "fire-adapted" communities (NASF 2009). A fire-adapted community is "a knowledgeable and engaged community in which the awareness and actions of residents regarding infrastructure, buildings, landscaping, and the surrounding ecosystem lessen the need for extensive protection actions and enables the community to safely accept fire as a part of the surrounding landscape"[17]. Fire-adapted communities can also be thought of as those that are relatively "safer from the risk of brush, grass, and forest fires" (NFPA 2006).

The creation of a fire-adapted community is a proactive process that produces a community-wide pre-fire strategy, as well as actions, to reduce risks and thus costs (Leschak 2010). In this way, communities do not rely solely on suppression activities for protection after a wildfire starts, but rather become less at-risk for damage to property and lives in the first place. To be successful, efforts to create and maintain a fire-adapted community must involve the entire community—including residents, government agencies, emergency responders, businesses, land managers, and others. Participants work together to remove fuels, reduce ignition sources, modify structures, prepare the larger landscape for fire, and build strong local response capability. Communities use codes and ordinances where possible, develop internal safety zones, build external fuel buffers, use prevention education, and form partnerships to address hurdles that can deter some people from participating in fire-risk reduction activities (Leschak 2010). This section explores some of these options in more detail. For additional information on fire-adapted communities, visit the National Fire Protection Association Websites: http://www.nfpa.org, and www.fireadapted.org.

Reducing the Risk—Prevention and Mitigation

One of the most effective ways to reduce the risk of damage to homes or property from a wildfire is to prevent an ignition in the first place. Communities with robust wildfire prevention programs are likely to have fewer human-caused ignitions, which occur most often unintentionally when kids play with matches or when people burn leaves or trash, toss cigarettes, leave campfires unattended, or drive through dry grass, for example. (See case study 1).

In addition to reducing human-caused ignitions, community wildfire prevention includes taking actions to protect homes and property from future wildfires. Such actions focus on modifying the vegetation in and around structures (Finney and Cohen 2003) and ensuring that all structures are constructed with fire-resistant materials.

Trees, shrubs, and other vegetation are removed or reduced from within and around a community to reduce the intensity and growth of future fires, and to create a

[17] This is the definition used by Fire Adapted Communities Program of the U.S. Forest Service's Fire and Aviation Management staff.

CASE STUDY 1: COST-EFFECTIVE WILDFIRE PREVENTION EDUCATION IN FLORIDA

Wildfire prevention education efforts can be a particularly cost-effective way to limit damages from wildfires, in conjunction with prescribed fire and other actions to reduce fire risk. Between 2002 and 2007, the State of Florida spent an average of $500,000 annually on wildfire prevention education, including such activities as media efforts, homeowner visits, informational brochures and flyers, and presentations. During this time, the number of fires started accidently by people was reduced, thereby reducing costs for firefighting and damage compensation. The study's authors suggested that for every dollar of increased spending on wildfire prevention education, some $35 in wildfire-related losses and suppression costs could be saved, a 35:1 benefit-to-cost ratio. While specific to Florida, the study strongly implies that educating the public about the dangers of accidentally igniting fires can lead to fewer wildfires and lower costs.

—Source: USDA Forest Service and others (2011).

Jenn Viane Riese

relatively safe place for firefighters to control and contain wildfires. Vegetation is removed or reduced by using prescribed fires to burn the vegetation and/or by reducing the number of trees and other vegetation (mechanical or manual treatments). In a recent assessment, 90 percent of fuel treatment efforts conducted on national forests were found to be effective in reducing the intensity of wildfires (see Fuel Treatment Effectiveness box). Because vegetation continues to grow, mechanical and prescribed fire treatments must be repeated over time to keep fuels from accumulating. (See case study 2.)

Wildfire damage to most homes and structures is due to wind-borne embers igniting after landing on a roof or wooden deck, or blowing in through vents (Cohen 1999, 2000). Ignitability of structures can be reduced if homeowners adopt actions collectively described as Firewise (www.firewise.org; see Community Education and Involvement Programs section later in this report); such actions promote the reduction of flammable vegetation and other wildfire hazards in the "ignition zone" around individual structures (also known as "defensible space") and the use of fire-resistant building

Beth Stein hauer/Black Hills National Forest

University of Nevada Cooperative Extension

One spark from a flying ember on a wood-shake roof could spell disaster. Homes with non-flammable roofing materials (such as metal or tile)—and those where debris is kept from collecting on the roof or in gutters—are likely to suffer less damage from a wildfire.

CASE STUDY 2: FIRE 'PRESCRIPTION' FOR WILDLIFE AND LONGLEAF PINE IN GEORGIA

In recent years, visitors at many Georgia State parks, wildlife management areas, and other natural areas have had the opportunity to observe habitat restoration in progress as prescribed fires have been intentionally set in the forest understory. Conducted outside most plants' active growing seasons, the burns are done to reduce fuel loads and to improve habitat for dozens of native plant and animal species by opening up overgrown areas. Each prescribed burn is planned, ignited, and monitored by a team of trained wildland fire specialists. In 2010, prescribed burns were conducted on more than 25,660 acres in Georgia.

Georgia Governor Nathan Deal signed a proclamation in 2011 to kick off Prescribed Fire Awareness Week, which recognizes prescribed fire as a safe way to apply a natural process that can be helpful for wildlife and people. Prescribed fire as a habitat management tool also is emphasized in Georgia's Wildlife Action Plan, a comprehensive strategy that guides State efforts to conserve biological diversity.

One major tree species that has benefitted from the prescribed fires is the longleaf pine, which today is found in a fraction of its historical range in the southeastern United States. A longleaf pine forest benefits a diversity of native animal species, including some threatened or endangered species in Georgia, such as the red-cockaded woodpecker, gopher tortoise, and eastern indigo snake.

—Potts (2011)

Longleaf pine forest in the Okefenokee Swamp, Georgia, provides habitat for the endangered red-cockaded woodpecker.

Jim McCormac

materials (including roofing, decks, and vents) (Nader and others 2007, NFPA 2006, Quarles and others 2010, BOF 2006). Such proactive action on the part of homeowners is critical because when a wildfire occurs, it might be impossible for firefighters to reach and protect all individual properties, depending on the fire's size and intensity and the availability of firefighting resources.

Homeowners in the Wildland-Urban Interface

In recent years a wealth of research on attitudes and behaviors of homeowners in the WUI, based on surveys of individual communities, provides useful insights to their varying levels of participation in and commitment to actions to reduce the risk of damage from wildfire, which can be due to a number of reasons related to motivation, means, and opportunity (Kent and others 2003, Reams and others 2005, Kocher 2011). Some findings include:

Fuel Treatment Effectiveness

Between 2006 and 2011, about 600 assessments were completed by the Forest Service on wildfires that burned into areas where hazardous fuels reduction treatments had previously been conducted (USDA Forest Service 2011a). These assessments evaluated the effects of prescribed fire as well as mechanical and chemical treatments on fire behavior and fire suppression actions. The data indicate that 90 percent of treatments reported in the database have helped to reduce wildfire intensity, allowing better control by firefighters. In most of these cases, as fires moved from untreated locations to areas treated by thinning, mowing, or prescribed burning, the fire behavior changed from active crown fires (burning an entire upper story of the forest) to passive crown fires (where only a single tree or small group of trees burned), or from passive crown fires to surface fires (burning only dry grass, shrubs, pine needles, and other flammable materials on the ground). Although proven effective for fire control in certain situations, fuel treatments must be carefully planned, with consideration of local ecological conditions, forest types, and wildfire conditions (DellaSalla and others 2004, USDA Forest Service 2011a).

Kari Greer / US Forest Service

Fuel treatments can slow the spread of wildfire and diminish wildfire intensity. The speed and intensity of the wildfire spreading downslope through the untreated forest along the top of this ridge were reduced dramatically when the wildfire entered the treated area (center of photo). This helped to save the 40 homes located at the bottom of the ridge.

- Homeowner involvement varies. Awareness of wildfire risk has been an important factor in the decision of many homeowners to reduce wildfire risk on their properties (McCaffrey and others 2011), and most homeowners in areas of high wildfire risk have undertaken some type of defensible space activity (McCaffrey 2009). However, the level and nature of effort ranges widely, from small-scale actions to fire-proof homes, to extensive fuels treatment actions (Brenkert and others 2006). Ninety-one percent of WUI residents interviewed in California, where defensible space ordinances are in place, have lowered fire risk by removing flammable vegetation from their property, while less than 50 percent of residents in Florida and Michigan had done this action (Vogt and others 2005).

NFPA Firewise Communities Program

NFPA Firewise Communities Program

"Defensible space" or reduced-hazard "home ignition zone" refers to the area around a house or other structure where vegetation has been significantly modified or removed to reduce the risk of damage from wildfire (see, for example, NFPA 2006, BOF 2006). For fire-resistant landscaping ideas and lists of desirable plant attributes see Doran et al. 2004, NFPA 2006, White and Zipperer 2010, and www.interfacesouth.org.

- Individual motivations vary. According to one survey, motivating factors for some individuals included friends and family, regulation, and the desire to clear property for building; for others, these factors were less important than agency outreach, influence of community leaders and homeowner associations, and government programs (McCaffrey and others 2011). Most homeowners do think that managing vegetation on their property to create defensible space is their

personal responsibility (McCaffrey and others 2011, Winter and others 2009). The presence of social networks within communities as well as between communities and various government agencies seems to increase the likelihood that a community will adopt wildfire mitigation actions (Jakes and others 2007, as cited in McCaffrey 2011).

- Perceptions of risk vary. Some homeowners tend to estimate the risk of wildfire damage to their own homes and property as being lower than the estimated wildfire risk elsewhere in their immediate area, in part because they may have taken at least some mitigation actions (McCaffrey 2008). A survey of WUI residents in Colorado, for example, indicated that although wildfire risk was acknowledged as an important issue and some safety measures had been adopted, most people had not engaged in fuels treatment activities in part because they saw no need to take that level of action until actually faced with a wildfire (Brenkert and others 2006).

- Time, resources, and knowledge can be limited. Some of the greatest barriers to action include the lack of time, money, assistance, and technical knowledge, as well as homeowner perceptions of costs and labor requirements (Hodgson 1995). Additionally, many homeowners have difficulty disposing of vegetation cleared to create defensible space (Winter and others 2009). To address such limitations, some communities provide free home inspections and free or cost-shared clearing, chipping, and disposal of debris (Reams and others 2005). (See case study 3.)

- Feelings towards regulations are mixed. Most homeowners prefer not to have mandatory regulations, although some see a role for government and insurance companies in requiring vegetation management to reduce the risk of wildfire damage, particularly when other policies and approaches have not been successful (Winter and others 2009). Homeowners are most likely to comply with risk-reduction guidelines and other rules if they see the guidelines as fair, if they trust the sources (Vogt and others 2005), and if they see their actions as part of a larger efforts involving fire-safe building codes and zoning/planning practices that discourage development in high-risk areas (Winter and others 2009, Monroe and others 2004).

- Aesthetic preferences can help or hinder. Although some homeowners enjoy the look of wildfire-resistant landscaping (such as minimal trees or selection of certain types of shrubs and other vegetation) (Winter and others 2009), others reject such actions for aesthetic and privacy reasons (Daniel and others 2003, Kent and others 2003, Nelson and others 2003, Brenkert and others 2006, Winter and others 2009). Studies have noted that some homeowners would rather make structural changes to their homes than make landscape changes they find unattractive (Brenkert and others 2006).

- Conflicts with best management practices. In areas where vegetation removal can lead to increased erosion, creating safer home ignition zones can be problematic because they sometimes conflict with local "best management practices" (BMPs) for soil and water protection. For example, residents of one community indicated that their State department of environmental quality guidelines prohibited the removal of vegetation over a certain size (Winter and others 2009).

- Conflicts with homeowner association restrictions. In the past, some homeowner associations restricted tree removal, dictated that roofs have wood shingles, or mandated certain kinds of vegetation for aesthetics, despite the potential fire hazard. Much progress has been made in this area, however, and most homeowner associations no longer have such clauses; some now require vegetation management to reduce fire risk (S. McCaffrey, personal communication). In one case, the State of Colorado passed a law to forbid homeowner associations from interfering with the rights of homeowners to create defensible space or install non-flammable roofing (General Assembly of the State of Colorado 2005).

Preparing Homes and Neighborhoods: Examples and Resources for Planners and Homeowners

Whether planning new developments, working to make existing developments and homes safer, or sharing information about what to do before, during, and after a wildfire, many resources are available for homeowners and community decision makers. Such resources typically fall into two general categories: community education and involvement programs, and community planning

CASE STUDY 3: FROM SOUP TO NUTS: MAINE FOREST SERVICE TAKES A COMPREHENSIVE APPROACH

The Maine Forest Service (MFS) offers a full meal deal when it comes to reducing the risk that a wildland fire might damage or destroy homes in its rapidly growing wildland-urban interface. Its WUI program includes everything a homeowner might need to be safer from wildfire: from conducting assessments of individual or community risk, to making recommendations for creating defensible space around a home, to providing DVDs and other educational materials online and in schools and communities; they even offer a free chipping service for getting rid of the branches and brush removed to reduce potential fuels. It's not a small undertaking in the Nation's most forested state, one that experiences upward of 700 wildfires annually. A third of those fires threaten structures—including those associated with dense housing development in forested areas, and those located on its coastal islands, where additional challenges of response time, road access, and limited resources complicate firefighting. The program got started in 2003, with a statewide assessment strategy and more than a dozen community risk assessments conducted by AmeriCorps employees. Today Maine's forest rangers collaborate with a non-governmental organization, the Island Institute, to conduct assessments, which then feed into the development of a community wildfire protection plan (CWPP). New in recent years is a "LakeSmart and FireWise" program to help educate lake and shorefront property owners on how they, too, can create defensible space while complying with zoning laws related to shoreline vegetation protection. See the details at http://www.maine.gov/doc/mfs/ , or read a summary of the program at http://www.wildfireprograms.usda.gov/index.html.

Maine Forest Service

and development options. A few specific examples are presented below to give a flavor of the wealth of detailed information that is available. In addition to resources and Websites noted here, see also: Blonski and others 2010, NACo (2010), Schwab and Meck (2005), and Southern Group of State Foresters (no date); or visit the American Planning Association Website at http://www.planning.org/resources/, and Interface South at www.interfacesouth.org.

Community Education/Involvement Programs

Involving communities in educational programs about fire safety is preferred by many homeowners over regulatory programs (Ryan and others 2006) and can also increase support for fuels treatments on nearby wildlands (Winter and Fried 2000). Successful public education programs are designed to reflect local values, foster neighbor contact (Sturtevant and McCaffrey 2006), and clearly state who is responsible for specific actions: land management agencies, other community entities, and/or landowners. In this way, fire mitigation becomes a true community effort (Kent and others 2003).

Key Ingredients for Education Programs

- Publications on hazard reduction, fire protection and safety, landscaping, fire-resistant plants (White and Zipperer 2010), and defensible space are geared to specific geographical areas (Reams and others 2005); they not only provide "how to" information but also explain why a particular intervention is important, as well as the likely impacts of the recommended action (Monroe and others 2004).

- Varied educational approaches and information pathways meet differing learning styles (Monroe and others 2004)—including the Internet, printed brochures, local community meetings, and materials

Larry Kohrnak / InterfaceSouth

US Fish and Wildlife Service Southeast Region

Larry Kohrnak / InterfaceSouth

for local schools; as well as a variety of information distributers such as extension agents, stores, landscape architects, and real estate agents (Monroe and others 2004). For example, homeowners in one survey expressed a preference for receiving information about WUI policies via written communication sent through the mail, rather than advertisements, Internet, or signage (Winter and others 2009); participants in a different survey indicated that their best source of information on current wildfire risk was from roadside signs (McCaffrey 2008).

- Media attention helps to heighten understanding of the need for wildfire protection and planning (Reams and others 2005).
- Targeted materials are created specifically for local school teachers and students, including computer interactive materials (Reams and others 2005).
- Personal interaction includes conversations with agency employees, elementary school programs, guided field trips, and public meetings that truly engage all participants (Toman and Shindler 2006).
- Hands-on, practical assistance is offered to homeowners, appropriate for their individual properties (Brenkert and others 2006), including one-on-one consultation by trained personnel (Winter and others 2009).
- Materials and approaches reflect the attitudes, beliefs, and perceptions of homeowners. For example, landowners who value wildlife viewing might be more likely to adopt wildfire mitigation measures if materials explain the benefits of defensible space to wildlife viewing (Monroe and others 2004).

What do homeowners need to know?

In addition to information on reducing hazards in home ignition zones, homeowners also need to know that:

- Once an area is ordered to evacuate from a wildfire, there is no time for homeowners to conduct last-minute mitigation efforts, such as emergency fuels treatments (Brenkert and others 2006).
- Wildfire mitigation is not an-all-or-nothing task; a series of small and large-scale treatments can be implemented over time (Brenkert and others 2006).
- Vegetation management (such as prescribed burning or tree removal) must be a continuous effort and not a one-time activity (McCaffrey and others 2011).

Firewise Communities Program

Firewise Communities is a program of the National Fire Protection Association (NFPA) and is supported by the U.S. Forest Service, the Department of the Interior, and the National Association of State Foresters. The goal of the Firewise Communities Program is to encourage local solutions for wildfire safety by involving homeowners, community leaders, planners, developers, firefighters, and others in creating fire-adapted communities. A cornerstone of Firewise is the development of wildfire hazard mitigation plans; formal, national recognition as a Firewise/USA community; and creation of defensible space.

Communities benefit from national recognition in a number of ways: they get organizational help, connect with experts to learn about fire risk and mitigation, attain peace of mind from knowing what to do and how to do it, foster community-building as neighbors meet and work together, gain pride in achieving national recognition for their efforts, engender publicity that brings attention to the community's achievement and spreads the word to others, and receive access to funding and assistance (http://www.firewise.org). Since starting with 12 pilot communities in 2002, more than 700 communities now participate in 40 States.

The NFPA Firewise Communities Program also provides a wealth of educational tools through its Website (http://www.firewise.org) and a free online catalogue of print and audiovisual materials. Sections of the Website include publications, interactive models, research reports, courses and training, Firewise discussion templates, presentations, and videos. One publication of particular interest to developers is Safer from the Start: A Guide to Firewise-Friendly Developments (NFPA 2009). The Firewise goal for its educational outreach: "to teach people how to adapt to living with wildfire and encourage neighbors to work together and take action now to prevent losses."

NFPA Firewise Communities Program

Ready, Set, Go!

The Ready, Set, Go! Program is sponsored by the International Association of Fire Chiefs and the U.S. Forest Service. This collaborative process is intended to help fire departments encourage local citizens to create fire-adapted communities, through wildfire safety messages and training for emergency response preparedness.

Career and volunteer fire departments use the term "ready" to teach the defensible space message promoted by Firewise; "set" to educate the public about situational awareness during a fire; and "go" to prepare people for a safe and speedy evacuation. Designed to improve coordination and communication between emergency response agencies and communities, Ready, Set, Go! builds partnerships and helps communities clarify and refine priorities to protect life, property, infrastructure, and other valued resources. This program is unique in that it focuses on life safety aspects and preparedness to evacuate homes and neighborhoods. The program began in 2009 with 9 pilot fire departments; by 2011 nearly 400 fire departments across the country were participating. Visit: http://www.wildlandfirersg.org/.

A Sampler of Other Educational Resources

Numerous Western States have developed local programs and resources that would be useful in promoting fire-adapted communities elsewhere in the country as well. Here are a few examples:

Fire Safe Council—This California-based organization provides resources for establishing and maintaining local fire safe councils (FSC), including a media handbook, a communications manual, and a newsletter, as well as grant-writing workshops and brochures for homeowners. Visit http://www.firesafecouncil.org .

Living with Fire—This program from Nevada focuses on living more safely in high fire hazard locations. It offers a consistent set of guidelines for homeowners, teaching how to safely coexist with wildfire before, during, and after it occurs. Visit http://www.livingwithfire.info/.

Take Responsibility—This campaign was created by the California Fire Alliance to encourage homeowners in the WUI to create and maintain 100 feet of defensible space around structures. Download resources at http://takeresponsibility.cafirealliance.com .

Community Planning and Development Resources

Key Ingredients for Effective Planning

While individual homeowner actions are essential to reduce the potential for wildfire damage to property, it is also critical that entire communities work together at the broader planning and development scale. A study of 15 communities across the United States at high risk for wildfires revealed the following four factors to consider when planning for development and when designing community wildfire preparedness efforts (Jakes and others 2007):

- Landscape. Level of fire risk, location of a community, and the attachment of community members to the land, can all influence community members to take on wildfire preparedness measures.
- Government. In each community surveyed, government leadership and involvement (in the provision of funds, equipment, and expertise) were critical to community wildfire preparedness.
- Citizens. The ability of citizens to apply their knowledge and skills of local conditions and practices was also an important factor.
- Community. The existence of community and regional groups, such as neighborhood associations and collaborative groups working across a watershed or region, can strengthen wildfire preparedness efforts.

Community Wildfire Protection Plans

Community wildfire protection plans (CWPPs), encouraged by the Healthy Forests Restoration Act of 2003 (HFRA), provide a framework to identify and reduce wildfire risk and promote healthier forests (Jakes and others 2011). Such plans can be as simple or complex as a community desires (provided they contain the key features listed below) and are meant to reflect local social and ecological contexts (Jakes and others 2011, Schwab 2005). In some cases local citizens organize to take responsibility; in others, a homeowners association or a community Fire Safe Council takes the lead; in still others, particularly those with limited resources, State or Federal agencies can play a critical role in initiating the CWPP process (Jakes and others 2011). (See case study 4.)

The National Association of State Foresters (NASF) estimates that nearly 6,000 communities nationwide had developed and implemented CWPPs by 2009, but these accounted for less than 10 percent of the nearly 70,000 communities identified by NASF as being at-risk (Jakes and others 2011). Although communities often face shortages of financial, social, or political resources that can deter proactive actions such as developing CWPPs, some have reported that the CWPP process itself actually helped communities build their capacity to leverage resources and relationships, enabling them to tackle other projects (Jakes and others 2011). In a study of 13 communities that had developed CWPPs, some reported that the CWPP process helped reinforce public attitudes supporting fire planning efforts that were already in place before the planning process, while others noted that the planning process changed attitudes and built support for fire management (Jakes and others 2011).

Key features of a community wildfire protection plan (SAF 2004) include:

(1) Collaboration,

(2) Identification and prioritization of areas for fuel reduction activities, and

(3) Taking steps to treat ignitability of structures.

For more information, download a handbook at: http://www.stateforesters.org/files/cwpphandbook.pdf .

CASE STUDY 4: COMMUNITY PLANNING AND WILDFIRE PROTECTION PLANS IN OREGON

Located in southwestern Oregon, Douglas County includes more than 5,000 square miles of land at high risk of wildfire, stretching from the Pacific Coast to the Cascade Mountains. More than half the land in the county is managed by the U.S. Forest Service or Bureau of Land Management.

In 2004 and 2005, the Douglas County Board of Commissioners directed the county planning department to develop community wildfire protection plans (CWPPs) for its at-risk communities. The resulting plans—which include an overall plan for the county and smaller plans for each of the 30 identified at-risk communities—provide a model of how a large county with multiple at-risk communities can structure a cohesive plan.

The CWPPs were developed according to Healthy Forest Restoration Act (HFRA) guidelines. The core team included wildfire specialists from the Douglas Forest Protective Association, Bureau of Land Management, Umpqua National Forest, Douglas County Sheriff, Office of Emergency Management, and Douglas County Planning Department. The team's risk assessment identified fuel reduction areas for each community, prioritized fuel reduction strategies, and developed plans to reduce wildfire hazards around each at-risk community. Each community then identified the specific areas where it wanted fuel reduction treatment to occur.

A key feature of the project was the development of action items to reduce structure ignitability and to help people protect themselves and their homes. These included:

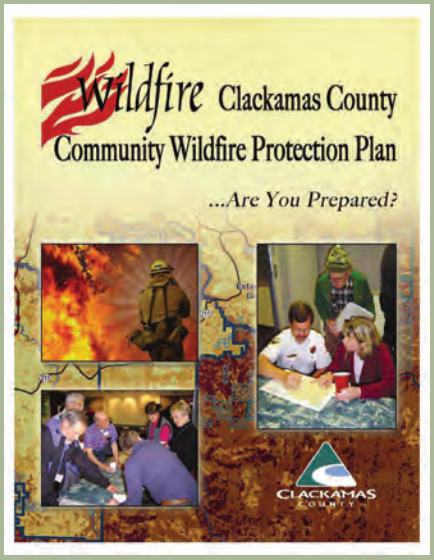
√ Educating homeowners about defensible space and fire-resistant materials;

√ Seeking assistance for homeowners to implement defensible space activities;

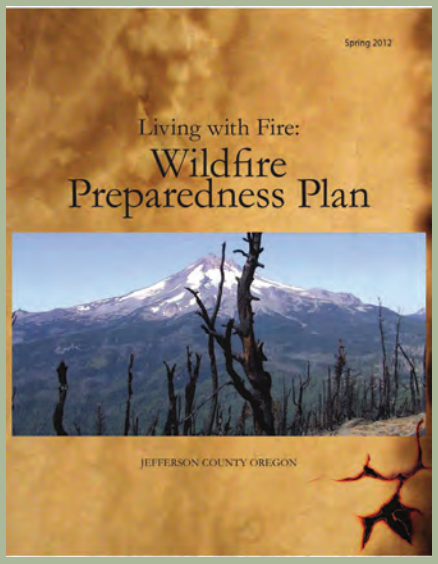
√ Promoting existing education and outreach programs such as Firewise, and developing other community education programs; and

√ Training volunteer firefighters to assist paid firefighters.

—Source: National Database of State and Local Wildfire Hazard Mitigation Programs, http://www.wildfireprograms.usda.gov/index.html.



Clakamas County, Oregon



Jefferson County, Oregon

Zoning Ordinances and Codes

Local ordinances and codes can be an important element of community preparedness and protection in fire-prone areas (Dombeck and others 2004, Schwab and Meck 2005). These can include mandatory defensible space standards, wildfire review processes for planned developments, subdivision regulations, development plan standards, real-estate disclosure of wildfire hazard zones, and insurance incentives for reducing risks in home ignition zones (Blonski and others 2010, Reams and others 2005, Schwab and Meck 2005). (See case study 5.) Typically, a hazard or risk is identified before zonings and codes are put in place. Blonski and others (2010) provides a helpful overview of accepted threat assessment methods.

A suite of codes and standards from the National Fire Protection Association can help a community address wildland fire. These include NFPA 1141, Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural, and Suburban Areas, which provides recommendations for planning fire protection infrastructure for new developments in a community; and NFPA 1144, Standard for Reducing Structure Ignition Hazards from Wildland Fire, which covers minimum design, construction, and landscaping elements for structures in the WUI (http://www.nfpa.org/catalog/). Additionally, the International Code Council has developed international codes, or I-Codes, providing minimum safeguards in a number of areas. The International Wildland Urban Interface Code (ICC 2008) contains provisions addressing fire spread, accessibility, defensible space, water supply, and other considerations for buildings constructed near wildland areas (http://www.iccsafe.org/).

CASE STUDY 5: FIREWISE-FRIENDLY DEVELOPMENT: RIVER BLUFF RANCH, WASHINGTON

River Bluff Ranch, a community developed in Spokane, WA, built Firewise-friendly elements into its infrastructure and guiding documents or covenants. The covenants include access requirements for firefighting and evacuation, including paved two-lane roads, secondary evacuation roads, and a network of forest roads. Also required are underground utilities; a series of non-potable-water storage tanks with dry hydrants (non-pressurized pipe systems); and fire-resistant roofing, double-paned windows, deep side yard setbacks, defensible space, and vegetation maintenance. The covenants further require that the community's homeowners' association enforce the covenants, educate the residents, maintain the roads and water storage facilities, manage an ongoing forest stewardship program, and implement the recommended Firewise Communities budget (in 2009, $2 per person) to be used for future Firewise efforts.

—excerpted from NFPA (2009)

Steve Wallin / Windermere Real Estate

It's the Code!

Many rural counties throughout the Western United States are adopting what they call the "Code of the West"—an advisory letter informing people about what it takes to live in the country. In the category called Mother Nature, the Code as adopted recently by commissioners in Stevens County, MT, advises:

"The physical characteristics of your property can be positive and negative. Trees are a wonderful environmental amenity, but can also involve your home in a forest fire. Building at the top of a forested draw should be considered as dangerous as building in a flash flood area. 'Defensible perimeters' are very helpful in protecting buildings from forest fire and inversely can protect the forest from igniting if your house catches on fire. If you start a forest fire, you are responsible for paying for the cost of extinguishing that fire" (Henneman 2011).

While these "codes" are neither universal nor enforceable, they indicate that some Western residents are concerned about growth in their communities and aware of the challenges from wildfire that accompany life in the wildland-urban interface.

SUMMARY AND CONCLUSIONS

Although wildfire has been and will continue to be fundamental to the ecological health of many wildland areas, wildfires can harm people and their homes, especially when weather, vegetation, and terrain create extreme conditions, and when communities are unprepared. People who live in the wildland-urban interface or WUI in particular may face increasing risk and property damage from wildfires of all sizes in coming decades. From 1990 to 2000 alone, the WUI increased by 18 percent and is expected to increase further in the years ahead. Homes and other structures across the United States, in a wide range of vegetation types from forests to shrub lands and grasslands, have already been lost to wildfire. Numerous opportunities are available for planners, developers, and others to help WUI communities adapt to wildfire through education, planning, and mitigation activities that can help limit the number of ignitions, reduce flammable vegetation, create Firewise homes, and thereby establish fire-adapted communities.

As with previous Forests on the Edge reports and other national assessments, the findings of this report derive from data available at a national level and may not precisely describe projections for all individual locations. Nonetheless, our findings can provide a useful tool for decreasing the potential for wildfire damage to homes, and for increasing the number of fire-adapted communities across the country.

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Wildfire smoke, seen from space.

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FORESTS ON THE EDGE

Forests on the Edge is a project of the U.S. Department of Agriculture, Forest Service, State and Private Forestry, Cooperative Forestry staff, in conjunction with Forest Service Research and Development, National Forest System staff, universities, and other partners. The project aims to increase public understanding of the contributions of and pressures on America's forests, and to create new tools for strategic planning. The first report (Stein and others 2005) identified private forested watersheds in the conterminous United States most likely to experience increased housing density. Subsequent reports have provided more in-depth discussion and data on: the development pressures on America's national forests and grasslands (Stein and others 2007), the impacts of increased housing density and other pressures on private forest benefits (Stein and others 2009), threats to at-risk species (Stein and others 2010), and sustaining America's urban trees and forests (Nowak and others 2010), among others. This report presents an overview of the relationship between housing in the wildland-urban interface and wildfire, including preventative measures that can help to create fire-adapted homes and communities.

Future Forests on the Edge work will include impacts of increased housing density in Hawaii, Puerto Rico, the U.S. Virgin Islands, and U.S.-affiliated Pacific Islands; impacts of forestland development on water resources; a report on America's private forest landowners; assessments of additional private forest benefits and risks; and construction of an Internet-based system that permits users to view, combine, and depict results for selected contribution and threat layers.

For further information on Forests on the Edge, contact:

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Lessons Learned from Waldo Canyon

FIRE ADAPTED COMMUNITIES
MITIGATION ASSESSMENT TEAM FINDINGS

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International Association of Fire Chiefs
National Fire Protection Association
The Nature Conservancy
U.S. Department of the Interior
National Association of State Foresters
National Volunteer Fire Council
U.S. Fire Administration
National Wildfire Coordinating Working Group–Wildland Urban Interface Mitigation Committee

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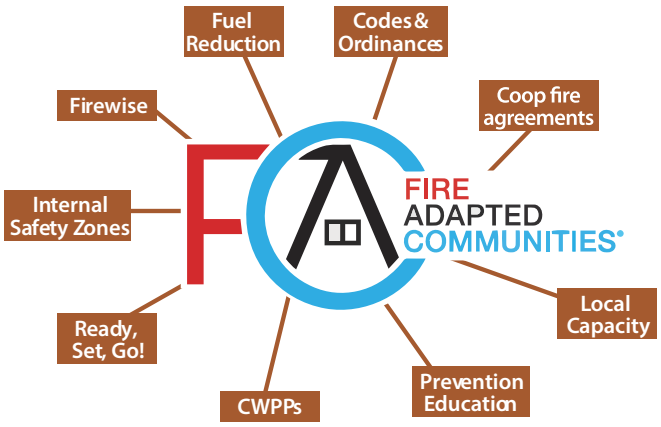
Introduction & Background

The Waldo Canyon Fire started the afternoon of June 23, 2012 near Colorado Springs, Colorado. The fire threatened the Cedar Heights community in the early hours of June 24, however no homes were lost. Two days later, the fire entered the Mountain Shadows neighborhood, where 346 homes were eventually destroyed on June 26.

Considered the worst fire in Colorado state history, Waldo Canyon forced more than 30,000 people to evacuate, scorched 18,247 acres, killed two residents, and took firefighters 18 days to fully contain. The fire burned through brush, mountain shrub, grass, and trees including oak, Pinyon-juniper, ponderosa pine, Douglas-fir, spruce and limber pine. In addition to disrupting thousands of lives and destroying hundreds of properties, the wildfire left the scarred landscapes vulnerable to flooding and/or debris slides that will pose long-term problems.

The Waldo Canyon fire presented the first opportunity for partners in the national Fire Adapted Communities (FAC) Coalition to collectively assess the performance of mitigation practices in Colorado Springs in a post-fire environment and to compare the results to the mitigation strategy recommended by the Fire Adapted Communities program. The assessment was conducted from July 18-20, 2012, by a FAC Wildfire Mitigation Assessment Team, which included two sets of researchers: structural assessment and forestry experts and social science and public education experts, accompanied by staff from the Colorado Springs Division of the Fire Marshal and the State of Colorado. The structural assessment team surveyed 40 homes that were damaged, undamaged and destroyed during the fire, toured fuels management projects, and examined a variety of mitigation initiatives including creation of defensible space, Wildland Urban Interface (WUI) Codes and Ordinances, wildfire preparedness information and awareness efforts. The team of social science and public education experts talked with local officials, homeowners and community leaders and also toured the above-mentioned areas. The FAC Mitigation Assessment Team included representatives from the USDA Forest Service, Insurance Institute for Business & Home Safety (IBHS), International Association of Fire Chiefs, National Fire Protection Association (NFPA) and The Nature Conservancy.



OVERVIEW OF FIRE ADAPTED COMMUNITIES STRATEGY

The USDA Forest Service developed the Fire Adapted Communities program in 2009. It is based on the Quadrennial Fire Review's recommendation that creating fire adapted communities is the best alternative to escalating wildfire in the Wildland Urban Interface. The strategy promotes multi-jurisdictional use of a suite of mitigation tools focused on helping communities live successfully with wildfire through mitigation and preparation, rather than depending upon suppression and protection resources that are not always available.

PRIMARY ELEMENTS OF A FIRE ADAPTED COMMUNITY:

1. An informed and active community that shares responsibility for mitigation practices.
2. A collaboratively developed and implemented Community Wildfire Protection Plan (CWPP).
3. Structures hardened to fire and including adequate defensible space practices; advocated by Firewise Communities, IBHS and others.
4. Local response organizations with the capability to help the community prepare and can respond to wildfire; advocated by Ready, Set, Go!
5. Local response organizations with up-to- date agreements with others who play a role in mitigation and response.
6. WUI Codes, Standards or Ordinances, where appropriate, which guide development
7. A visible wildfire reduction prevention program that educates the public about the importance of a communitywide approach and the role of individual homeowners.
8. Adequate fuels treatments conducted in and near the community, including development and maintenance of a fuels buffer or firebreak around the community.
9. Established and well-known evacuation procedures and routes.

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OVERVIEW OF COLORADO SPRINGS MITIGATION

Colorado Springs metro area has about 650,000 people living in an area roughly 195 square miles. About 24 percent of the metro area's population resides in the 28,000 acres of WUI, which runs from the Air Force Academy south to Cheyenne Mountain Air Force Station. Much of the WUI is in forested/vegetated foothills on alluvial fans along narrow drainages and ridgelines with slopes up to 45 percent. Average annual precipitation is about 17 inches and summer temperatures can reach 100 degrees.

Colorado Springs Wildfire Mitigation Section has an annual budget of about $300,000 and two full-time employees. Additional grant funding for mitigation projects is often sought through public and private sources. See Appendix A for a brief overview of the mitigation measures Colorado Springs Fire Department has put into place since creating the Wildfire Mitigation Section in 1993.

Community Education and Outreach

The Colorado Springs Fire Department Wildfire Mitigation Section developed a strong community education effort early in the process and has built on its success. Outreach included development of the "Sharing the Responsibility" campaign, active engagement with residents and homeowners' associations, community and neighborhood meetings, development of homeowner guides, education about evacuation, on-site risk assessments and consultations, online resources, brochures and other educational tools. The effort has evolved into a community lecture series that discusses wildfire risk mitigation, wildfire behavior and forest health and arbor care. The community also has a Wildfire Mitigation Season kick-off each spring to alert residents of the need for action prior to the official start of wildfire season.

A series of stakeholders meetings began in 2000 and a Core Advisory Group was formed. Grants from the U.S. Forest Service and the U. S. Fire Administration Assistance to Firefighters propelled the program in 2001 with the production of wildfire risk materials, including a video for public access cable channel. Voters approved the Public Safety Sales Tax, which helped fund the mitigation program.

The Colorado Springs Firewise program, patterned after the national Firewise Communities Program, became part of homeowner mitigation and outreach messaging in 2001. A Firewise Program Coordinator was hired and began a series of community Firewise meetings to discuss risk, mitigation, and evacuation. In 2002 Colorado Springs launched an interactive Firewise website which combined mitigation messages aimed at the homeowner and each property's hazard rating which encouraged a sense of community competition among neighbors.

It should be noted that the Colorado Springs Wildfire Mitigation Firewise program is substantially different from the national Firewise program in regards to scope, regulation and size. With 36,485 addresses and 28,800 acres identified in the Colorado Springs WUI, the fire department is actively engaged with 87 neighborhoods by providing:

- a wildfire risk assessment down to the lot level through aerial photographs and windshield drive-by methods;
- development review process that involves progressive code requirements for new construction and rebuilding post-fire;
- education and outreach to homeowners and neighborhood organizations;
- a fuels mitigation program that addresses neighborhood chipping; residential properties and adjacent common areas and open spaces;
- champion recognition;
- grant funding and administration;
- fire danger monitoring, and
- oversight of a self-regulating process that is performed by the citizens in partnership with the fire department to "Share the Responsibility" without an enforcement posture.

The Mitigation Assessment Team found that regular, consistent and open communication with targeted neighborhoods about services offered by the fire department and the need for individual responsibility on the part of homeowners helped the community understand both the need for and how to implement mitigation work. The Colorado Springs Firewise effort is the core of the education and outreach effort. Colorado Springs Fire Department made residents partners in the process by sharing risk information and helping them conduct mitigation efforts. It also identified Firewise Champions in WUI neighborhoods and

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recognized them during both state Wildfire Awareness Weeks and official city-sponsored Firewise Weeks. Many more Firewise Communities were created by promoting champions each year and highlighting the successes of individuals and their neighborhoods.

Codes and Ordinances

Colorado Spring passed its first wildfire-related ordinance in 1993 and has since continued to work with the city council and with local developers and residents to address WUI issues through regulation. The office of the Fire Marshall provides free Hazard Risk Assessments for developments planned in the WUI. The review includes vegetation and landscape design as well as building components. All building permits must be processed through city offices.

The city's fire code is based on the International Fire Code and defines the WUI and at-risk areas. The code does not allow new construction with wood shake roofs; pre-existing cedar shake roofs are "grandfathered" in until homeowners replace roofs due to routine maintenance, at which time roof replacement cannot be with wood shakes. Additionally, the code now restricts development on slopes in the WUI, requires a Class "A" roof for all residential occupancies, [has requirements for other exterior-use materials] and fuels management measures such as creating defensible space, and many other measures intended to reduce wildfire risk.

The Mitigation Assessment Team found that Colorado Springs existing ordinances had been effective in reducing risk. See additional information in the section, "Assessment Findings Reinforce Need for Mitigation." Replacement of 55,000 cedar shake roofs over the last six years had a significant impact on ember starts as did use of fire resistant materials, home design and placement, and landscaping. Mitigation measures, building siting or location, fuels reductions, and building materials all were addressed. The Waldo Canyon Fire was responsible for igniting homes in close proximity to the blaze and igniting combustible building materials on or near other homes that ultimately resulted in the homes being damaged or destroyed.

As a result of post fire inspection the Colorado Springs Fire Marshal's office worked closely with the city council, the local builders associations, and residents to amend the city's fire code to provide more guidance on exterior-use materials, soffit screening size, and other factors intended to reduce risk. The effort to amend the ordinance was successful. The full text of the amended ordinance is available at ***http://www.springsgov.com/SIB/files/Ordinanace_No__12-111[1](2).pdf.***

Community Wildfire Protection Plan (CWPP)

Colorado Springs Community Wildfire Protection Plan (CWPP) is an active one that is implemented and is updated on a regular basis, the last time in 2011. Partners in the plan include Colorado Springs Utilities, Cheyenne Mountain Zoo, University of Colorado, USDA Forest Service, the City of Colorado Springs, Palmer Land Trust, Colorado State Forest Service, Colorado State Parks, El Paso County, Coalition for the Upper South Platte, U.S. Air Force Academy, Mount St. Francis, the Development Review Enterprise, and a host of residents representing homeowners associations.

The 48-page plan addresses a wide array of pertinent issues affecting wildfire impact on Colorado Springs and has served as the community's guide to mitigation and preparedness. The goals of the plan are to reduce risk to residents, firefighters, property, infrastructure and natural resources by educating residents about minimizing risk by reducing natural hazardous fuels around and adjacent to buildings and infrastructure, improving structural characteristics around new and existing construction through ordinances, development reviews, and individual consultations and to manage common areas and open spaces wild respecting natural characteristics and protecting habitat.

The plan calls for a minimum of 10 feet of clearance around structures and 30 feet of mitigated vegetation. Adjacent areas and open spaces calls for reduced stand density, removal of ladder fuels, separation between oak clumps by at least 10 feet, a minimum of two snags per acre for wildlife habitat, and a thinned understory in mixed conifer and mature pine.

The Colorado Springs Fire Department Wildfire Mitigation Section used the Wildfire Hazard Risk Assessment (WHINFOE) tool to determine risk ratings from low to extreme. Nearly 36,000 homes were identified as at-risk in the interface in 63 neighborhoods. Property owners can access their risk ratings on line at any time and compare

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them to those of their neighbors, thus using peer pressure to encourage mitigation. The risk information is updated as property owners make modifications or upgrades. A full update of the hazard risk map is done every 10 years; view the information at ***http://csfd.springsgov.com.***

The Mitigation Assessment Team found that the CWPP was a living document that resulted from a wide collaborative effort, including many stakeholders at the federal, state, and local level, as well as residents and homeowner associations. This broad-based support and collaboration provided credibility to the CWPP as a community-developed and accepted document. The community was invested through participation and better understood the issues involved, which fostered support for the plan's implementation, according to local officials and community leads. The CWPP outlines the community's wildfire risk issues and ways to address or mitigate them. In fact, the document goes into detail to describe mitigation practices and programs. The document is updated regularly and serves as the action plan for mitigation and risk reduction. Download the CWPP at: ***http://www.springsgov.com/units/fire/wildfire/COS_CWPP_2011.pdf.***

The Stewardship Program Agreements and Fuels Management

The Wildfire Mitigation Section gets fuels management work done through stewardship agreements with private and public property owners. Those agreements, which outline fire department and property owner responsibility and liability, are signed and in place before any mitigation work is undertaken.

Colorado Springs fuels management projects are anticipated to result in a savings of $12 to $24 for every $1 invested in mitigation. The Wildfire Mitigation Section treats nearly 1,000 acres annually through maintenance, prescribed burning, volunteer projects and neighborhood chipping. The fire department also works on cross-boundary projects with the USDA Forest Service, Air Force Academy, El Paso County, and Colorado Springs Utilities.

Colorado Springs conducts about 900 acres of fuel treatments annually. Roughly 300 acres are treated in parks, open spaces and common areas and 600 acres are treated on private property through the neighborhood chipping program. Treatments cost $800 to $2,500 per acre and can have multiple objectives. Aesthetics are important to nearby residents. City licensing requirements limit the pool of contractors, while city ordinances limit types of treatments. The city does not currently conduct broadcast burning.

In general, continuous fuel layers are broken up into clumps; small trees are thinned out and ladder fuels are removed. The hope is, these treatments will moderate the behavior of any wildfires and allow firefighters to extinguish fires before they damage structures.

More than 60 City neighborhoods/ homeowner associations participate annually in the CSFD community chipping program, which is funded by the Public Safety Sales Tax. This keeps a two-person crew busy eight months out of the year. Homeowners qualify for chipping by having a free wildfire risk assessment at their home or by attending a CSFD Wildfire Mitigation Meeting. If stacked according to CSFD guidelines, woody material is removed free of charge during a designated week. Mitigation efforts are not enforced.

Treatments also are conducted in residential common areas, parks and open spaces where the city has fire suppression responsibilities. Priority is given to forested areas adjacent to neighborhoods with high fire risk. Project area limitations include economic and contracting feasibility and ownership. The city has a seasonal five-person fuel mitigation crew and also hires contractors through an RFP process to conduct mitigation projects. Vegetation is not physically removed from treatment areas; rather, it is cut, chipped and spread across the ground to a depth of no more than 4 inches. The goal is to re-treat areas every two to four years depending upon regeneration.

Specific treatment prescriptions are based on the vegetation types and condition and terrain. In areas dominated by Gambel oak and similar shrubby species, hazard mitigation objectives focus on breaking up fuel continuity. According to Jester et al,[1] "spacing requirements between clumps of brush and/or shrubs are 2½ times the height of the vegetation. The maximum diameter of clumps is 2 times the height of the vegetation." In mixed conifer and ponderosa pine stands, thinning from below treatments are the norm. Mature trees are retained and the more flammable understory trees are cut, as are limbs that serve as ladder fuels.

[1] *N. Jester, K. Rogers, and F.C. Dennis (2012). "Gambel Oak Management," Natural Resources Series, No. 6.311. Colorado State University Extension, 115 General Services Building, Fort Collins, CO.*

Introduction & Background

The Mitigation Assessment Team found the most significant fuel treatment "story" played out at Solitude Park on June 24. The area known as Solitude Park lies above the neighborhood of Cedar Heights and covers approximately 300 acres. It is located between the residential neighborhoods and the national forest. Fuel treatments were conducted in 2010 across approximately 300 acres of the area. Vegetation types in the treated areas are primarily Gambel oak shrubland, ponderosa pine woodland, mixed conifer forest, and pinyon-juniper woodland. The treatments were funded by the city through a FEMA grant and carried out primarily by contractors as described in the above section.

In places where there had been a continuous layer of dry, shrubby fuels (decadent Gambel oak), the treatment broke the layer into clumps (Figure 1).

Figure 1: Solitude Park parcel dominated by Gambel oak, where the results of the fuel treatment by breaking up a continuous layer of shrubby fuels, are still obvious. The Waldo Canyon Fire spread to this treated area. It was extinguished before it spread to homes. Source: USDA Forest Service.

When the wildfire approached on June 24, this alteration of the fuel structure allowed firefighters to anchor in a safe zone and create a dozer line, which was instrumental in fighting the fire there and protecting the Cedar Heights community adjacent to the treatment area. It was also easier for firefighters to address spot fires in areas where the fuels were discontinuous (Figure 2). Water and retardant drops near the fuels treatment reinforced its effectiveness. Ultimately no homes were lost in the Cedar Heights neighborhood which is adjacent to the treatment area, partially due to the fuels treatment, firefighters anchored in the safe zone that put out spot fires, and changes in fire behavior.

Figure 2: The wildfire stopped or was extinguished in the middle of this treated area. Source: USDA Forest Service.

OVERVIEW OF HOME ASSESSMENT SURVEYS AND LOCATIONS

Following are the detailed findings of the FAC Wildfire Mitigation Assessment Team surveys regarding structural perofrmance, with particular emphasis on construction details that can increase the vulnerability of homes to wildfire exposures. It is intended to highlight the importance of choosing the right types of building materials and following proper installation and maintenance practices for properties located in wildfire-prone areas.

Home and buildings that were damaged and destroyed were located in the area to the west of Centennial Boulevard and to the north of N. 30th Street. The homes and other buildings in this area were represented on a preliminary damage assessment survey map published July 2, 2012 by the Colorado Springs Division of the Fire Marshal, shown in Figure 3, and included approximately 1,525 buildings. Of these, 346 were destroyed and 38 were damaged; all were located on streets accessed by Flying W Ranch Road.

Introduction & Background

Figure 3: The red circles indicate areas in the Mountain Shadows neighborhood where home assessments were conducted. Source: Colorado Springs Division of the Fire Marshal and IBHS.

Introduction & Background

Forty homes were included in the FAC Wildfire Mitigation Assessment Team survey; 38 were located in the Mountain Shadows neighborhood and two were located in the Cedar Heights neighborhood. All homes within the nominal fire perimeter were not examined.

The relative location of the Mountain Shadows and Cedar Heights neighborhoods are shown in Figure 4. Of the 38 homes included in the survey from the Mountain Shadows neighborhood, 26 homes were destroyed, 10 homes were damaged, and two homes were not damaged. The areas within the Mountain Shadows neighborhood where assessments were conducted are shown in Figure 3. The damage assessment survey form used for the home assessments is shown in Appendix A. This form was based on the NIST/USDA FS WUI-1 Damage Assessment Report form, but was modified for use in this survey. Some general observations about the role of landscape vegetation and landscaping during the fire are in Appendix B.

Home Assessment Focus

When conducting the field inspections, the FAC Wildfire Mitigation Assessment Team examined the types of building materials and construction techniques used in damaged and undamaged homes and looked for vulnerabilities that could be responsible for damage to homes and buildings. For destroyed homes, the team surveyed debris for evidence of the type of building materials used and examined landscaping vegetation and features to determine whether and how the fire might have reached and ignited the houses. As with prior post-wildfire field investigations, there was evidence of several types of possible ignition scenarios, including wildfire-to-building and house-to-house fire spread. Wildfire-to-building fire spread could occur from wind-blown embers or the flaming front or flank of the fire. By its very nature, wildfire is a fast-moving natural hazard that leaves little time for preparation when a fire is threatening. This fact, combined with the potential for multiple causes of ignition that can result in wildfire damage, further reinforces the need for a communitywide approach to wildfire mitigation to complement the role of individual responsibility among homeowners.

Approximately 90 percent of homes ignited by the Waldo Canyon Fire were completely destroyed. Of those that were damaged, firefighter intervention was the likely reason the house was saved. This pattern is similar to other wildfires where a large number of homes were destroyed and few are damaged, as indicated by many prior post-fire surveys. This report provides examples of situations where firefighter intervention was reported, and confirmed by Colorado Springs Fire Marshal's personnel, and examples where intervention did not likely occur.

How Homes Ignite during Wildfires

Wildland fire-to-building ignition resulting in damage or loss during wildfires occurs if the fire can burn directly to the building; directly or indirectly from wind-blown embers (also known as firebrands) or from exposure to embers generated by the burning wildland vegetation. An example of loss due to indirect exposure is ember ignition

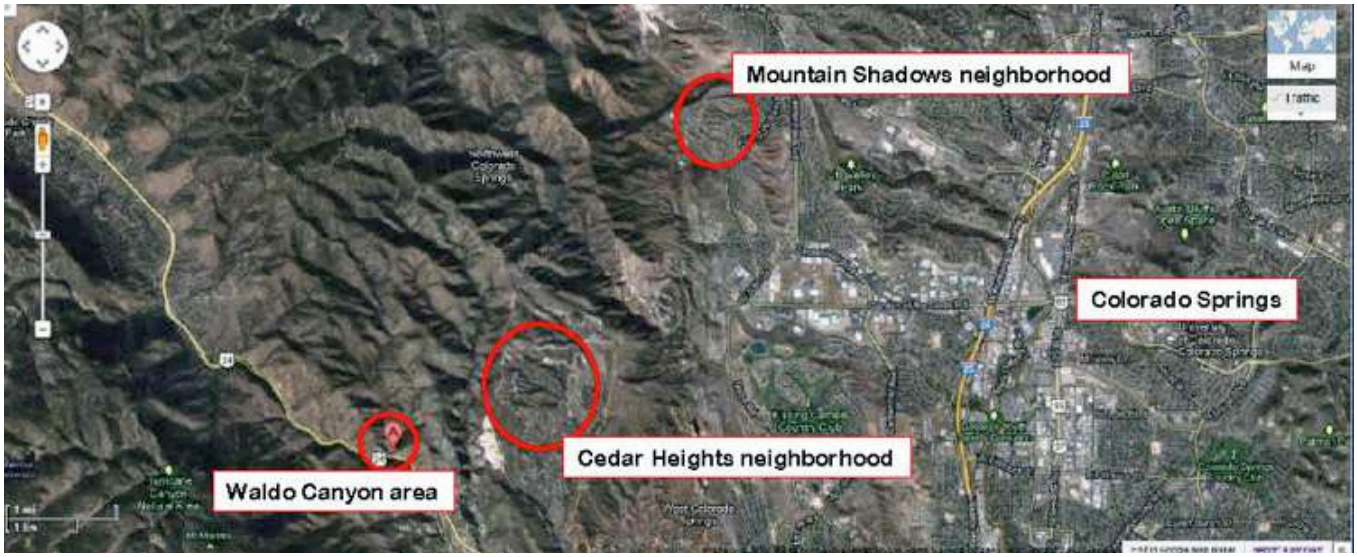


Figure 4: Relative locations of the Cedar Heights and Mountain Shadows neighborhoods in Colorado Springs. Source: Google Maps.

Introduction & Background

of vegetation or other combustible materials located near the building resulting in subsequent ignition of a building component from a radiant and/or direct flame contact exposure. Depending on the extent and duration of a radiant heat exposure, pre-heating or ignition of a material can occur, or the glass in a window or door can break. An example of loss due to direct ember exposure would be ember entry through a vent or open window with subsequent ignition of combustible materials inside the building. Direct ignition by embers also can occur through ember accumulation on combustible materials, such as a wood shake roof or combustible decking or immediately adjacent to combustible materials, such as siding.

Once homes and other buildings ignite and burn, they also become a source of embers and threaten other homes and buildings – this report will not distinguish between vegetation and buildings as the sources of embers. Once an initial wildland fire-to-building ignition has occurred, depending upon building-to-building spacing and other topography features, additional building ignitions can occur via building-to-building fire spread. It was reported that during the 2007 Witch Creek Fire, building-to-building fire spread was more likely if between-building spacing was less than 15 feet[2]. The role of proximity between houses also was present in Waldo Canyon, where many of the destroyed houses were spaced 12 feet to 20 feet apart.

In the report on the 2007 Witch Creek Fire, Maranghides and Mell[3] described three categories for building ignition: 1) uninterrupted vegetative or ember ignition, 2) vegetation fire or ember ignition and 3) ember ignition. As indicated in this report, ignition by uninterrupted vegetative fire spread would be limited to buildings located on the perimeter of a community of neighborhood since roads would provide a fuel break that would preclude vegetative fire spread. Ember ignition is included in category one because, without an eyewitness account, it would be difficult to exclude the possibility of direct ember ignition, even in cases where there is an uninterrupted vegetative path between an oncoming wildfire and a building. Loss from direct or indirect ember exposure would be included in categories two and three, with direct exposure in category three being determined either by the lack of near-building vegetation or the lack of damage to near-building vegetation.

Examples of building-to-building fire spread and the three categories of wildland fire-to-building fire spread described by Maranghides and Mell were observed during the FAC Wildfire Home Assessment Team's on-site surveys. Examples of these wildfire risks are described in the following sections, along with mitigation strategies that could minimize property damage associated with the various risks.

[2] *Insurance Institute for Business & Home Safety (2008). Megafires: The Case for Mitigation. IBHS field investigation: Witch Creek Wildfire, San Diego, CA, Insurance Institute for Business & Home Safety, Tampa, FL.*

[3] *Maranghides, Alexander and William Mell (2009). A Case Study of a Community Affected by the Witch and Guejito Fires, NIST Technical Note 1635. National Institute of Standards and Technology, Gaithersburg, MD.*

Observed Wildfire Risks and Mitigation Strategies

MOUNTAIN SHADOWS

Most of the homes in Mountain Shadows that were included in this survey were single-family detached houses, with the exception of one townhome/duplex. All of the survey homes had basements with windows and window-wells. A combination of materials, including wood-lined, stone, and metal-lined window-well retaining walls were observed. On newer homes or homes, where the window-well retaining wall had been replaced, stone or metal-lined window wells were present. Wood-lined enclosures consisted of 4 x 4 (or greater dimension) vertical support members and nominal 2x horizontal planking. The accumulation of vegetative debris in windows wells was common. In general, the fire consumed wood-lined enclosures on homes that were destroyed, but it was not clear if they were a cause of ignition or whether they were ignited by the burning home.

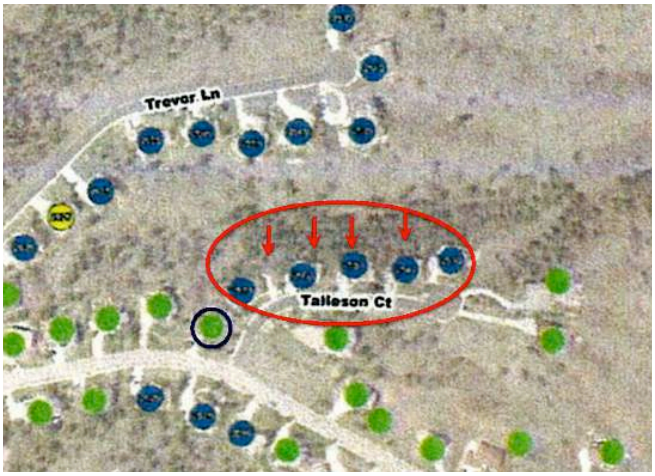


Figure 5: Five homes on Talleson Court were destroyed (red circled). These homes were located at the top of a slope and each had overhanging decks. One home suffered minor damage (blue circled).

Wildfire-to-Home: Uninterrupted Vegetative or Ember

Area Focus: Talleson Court

Although some perimeter homes were included in the assessment survey, none provided clear evidence of uninterrupted vegetation fire spread from the main body of the wildfire. The destroyed homes on Talleson Court represented an example of wildfire-to-home spread, with embers first igniting a wooded area within the community with a subsequent direct flame contact exposure to the home (Figure 5). These homes were located at the top of a steep slope (> 30%) and were rated as being in an "extreme" hazard zone by the Colorado Springs Division of the Fire Marshal.

RISK: WOODED SLOPE

Each home had a deck overhanging the slope. Figure 6 shows a view from the top of slope where the deck was located, looking down slope. The spot fire in the wooded area crowned and separation from homes to the trees was insufficient to avoid a direct flame contact to the overhanging decks. Fire then spread from the deck to the interior of the homes. An interview with a homeowner, who was present during the site visit and whose house was destroyed told members of the assessment team that the house had a lower and upper deck, and that one deck was constructed using wood, while the other deck was built using a wood-plastic composite decking product.

Figure 6: View down slope from a Talleson Court home. Note the lack of needle vegetation on the trees, indicating the fire crowned in these trees. Source: IBHS.

MITIGATION STRATEGIES

Mitigation strategies for this threat would include thinning trees and removing ladder fuels. Building a cross-slope retaining wall using noncombustible materials down-slope from the homes could also be an effective strategy for shorter brush-type vegetation[4]. However, this would not work in a wooded area with taller trees since a crown fire would burn over top a typical retaining wall. This mitigation strategy is an example of where a communitywide effort would produce the most effective results.

[4]NFPA (2008). NFPA 1144, Standard for Reducing Structure Ignition Hazards from Wildland Fire (Appendix A). National Fire Protection Association, Quincy, MA.

Observed Wildfire Risks and Mitigation Strategies

RISK: WINDOWS

Figure 7 depicts a home that suffered minor damage from radiant heat. This home was located approximately 30 feet from the home that was destroyed. Damage consisted of deformed vinyl frames in two windows and cracked outer glass panes in the same windows. A near-home pine tree showed signs of needle scorch. No damage was observed on the stucco-type exterior cladding. In this case, because of the limited damage to the vinyl frame windows, and because the damage was caused by the radiant heat exposure from the adjacent home, human intervention wasn't likely. Because the glass in the windows did not completely fail (i.e., the outer glass pane remained intact and the frame did not ignite), ember entry into the home did not occur.

It should be noted that, with the exception of the pine tree located near the home and a small bush in the interior corner, the defensible space on this side of the house was good (Figure 7). A noncombustible gravel product was used within 10 feet of the house. Any ember deposition and accumulation would have been on this material.

MITIGATION STRATEGIES

Mitigation strategies for this threat would include installing multi-pane windows that incorporate tempered glass. Studies have shown that the glass is the most vulnerable component of window in terms of complete failure. When glass breaks, it creates openings large enough for fire or embers to enter the home. Tempered glass is several times stronger than annealed glass (the type of glass most commonly used in windows) and therefore will require a radiant heat exposure that is higher than that required to break annealed glass. Because of this difference, tempered glass is recommended for use in these applications.

As already noted, the vinyl window frames deformed when subjected to the radiant heat exposure from the adjacent destroyed homes. To avoid these aesthetic types of damage, shutters or other coverings that could be deployed when wildfire threatens could be used. Use of shutters or coverings, and minimally multi-pane tempered glass windows, should be used in neighborhoods with close home-to-home spacing.

Wildfire-to-Home: Uninterrupted Vegetative or Ember with Subsequent Home-to-Home Fire Spread

In wildfires where large numbers of homes are destroyed, it is common for a significant number of home ignitions to result from home-to-home fire spread, with the wildfire becoming an urban fire. Close home-to-home spacing is an important component for this kind of fire. Topography and weather (wind) will also contribute to fire spread during these events. An example of this wildfire-to-urban fire scenario is the October 1991 Oakland-Berkeley Hills Tunnel Fire. The Tunnel Fire destroyed more than 3,600 homes while burning more than 1,500 acres. Similarly, during the Waldo Canyon Fire, a large number of homes were destroyed as a result of home-to-home fire spread after a smaller number of wildland fire-to-home ignitions occurred.

Figure 7: This damaged Talleson Court home was approximately 30 feet from a destroyed home. Two windows were damaged (one is circled in red; another window of the same size is located to the left of the one shown). The tall pine tree had lower branches removed and noncombustible gravel was used within approximately 10 feet from the house. Note the scorch on the destroyed home side of the pine tree and small tree in the foreground. Source: IBHS.

Observed Wildfire Risks and Mitigation Strategies

Area Focus: Majestic Drive

Aerial photographs of the Majestic Drive area before and after the fire are shown in Figures 8 and 9 As shown in Figure 8, the fire burned down to Flying W Ranch Road, burning the vegetation on the west side of the road (left-hand side in Figure 8). Flying W Ranch Road is a major thoroughfare through the community and is approximately the width of a four-lane road: it consists of two lanes with a center common turning lane and wide, paved shoulders. Because of the width of Flying W Ranch Road, the homes in this area ignited either from direct or indirect ember exposure or home-to-home spread. Although it was not determined which of the homes in the Majestic Drive area were ignited by embers and which were specifically ignited through home-to-home fire spread, because of the relatively close between-home spacing, it is probable that many of the 135 homes destroyed in this area were the result of home-to-home fire spread.

Figure 8: Majestic Drive area of the Mountain Shadows neighborhood prior to the Waldo Canyon Fire. Source: Google Maps.

Figure 9: Majestic Drive area of the Mountain Shadows neighborhood after the Waldo Canyon Fire. Source: Colorado Springs Division of the Fire Marshal.

RISK: HOME-TO-HOME SPACING

The homes in included in the assessment from this area were on Hot Springs Court. Between-home spacing for these homes was between 12 and 20 feet, representative of the other homes in the Majestic Drive area. Four homes were inspected in this area: two that were destroyed and two that were damaged (Figure 10). The homes had a Class A (asphalt composition shingle) roof covering and wood composite (hardboard) siding. The homes that were damaged had soffited (and vented) eaves. Decks on these homes used both solid wood (non-fire retardant treated) and wood-plastic composite deck boards. Both of these products are combustible. Neither qualifies as being an ignition-resistant material, which requires passing a longer-duration (30 minutes versus 10 minutes) version of the test used to evaluate the flame spread rating of a material. This test and designation applies to materials used as siding, decking and trim. Only a few commercially available materials qualify as an ignition-resistant material–the most common being wood products treated with an exterior-rated pressure impregnated fire retardant chemical formulation.

MITIGATION STRATEGIES

Maranghides and Johnsson[5] reported that by using a one-hour, fire-rated wall construction, the spread of fire from one building to another located 6 feet away could be slowed down compared to a building clad with combustible materials that did not include the underlying materials (such as a fire-rated gypsum wallboard product) to provide the fire-rating. Since fire-resistance is measure of fire penetration through the wall assembly, and does not evaluate flame spread up the wall, or ignition resistance, a one-hour fire-rated wall would not be the complete answer to hardening a building, but it could help in situations where there is close home-to-home spacing.

[5] *Maranghides, Alexander and Erik L. Johnsson (2008). Residential Structure Separation Fire Experiments, National Institute of Standards and Technology, Gaithersburg, MD.*

Observed Wildfire Risks and Mitigation Strategies

Mitigation strategies for this threat would also include installing multi-pane windows that incorporate tempered glass. Studies have shown that the glass is the most vulnerable component of window in terms of complete failure. When glass breaks, it creates openings large enough for fire or embers to enter the home. Shutters or other coverings that would be deployed when wildfire threatens could also be used. Shutters and coverings are typically active devices, meaning that a resident must be present to deploy or install. There are advantages to passive devices since they are always enabled.

Figure 10: Majestic Drive area of the Mountain Shadows neighborhood showing destroyed (blue), damaged (yellow) and undamaged (green) homes, as shown in the preliminary damage assessment survey map. An undamaged home in the middle identified by an arrow was not included in this field assessment. Source: Colorado Springs Division of the Fire Marshal.

Ignition of the destroyed home at 2551 Hot Springs Court, shown as the upper most home in the red circled area in Figure 10, was either from the adjacent destroyed home located 16 foot away or through direct ember ignition. Defensible space was very good; rock mulch surrounded the home and the balance of the property consisted of irrigated lawn. The wood "half wine-barrel" planters were either largely undamaged, or burned on the house-facing side, indicating exposure from the burning house.

Figure 11: The distance between the destroyed home on the left and the damaged home on the right was approximately 16 feet. Source: IBHS.

Figure 12: Embers ignited a firewood pile located next to the garage of this home. The direct flame contact exposure from the burning firewood ignited the composite wood (hardboard) siding product. Source: IBHS.

RISK: NEAR-HOME COMBUSTIBLES

The distance from the destroyed home to the adjacent damaged home included in this survey was also approximately 16 feet (Figure 11). Damage to this home occurred on two sides: the side facing the adjacent destroyed home at 2551 Hot Springs Court and the opposite side, facing the non-damaged home (green dot within red circle in Figure 10). Damage to the side facing the destroyed home was relatively minor – one window in the window-well was damaged. Damage to the opposite (garage) side was more extensive, and was caused by the ember ignition of a fire wood pile immediately adjacent to the wood siding. The wood siding was ignited by the flames from the burning fire wood pile and the fire ultimately entered the garage (Figure 12). Firefighter intervention was reported at this home, and there is clear evidence that intervention occurred with wood from fire wood pile being kicked away from the building.

Observed Wildfire Risks and Mitigation Strategies

MITIGATION STRATEGIES

Ignition of the firewood pile by wind-blown embers points to the importance of creating and maintaining a noncombustible zone, or at minimum a low combustible zone, within five feet of a home or building. Firewood piles, lumber and other combustible materials, bark and rubber ground mulch products, and woody vegetation should not be stored, planted or used in this area. The goal is to create a "near-home" zone that minimizes the opportunity for a direct flame contact exposure to the side of the house or to the underside of the deck.

The relatively minor damage to the side of the home shown in Figure 11 is unusual given the close between home spacing. The lack of charring or scorch on the siding and shrubs (not shown in Figure 11) indicated that the destroyed house largely burned within the interior and then collapsed before involving most of the exterior. This would imply minimal window area on the sides facing the damaged home. A portion of the unconsumed wood-framed wall was standing on the side of the destroyed home facing the damaged home. The terrain at this location was relatively flat which could also help minimize exposure to the adjacent home[6].

Damage to the remaining non-destroyed home on this court consisted of bubbling paint on window and other trim boards and a deformed vinyl window frame (Figure 13). The distance to the destroyed home was approximately 20 feet.

Figure 13: Radiant heat from the burning home, which was destroyed and was located 20 feet from this damaged home, was sufficient to cause paint on the wood trim to bubble (circled blue) and thinner components on the vinyl window frame to deform (circled red). Source: IBHS.

Area Focus: Courtney Drive

RISK: HOME-TO-HOME FIRE SPREAD

The perimeter homes located on the west side of the road (left side in the figure) shown in Figure 14 were included in the assessment. Evidence observed at the site indicated the likely wildland fire-to-home ignition occurred at 2340 Courtney Drive (Figure 14). This was likely due to the initial ignition of a detached storage shed and fire that subsequently spread to the home. Six additional homes were destroyed through home-to-home fire spread. The between-home spacing was consistently between 12 and 17 feet, which is consistent with the findings from prior post-fire field investigations, indicating the vulnerability of closely spaced homes to this type of home-to-home fire spread. All the homes were located on a moderate upslope between 10% and 20%, with the home at 2340 Courtney Drive being located at the bottom of the slope (Figure 15).

The defensible space around the destroyed homes was adequate. Observations during the site visit showed that burned and scorched vegetation and other combustibles were from radiant heat and / or fire spread out from the burning homes rather than the wildfire (Figures 16 and 17).

Figure 14: Homes on Courtney Drive that were destroyed by home-to-home spread after an initial wildfire-to-home ignition (indicated with red arrow). One home at the top of slope (red circled) suffered minor damage. The home to the east (right) of the wildfire-to-home, shown as a non-damaged green dot in this figure (blue circled), also had minor damage. Source: IBHS.

[6]*Interpretation of this event includes input resulting from personal communication with Dr. Jack Cohen, USDA Forest Service, Missoula, MT.*

Observed Wildfire Risks and Mitigation Strategies

Figure 15: A composite figure showing destroyed Courtney Drive homes, as viewed from upslope and down slope different perspectives. Source: IBHS.

Figure 16: Composite figure of backyards of two destroyed homes on Courtney Drive; photos taken from the home site location. Damage to vegetation and other combustible components was from burning home, not wildfire. Source: IBHS.

Figure 17: Damage to the play structure slide resulting from radiant heat exposure from the burning Courtney Drive home. Deformation of plastic components (slide and roof) was observed. Scorch or charring of wood structural support members was not observed. Source: IBHS.

Figure 18: A composite figure of two damaged homes on the west side of Courtney Dr. The up-slope home is above and the down-slope home below. The charred combustible siding in the up-slope home is not visible in this figure. The damaged components in the down-slope home are circled. Source: IBHS.

Observed Wildfire Risks and Mitigation Strategies

MITIGATION STRATEGIES

The mitigation strategies here are the same as those recommended by Maranghides and Johnsson referenced in the Majestic Drive section of this report.

The Courtney Drive homes included in this survey suffered from radiant heat damage to the siding, windows and/or the edge of the roof (Figure 18). The combustible siding on the upslope home was charred (the damaged home shown in the upper photograph in Figure 18). This home was approximately 25 feet away from the adjacent destroyed home, and was off-set from the other homes on this side of the street. Damage to the down-slope home (bottom in Figure 18) was limited to deformation of the vinyl frame in one window, similar deformation of part of a satellite dish and evidence of the flow of heated asphaltic compound in the asphalt composition roof covering; the combustible component of this Class A fire-rated roof covering. As was the case with the damaged home on Talleson Court, because the damage resulted from a radiant heat exposure, firefighter intervention did not likely occur.

WILDFIRE-TO-HOME: EMBER IGNITION

Embers, either via direct or indirect means, have been identified as the major cause of building ignitions during wildfires. It is difficult to quantify wildfire ember exposure of a component in terms of the mass or number of embers that land during a wildfire. Several examples of ember accumulation on or adjacent to materials will be discussed in this section. In most cases the accumulation of embers resulted in ignition.

RISK: EMBER ACCUMULATION AT THE BASE OF EXTERIOR WALLS

Low ground-to-siding clearance is commonly observed in construction. This condition was observed on many homes that were included in the assessment. When wood or wood-based siding is used, the building code requires a six-inch earth-to-wood clearance. This means the concrete foundation must extend 6 inches above the ground before the first course of wood siding is applied. This requirement is included in the code to minimize degradation to the siding (e.g., fungal decay or subterranean termite damage). Construction assemblies where clearance is low may be vulnerable to the accumulation of embers at the base of the wall. Ember accumulation at the base of a wall in Mountain Shadows home resulted in ignition of the wall assembly. Construction details that could be vulnerable to ember accumulation were observed on a Cedar Heights home. These conditions will be discussed in the following section.

Area Focus: Lanagan Street

The exterior siding on the garage of a Lanagan Street home (the location of this street is shown in Figure 3) consisted of an exterior insulation finishing system (EIFS) assembly (Figure 19). In this case, the EIFS assembly consisted of a thin noncombustible stucco-like outer layer, an underlying foam insulation board, oriented strand board sheathing, and wood framing. There was a (metal) weep screed at the base of the wall to allow for drainage of water that gets behind the outer-most siding layer. As seen in Figure 19, combustible components in the middle and right-hand columns ignited. The apparent cause was from an accumulation of embers at the base of the EIFS wall. The bottom of the weep screed is perforated to allow for water to exit the wall assembly. These perforations also allowed for easier access of the accumulating embers at the base of the wall to the combustible components in the wall assembly (Figure 20). The combustible materials included the foam insulation, wood-based sheathing, building paper or house wrap and wood framing.

Observed Wildfire Risks and Mitigation Strategies

Figure 19: Photographs of the left, middle and right side columns of the two-car garage at a home on Lanagan Street. Note the low clearance between the concrete driveway and the EIFS system, as shown in the left-hand side column. The metal weep screed is visible at the base of the middle column. Source: IBHS.

Figure 20: The components of this EIFS system include a noncombustible stucco outer coating, and inner layers of combustible foam insulation, wood-based sheathing, and wood framing. Source: IBHS.

CEDAR HEIGHTS

While the Waldo Canyon Fire threatened the Cedar Heights community no homes were lost. This is a community of single-family detached homes that are more widely spaced than those in Mountain Shadows. The Mitigation Assessment Team found significant fuel treatment actions in Solitude Park, which is located above the neighborhood and covers approximately 300 acres, significantly assisted firefighters in their quest to save homes in this community. However, there was evidence of potentially vulnerable conditions around homes in Cedar Heights, which may not have performed as well if weather conditions had changed.

Area Focus: Outer Vista Point Road

One home on Outer Vista Point Road in the Cedar Heights neighborhood was included in the assessment survey. This home exhibited two different low clearance conditions that would make this home vulnerable to the accumulation of embers at or near the base of the wall. The front of this home is shown in Figure 21; the wall assembly at this location included a noncombustible fiber-cement shingle product and a wood-based sheathing product that was exposed at the bottom of the wall. Bark mulch was used at this location. The vulnerability of this location is exacerbated as a result of the bark mulch which can be ignited by

Observed Wildfire Risks and Mitigation Strategies

embers during a wildfire. If the mulch ignited, the resulting fire could spread to the exterior wall. This assembly shows one way that the protection offered by a noncombustible cladding product can be by-passed, since the underside of the wall assembly (and the wood-based sheathing) would be exposed to a direct flame contact exposure. If the sheathing ignites, the fire could spread into the wall cavity and then into the living space of the home. Flame height would depend on the type and depth of the mulch product, but given this condition, earth-to-siding clearing would have to be greater than that needed to avoid damage if accumulation were occurring on a noncombustible surface, such as the driveway at the Lanagan Street home.

Figure 21: The siding on this home was a noncombustible fiber-cement shingle product (upper photo). The assembly at the base of the wall, showing combustible wood-based sheathing, is shown in the lower photo. Source: IBHS.

A noncombustible rock mulch product was used on the back side of this home (Figure 22), along with a fiber-cement shingle product. As was the case of the Lanagan Street home, the ground-to-siding clearance for this home was minimal and accumulation of embers at the base of the wall could result in the ignition of the underlying wood-based sheathing. In this case, the foam insulation was not included in the assembly.

MITIGATION STRATEGIES

In each of the construction conditions discussed in this section, increasing the ground-to-siding clearance would result in a less vulnerable assembly. Mitigation strategies for the Lanagan Street home would include increasing the height of the concrete foundation to increase the distance between the driveway and the beginning of the EIFS cladding system. Use of a six-inch driveway-to-EIFS clearance would correspond to the already code-required earth-to-wood clearance for wood-based siding products. A six-inch clearance may or may not be the optimal separation to avoid ember accumulation-related damage via smoldering and / or flaming combustion, but based on these observations, it would be the preferred option to the observed much lower earth-(or ground)-to-siding clearances.

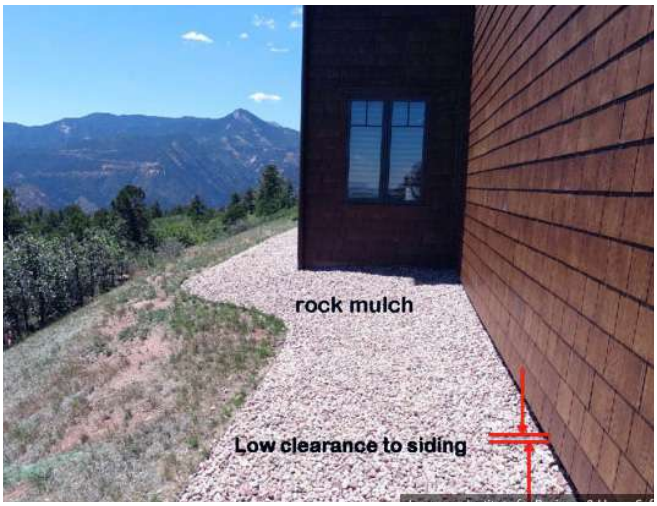


Figure 22: The back side of the home on Outer Vista Point Road. Noncombustible rock mulch and fiber-cement shingle siding products were used. The low clearance may allow for the underlying wood-based sheathing product to be vulnerable to ember accumulation at the base of the wall. Source: IBHS.

For the condition at the front of the Outback Vista Point Road home, where combustible mulch was used near the home, the best option would be to use noncombustible siding and noncombustible mulch products to reduce the vulnerability of the home to a wind-blown ember exposure.

Detailing using noncombustible materials, such as an a concrete foundation wall, should generally be used at the intersection between horizontal and vertical surfaces where one or both of the materials are combustible or where the assembly incorporates an exposed combustible component, would reduce the vulnerability of these

Observed Wildfire Risks and Mitigation Strategies

assemblies. In some situations, such as a deck to wall intersection, metal flashing could be used. The metal flashing detail could be more easily incorporated into a mitigation strategy for an existing home.

These findings are in agreement with those of Barrow. In his report about the 1944 Beaumaris Fire (Australia), Barrow stated his observations "… showed that the resistance to fire is determined more by the details of construction than by the materials used in the walls."[7] Hardening the building using appropriate details can be as important as hardening with materials alone (e.g., using noncombustible materials) since poor detailing can result in a given wildfire exposure by-passing the protection offered by the exterior material.

RISK: ROOF VULNERABILITY TO EMBERS

A similar vulnerability can also occur on complex roofs, as shown in Figure 23. This detail was observed on a home in the Majestic Drive area, but is common on complex roof systems. The code required clearance between the roof and wood and wood-based siding is two-inches (less than that required for earth-to-wood siding). Ember ignition of vegetation debris in gutters and on the roof at roof-to-wall intersections has been demonstrated[8] as has the ignition of wood decking, without an accumulation of vegetative debris[9].

Figure 23: The roof-to-siding return on this complex roof consists of a composite wood (hardboard) siding product and a Class A fire-rated asphalt composition shingle roof covering. Even without vegetative debris at the roof-to-wall intersection, an accumulation of embers could result in ignition of the wood-based siding. Source: IBHS.

MITIGATION STRATEGIES

As mentioned with the EIFS cladding system, detailing using noncombustible materials, such as metal flashing, at the intersection between horizontal and vertical surfaces, where one or both of the materials are combustible or where the assembly incorporates an exposed combustible component, would reduce the vulnerability of these assemblies. The metal flashing detail could be more easily incorporated into a mitigation strategy for an existing home. If using a flashing detail, to avoid moisture-related degradation, the upper portion of the flashing should be tucked in behind (or into) the siding in such a way that rain water cannot get into the space between the flashing and the siding.

Area Focus: Rossmere Street and Champagne Drive

The vulnerability of (non fire-retardant treated) wood shake roofs has been documented. Removal of wood shake roofs and replacement with Class A fire-rated roof coverings has been a strong recommendation by the fire service and others involved in homeowner educational programs for a number of years. The roof represents a large relatively horizontal surface that can and will collect embers. Highly combustible roof coverings, such as wood-shake coverings, can be easily ignited. In many locations, including Colorado Springs, use of wood shake roofs in wildfire-prone areas is not allowed when a roof covering is replaced. Although many homeowners in the Colorado Springs have replaced their wood shake roofs in recent years, many homes still have this type of roof covering.

Figure 24: Location of the Rossmere Street and Champagne Drive homes (circled red) within the Mountain Shadows community. Source: IBHS.

[7]Barrow, G.J. 1945. A Survey of Houses Affected in the Beaumaris Fire, January 14, 1944. Journal of the Council for Scientific and Industrial Research. 18
[8]Quarles, Stephen L (2012). Vulnerabilities of Buildings to Wildfire Exposure. http://www.extension.org/pages/63495/vulnerabilities-of-buildings-to-wildfire-exposures.
[9]Manzello, Samuel L. and Sayaka Suzuki. 2012. Exposing Wood Decking Assemblies to Continuous Wind-Driven Firebrand Showers. NIST Technical Note 1778. National Institute of Standards and Technology, Gaithersburg, MD. 20 pp.

Observed Wildfire Risks and Mitigation Strategies

RISK: WOOD SHAKE ROOF

Two homes in the Mountain Shadows neighborhood, both located well-away from the perimeter of the community (Figure 24), had wood shake roofs that were ignited by wind-blown embers (Figure 25). The actions of firefighters saved each home, supporting findings from many other post-fire surveys and investigations of the benefit of intervention / suppression efforts in saving homes that have ignited. Fires in homes that are destroyed start out as relatively small fires and can be extinguished if discovered early. The Rossmere Street photo in Figure 25 shows three neighboring homes, with the middle one having the wood shake roof. The two adjacent homes have a Class A fire rated roof covering. These homes were not damaged. Given the proximity of the homes to each other, the ember exposure to each was likely similar, demonstrating the importance of replacing a wood shake roof covering.

Figure 25: Homes on Rossmere Street (upper) and Champagne Drive (lower), each had wood shake roof coverings that were ignited by wind-blown embers. Source: IBHS.

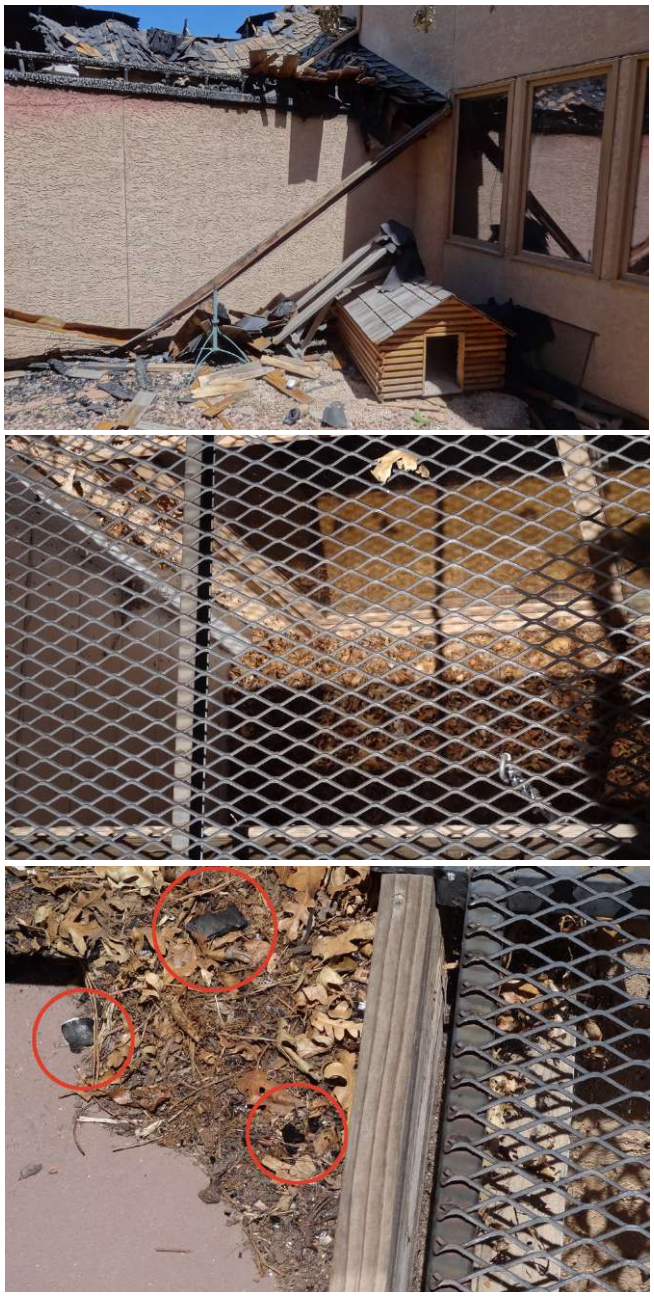


Figure 26: Combustible materials were present in the near-home zone of the Rossmere Street home. Embers are evident in the right-hand middle photo (embers circled in red). Source: IBHS.

Each of the two homes with wood shake roof coverings also had relatively poor defensible space in the near-home, 0-5 foot zone (Figures 26 and 27), and an ember exposure to near-home combustible materials was evident. The front of the Rossmere Street home had a design feature that,

Observed Wildfire Risks and Mitigation Strategies

coupled with the wood mulch on the ground, resulted in a vulnerability to the home (Figure 28). This condition is very similar to the previously discussed earth-to-wood condition observed at other homes in Mountain Shadows and Cedar Heights. Although an ember exposure occurred in this area at the front of the home, ignition of mulch was not evident. Although any of these could have resulted in ignition of the home indirectly, given a large enough ember exposure, the wood shake roof was the most vulnerable feature on these homes.

Figure 27: Combustible materials were present in the near-home zone of the Champagne Drive home. Source: IBHS.

Figure 28: The "bump out" design feature at the front of the Rossmere Street home would be been vulnerable, if the wood mulch had been ignited by the observed ember exposure. Given the low earth-to-wood clearance, flame spread to the bump out would have provided a flame contact exposure to the combustible underside feature. Source: IBHS.

MITIGATION STRATEGIES

Wood shake roofs should be replaced with Class A fire-rated roof coverings. Adequate defensible space in the three zones: 0-5 feet (the noncombustible zone), 5 feet- 30 feet and 30 feet-100 feet or to the property line, should be created and maintained along, with regular roof maintenance to keep gutters clear and the roof free of debris, particularly at intersections where debris can easily accumulate.

SUMMARY AND CONCLUSIONS

The Waldo Canyon Fire represented the first opportunity for the partners in the Fire Adapted Communities Coalition to study a community post-wildfire. The FAC Mitigation Assessment Team found that Colorado Springs' post-fire mitigation work closely mirrors recommendations of the Fire Adapted Community strategy in most aspects (see chart below).

The mitigation work conducted in the high risk areas of the community was credited with helping the fire department achieve an 82 percent save rate. According to estimates provided by the Colorado Springs Mitigation Section and FEMA, the cost benefit ratio for the mitigation efforts for the Cedar Heights neighborhood was 1/257; $300,000 was spent on mitigation work and $77,248,301 in losses were avoided. Combined cost benefit ratio was 1/ 517 for the three neighborhoods with the highest impacts. However, it should be noted that changes in fire weather behavior such as wind shifts could have resulted in significantly higher fire losses.

This field survey has confirmed findings of other post-fire surveys in terms of the basic mechanisms whereby buildings can ignite, particularly by exposure to wind-blown embers. Construction details were identified that can make buildings vulnerably to wildfire and solutions to mitigate these vulnerable features were offered. This survey confirmed that effective pre-fire mitigation efforts must be conducted at both the individual and community levels in order to create fire-adapted and fire-safe neighborhoods in wildfire-prone areas. Wildfires will continue to occur and homes and communities in wildfire prone areas must be prepared to resist the associated wildfire exposures.

By addressing the vulnerabilities identified in this report, coupled with mitigation strategies outlined, residents with existing properties can significantly reduce their risk of wildfire-related property losses. However, regular maintenance of properties located in wildland areas is also a

Observed Wildfire Risks and Mitigation Strategies

critical component of this process. By incorporating mitigation strategies when rebuilding or repairing properties post-fire, communities will take an important step toward becoming more fire-adapted.

Major Findings of FAC Mitigation Assessment Team

BUILDING DESIGN AND MATERIALS IMPROVEMENTS AND MAINTENANCE COULD HAVE REDUCED LOSSES

- Ember ignition via ignition of combustible materials on, in or near the home was confirmed by the surveys. This reaffirms the serious risk posed by ember ignitions to properties during wildfires. This reinforces the importance of maintaining an effective defensible space and regularly removing debris from areas on and near the home.
- Home-to-home fire spread was again a major issue, as with prior post-fire field investigations. When it occurred, it was dependent on at least one wildland fire-to-home ignition and then home spacing and slope / terrain. Home-to-home fire spread was attributed to a relatively large number of home losses in this survey.
- Wildland fire-to-home ignition was influenced by location of home on slope and fuels treatment(s) or lack of on the slope leading to the home.
- A building can be hardened with noncombustible materials, for example, but it is also necessary to incorporate appropriate construction details, which will help ensure that the protections offered by those materials is not by-passed.
- Individual homeowners must take responsibility for fortifying their property against wildfire damage by taking appropriate measures to incorporate noncombustible building materials and construction details.

A COMMUNITY-WIDE APPROACH IS BEST

- Community leaders must recognize the value of community-wide collaboration, an essential component to home survival and creation of fire adapted communities.
- While creating ember resistance, defensible space, and ignition-resistant construction are key wildfire mitigation features,

FAC Elements Compared to Colorado Springs Mitigation	Yes	No	N/A
Engaged, active community	X		
Firewise defensible space, hardened structures	X		
Codes and Ordinances	X		
Wildfire Prevention, Fire Danger Monitoring	X		
Fuels Treatments	X		
Evacuation Routes	X		
CWPP	X		
Co-op Agreements			X
Local Capacity			X

Observed Wildfire Risks and Mitigation Strategies

equally important are mitigation efforts conducted neighborhood-by-neighborhood and community-by-community.

- A small dedicated/motivated organization or group can have a big impact.
- Homes located closer than 15 feet apart can be vulnerable if a neighboring home has not been well prepared and ignites.
- The community tax base is significantly impacted by the widespread damage and destruction of homes and businesses during wildfires. This has economic consequences for all residents.

FUELS REDUCTION IS IMPORTANT

- Hazardous fuels reduction should continue both around neighborhoods and in more remote areas containing flammable vegetation. Treatments should have explicit, specific objectives.
- While the Waldo Canyon Fire caused widespread damage, it also left behind a healthier landscape by reducing the amount of fuel for future fires. The FAC site visit underscored the importance of prescribed fire as a fuels reduction tool.

PARTNERS IN PREPAREDNESS CAN EQUAL SUCCESS

- The preparedness message is most effective when carried by a variety of partners. Public policymakers, officials and local community and business leaders should echo best practices provided by the Fire Adapted Communities Coalition to reinforce the need for wildfire mitigation efforts at every level.
- Partnerships are critical in building support and extending the area of influence for wildfire preparedness efforts.
- The Colorado Springs Mitigation Section integrated a variety of methods that mirrored, to a large extent, the Fire Adapted Communities effort and were able to accomplish significant mitigation, even with a relatively small staff and budget. This was the result of collaborative efforts with important partners.
- There is a need to create WUI messages that work for different neighborhoods, different audiences, and different contexts. This is particularly true for rural and urban communities. People may not identify with their risk if they don't see their neighborhood as being in the traditional WUI.
- Contractors and design professional, along with code/ordinance development bodies, have an important role to play in wildfire preparedness. By incorporating best practices to reduce wildfire vulnerabilities into building design and construction techniques and ordinances the risks to properties can be reduced.

APPENDIX A: THE HISTORY OF THE COLORADO SPRINGS WILDFIRE MITIGATION SECTION

1993: City ordinance passed regarding vegetation management, roadway width and sprinkler installation that applied to development after April 1993.

1994: Chief Manuel Navarro was hired and immediately acknowledged the need for a wildfire mitigation program, based on prior experience in California.

1999: A Tri-Data Study identified need to address wildfire risk in the community.

2000: Office of the Fire Marshal created a wildland risk manager position and began meetings with stakeholders toward formation of a Core Advisory Group. Risk model analysis began. Risk assessments conducted on 44,000 properties.

2001: Wildfire Mitigation Plan completed, including partnering with Colorado Springs Utilities.

- First grants received through USDA Forest Service and U. S. Fire Administration Assistance to Firefighters.
- Senior GIS analyst hired.
- Voters approved Public Safety Sales Tax to fund Wildland Risk Management Program.
- First wildfire risk materials created.
- Colorado Springs Firewise Program Coordinator hired to serve as liaison between homeowners and fire department.
- "Sharing the Responsibility" tagline created and public awareness education and outreach launched.
- Mandatory evacuation ordinance presented to the city council.

2002: Launch of interactive Colorado Springs Firewise website. Free onsite mitigation consultations for homeowners by mitigation specialists begin. Research begins on development of a cedar shake roofing ordinance. Class "A" Roofing Ordinance passed.

2003: Class "A" Roofing Ordinance takes effect on Jan. 1.

- Vegetation Management Coordinator hired. Neighborhood Stewardship Agreements begin.
- Collaboration with City Parks and Open Spaces begins.
- Mayor proclaims an annual Firewise Week.
- Outreach to Peak-to-Prairie Landscaping Symposium, Home Builders Association Home and Garden Show, Insurance Company Outreach with State Farm and California Casualty.
- Mitigation media campaign launched. First homeowners' association mitigation project completed with help of Eagle Scouts.

2004: Curbside Chipper Program begins. Neighborhood demonstration sites created. Third in a series of Colorado Springs Firewise videos produced for city's cable access channel.

2005: FEMA Pre-disaster Mitigation Grant received. First Colorado Springs Firewise Newsletter mailed to homeowners. 20 Firewise Champions from 14 neighborhoods recognized during Wildfire Awareness Week.

2006: FEMA Pre-disaster Mitigation Grant received by 28 new Firewise Champions. First Annual Patrick Niedringhaus Memorial Award presented to a homeowner; recipient embodies Niedringhaus' spirit, energy, and enthusiasm for preserving community and its natural beauty. Niedringhaus, who was killed in an avalanche in 2005, was the first Eagle Scout to complete a mitigation project with the Wildfire Mitigation Office.

2007: FEMA Pre-disaster Mitigation Grant received.

2008: 65 more Firewise Champions recognized. Eight Colorado Springs neighborhoods become NFPA Firewise Recognized Communities.

2009: FEMA Pre-disaster Mitigation grant received. Fuels crew established.

2010: Colorado re-brands Firewise for local application.

2011: Two new NFPA Firewise Communities recognized.

2012: Waldo Canyon Fire strikes destroying more than 300 homes and killing two people; 82 percent of impacted homes are saved due to response and previous mitigation work.

APPENDIX B: DAMAGE ASSESSMENT FORM

Colorado Springs - Waldo Canyon Fire - Damage Assessment Form

Day - (circle one) Wednesday 7/18/2012 Thursday 7/19/2012 Friday 7/20/2012 Time: _____

GPS Location:
_____
_____

Photograph Number(s): _____

Site Information -

_____ _____ _____
Street Number Street Name Unit No. (if applicable)

Parcel and Residence Information -

Reason for inadequate D-space:

Type of Parcel: Single Family □ Townhouse □ Apartment □

Slope: Low (Flat-10%) □ Moderate (11-30%) □ Steep (>30%) □

Extent of Damage: None □ Minor □ Destroyed □

Type of Ignition: Ember/0-5 □ Vegetation Ember/5-30 □ Ember/Building □ Wildfire □
Radiant Heat / Flames from Neighbor □

Topography / Location: Flat □ Bottom – Lower 1/3 □ 1/3 – top of slope □

Adequate Defensible Space: 0-5 ft. (including fencing) □ 5-30 ft. □ 30-100 ft. □

Proximity to Neighbor / Secondary Building(s): Front ___ Left ___ Back ___ Right ___
(*Relative to Front*)

D-space Comments:

Roof-type: Flat □ Sloped □ [Steep (>5:12) yes □ no □] Simple □ Complex □ Not Known □
Skylights: No □ [Yes □ Glass □ Plastic □]

Roof Material: Asphalt Comp □ Metal □ Tile-Flat □ Tile-Barrel □ Wood Shake □ Other / Unknown □
Bird Stop evident: yes □ no □ n/a □

Vents: Eave □ Gable End □ Through-roof □ [Ridge □ High Wind? yes □ no □ Not Known □]

Gutter: Vinyl □ Metal □
[Evidence of cover: yes□ no□] [Evidence of drip edge: yes□ no□]

Eave Type: Open □ Soffited □ Not Known □ Material: _____

Deck: Solid Surface □ Combustible (Wood / W-P Composite) □
Enclosed: Horizontal □ Vertical □ n/a - Not Known □

Window Frame: Vinyl □ Other □ Glass: Single Pane □ Multi-pane □ Tempered □
Window Screen: Yes □ No □

Foundation: Slab on Grade □ [Raised Floor □ Vented? yes □ no □] Basement □
Earth-to-Siding: <6 inches □ > 6 inches □

Siding: Solid Wood □ Heavy Timber / Log □ Shingles □ Composite (HB/OSB) □ Vinyl □ Noncombustible □

APPENDIX B

APPENDIX C: OBSERVATIONS ON THE ROLE OF FUELS MANAGMENT AND LANDSCAPE VEGETATION AND FEATURES

WALDO CANYON: FUEL TREATMENT EFFECTIVENESS AND FIREWISE LANDSCAPING

Cedar Heights

Past fuel treatments, by mastication, in heavy, continuous, mature Gambel oak retained multi-season effectiveness for reducing wildfire spread. Two and three year old oak treatments did not carry fire. Oak leaves were scorched, but did not typically burn (Figure C1). Arboricultural explanation: Re-sprouted oak is connected to a well-developed root system necessary to support mature oak. Even during drought conditions, a large root system was supporting a much smaller, above-ground biomass. In effect, it retained characteristics of a Firewise plant.

Figure C1: Crown Fire (left), treated Gambel oak (right). Source: NFPA.

Mountain Shadows

Hardened landscape barriers such as noncombustible retaining walls, paths, and gravel borders were effective in stopping fire in lighter fuel types. Landscape ignitions, when isolated by gravel borders and other hardscaping features, did not spread to adjacent areas (Figure C2). These hardened areas were observed to be effective in preventing fire spread caused by ember ignitions of native fuels in adjacent open spaces.

Figure C2: Ember ignition in landscaping contained by rock border. Source: NFPA.

Pruning and thinning of ladder fuels in Gambel oak clumps as a Firewise practice by homeowners appeared to be effective in keeping fire on the ground, and reducing crown fire potential (Figure C3). Fire burned underneath the treated clumps and scorched the leaves, but generally did not crown (Figure C4). There are two explanations for this: 1) ladder fuels contribute significantly to the fuel loading, and crown fire potential of Gambel oak as a native fuel; and 2) cleaned out and thinned native oak clumps more closely meet the criteria for Firewise landscape plants: lean, clean and green.

Figure C3: Ember ignition and under-burn below treated Gambel oak. Source: NFPA.

APPENDIX C: OBSERVATIONS ON THE ROLE OF FUELS MANAGMENT AND LANDSCAPE VEGETATION AND FEATURES

Figure C4: Ember ignition with treated ladder fuels in oak and pines. Source: NFPA.

Figure C6: Torched Austrian pine in front of scorched deciduous shrubs below window. Source: NFPA.

Firewise landscape plants, primarily deciduous trees and shrubs, were scorched, but did not burn when exposed to heat from adjacent crowning fuels (Figure C5). Two examples were: crabapple trees planted in a row below a deck and retaining wall that were scorched, but did not carry fire to the deck and shrub plantings adjacent to structures that were scorched, but did not ignite even from crowning fuels that were located within 15-18 feet (Figure C6).

Figure C5: Scorched deciduous trees in foundation planting below deck. Source: NFPA.

Landscaping fencing contributed to fire spread from adjacent native areas to structures (Figure C7). Split rail and cedar privacy fencing both led fire to structures. In many instances, home loss was prevented by intervention of the fire services when resources were available to the remove the fence connection to the structure. This observation re-enforces the message that ,"If it's connected to the house, it's part of the house."

Figure C7: A partially burned cedar privacy fence. Source: NFPA.

APPENDIX C: OBSERVATIONS ON THE ROLE OF FUELS MANAGMENT AND LANDSCAPE VEGETATION AND FEATURES

Summary of Firewise Landscape Observations

- Past fuel treatments by mastication in heavy, continuous, mature Gambel oak retained multi-season effectiveness for reducing wildfire spread. Two- and three-year-old oak treatments did not carry fire. Oak leaves were scorched, but did not typically burn.
- Hardened landscape barriers such as noncombustible retaining walls, paths and gravel borders were effective in stopping fire in lighter fuel types.
- Pruning and thinning of ladder fuels in Gambel oak clumps, as a Firewise practice by homeowners, appeared to be effective in keeping fire on the ground and reducing crown fire potential.
- Firewise landscape plants, primarily deciduous trees and shrubs, were scorched but did not burn when exposed to heat from adjacent crowning fuels.
- Landscaping fencing contributed to fire spread from adjacent native areas to structures. Split rail and cedar privacy fencing both led fire to structures.

APPENDIX D: CASE STUDIES

Case Studies

Information about the inspection of two undamaged homes in the Cedar Heights neighborhood and one undamaged home in Mountain Shadows neighborhood is provided here. The fire came close to the Cedar Heights neighborhood (Figure D1), but did not reach it. The Outer Vista Point Road home in this neighborhood would be considered a perimeter home and the Manor Rock Lane home was an interior home. The Darien Way home in the Mountain Shadows neighborhood was an interior home.

Figure D1: The fire came within about 500 feet of the neighborhood at the Outer Vista Point Road perimeter. Source: IBHS.

Outer Vista Point Road

The Outer Vista Point Road perimeter was directly across the street from the home that was inspected (Figure D2). The defensible space around the home is shown in Figures D3 – D6, with one figure showing the general condition on each side of the house. Defensible space was generally good, particularly on the two sides (left and rear) that used rock in the near-home zone. Bark mulch was used in the near-home zone in the front and right sides of the house. Bark mulch has been shown to be ignited by embers and therefore on these exposures any ember-ignited mulch would result in a flaming exposure to the side of the house. The fiber cement shingle siding is a noncombustible product, but the construction detailing of the wall-assembly exposes the wood-sheathing product (Figure D4 and 19). Given a direct flame contact exposure to the wall system, the sheathing would become the vulnerable component. This provides an example of a situation where the noncombustible "near-home" zone is critical even in situations where a noncombustible exterior siding product is used. This detail could also be vulnerable to an ember ignition of a sufficient quantity of dried debris on rock mulch (Figure D5).

Figure D2: The Outer Vista Point Road, located at the top of the Cedar Heights community. Source: IBHS.

APPENDIX D: CASE STUDIES

Figure D3: These photographs depict the vegetation management (defensible space) in the area at the front of the house. The upper photograph is representative of the 5-to-30 foot zone and the lower photograph is representative of the 0-to-5 foot (near home) zone. Source: IBHS.

Figure D4: The upper left photograph depicts the vegetation management (defensible space) in the 0-to-5 foot zone on the left side of the house. The lower right photograph is a bottom-view of the wall construction consisting of oriented strand board sheathing under the fiber cement shingle siding product. Source: IBHS.

Figure D5: The upper left photograph depicts the vegetation management (defensible space) at the rear of the house. The lower right photograph shows an accumulation of dried vegetative debris in the corner, on top of the rock mulch. Source: IBHS.

APPENDIX D: CASE STUDIES

Figure D6: The upper photograph depicts the vegetation management (defensible space) in the 0-to-5 foot zone on the right side of the house. The lower photograph shows low earth-to-siding clearance. Source: IBHS.

Another vulnerability observed at this home was unscreened vents into a room at the rear of the home that contained gas appliances (Figure D7). Although 1/8-inch mesh screen will not prevent embers from passing through the vent and into the home, 1/8- inch mesh screen and finer, as allowed by the building code) will reduce the size and number and is a better choice compared to non-screened vents and ¼-inch mesh screening. Finer mesh screen will be more likely to become occluded with air-borne debris and so will require more maintenance to keep the screen clear so it can perform its moisture management function and also to supply make-up air for combustible appliances.

Although it is more commonly understood about the need to plug ("bird-stop") the ends of certain styles of roof coverings (e.g., clay-barrel tile and certain metal roof coverings), openings along the ridge and hip must also be plugged with a noncombustible material. As shown in Figure D8, this home had a flat tile roof. An opening at the end of the roof is not as likely with this style, but openings still occur at the hip and ridge.

Figure D7: These photographs show venting for the make-up air to a room containing gas appliances. Metal screening was missing from these vents, as seen in the lower photograph. Source: IBHS.

APPENDIX D: CASE STUDIES

Monitor Rock Lane

The other home that was inspected in the Cedar Heights neighborhood was located on Monitor Rock Lane (Figure D9). The defensible space for this home is shown in Figures D10–D15. As seen in these figures, the defensible space, particularly in the 0-5 foot "near-home" zone is inconsistent. The right and left sides of the home have good defensible space, with rock mulch in the near-home zone (Figures D12 and D15). Defensible space at the front (Figures D10 and D11) and some of the rear of the home (Figure D13 and D14) is poor.

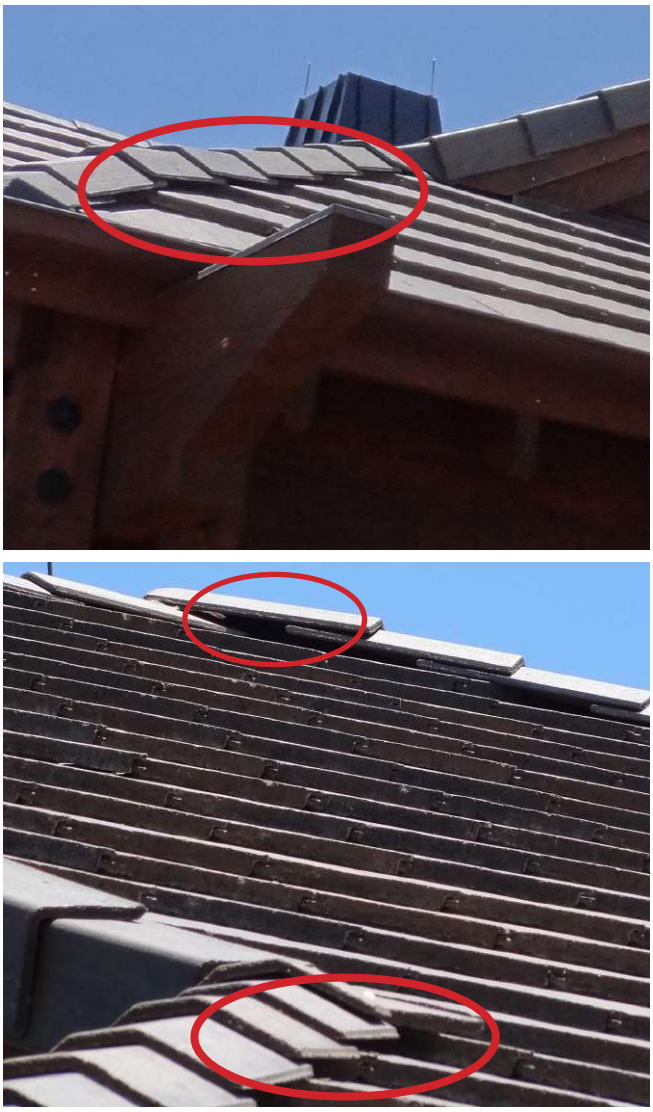


Figure D8: Un-stopped/unblocked openings at the hips of the flat-tile roof. Source: IBHS.

Ignition of near-home vegetation increases the chance for flame contact exposure to the exterior wall (siding, windows and other components) and the under-eave area, including any under-eave vents. A noncombustible stucco-type cladding was used on this home, but in this case, the windows and under-eave areas would still be vulnerable. The same detail whereby the wood-based sheathing is exposed at the bottom of the wall was used on this home, making a nominally noncombustible wall vulnerable because of a combustible component in the wall assembly (Figure D14). This detail was also observed on the Outer Vista Point home (Figure D4). Note the open window in Figure D10. Although a wildfire was not threatening this home on the day of the site-visit, residents should remember that windows should be closed when a wildfire is threatening. In order for the defensible space of a home to be effective, it must be consistently implemented and maintained.

Figure D9: The Monitor Rock Lane home located in the Cedar Heights neighborhood. Source: IBHS.

APPENDIX D: CASE STUDIES

Figure D10: Near-home vegetation was prevalent at the front of this home. Note the open window in the lower photograph. Source: IBHS.

Figure D11: Near-home vegetation located at the front of the home. Note the fine fuels on the ground and in the vegetation. This fine fuel would facilitate ignition by wind-blown embers. Source: IBHS.

APPENDIX D: CASE STUDIES

Figure D12: The left side of the house had good defensible space, particularly in the 0-to-5 foot near-home zone. Source: IBHS.

Figure D13: The defensible space at the rear of the home was very good on one side on one side (top photograph). The near home zone was poor on the other corner (bottom photograph). Source: IBHS.

APPENDIX D: CASE STUDIES

Figure D14: Bark mulch was used in areas at the rear of the home, under one of the decks. Note that the wood-based sheathing product is exposed (lower photograph). Source: IBHS

Figure D15: The defensible space in the near-home zone on the right side of the home was good. Source: IBHS.

The eave design incorporated a vented soffited eave (Figure D16). Soffited eaves have been shown to be a good detail, both in resisting ember entry into vents and being better able to resist flame contact exposures. At least some vents in the soffited eave did not have screens (Figure D16), making the vent more susceptible to ember entry. Regardless of the presence or absence of mesh, given the near-home vegetation at the front of the house, these under-eave vents could be vulnerable to flame contact exposure if the vegetation ignited.

APPENDIX D: CASE STUDIES

Figure D16: A soffited eave was used on this home. Some of the under-eave vents did not have mesh screening. Source: IBHS.

This house had a clay-barrel style roof covering. The ends of the roof covering at this house were not plugged, i.e. "bird-stopped." Debris was observed at one roof-edge location (Figure D17). Wind-blown embers could ignite this roof-edge debris, and potentially other debris that have blown under the roof. When a roof such as this one is not "bird-stopped," wind-blown embers can easily by-pass the protection offered by this Class A fire-rated (and in this case, also noncombustible) roof covering. Bird-stop materials are available from the manufacturer. The homeowner can also plug the openings with a mortar mix. The tiles at the hip are also open; these openings should also be plugged.

Figure D17: The ends of the barrel-tile roof covering on this home were not "bird-stopped." Note the debris in the under-roof area at the end of the roof (lower photograph). Source: IBHS.

Most decks are built using combustible materials for both the structural support system and the walking surfaces. Combustible materials used for the structural support system are typically wood joists (2 x lumber) and larger dimension posts and beams (i.e. 4 x material and larger). Combustible materials used for walking surfaces include wood, plastic and wood-plastic composite decking materials. One deck on this home incorporated a noncombustible (flagstone) walking surface and the typical wood-based structural support system (Figures D18 and D19). The solid surface, noncombustible walking surface option is considered a better choice for homes in wildfire-prone areas,

APPENDIX D: CASE STUDIES

although this option is more expensive. Given the typical combustible structural support system with these decks, unless the underside is enclosed with a noncombustible material, the advantage applies most directly to an ember exposure to the top of the deck, and would assume a noncombustible material at the deck-to-wall intersection, where embers might accumulate.

As seen in Figure D19, a between flagstone joint failed, allowing water to enter behind the surfacing material. Water entry occurred long enough for fungal decay to occur in the underlying wood and wood-based structural support system (Figure D19, lower photograph). If dry, this material would be more easily ignited. Vegetation was observed growing under the deck (Figure D18, lower photograph) – ignition of this vegetation by embers or other adjacent burning vegetation would result in a flame contact exposure to the underside of this deck. A flaming exposure to any part of the home should be avoided. In this case, the damaged deck should be repaired, and the under-deck and adjacent vegetation removed.

Figure D18: These photographs show the solid surface deck (upper) and the near-home vegetation under and near the deck (lower). The lower photograph was taken while under the deck. Source: IBHS.

APPENDIX D: CASE STUDIES

Figure D19: The flagstone covering on this solid surface (noncombustible) deck had failed (upper) allowing water to get below the covering, eventually resulting in fungal decay in the horizontal wood-based sheathing (lower). Source: IBHS.

Darien Way

The undamaged Mountain Shadows home included this case study was located on Darien Way, show in Figure D20.

The defensible space for this home is shown in Figures D21 and D22. As seen in these figures, with the exception of the area in the front of the home, the defensible space, particularly in the 0-5 foot "near-home" zone is good. Rock mulch or a concrete walk was used next to the home and under the decks on the other sides of the home. Rock mulch was used at the front of the house, but if ignited, the low-to-ground vegetation, located under the drip line of the adjacent tree, could serve as ladder fuel. Removal of the ladder fuel vegetation and pruning the tree would improve the defensible space in this area.

The window well shown in Figure D22 contained accumulated debris. Burned-out embers were observed on the ground, but the number that accumulated was insufficient for ignition. Use of a rock retaining wall, as shown in this photograph, would be a better option.

Figure D20: The Darien Way home, located in the Mountain Shadows neighborhood. Source: IBHS.

APPENDIX D: CASE STUDIES

Figure D21: Defensible space on the front and left side of the home. Source: IBHS.

Figure D22: Defensible space in the right side and rear of the home. Source: IBHS.

APPENDIX D: CASE STUDIES

The decks on this house used wood joists and beams for the structural support system and a wood-plastic composite (walking surface) product for the deck boards. The space under the deck consisted of noncombustible rock mulch. No storage of combustible materials was observed. Deck furniture was only observed on one of the decks (Figure D23). Wood and wood-plastic composite decking are both combustible materials. Ignition of these decks can be caused by a flame contact to the underside of the deck, or potentially by ignition of combustible materials on top of the deck. Ignition of wood decks by an ember exposure was recently demonstrated. This study did not evaluate the performance of wood-plastic composite and other decking products with a plastic component. The California Office of the State Fire Marshal (OSFM) standard test method (SFM 12-7A-4 and 12-7A-4A) uses two different exposures to evaluate the performance of combustible decking products. The first is an under-deck flame contact exposure and the second uses a 6 inch x 6 inch standard Class B burning brand placed on top of the deck. This brand is specified in the American Society for Testing and Materials (ASTM) Standard E108 (a standard test method used to classify the fire rating of roof coverings). Since both of these decking products are combustible, and based on performance from the OSFM standard test they can perform similarly, the same mitigation options should apply to each (e.g., no storage of combustible materials under the deck, etc.)

Home ignitions from ember entry into dryer vents were reported during the recent Washoe Drive Fire (January 2012) in the Reno, Nevada area[10]. The closure plate used on the exhaust vents on this house would reduce the chance of ember entry into these exhaust vents (Figure D24) since the plate would be in the closed position unless the dryer was operating.

Figure D23: The decks at this home used wood for the structural support system and a combustible wood-plastic composite decking (walking surface) product. Source: IBHS.

[10] *"Personal Communication (2012). Mark Regan, North Lake Tahoe Fire Protection District and Ed Smith, University of Nevada Cooperative Extension."*

APPENDIX D: CASE STUDIES

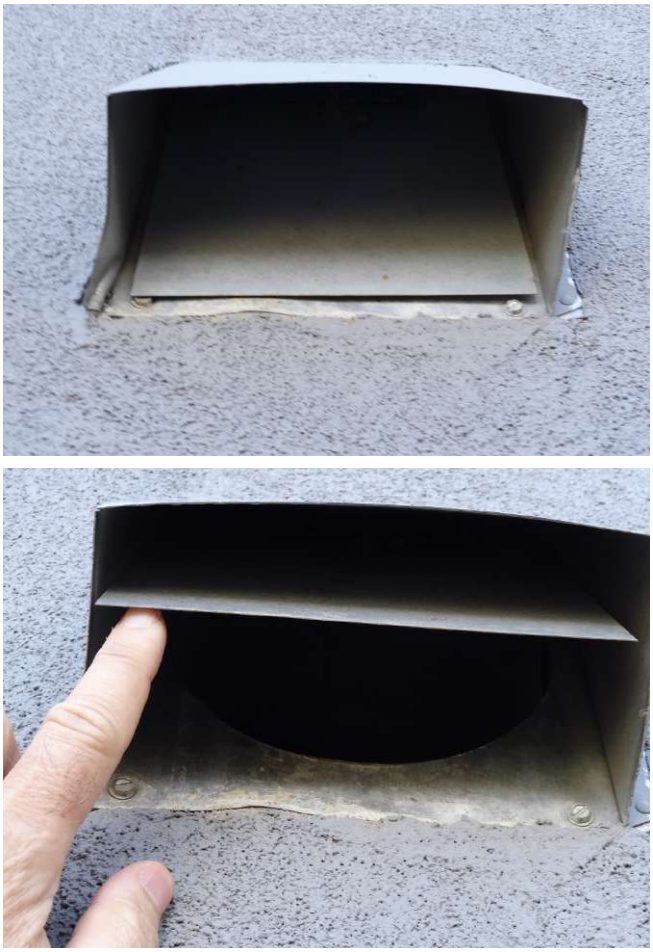


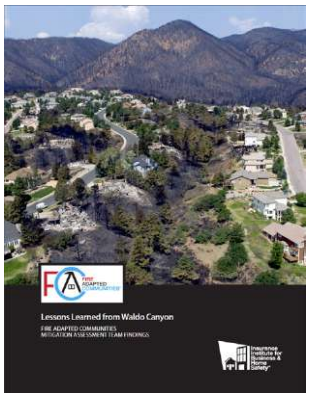
Figure D24: Dryer and other exhaust vents used vents coverings that were normally closed (upper left); when operating positive pressure in the duct would force open the closure flam to at the outlet. Source: IBHS.

Figure D25: A flat concrete tile was used for the roof covering on this house. Note the openings at the hip and edge of the roof. Source: IBHS.

This house had a flat-tile covering (Figure D25). As was the case with the Outer Vista Point Road home the hip openings were not plugged with a noncombustible materials (e.g., with a mortar mix). As a result of the installation details of this covering, openings also occurred at the end of the roof (i.e., the area above the gutter) along the ridge and hip that must also be plugged with a noncombustible material. These openings should be plugged to minimize the opportunity for embers to get under the noncombustible roof covering, potentially igniting fine fuels that have accumulated.

Lessons Learned from Waldo Canyon

FIRE ADAPTED COMMUNITIES
MITIGATION ASSESSMENT TEAM FINDINGS



A
REPORT
TO THE
COUNCIL OF WESTERN STATE FORESTERS

FIRE IN THE WEST

THE WILDLAND/URBAN INTERFACE FIRE PROBLEM

Alaska
Arizona
California
Colorado
Guam
Hawaii
Idaho
Kansas
Montana
Nebraska
Nevada
New Mexico
North Dakota
Oregon
South Dakota
Utah
Washington
Wyoming

A
Report
for the
Western State Fire Managers
by

William C. Teie
Brian F. Weatherford

September 18, 2000

TO: Council of Western State Foresters
FROM: Western State Fire Managers

Structures Lost! is the headline on the morning news more and more these days. It has been thought that this was a problem only in California. It isn't! It is a growing problem throughout the West.

This report was developed in an effort to paint a true picture of the extent of the wildland/urban interface fire problem in the West, and present an action plan on how the states should proceed in an effort to deal with this growing problem. The two most salient points in the report are:

- This problem is going to get a lot worse before it gets better!
- We know what has to be done! We don't have to invent anything! We just have to implement "FireSafe" construction and streamline how we operate.

The Western State Fire Managers want to thank William C. Teie and Brian F. Weatherford for this outstanding report.

Sincerely,

David Behrens, Chair

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Acknowledgment

We would like to thank all those who provided us their expertise on the subject of the wildland/urban interface fire problem. In particular, we would like to thank each of the state fire managers for their input and support. Those questionnaires were not easy to complete.

Specifically, we would like to thank Dave Behrens, Arizona State Land Department; Rich Homann, Colorado State Forest Service; Brian Shiplett, Idaho Department of State Lands, and Tim Murphy, Montana Department of Natural Resources and Conservation; for their support and review of the draft. In addition, we would like to thank Ronny J. Coleman, President FETN and the retired California State Fire Marshal and Chief Deputy Director for the California Department of Forestry and Fire Protection; Ken Blonski, University of California Forest Products Laboratory; Steve Frady, Nevada Division of Forestry; Chris White, Boulder County Land Use Department; Ross Hesseltine, FireSafe Spokane; Gary Marshall, Bend (OR) Fire Department; Jim Graue, Spokane County Fire District 9; and Bob Leaverton, Santa Fe National Forest; for their time and efforts in providing valuable information.

Without the help of these experts, this report would not have been possible.

Additional Copies

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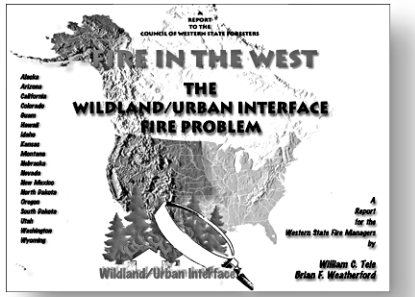


Executive Summary

• Every year wildfires destroy hundreds of structures throughout the West. The wildland/urban interface fire problem exists in every state, and is getting worse. It will continue to get worse before it gets better.

• We already know why houses burn. Quite simply it is because they are not built with fire safe materials and methods, or do not have sufficient clearance from flammable wildland fuels. Building codes, fire codes, and the Urban-Wildland Interface Code have been developed to address the problem. What is lacking is the public and political will to implement the known solutions.

• An increasing amount of attention is being paid to the wildland/urban interface fire problem, both by the media, some state forestry organizations and by the federal government. Attention and funding should be focused on initial attack, mobilization and fuels reduction.

• The disastrous Cerro Grande Fire in Los Alamos provides us a "peek" into the future, and illustrates the "ills" in the wildland fire protection system and how it can fail. It represents an unprecedented learning opportunity for all the players.

• Each state is unique in the authorities and responsibilities given its wildland fire protection agency. Unfortunately, most state forestry departments are not adequately empowered to address the wildland/urban interface fire problem. Codes, regulations, and building standards that would provide for fire safe development in wildland areas exist, but few states or communities have summoned the public and political will to implement them. The most important issues are **ignition-resistant construction** and **defensible space**.

• We need to develop programs that will educate our target public audience (homeowners, legislators, planners, and developers) to the potential for personal disaster in a wildland/urban interface fire. We must change public perceptions and attitudes, and generate a concern for fire safety that will overcome existing public apathy and political inertia.

• States need to map and assess the extent of the wildland/urban interface problem, and share this data with the fire community, planners, developers and legislators.

Wildland/Urban Interface

• The states need to improve their support to local fire forces that can add tremendous capability to initial fire attack operations and structure protection mobilization during major fires. State agencies need to assess and improve their ability to respond to the wildland/urban interface fire problem and to effectively mobilize and manage available local government fire resources.

• States need to take the initiative in transforming their relationship with the federal wildland agencies to one of true cooperation, framed in cooperative fire protection agreements and operating plans.

• States need to apply pressure to the federal government to focus more attention on the problem in the West, and to pressure FEMA to move from funding rebuilding of burned structures to funding mitigation measures before the fire.

• An opportunity exists to combine wildland/urban fire problem mitigation efforts with forthcoming forest health initiatives. Both will require careful planning and execution to be successful. Increased use of prescribed fire can serve both purposes simultaneously, but may require some loosening of Clean Air Act regulations. States need to enact tort claim protections for use of prescribed fire.

• With a proposal to provide an additional $1.6 billion to the budgets of the USDA Forest Service and the Department of Interior for 2000 fire season related issues, and in particular the wildland/urban interface fire problem, it is imperative that the states have a plan.

• The states need to increase the involvement of the private sector in the solutions to the problem. Small landowners, timber companies, insurance companies, developers and builders, and the banking community all have a vested interest in solving the wildland/urban interface fire problem and need to be brought into active partnerships with the total fire community.

• The states should develop plans to move beyond federal excess property. This equipment has served the states and rural fire departments well, but there is a need to develop plans to replace this equipment.

Wildland/Urban Interface

• Critical solutions that need to be implemented include: assessment and mapping of problem areas; public education; adoption of the Urban-Wildland Interface Code; clarification and revision of the Federal Fire Policy; increased use of prescribed fire (both for hazard reduction and forest health); construction of fuelbreaks; improving the training, equipment, and mobilization of local fire forces; establishment of state interagency fire management teams; and clarification of relationships through written cooperative fire agreements and operating plans.

• If nothing else is possible, states should at least focus their limited resources on achieving compliance with **ignition-resistant roofing standards** and providing **defensible space** around all structures in the wildland/urban interface.

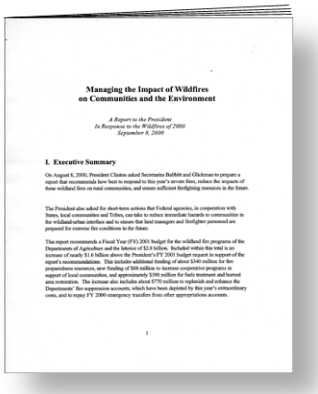
Wildland/Urban Interface

Preface

The wildland/urban interface fire problem has been studied and discussed for years. In the “old days” it was a rural problem. Then in 1961 the Bel Air Fire destroyed over 400 homes in the hills above Los Angeles and a new phrase was born – wildland/urban interface. We as a society want quick fixes to our problems, but there will be no quick fixes to this one. Developing an immediate and politically acceptable solution is unachievable!

The solutions are well understood. It is the implementation of these solutions that is lacking. This report will attempt to put the problem in prospective and present an action plan that is practical and achievable, IF there is a will to do it.

On September 8, 2000, the ***Managing the Impact of Wildfires on Communities and the Environment***, ***A Report to the President***, was published. This report recommends the addition of $1.6 billion to be added to the 2001 budgets of the USDA Forest Service and the Department of Interior. The proper implementation of the recommendations contained in this very important report can go a long ways toward lessening the impacts of the forest fuel buildup and the wildland/urban interface problem.



Managing the Impact of Wildfires on Communities and the Environment

A Report to the President
In Response to the Wildfires of 2000
September 8, 2000

I. Executive Summary

On August 8, 2000, President Clinton asked Secretaries Babbitt and Glickman to prepare a report that recommends how best to respond to this year's severe fires, reduce the impacts of these wildland fires on rural communities, and ensure sufficient firefighting resources in the future.

The President also asked for short-term actions that Federal agencies, in cooperation with States, local communities and Tribes, can take to reduce immediate hazards to communities in the wildland-urban interface and to ensure that land managers and firefighter personnel are prepared for extreme fire conditions in the future.

This report recommends a Fiscal Year (FY) 2001 budget for the wildland fire programs of the Departments of Agriculture and the Interior of $2.8 billion. Included within this total is an increase of nearly $1.6 billion above the President's FY 2001 budget request in support of the report's recommendations. This includes additional funding of about $340 million for fire preparedness resources, new funding of $60 million to increase cooperative programs in support of local communities, and approximately $380 million for fuels treatment and burned area restoration. The increase also includes about $770 million to replenish and enhance the Departments' fire suppression accounts, which have been depleted by this year's extraordinary costs, and to repay FY 2000 emergency transfers from other appropriations accounts.

1

The Council of Western State Foresters asked the Western State Fire Managers to develop a wildland/urban interface strategy for the West. Toward this end, the fire managers commissioned William C. Teie and Brian F. Weatherford to develop a report analyzing the situation, making recommendations on the best strategies and tactics to implement, and providing a list of some of the initiatives being used in various locations in the West.

Wildland/Urban Interface

Introduction

Each summer the headlines in the newspapers of the West read, "***Structures Lost***!" as a reminder that a wildfire has again destroyed someone's home or business. The wildland/urban interface fire problem is one that will get a lot worse before it gets better—and it will never completely go away.

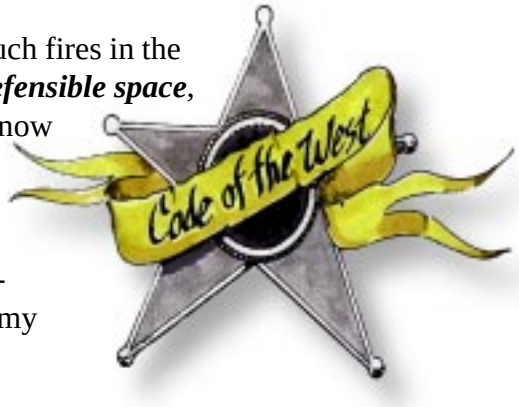
It is no longer just a California problem!

As far back as you want to remember, the wildland/urban interface fire problem was one that most felt was a California problem. With a large population, highly flammable fuels, steep terrain, hot dry summers and the infamous Santa Ana winds, it seemed that each summer and fall homes were burning in the Golden State. The statistics bear this out, with California having had 203 interface fires between 1955 and 1999. These fires burned over 3.2 million acres, destroyed over 11,000 structures and caused the deaths of 62 firefighters or civilians. But the picture has changed in the last decade.

Since the beginning of the '90s, the rest of the West has experienced a growing number of wildland/urban interface fires. Nearly all of the Western States have experienced wildfires that have destroyed homes or businesses. Most of the Western States have now joined California as states that have experienced serious wildland/urban interface fires that have destroyed scores of homes. (See the Appendix for detailed information).

We already know how to make homes FireSafe!

After each devastating fire, people asked, "how can we prevent such fires in the future?" We know the answer…it's ***ignition-resistant construction, defensible space***, enclosed eaves and decks, adequate water, etc. It is not that we don't know the answer, it is that we cannot get the general public, politicians, or private industries interested in implementing the solutions.



The "Code of the West" comes into play…whether it is the homeowner who says: "I didn't move into the woods to cut it down…leave my

Wildland/Urban Interface

trees and brush alone," or the politician saying, "you moved into the country, so don't expect the same level of service you had in the urban area."

Both sides of the issue think it is a problem that will happen to someone else in some other place. That is, until it visits them! Any person who lives in a wildland area is potentially a target for a wildland fire, although some areas are more prone to serious fires than others.

Mitigate growth, existing problems and respond as needed!

Any plan to move toward solving the problem must not only address the growth in the West, it must address the problem of millions of existing structures at risk. It must also address the existing level of fire protection and it's ability to cope with this ever-increasing problem.

In a nutshell, the public, planners, and politicians need to be convinced it is in their best interest to address the issue of growth in the wildland as it develops and to implement actions that will bring both new and existing structures into compliance with fire safe guidelines. Incentives such as strict laws and regulations, low-interest loans, or reduced insurance premiums must be developed to insure the full participation of all homeowners in the wildland/urban interface.

The West is different!

There are several factors that make the West unique when compared to the rest of the Nation. These distinctions must be fully understood and appreciated before we can focus on appropriate funding allocations. Some of those factors are:

Its Size—The West is large. There are 2,119,441 million square miles in the seventeen western states. This is just over 57 percent of the total acres in the Nation.

Its Topography—The West has mountains; "you can lean against most of it." This has a direct impact on fire behavior, resistance to control, access and local weather.

Its Weather—The weather in most of the West features long dry summers, hot dry winds, and extremely low relative humidity; all of which have a direct impact on fire behavior. The regional weather patterns annually spawn dry lightning storms that start thousands of fires. The fall brings strong winds.

Wildland/Urban Interface

Its Forest Conditions—The nature of the wildland vegetation and the many "fire regimes", in combination with topography and weather, create large areas with very high to extreme fire hazard. The forest health is suffering and the buildup of residual fuels is at dangerous levels. This is further complicated by federal land management ownership and policies.

Its Federally Owned Lands—Over 58 percent of the West is in federal ownership. This makes the various federal land management agencies major players in how the forests of the West are managed and protected (Figure 1).

Its Federal Partners—There are six federal wildland fire "fighting" agencies in the West: USDA Forest Service, USDI Bureau of Land Management, USDI National Park Service, USDI Bureau of Indian Affairs, USDI Fish and Wildlife Service, and the Department of Defense. Each of the agencies has different "charters" and land management policies.

	Areas, in acres.							
	Forest Service	*Bur of Land Management*	*Bur of Indian Affairs*	*Fish and Wildlife Service*	*National Park Service*	*Dept of Defense*	*Other Federal*	*TOTAL*
Alaska	22,004,745	86,908,060	1,140,410	76,321,037	52,891,681	1,677,718	22,851	240,966,502
Arizona	11,250,693	14,252,778	20,718,207	1,716,858	2,629,633	1,219,717	2,751	51,790,637
California	20,627,691	14,556,074	191,020	323,642	4,615,013	1,753,493	434,695	42,501,628
Colorado	14,501,592	8,296,512	32,835	81,574	574,689	415,473	358,175	24,260,850
Hawaii	1	0	0	288,511	220,410	127,734	1,627	638,283
Idaho	20,442,651	11,847,328	55,700	76,068	86,866	14,402	1,067,840	33,590,855
Kansas	108,175	0	40,234	58,332	698	143,447	97,088	447,974
Montana	16,872,610	8,060,382	1,074,907	1,153,013	1,221,314	2,540	316,204	28,700,970
Nebraska	352,133	6,580	66,469	172,360	5,863	18,703	119,139	741,247
Nevada	5,815,856	47,844,391	1,233,000	2,318,069	165,500	484,965	1,699,739	59,561,520
New Mexico	9,326,599	12,770,569	8,349,148	384,251	371,827	3,180,226	453,865	34,836,485
North Dakota	1,105,779	59,717	866,896	487,654	71,640	2,112	1,273,320	3,867,118
Oregon	15,664,078	16,223,739	796,588	557,479	194,859	31,072	133,625	33,601,440
South Dakota	2,013,628	279,869	5,002,056	198,086	263,629	890	60,455	7,818,613
Utah	8,112,462	22,877,713	2,331,094	419,169	2,015,426	939,973	660,613	37,356,450
Washington	9,174,956	370,110	2,602,254	186,369	1,932,401	433,251	752,979	15,452,320
Wyoming	9,258,281	18,383,926	1,889,532	86,486	2,393,198	9,512	815,841	32,836,776
TOTAL	166,631,930	262,737,748	46,390,350	84,828,958	69,654,647	10,455,228	8,270,807	648,969,668

Figure 1. Over 58 percent of the land in the West is owned by the Federal government.

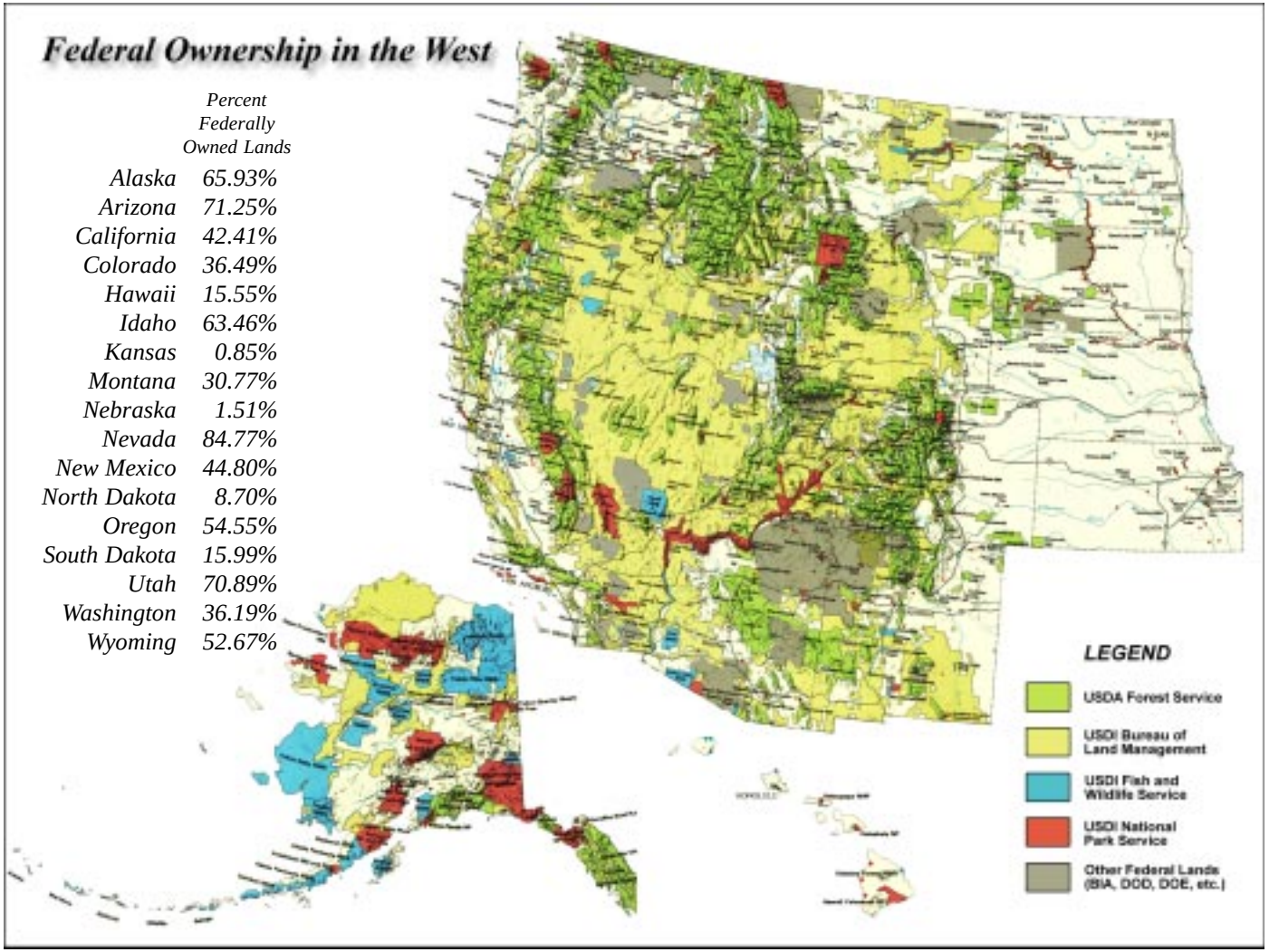
Wildland/Urban Interface

Its Sovereign Nations—The vast majority of Tribal Lands in the Nation are in the West. This is further complicated by the evolving relationship between the USDI Bureau of Indian Affairs and the various Tribal Governments.

Its Forest Service Organization—The Forest Service has seven regional foresters in the West. This complicates the development of a single strategy for how federal dollars will be spent in the West.

The Wildland/Urban Interface Fire Problem—The extent of the Wildland/Urban Interface fire problem in the West cannot be understated. The urban sprawl will continue to grow, placing more homes in danger each year. The West as a whole is now experiencing more and more wildland/urban interface fires. The 2000 fire season dramatically supports this contention.

Its Wilderness and Roadless Areas—The vast majority of federal wilderness and roadless areas are in the West. Both have a significant impact on wildland firefighting operations.



Gathering the Data

The initial phase of data collection for this report was a questionnaire developed by the consultants and sent to the fire managers of each of the seventeen western states and the Pacific island territories. Each of the states completed and returned the questionnaire, along with supporting documents and data relative to their specific issues.

The questionnaire consisted of 24 questions relating to the nature of the wildland/urban interface problem in the state, the state agency's authorities and responsibilities to mitigate the problem, what state fire managers are doing and what they think they should be doing, mutual aid, training, federal agency involvement, and what ideas for problem solutions may be lurking out there.

Fire Managers Responses
Within this report, the responses of the state fire managers to the questionnaire are summarized in text boxes like this one.

Guam

Of the U.S Pacific trust territories, only Guam replied to our wildland/urban interface fire problem questionnaire, and "Yes, Virginia, there is a" wildland/urban interface fire problem in Guam. Because Guam's fire protection system and interface problem are so different, it deserves its own section in this report.

Located some 3,700 miles west of Hawaii, Guam is on the other side of the International Date Line, and thus *"where America's day begins."* While most of us would consider Guam's climate to be tropical (70-90" of rain per year), it has a definite dry season and large areas of grass and brush. El Nino weather patterns bring drought and high fire danger. Much of Guam is set aside in natural reserves (mini-wilderness areas) that complicate the wildland fire problem. Many villages are experiencing rapid growth due to land and housing initiatives for native peoples, and homes are spreading into the wildland. Despite its differences, Guam, like many western states, has lost structures to wildland fires large enough to qualify for FEMA funding. For a more complete description of the wildland/urban interface problems in Guam, refer to the Appendix.

Wildland/Urban Interface

Background

You cannot really understand the complexities of the wildland/urban interface fire problem in the West until you understand something about the fire protection systems in this Nation.

Benjamin Franklin started the first organized fire department in the United States in Philadelphia on December 7, 1736. For over a hundred years fire protection focused on urban areas…rural and forested areas of the Nation went unprotected. The rural areas of this Nation could not afford the level of protection found in most cities. The rural residents provided their own fire protection, using old equipment and staffing the engines with citizen volunteer firefighters. It wasn't until the Forest Service was formed early in the 20th Century that fire protection was provided to wildland areas.

Fire Protection Jurisdictions and Responsibilities

In the United States, there are three basic levels of government: local, state and federal. Each level of government has different authorities and responsibilities, but each has an important role to play in mitigating the wildland/urban interface fire problem.

Local government is defined as incorporated cities, counties, boroughs, or special districts. Volunteer fire companies will be listed under local government. There are thousands of fire departments in the West, most of which have their own fire authority or agency (Figure 2). The protection of life and property is the primary function of a local fire department.

The number of rural and municipal fire departments varies greatly in the West. Hawaii has only seven to deal with, where California has over 900 fire departments in the state. At last count, there are 6,394 rural or municipal fire departments in the West.

Local fire departments often play a major role in protecting structures that are being threatened by a wildland/urban interface fire. None of the western States can adequately deal with a major wildland/urban fire situation without the assistance of local fire departments and the cooperation of the Federal land management agencies. In some parts of the West, rural fire departments are not supported by any taxing authority. In fact, large areas may have no organized fire protection at all.

Even where they do exist, local fire departments provide greatly differing levels of fire protection services. Depending on local conditions, some may have grass or brush fire trucks to deal with small grass or grain fires, but very few have the resources (engines, water tenders, handcrews, aircraft, etc.) to tackle a major wildland fire without state and/or federal assistance.

A typical local government fire department involved in the wildland/urban interface fire problem would be a rural fire district centered on an unincorporated small town with maybe two fire stations, each with a structural fire engine, a grass rig, a water tender, and probably a rescue squad staffed by a small, but dedicated, group of volunteer fire fighters.

While training and equipment standards vary greatly, these local government fire departments wind up being the key players in protecting structures from encroaching wildfires in the wildland/urban interface.

	Number of Local Fire Departments
Alaska	***288***
Arizona	***252***
California	***927***
Colorado	***398***
Hawaii	***7***
Idaho	***209***
Kansas	***673***
Montana	***420***
Nebraska	***490***
Nevada	***211***
New Mexico	***359***
North Dakota	***396***
Oregon	***438***
South Dakota	***364***
Utah	***230***
Washington	***560***
Wyoming	***172***
	6,394

Figure 2. Local fire departments play a vital role in the protection of each state's wildland resources. They especially come into play for structure protection during a wildland/urban fire.

Rural Fire Protection – The most basic of fire protection is provided by thousands of dedicated volunteer firefighters. They provide basic fire protection services to their communities for no pay…just the satisfaction of serving their community. In a lot of cases, taxing authorities do not support these fire departments. They have to raise the money for the gas, oil and insurance by selling baked goods or sponsoring raffles. These types of fire departments usually respond to structure fires, medical aids, traffic accidents and wildland fires. Each year they make the first attack on thousands of wildland fires in the West. They provide this protection with little or no training and frequently are poorly equipped.

Wildland/Urban Interface

Municipal Fire Protection – As the population of an area increases and the community can afford it, a city or fire protection district may hire some full-time firefighters, operate aerial truck companies, and evolve to a municipal fire department. Municipal fire departments respond to the same type of emergencies as those in the rural areas, but the structures may be taller and the fire protection operations more technical and specialized. Most municipal firefighters, be they volunteer or full-time, are not adequately trained or equipped to fight wildland fires.

Authorities and Responsibilities

Surprisingly, not every state forestry agency has the legal authority to fight wildfires, let alone initiate programs aimed at the wildland/urban interface fire problem. Only four of the state wildfire agencies (CA, KS, NV, WY) have the authority to fight structure fires in the wildland/urban interface. Eight states share responsibility for actions in the interface with some other entity, usually a local government fire agency. Thirteen of the seventeen states said that they thought most of the "players" in the interface understood their individual roles and responsibilities.

State Level Fire Protection

State government in the West addresses fire protection issues in varying ways. In most states, there may be more than one state agency that has some role to play in wildland fire protection. There are the State Forester, the State Emergency Management agency, the National Guard, and the State Fire Marshal, to name a few.

State Forestry Agencies – The state forestry agencies in the West vary greatly in their authorities and responsibilities. Several states have adopted laws that direct the State Forester to provide wildland fire protection and provide funding, personnel, and equipment to deliver services. Other states give the responsibility of providing wildland fire protection to the State Forester, but do not provide funding for such protection. Only Nevada has given its State Forester the responsibility to provide fire protection at the same level as traditional local governmental entities.

Federal Level Fire Protection

Federal Government agencies own or control 648,969,668 acres or 58 percent of the land in the West. The Federal land management agencies provide differing levels of wildland fire protection depending on their authorities and responsibilities. The levels of wildland fire protection provided by the USDA Forest Service and the USDI Bureau of Land Management differ from that provided by the USDI National Park Service, simply because their missions are different.

In some cases, the various authorities and responsibilities between federal, state and local agencies may be overlapping and in conflict. This can lead to confusion and frustration. The wildland fire

Wildland/Urban Interface

protection problem is further compounded by the fact that wildland fires know or respect no political boundaries.

Jurisdiction vs. Responsibility

There is a lot of the West that has no form of fire protection, but where there is protection, there are four basic types: Rural; Municipal; State Forestry; and Federal. Each jurisdiction or agency has different authorities and responsibilities. This section of the report will attempt to describe these differences.

On each piece of ground, only one level of government, and one government agency has *jurisdiction* for wildland fire protection. On federally owned wildland that is one of the federal land management agencies. On private lands, perhaps the state, or a county, city, or district may have jurisdiction. Jurisdiction means having both the legal authority and the financial obligation for fire protection The area of jurisdiction for a city or special district is easily defined; it is the area within the city limits or district boundary. The area of responsibility for a federal agency is the land it owns. The area of jurisdiction for a state is usually most complex. This area, called ***state responsibility area***, is defined in a piece of legislation that places "qualifiers" on the land. It may be land owned by the state, or all forested lands within the state that are not within an incorporated city or owned by the federal government, or all privately owned forested lands (Figure 3).

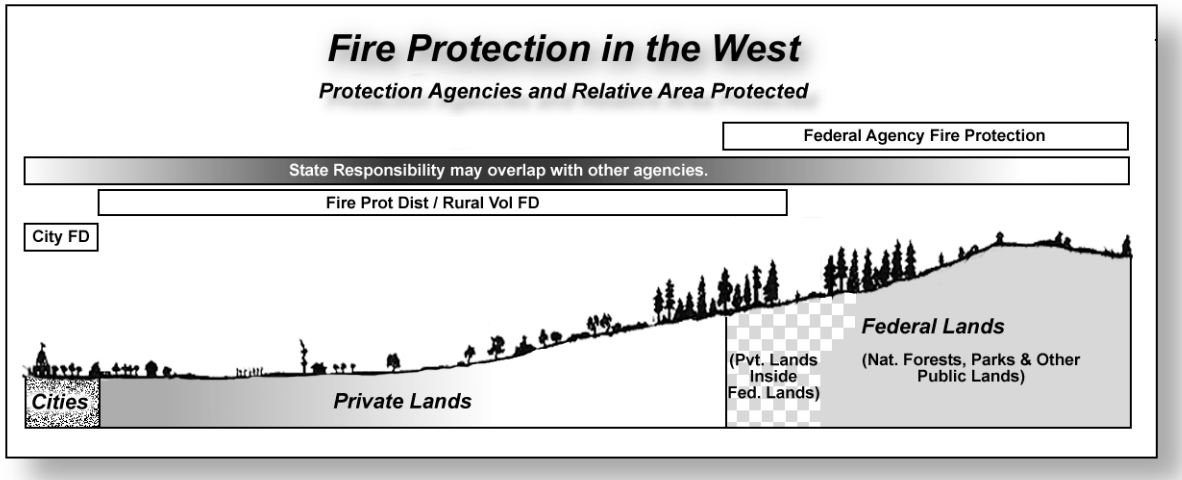


Figure 3. Wildland fire protection can be very complicated. There may be areas where the protection responsibilities overlap and may even be in conflict. Local authority is usually the simplest. State responsibilities differ with each State and usually overlay local government. Federal protection responsibilities differ between the agencies, and the federal government provides some funding to the States and volunteer fire organizations in the West.

There is a difference between jurisdiction and protection responsibility. A jurisdiction may contract the protection of its land to another agency (e.g. in a "balancing of acres" co-operative fire protection agreement, or formal contract).

A *state* ***direct protection area*** is that area of the state where state forces provide direct fire protection. The direct protection area usually includes state responsibility area, but it may also include lands of another agency that it protects under the authority of a contract or cooperative agreement. The best example of this type of protection is when a state protects federal lands that are adjacent to state protected lands, or when the Forest Service protects private lands within a national forest.

A ***local protection area*** is an area where the state has not declared it has a direct responsibility. This may be non-forested area within a city or fire district. The primary fire protection responsibility in these areas lies with the local governmental entity, or there may be no fire protection at all.

Levels of Protection

To fully understand the extent of the wildland fire protection in the West, there has to be a discussion of the various levels of protection provided by the states. As mentioned, there is a vast difference in the authorities, responsibilities, and the levels of protection provided (Figure 4). There are three general levels of wildland fire protection provided by the western states:

- ***Direct Protection*** – A state is providing direct protection when it provides funding for personnel and equipment to protect its state responsibility area. There is a command authority and direct employment of firefighting personnel designated to provide protection. Examples: Alaska, California, Idaho, Montana, Oregon, and Washington.

	Area Protected (in acres)			
	Direct	Cooperative	Coordination	Total
Alaska	151,695,898			151,695,898
Arizona		22,200,000		22,200,000
California	27,740,608	11,000,000		38,740,608
Colorado	41,432,979			41,432,979
Hawaii	850,000		3,306,300	4,156,300
Idaho	6,025,690			6,025,690
Kansas			46,400,000	46,400,000
Montana	5,192,118	45,300,000		50,492,118
Nebraska			49,083,520	49,083,520
Nevada	11,999,791		20,919,540	32,919,331
New Mexico		42,500,000		42,500,000
North Dakota			31,878,661	31,878,661
Oregon	11,300,000	2,300,000		13,600,000
South Dakota	949,117		47,000,000	47,949,117
Utah		15,000,000		15,000,000
Washington	12,708,567			12,708,567
Wyoming	4,237,000		24,863,000	29,100,000
	274,131,768	138,300,000	223,451,021	635,882,789

Figure 4. Each State defines its responsibilities differently. If the State establishes a direct protection area and provides funding and resources to protect it, this is direct protection. Other States may take the responsibility to assist in protection, but use forces from other agencies to protect the area...this is considered cooperative protection. The third type of protection is coordinated protection. This is when the State has given the State Forester broad responsibilities, but limited funding to provide the protection.

- ***Cooperative Protection*** – A state is providing cooperative protection when it provides funding for the protection of its state responsibility area, but provides the protection using other agencies' forces under a cooperative agreement. There is a command authority and limited firefighting forces, but the primary firefighting forces are another agency's employees. Examples: Arizona, New Mexico and Utah.

- ***Coordinated Protection*** – A state is providing coordinated protection when it does not have funding to provide suppression activities, but provides coordination of wildland fire prevention activities and suppression efforts throughout the state. Fire protection of privately owned lands is the responsibility of local agencies. Examples: North Dakota, Kansas, and Nebraska.

There may be hybrids of these three levels of protection. An example is Montana. The state Department of Natural Resources Conservation provides direct protection to 5 million acres of privately or state owned timberlands, but they also provide cooperative protection on 45 million acres of non-forested private lands in the eastern part of the state.

Fire Protection Types

There are three primary types or levels of fire protection services:

- ***Life and Property Fire Protection*** – a service with the primary responsibility to protect structures AND the people who occupy these structures from injury or death. This fire protection service is normally provided by rural and/or local government fire departments, with specially trained and equipped personnel. After life safety, the priority is to keep the fire from leaving the area of origin. It also includes protecting the structure from an advancing wildland fire. Local taxpayers fund this service through a variety of taxing authorities. (The equipment and training required to conduct life and property protection is not normally provided to the wildland firefighter.)

- ***Wildland Fire Protection*** – a service with the primary responsibility of protecting natural resources and watersheds from damage by wildfires. State and federal forestry or land management agencies normally provide wildland fire protection with specially trained and equipped personnel. Various taxing authorities and fees fund this service. Some wildland fire protection agencies have the responsibility for intermingled life and property protection when a

wildland fire threatens structures...and some do not. It is nearly impossible for an incident commander to separate these responsibilities (and the associated costs) during a wildland fire. (The equipment and training required to conduct wildland fire protection is not normally provided to the local government fire department firefighter. If a fire protection agency is routinely called upon to fight wildland fires, they are usually trained and equipped to do so. A significant safety problem arises when personnel from any agency are called upon to fight fires for which they are NOT properly equipped or trained.)

- ***Wildland fire management***– allowing a fire to burn in specific areas, under specified weather conditions, to achieve specific resource management and/or protection objectives. The fire may be an unwanted or a prescribed fire from a natural or planned ignition source. Requires ownership or management authority over the land by the fire protection entity.

Wildland/Urban Interface Conditions

The wildland/urban interface exists where humans and their development meet or intermix with wildland fuels. There are four different wildland/urban conditions:

- ***Interface Condition*** – is a situation where structures abut wildland fuels. There is a **clear line of demarcation** between the structures and the wildland fuels along roads or back fences (Figure 5). Wildland fuels do not continue into the developed area. The development density for an interface condition is usually 3+ structures per acre. Fire protection is normally provided by a local government fire department with the responsibility to protect the structure from both an interior fire and an advancing wildland fire (unless the line of demarcation is also a jurisdictional boundary).

Figure 5. Interface Condition, where there is a clear line between the structures and the wildland fuels.

- ***Intermix Condition*** – is a condition where structures are **scattered throughout** a wildland area (Figure 6). There is no clear line of demarcation; the

wildland fuels are continuous outside of and within the developed area. The development density in the intermix ranges from structures very close together to one structure per 40 acres. Fire protection districts funded by various taxing authorities normally provide life and property fire protection, and may also have wildland fire protection responsibilities.

Figure 6. Intermix Condition, where there the structures are scattered throughout the wildland fuels.

- ***Occluded Condition*** – is a situation, normally within a city, where structures abut an **island** of wildland fuels (park or open space). There is a clear line of demarcation between the structures and the wildland fuels along roads or fences. The development density for an occluded condition is usually similar to those found in the interface condition and the occluded area is usually less than 1,000 acres in size. Fire protection is normally provided by a local government fire department. The trend is for local government to require developers to include open space in their plans, but not include a long-term mechanism for their maintenance; thus the hazardous fire condition increases over time.

- ***Rural Condition*** – is a situation where **scattered** small clusters of structures (ranches, farms, resorts, or summer cabins) are exposed to wildland fuels (Figure 7). There may be miles between these clusters. Structural fire protection service may not be available. These types of developments often exceed the capabilities of both the structural and wildland fire protection systems. Wildland fire protection agencies have little or no control over such development and may be unable to provide protection due to statutory barriers.

Figure 7. Rural Condition, where the structures or clusters of structures are situated in wildland fuels. These structures or clusters are often miles apart.

Wildland/Urban Interface

The Status of the Problem in the West

This section of this report will outline the various aspects of this complicated issue. Most of the information that is presented was gathered from the extensive questionnaire and interviews with experts in the field.

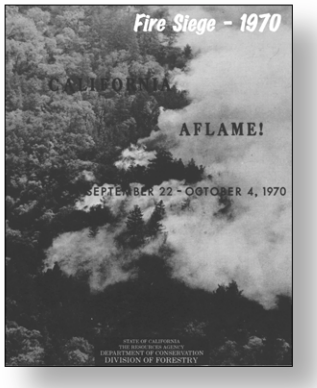
History of Wildland/Urban Interface Fires in the West

The list of wildland/urban interface fires in the West is impressive. There is no question this is a Western problem. Yes, Florida and several other states in the other parts of the Nation experience wildland/urban interface fires, but it is spotty, and usually only during prolonged drought conditions. The West has the dubious distinction of having "the mostest" every year. Not every year will be a bad fire year in every western state, but every year wildland/urban interface fires will threaten and destroy structures somewhere.

Problem Analysis
Every state reported that it had a wildland/urban interface problem, ranging from a small problem in the plains, to an extreme problem in South Dakota, Colorado, Utah, Washington, and California. All states agreed that the problem was increasing. The states reported that the problem was destined to get worse due to high population growth (e.g. +825,000 people by 2010 in Colorado; 30,000 acres per year lost to development in Washington, etc.), lack of local control over development, leapfrog development (i.e. "urban sprawl"), checkerboard ownership patterns, and public ignorance and apathy.

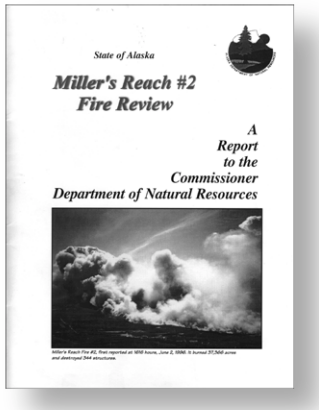
As part of the data collection process for this report, each state submitted its wildland/urban interface fire statistics. For purposes of this report, a wildland/urban interface fire is one that burned more than 25 acres of wildland and destroyed at least three structures. (See Appendix for detailed fire history data). The data support some of our preconceptions, but also reveal some new truths about fire in the interface.

As we would expect, the fire data list from California is by far the most extensive. Since the 1960's, hardly a year goes by in the Golden State without significant structure loss to wildfire. Some years, single large fires (e.g. Bel Air-1961-484 structures) are to blame, and other years a series of large fires (e.g. 1970 Series –722 structures) was responsible for the destruction. A single fire, the Tunnel Fire in Oakland in 1991 created both a lesson for fire managers and a statistical anomaly when it destroyed more than 2900 structures and killed 25 people while burning just 1,600 acres in a densely urban area.



Wildland/Urban Interface

But wildfires with major structure loss do not occur only in California. One of the biggest structure loss wildfires is the Miller's Reach #2 fire in Alaska (our least densely populated state), which destroyed 454 structures in 1996. This year's Cerro Grande fire in New Mexico burned 47,650 acres and destroyed 350 structures, most in the City of Los Alamos. Each year in the 1990's, Montana's list of wildfires destroying structures has been getting longer, and in 2000 apparently will set new records. Of all the western states, only Kansas could not produce data showing structures lost to wildland fire.


State of Alaska

Miller's Reach #2
Fire Review

A
Report
to the
Commissioner
Department of Natural Resources

Unfortunately, not all states regularly collect comprehensive data on wildfires, including structure loss. Some states had to be reminded by old timers of fires that destroyed numerous structures, but which are not captured in a database. Lack of a nationwide, standardized statistical forest fire reporting system and database hinders broader understanding of the wildland/urban interface fire problem.

During the late 80s and 90s, all of the other states (except Kansas) experienced a significant increase in fire activity. Some of the fires of significance were:

	Fire Name	*Year*	*Acres*	*No. Structures lost*
Alaska	Miller's Reach #2	1996	37,336	454
Colorado	Bobcat and High Meadows	2000	21,527	73
Idaho	Lightning Fire Series	2000	1,283,998	100+
Montana	Lightning Fire Series	2000	922,124	322
New Mexico	Cerro Grande	2000	47,650	350
Oregon	Hull Mountain	1994	7,990	44
South Dakota	Westberry Trails	1988	3,840	57
Utah	Wasatch	1990		43
Washington	Fire Storm 91	1991	350,000	191

Wildland/Urban Interface

The 2000 Fire Season

One would hope that the 2000 fire season is an anomaly; but don't bet on it. It is felt that it is just a peek at what can be expected in the future. In 1910, the worst year for fires in the Northern Rockies, the fires burned in forests that had been logged. Ninety years later we say that the fires are burning in

fuels as a result of effective fire suppression efforts. But, let us not forget, it is the weather that starts these fires, and the weather that allows these fires to burn the way they do.

Just look at the acres burned in the Nation since 1990 (Figure 8). The trend predicts a steady increase. If you only look at the last several years the trend line really shows an increase in annual acres burned.

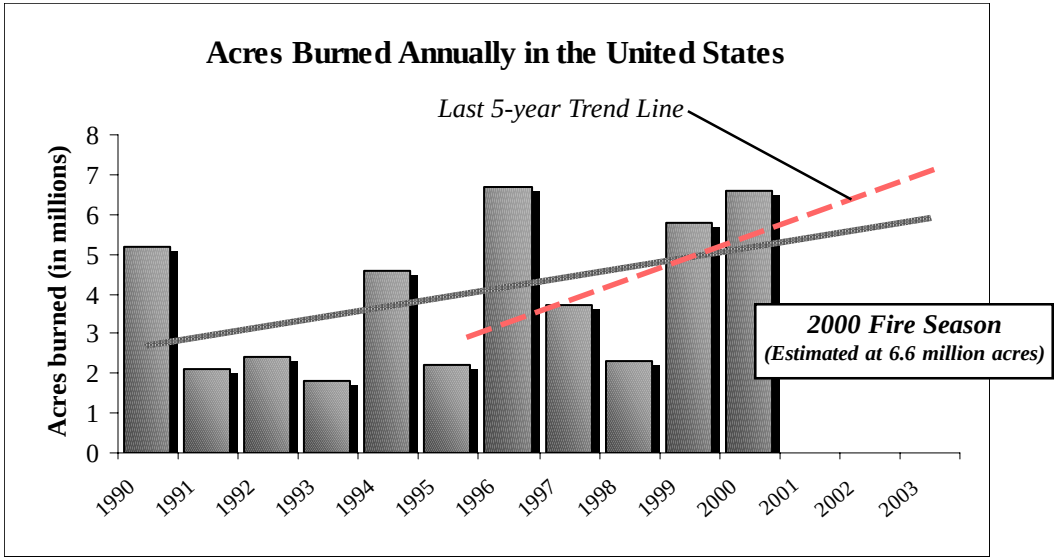


Figure 8. The number of acres burned each year in the United States is on the rise.

Cerro Grande Fire

Early in the 2000 fire season, there was a fire that brings into focus most every thing that is wrong with the system. The Cerro Grande Fire provides a peek into the future…we must learn from this disastrous fire and work toward correcting some of the problems.

The Cerro Grande Fire started on the National Park Service, Bandelier National Monument as a prescribed fire on May 4, 2000. On May 5, 2000 it escaped and was declared a wildfire. On May 10th the fire entered Los Alamos, New Mexico, destroying 450 structures (235 residential structures that housed 410 dwelling units, 195 outbuildings and 20 structures on the National Laboratory). This fire was unique in several ways, and it provides a "peek" into the future. The following are some of the issues raised by this fire:

- **Prescribed Fire** – It doesn't take nuclear scientists to figure out that our land management agencies must conduct more prescribed fires to reduce the buildup of fuels. Planning and conducting a prescribed fire is not an "exact science." Even if all the rules are followed, escapes will happen and homes may be threatened or destroyed. There is a real need to conduct more prescribed fires throughout the West and for everyone to understand that a small percentage of these will escape control. If agency policy and procedures are not followed in planning and conducting prescribed fires, the number of escapes will increase dramatically.

- **Environmental Impact Requirements –** In 1996, the Santa Fe National Forest leadership initiated a report on the wildland/urban interface fire problem in Los Alamos. They developed a plan of action to deal with it. It took four years to complete the environmental review documents so that the work could begin. The fire hit before the work could be completed.

Wildland/Urban Interface

- **Firefighting Forces** – The execution of a prescribed fire taps firefighting forces and these suppression forces are not available to fight wildland fires.

- **Human Development** – Urban development in or adjacent to the wildlands complicates the use of fire to remove the accumulation of fuels.

- **Smoke** – Some of the more useful prescriptions use low intensity fire, but generate more smoke. Increased burning restrictions from EPA are an obstacle to fuel reduction efforts.

- **Wildland/Urban Interface Planning** – The Santa Fe National Forest had identified the Los Alamos area as a wildland/urban interface area at high-risk for a disastrous fire. They had developed a plan to mitigate this problem, but this plan was shelved until the Environmental Impact Assessment could be completed. Some work had been started, and this was effective.

- **Suppression Operations** – The Incident Organization showed a Structure Protection Group. This group was never fully supported. This was probably a result of the federal fire policy.

- **Clearances** – There were no local ordinances requiring defensible space. There are not any ordinances because the people don't want any. Even after the fire, there are people who do not want to clear the vegetation back from their homes.

- **Building Codes** – There were no extraordinary code requirements developed to attempt to mitigate the hazard that existed.

- **Mobilization** – There was no authority or plan to mobilize local government fire suppression forces available in the State.

- **BAER** – Burned Area Emergency Rehabilitation is a new term in our vocabulary. This is where some of the firefighters have gone! Fire

Wildland/Urban Interface

suppression forces are now used to accomplish this new task. Over $20 million was spent rehabilitating the Cerro Grande fire scar. The actions taken by the Department of Energy, USDA Forest Service and the USDI National Park Service have raised the level of expectation of public related to extent of burned-area rehabilitation that will be taken. Those impacted by wildland fires in the future will expect the government to do more to rehabilitate the burned area.

- **Fire Assignment Rotations** – The federal land management agency fire assignment policy has reduced the maximum days for fire assignments from 21 to 14 days for the 2000 fire season. This will increase the number of firefighters needed to accomplish the same task by at least one-third, and greatly increase travel costs to deliver fresh troops.

- **Area Command** – With the reduction in the level of fire expertise in the various federal agency administrations, some areas have had to establish Area Command Authorities to fill the role of MACS.

- **Incident Management Teams** – The use of these teams has grown tremendously; while the number of teams and level of expertise are declining.

- **Specialization** – The use of more specialists within the federal agencies has depleted the firefighting "militia."

- **Timber Cut** – With the federal land management agencies reducing their annual cut, revenue is lost, the workforce available to fight fire is reduced, and the number of private companies needed to reforest the cut areas is reduced…these people planted in the winter and fought fire in the summer.

- **Budgets** – Fire budgets are static, but the use of these funds is changing. (Example…the timber budgets in some areas were used to purchase engines…for use in slash burning. Now the fire budget has to purchase the engine.)

Roles of State Agencies

Each state government is organized differently, with some fielding strong state forestry agencies with extensive authorities and responsibilities for wildfire prevention and suppression. In other states, the state forester merely provides technical advice, and fire protection is left to local government forces. Funding for wildland/urban interface fire protection is very limited.

If they had the opportunity, the majority of the state agencies would like to be able to sponsor prevention initiatives, provide coordination of mutual aid, provide operational support to local fire agencies, sponsor hazard reduction initiatives, provide more financial support, and have a greater role in direct fire suppression in the wildland/urban interface.

Several states mentioned the need to perform an assessment and mapping of the problem, and to provide more/better wildland fire training to local firefighters.

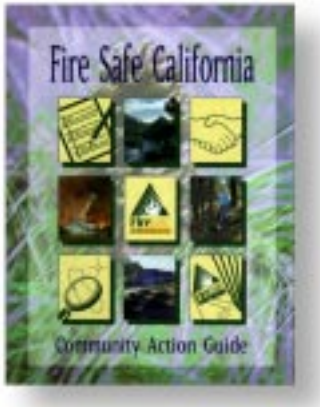
Legislation

Several states reported that significant wildfire events had resulted in some kind of fire safety legislation. After the 1993 fire storms in southern California, the legislature passed the first statewide Class A roofing requirement for high fire hazard areas; after the Tunnel Fire in Oakland, the legislature directed CDF to expand its wildland fire hazard classification system to areas of local responsibility. In Montana, following the disastrous 1988 fire season, the legislature directed the DNRC and State Fire Marshal to develop fire safe guidelines. In Nevada, roofing regulations were developed as the result of bad fires with structure losses. Colorado received a budget augmentation for fire equipment following the 1994 fire season. Unfortunately, most states reported little legislative support for the wildland/urban interface problem.

Twelve of the western states have no state regulations or building standards governing development in the wildland/urban interface. Only seven states have building or fire regulations that can be used to address the interface problem, usually the Uniform Fire Code. In Washington, despite an extreme interface problem and a history of large, damaging fires, the DNRC may only recommend *fire safety features for new development.*

Codes, Regulations and Building Standards

We know the technical measures needed to mitigate the wildland/urban interface fire problem in the West. Unfortunately, we can only implement actions as fast as society allows. Hopefully we are still a system of government that responds to the needs and will of its citizens. Solutions will be implemented only when there is a clear need and strong public support for action. Codes, regulations and ordinances are available if the public can be made sufficiently aware of the problem to generate support for their adoption.



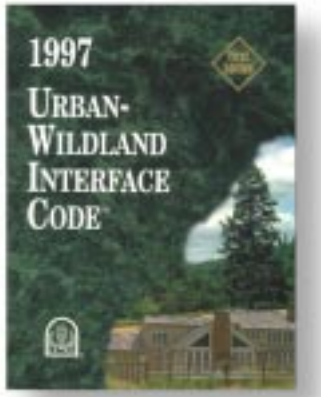
FireSafe California

A variety of FireSafe regulation packages exist in the West. They range from the comprehensive package of statutes adopted by California, to a less-intimidating set of rules adopted by the County of Spokane, and include the new Urban-Wildland Interface Code and NFPA 299. In order to successfully mitigate the wildland/urban interface fire problem in the West, each state legislature must adopt a comprehensive package of FireSafe statutes that apply to the whole state. The problem is too severe and the costs too high to both state and federal taxpayers to leave the implementation of appropriate FireSafe statutes to the multitude of local governments.

Urban-Wildland Interface Code

The 1997 Urban-Wildland Interface Code, published by the International Fire Code Institute, is the first code package developed especially to address mitigation of fire hazards in the wildland/urban interface. The

regulations address both land use and the built environment. Construction requirements are based on the exposure hazards to which the structure may be subjected. Bridging the gap between building codes and fire codes, this code is intended to be enforced by designated local officials of the jurisdictional agency. If adopted by a state, local fire officials could also be delegated enforcement authority. The code is correlated with model building and fire code regulations to avoid conflicting provisions. It offers an opportunity for states or local government entities to adopt a comprehensive package of regulations that can effectively reduce the propagation of the wildland/urban interface fire problem to new developments, and begin the formidable task of applying effective solutions to existing properties.



Roof Coverings and Clearances

The two most important factors in mitigating the wildland/urban interface fire problem in the West are converting to ***ignition-resistant roofing materials*** and achieving ***adequate defensible space***. States need to concentrate their initial efforts on obtaining full compliance with a fire-resistive roofing standard and clearance of flammable vegetation and other materials from around structures in the identified high fire hazard areas. If unable to take any other actions, whether due to political inertia or lack of funds, these two items will contribute to a significant reduction in the number of structures lost to wildfire each year.

An effective fire-resistive roofing standard is not difficult to obtain. A variety of roofing materials are available on the market today that can prevent flying embers from taking hold while still achieving architectural attractiveness. Restrictive CC&R conditions must be eliminated in subdivisions in high fire hazard areas, by state legislation if necessary, in order to allow retrofitting of flammable shake/shingle roofs with ignition-resistant products. Insurance companies could offer premium reductions and lending institutions could offer low-interest loans to encourage residents to switch to nonflammable roofs.

Defensible space is an absolute necessity if firefighters are to be successful in defending structures from encroaching wildland fires. Placing firefighters' lives in jeopardy to try to save a structure where the owner has not provided appropriate defensible space is no longer an acceptable risk. Defensible space (30-100 feet, depending on slope and cover type) can be achieved without decimating the

Wildland/Urban Interface

Interface Firefighting
The majority of the state agencies are actively involved in the firefight in the interface, with 14 providing direct suppression, 15 providing operational support to other fire agencies, 14 coordinating fire fighting efforts, 11 providing financial support, and 5 providing other aid such as logistical support, contractual assistance, and Incident Command/Management Teams. Only three states thought that their roles might change significantly in the future, due primarily to changes in federal fire policy and reduced funding for federal fire forces.

landscape. Specimen trees, appropriately spaced and pruned, can provide adequate shade and beauty. Fire-resistant shrubs and ground covers can be used in landscaping to achieve desired decoration without adding to the fire hazard. Decks and eaves can be enclosed so as not to trap embers, firewood can be moved away from the structure, and appropriate areas can be sprinklered to maintain high fuel moistures. All that is needed is for residents to understand and appreciate both the severity of the fire hazard and the value of these measures in protecting their homes.

Even if nothing else can be accomplished, converting to ***ignition-resistant roofing*** and providing adequate ***defensible space*** in the high fire hazard areas could significantly reduce the loss of structures to wildfire each year.

Public Education

You cannot legislate a change in attitude! What are needed are incentives that eventually change of habits and attitudes of an educated public. The desired attitude with reference to the wildland/urban interface fire problem is that the residents living in a wildland/interface area must plan, construct and maintain a home that is resistant to ignition. Appropriate goals for educational efforts are:

- The education of individual homeowners to what constitutes a FireSafe home; that it is ultimately their responsibility and they may lose what can never be replaced.

- The education of residents to FireSafe practices so that the community polices itself.

- The enactment of realistic building codes and other regulations that will move toward a more FireSafe community.

- The issuance by lending institutions of low interest home improvement loans for FireSafe projects.

- The adoption by the insurance industry of premium cost reductions for FireSafe structures.

Wildland/Urban Interface

It isn't just your home you will loose!

Homes and other buildings are not the only victims of wildfire in the wildland/urban interface. There are all the regular victims of forest fires: air quality, water quality, fish and wildlife habitat, recreational opportunities, viewsheds, etc. There are the losses to the community infrastructure (power and phone lines and poles, bridges, fences, roads, etc.) Then there are the ripple economic effects in the community from time lost from work, lower productivity due to stress, displaced businesses, etc. If the damages from the fire are significant, there will be further damage potential from subsequent floods and mudslides. The destruction of the natural environment may cause people to move out of the community or stagnate growth. Any way you measure it, wildfire in the wildland/urban interface is usually a losing proposition for everybody.

Developing Peer Pressure

One of the biggest needs is to achieve broad scale understanding of the wildland/urban interface fire problem among the whole population so that they might generate enough political interest to overcome inertia. As each state completes its assessment project, it then needs to initiate one of the available fire prevention models (FireWise, FireSafe, etc.), and especially the public education component of the model, in its identified target hazard areas. Only when the public truly understands the nature of the wildland/urban interface fire problem will the community-based coalitions needed to effectively mitigate the problem be successful.

Protection in Place

We need to rethink our current attitudes and policies about evacuation. Most fire managers are so afraid of the potential repercussions from a civilian death in a wildfire, that they have trouble seeing the advantages of limiting evacuations and protecting people in place, let alone encouraging able-bodied property owners to stay and assist in protecting their property. The Australian Model not only encourages property owners to stay, it provides them with detailed information on preparing their property and

Public Perceptions

Ideas advanced for correcting the public perception that "their fire department" will save their house in the event of a big wildland fire included public education campaigns, a multimedia advertising campaign, statistical comparisons of structure losses with and without clearance, show me trips after big fires, and putting the public on notice that protecting their home is their responsibility. While the majority of the states agreed that the ultimate solution lies with the homeowner, a significant minority (and one of the authors) believes that the only practical solution is a cooperative effort between homeowners, landowners, and government. Some foresters argued that the land has to be managed on a watershed scale across property lines to achieve forest health, which would presumably lower fire danger.

Wildland/Urban Interface

Evacuation
Half of the states have an evacuation policy, although some confused authority to evacuate with a policy on evacuation. Some policies are not written, and a couple are in the draft stage. Some places have adopted the "Missoula County Evacuation Plan (McMeekin Plan). In most cases, local law enforcement (especially the sheriff) has the authority to initiate evacuations, but in some states the authority resides with the county commissioners. It appears that little preplanning has gone in to the evacuation issue in the wildland/urban interface.

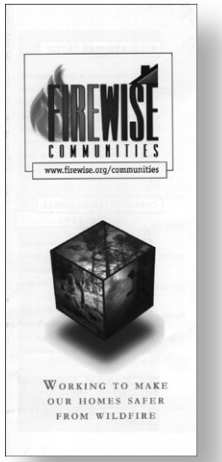
themselves to withstand the onslaught of wildfire. Reducing the amount of people being evacuated reduces traffic congestion, which improves ingress for fire apparatus. It also reduces the likelihood of injuries from traffic accidents. In many mountain communities, the risk to civilians would be less if they were protected in place in a place of refuge (safety island) within the community than left to try to drive themselves out of the area over inadequate roads. Firefighters need to understand the authorities and policies of the agency with evacuation jurisdiction in order to make well-informed decisions about the merits of evacuation.

Australian Evacuation Model

Opposition to the concept that homeowners should be responsible for protecting their homes and not be evacuated was nearly unanimous. Many said "it can't be done", that it conflicted with the goal of maximizing property protection while minimizing risk to the public and firefighters, and that they "can't even conceive of this happening". While a small majority supported homeowners purchasing firefighting equipment, many commented that the private fire protection should be built-in, not requiring people to operate it during the fire. Some said that no policy was the best policy, and that the decision to evacuate should be left to common sense. A few commented that some people could be useful to supplement the efforts of beleaguered local volunteer firefighters.

FireWise

FireWise is a public education model program developed by a consortium of the federal wildland fire agencies, the National Association of State Foresters, the National Fire Protection Association, and Federal Emergency Management Agency as part of the National Wildland/Urban Interface Fire Protection Program. It provides a video, brochures, pamphlets, checklists, etc. directed at fire safety in the wildland/urban interface which state and local agencies can modify with local photographs and statistics to make the program more tailored to local needs. It is a valuable tool readily available to any fire agency to begin making its residents more aware of the wildland/urban interface fire problem and what they can do to make their properties safer from encroaching wildfire.



Wildland/Urban Interface

A series of 2-day seminars is being held in major cities nationwide to acquaint local and state fire officials, as well as interested private citizens and civic groups, with the FireWise program. (Also see: www.firesafe.org)

At least two states, Alaska and Colorado have adopted FireWise as their primary wildland/urban interface fire prevention program statewide.

The package for Alaska is sponsored by the Alaska Wildfire Coordinating Group and follows closely the FireWise model, providing information on the six standard elements of landscaping, access & signs, emergency water supply, FireWise construction, home planning, and when wildfire threatens. The glossy color pamphlets feature photographs of local places, people, and fire situations, which add to the appeal of the product. In addition to the FireWise video, the packet includes numerous fire prevention pamphlets, and a Fire Risk Rating For Homes score sheet.

The Colorado State Forest Service has taken components of the FireWise model and modified them to fit local conditions. They have published a detailed instruction booklet on *"FireWise Construction – Design and Materials"* to help educate developers and builders. In Larimer County in the Rocky Mountain front country, where several significant wildland/urban interface fires have occurred in the past, the Project has produced a very polished and colorful package of educational materials, including the FireWise video, for homeowners associations, community civic organizations, etc. that tailors the standard generic fire safety recommendations to the local conditions in the county. The package starts off with a hard-hitting introduction that asserts, "You are at risk!" and details the wildfire threat in Larimer County. It then covers the gamut of fire safety guidelines for access, water supply, defensible space, fuel management, building construction, and interior fire safety. It concludes with a "What to do when…" checklist to help people prepare themselves to survive a threat from wildfire.

Existing Initiatives
The most popular local wildland/urban interface fire prevention programs were FireWise (AK, CO, HI, WY), FireSafe Councils (CA, NV, HI, WA), and "Living with Fire" in Utah. See the Appendix for discussions of these programs.

FireSafe Spokane

Following a series of major fires in the Spokane (WA) area during a windstorm in October of 1991, several class-action lawsuits against local electric utility companies were combined. The settlement of this suit provided $300,000 to develop a method to improve defensible space around vulnerable homes in this forested community in dry eastern Washington. Thus, *"FireSafe Spokane"* was born.

The mission of this nonprofit corporation, with a five-member board of directors representing the electric utilities, the fire community, and Washington DNR, is to educate, facilitate, and coordinate local community efforts to improve defensible space around homes in the wildland/urban interface to the extent that both fire damages and suppression costs are reduced.

Projects of FireSafe Spokane include demonstration FireSafe houses, educational materials, free home inspections, a spring clean-up week, FireSafe film short, and special teams to emphasize the wildland/urban interface fire problem to the media.

Active since 1998, FireSafe Spokane now has an executive director who has completed a problem assessment and action plan. The group is currently seeking long term funding to extend the project beyond its current three-year funding window. For more information, see Appendix.

FireFree Bend

After the Skeleton Fire in 1996 destroyed 19 structures outside of Bend (OR), the SAFECO insurance company approached the Bend Fire Department with the offer of a donation to buy fire equipment to improve fire protection in the area. The Bend Fire Marshal made a pitch for a prevention program that would get residents to change their attitudes and behaviors about fire. This project was agreed to, with SAFECO providing initial funding of $75,000. A steering committee contracted with a public relations and marketing firm, the RalstonGroup, which has developed an effective and very professional multimedia campaign using a FireFree! logo and a "get in the zone" (i.e. ***defensible space***) motto.

The objectives of FireFree Bend are to mitigate the loss of life and property caused by wildfires through public education; develop a program to foster and promote public education for fire safety; to change attitudes and behaviors toward wildfire safety and survival; and to establish a review and measurement process to assess the effectiveness of the program, and assist the insurance community and fire service in evaluating high fire hazard interface area.

The project has had considerable success and garnered many additional corporate sponsors and significant additional funding. They have produced a professional quality video using "locals" as stars, and sponsored cleanup weekends that have removed more than 10,000 cubic yards of combustible yard waste in one weekend. FireFree Bend now has a self-sustaining hazard reduction program supported by an aware local populace. They have starter kits available for communities interested in starting their own programs. For more information, see Appendix.

Project Impact - Deschutes County

Deschutes County (OR) became one of the first communities in the nation to receive a FEMA Project Impact grant for wildland fire hazard reduction as the result of a grant application put together by the Bend Fire Department.

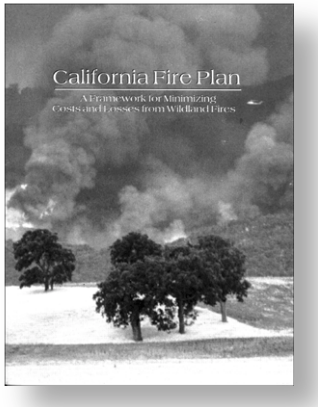
Project Impact is a federally funded grant program that provides funds to one community in each state each year for projects to better prepare it to survive a large-scale disaster. Located on the dry east side of the Cascade Mountains in east-central Oregon, Bend is a growing resort community in the piney woods with a significant wildland/urban interface fire problem.

With $300,000 in federal and $100,000 in local grant funds, the Deschutes County Project Impact team has established the goals of supporting the FireFree Bend project and expanding it countywide, developing additional means of ingress/egress in targeted high-risk subdivisions, completing a standardized rural addressing project, and completing a GIS map database for the county. For more information see Appendix.

Mapping

Thirteen of the states have mapped or begun mapping the extent of their wildland/urban interface problem, most using GIS programs, with ArcView the most common software. Only a few of the states were making these maps available to outside agencies (e.g. other fire agencies, planning departments, etc.). Nine states reported that they were seeking funding sources (usually federal grants) to be able to complete their assessment and mapping projects. Few of the states felt that the current USDA Forest Service project to map the wildland/urban areas in the nation would be useful, as the scale would be too broad, not enough detailed information would be available, and the results would be subject to misinterpretation by the uninformed. Most felt that the project should start at the local level with the data rolled up into a national database.

Mapping of the Wildland/Urban Interface Areas



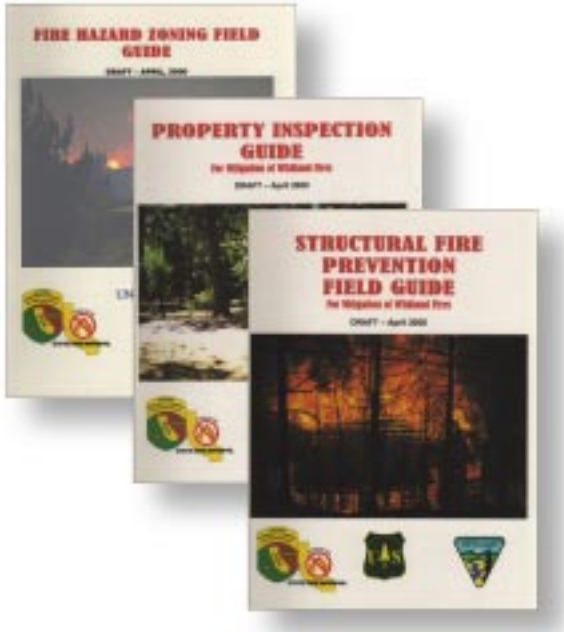
Before you can intelligently discuss the wildland/urban interface fire problem, you must map the areas of concern. Most fire managers can point to the areas within their jurisdiction that pose a problem. The key is to delineate these areas on a map so that they can be defined in detail.

These maps should be of a scale that you can determine whether an individual parcel is in or out of the area of concern. It is best that these maps be developed using geographic information system software (GIS). In this way, the information can be stored, manipulated and shared with cooperating agencies and the insurance industry.

www.ucfpl.ucop.edu

California Fire Plan

One of the most complete programs of wildland/urban interface mapping has been conducted in California. Under policy direction from the Legislature and the Board of Forestry, the Department of Forestry and Fire Protection has mapped the entire state, categorizing areas as to their level of hazard. This mapping is then tied to the ***California Fire Plan, A Framework for Minimizing Costs and Losses from Wildland Fire***, and an outstanding example of a fire plan.



As part of the implementation strategies, the University of California Forest Products Laboratory has produced three guides directed at the wildland/urban interface fire problem. They are the:

- ***Fire Hazard Zoning Field Guide***
- ***Property Inspection Guide***
- ***Structural Fire Prevention Field Guide***

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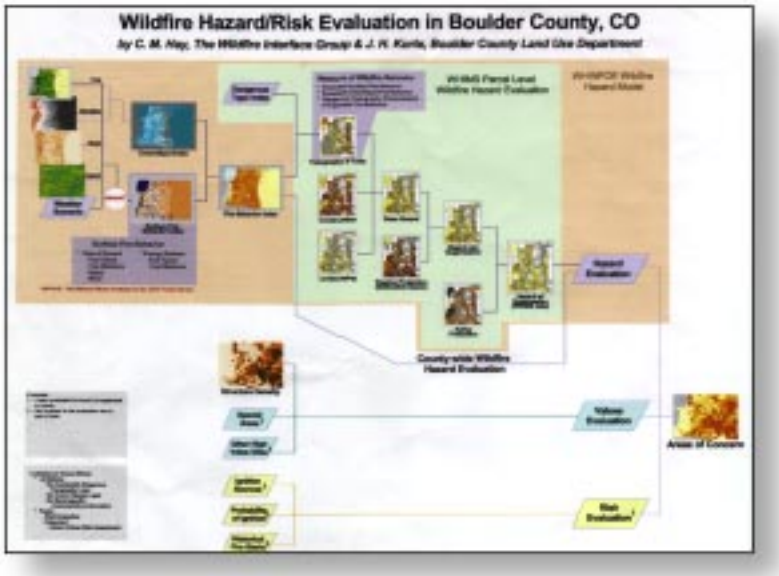
The material developed in California is outstanding. It includes plans and actions that can be taken on a statewide basis, as well as tools for planners and firefighters alike. If any agency is planning on moving their programs forward, time would best be served by reviewing this work.



Boulder County Wildfire Hazard/Risk Assessment

As a result of disastrous fires in the area, the Boulder County (CO) Land Use Department has developed one of the most comprehensive hazard/risk mapping and assessment programs in the nation. This award-winning program is a model that needs to be emulated.

The evaluation program ties all the elements (fuel, elevation, slope and aspect) with weather and predicts fire behavior. This then provides three evaluations: Hazard Evaluation; Values Evaluation; and Risk Evaluation. From all of these various "layers" an Area of Concerns map is produced. See the Appendix for more information.

Mobilization Initiatives

The mobilization of large forces to combat major fires will always be necessary. The states need to address several of the following factors as a means of streamlining emergency operations.

It Isn't Just Mapping

States need also to do an analysis of their capability to respond to the wildland/urban interface fire problem, both before and after the fire. Mitigation of fire hazard and exposure through effective fire prevention programs and effective initial attack suppression actions can significantly reduce the anticipated losses from a major fire.

Federal Funding

If given funding, with which to address with wildland/urban interface fire problem, the state agencies identified mapping/preplanning, supporting local initiatives, adopting FireWise or similar programs, hazard reduction projects, fuelbreaks, demonstration projects, home inspection programs, and tax incentives to homeowners as their priorities. Several states indicated that if "matching funds" were required for grants, they would have little hope of obtaining such funds, let alone the staff to administer such grant programs.

Do you have the Facts?

One of the problems with identifying and assessing the wildland/urban interface fire problem is that in order to make good decisions, you need all of the facts. Many of the states do not at this time have access to the facts (data) necessary to do an effective assessment. Each state needs to make sure that it builds the appropriate foundation for planning and developing solutions by acquiring and maintaining the following types of data:

- Fire weather data
- Fuels data
- Fire occurrence and causal statistics
- GIS data base (interactive with other sources)
- Maps for everybody
- Road/street and addressing database
- Water systems configurations and capabilities
- Telecommunications systems data
- Suppression resource inventories
- Hired equipment vendor database
- Cooperative agreements and operating plans
- Model assessment guide
- Model statutes, codes, and ordinances

Gathering of basic facts and information is the critical first step towards developing a meaningful analysis and understanding of the wildland/urban interface fire problem in any area. If you don't know what's really happening out there, you are probably not prepared to offer meaningful solutions.

Fire Prevention

Fire prevention programs designed to reduce risk need to be targeted at the real causes of large, damaging fires in the high hazard areas. This requires on-going collection and analysis of data on fire causes from all jurisdictions. The need is to be able to target the sources of risk that cause major fires, not just lots of small fires (e.g. power lines vs. kids and matches). Each state needs a comprehensive, standardized fire statistics database collecting information from (and accessible to) all fire agencies. Fire prevention programs such as FireSafe and FireWise are targeted at reducing exposure of existing structures to loss from wildfire. This type of program needs to emphasize to two most important factors in structure survivability: ***ignition-resistant roof coverings*** and ***defensible space***.

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Pre-fire Planning

The capability of the suppression system response to the wildland/urban fire problem needs to be analyzed to determine its effectiveness. Are *all* of the fire agencies in the high hazard areas actively involved in joint response planning, training, and drills? Do they have the most effective types of apparatus and equipment, and adequate numbers of trained personnel to operate it? Are there auto aid and mutual aid pre-plans in effect that assure the immediate response of the closest available types of correct resources? Can the players communicate on common radio frequencies when they arrive on the fire ground? Do the initial attack fire agencies have immediate access to specialized types of equipment (e.g. air tankers, helicopters, bulldozers, etc.)? Has the concept of Unified Command been accepted and practiced? If so, the capabilities of the suppression force can mitigate a lot of damage in the wildland/urban interface. Just remember that no suppression force is invincible in the face of the worst possible wildfire conditions.

Training, Communications, Equipment

The most critical components of an effective suppression system in the wildland/urban interface are training, communications, and equipment.

Training means that the players from all agencies (especially the local municipal fire departments and districts) receive regular training in wildland fire fighting techniques. Such training needs to focus on basic wildland fireline evolutions and firefighter safety, not just ICS position training. Regular interagency wildland drills are necessary to keep the players ready. Live fire training is invaluable, if it can be conducted safely.

Training

In the training arena, all of the states provide instructors for wildland firefighting training courses, and the majority also provide training materials to local government firefighters. Several of the states also train/credential local instructors, and/or maintain a certification/qualification system for wildland firefighters. If given more money for training, most states responded that they would expand their existing programs with more instructors, more/better materials, standardized curricula, credentialed instructors, etc.

Communications means primarily radio communications, with two important factors. A dispatch system that can interface with all fire agencies to provide timely dispatch of automatic and mutual aid resources, as well as serve as an efficient collection point for fire intelligence data is critical to effective response in the high hazard areas. Mobile (and portable) radio communications is the second factor. The personnel arriving at the fire scene need to be able to effectively communicate with each other to be able to work safely and efficiently. Common radio frequencies with pre-planned shared use agreements are critical. Adequate numbers of command and tactical nets must be provided.

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Mountain top repeaters (or mobile relays, or remote bases, etc.) are important to maintaining effective communications over wide areas of difficult terrain.

Equipment means the tools of the trade appropriate for the job at hand. If the job is initial attack on a wildfire in the wildland/urban interface, this means engines of a size that can negotiate narrow country roads, light bridges, steep grades, and preferably operate off-road as needed (Type III engines), as opposed to structural engines (Type I engines) that might suffice for structure protection, but won't contribute much to perimeter control. Equipment means having lightweight wildland fire hose, lightweight personal protective equipment, portable pumps, Class A foam systems, etc. Many city fathers in the West would be well advised to acquire a few Type III, four-wheel-drive, pump and roll, foam-equipped engines before "the big one" happens in their backyard.

Only when training, communications, and equipment of all the fire agencies that can reasonably be expected to operate on the fire in the wildland/urban interface in a high fire hazard area have been maximized, can response somewhat mitigate hazard, risk, and exposure.

Master Mutual Aid Agreements

Historically, when fire agencies want to share resources, they enter into local mutual or automatic aid agreements. This system works well when the number of agencies involved are small. As numbers grow, there comes a time when there is a need for state-level legislation that allows the various jurisdictions within a state to move across jurisdictional lines an assist others in need.

As the wildland/urban interface fire problem has grown, the use of local forces to protect threatened structures has increased. Many of the states still do not have adequate authority to properly mobilize the existing forces.

Such agreements are referred to as Master Mutual Aid Agreements. Some of the best systems are found in California, Montana, Oregon and Washington. The system in each state is different in its operations, but similar in that it allows for the movement of firefighting resources statewide.

Mutual Aid

While thirteen of the 17 states have a statute-based mutual aid system, several mentioned the need for improved planning, coordination, and communications in order to make the system functionally effective. Again, additional training was identified as a need in the mutual aid system. Washington for example, had recently overhauled its state mobilization plan, creating regional coordinating groups staffed by local/state fire officials to improve mutual aid coordination.

Compacts

The States have authority to enter into interstate compacts for the movement of firefighting resources and other assets. Compacts are not simple to establish. Since the Civil War, the Congress requires their stamp of approval before they are ratified. There are two compact agreements in the West.

> **Interstate Civil Defense and Disaster Compact –** In 1977 the states of California, Oregon, Washington, Nevada and Idaho entered into a compact to share "forest fire" fighting resources. Since that date, the states of Utah (1987) and Wyoming (1989) have been added. This compact is used when two states want to provide assistance to each other. It can also be used when the national system through the National Interagency Fire Center (Boise) is not responsive.
>
> **Northwest Forest Firefighting Compact –** Congress just recently ratified an agreement between the states of Alaska, Washington, Oregon, Idaho and Montana, and the Canadian Provinces of British Columbia, Alberta and Yukon. It provides for the movement of resources between the various states and the three provinces of Canada.

Compacts should only be used when there is a special need to move forces between the states, or when the national system is not able to respond in a timely fashion. There is a need for those states not presently "signed on" to do so.

Cooperative Relationships

Fighting fire in the wildland/urban interface is a cooperative venture. No one agency can do it alone. For close to a century, the federal land management agencies and the state forestry organizations have had some level of cooperative relationships. The level of these relationships has varied, but the need is greater now. As more large, damaging fires threaten more structures, there is greater need for effective cooperative relationships between wildland fire agencies.

The area that needs the most work is between the state forestry organizations and the various forms of local government fire protection, be it municipal, rural or volunteer. There are many examples of great relationships, but, there more of poor or nonexisting working relationships.

Wildland/Urban Interface

Use of Local Firefighting Forces

Each state needs to assess its needs for both initial attack forces and structure protection engines from local fire agencies, and preplan the mobilization of these resources. Developing cooperative agreements and operating plans that clearly define the responsibilities and roles of the cooperating agencies should be high on the agenda of each state wildland fire agency. States must also establish mutual aid authorities and mobilization plans that allow the effective mobilization and deployment of local government fire resources on a preplanned basis to any major wildfire in the state.

The effective use of local government fire forces, both for initial attack and for structure protection on wildland fires, will require additional training and specialized equipment, especially wildland personal protective equipment. States need to consider the minimal cost of wildland Nomex for local firefighters against the savings in fires held to a small size and structures saved.

Some of the elements of a good mobilization system are:

- ***Enabling Legislation*** – The State Legislature needs to develop legislation that allows state and local government forces to assist each other.

- ***Workers Compensation*** – A system must be in place that provides for firefighters responding to a call for mutual aid to be protected in the event of injury.

- ***Dispatch Coordination*** – The system to mobilize the local forces must use an existing organizational structure, AND involve the local government fire leadership. The system will only work if the locals have a buy-in and are involved in the process.

- ***More than just fire engines*** – The system has to include a way to mobilize more than just fire engines and their crews. Leadership is mandatory if a firefight is to be organized, efficient and effective. Incident management teams are a method of organizing overhead to support large fires.

- ***Payment*** – Mutual aid, by definition is without cost. Mutual aid works when the commitment of the assisting forces is not for an extensive period of time. Since wildland fires can take days before they are controlled, a mechanism has to be established that allows the assisting forces to move from no-cost mutual aid to assistance for hire.

- ***Training*** – Firefighters are only as good as their training. There has to be a way to train all firefighters to effectively and efficiently fight wildland/urban interface fires. There also has to be training on how to manage these types of incidents.

- ***Tactical Communications*** – Day-to-day tactical communications systems do not work well under the workloads placed on them by a fast moving wildland fire. Statewide communications plans need to be developed and implemented to make any major firefight effective.

Equipment

The Federal Excess Personal Property (FEPP) program was a good start. It allowed states to acquire surplus equipment that could be rehabbed and retrofitted and assigned to local volunteer fire departments to give them a wildland initial attack capability they might not otherwise have. The complexity of the wildland/urban interface problem and the increased fuel loading, fire intensities, and values at risk make it now time to move beyond the used equipment concept. Congress (and the states?) needs to provide funding to equip local volunteer fire departments with new, safe, reliable and effective fire apparatus, firefighting equipment, personal protective equipment and the training to properly utilize it. Better equipment and training improves the effectiveness of local volunteer firefighters on initial attack on wildland fires and increases their ability to respond to major disasters. With more frequent large, damaging fires, and declining federal wildfire resources, we need to increase our pool of available resources.

Federal Agencies

The USDA Forest Service is the largest of the federal land management agencies. Congress has provided funding for state and volunteer fire protection through the Forest Service budget for many years.

Federal Fire Policy

You cannot discuss the Federal Fire Policy and its impact on the wildland/urban interface fire problem in the West, unless you first understand the evolution of the USDA Forest Service. For the better part of the 20th Century, the USDA Forest Service operations focused on the "multiple use" of the national forest system lands. They managed the forests for water, recreation, wildlife and sustained forestry. Many of the forests were used for the harvesting of timber, and substantial portions of their budgets were devoted to timber management and protection.

Federal Fire Policy
Most states said that the implementation of the Federal Fire Policy has impacted their state, expressing concerns about reduced federal fire forces, withdrawal of federal fire forces from the interface, less federal agency support for major fires, and reduced cooperation. Only five states indicated they are changing their protection system to compensate for changes in the Federal Fire Policy, most by redeploying or adding state forces to make up for reductions in federal forces. Some were increasing their oversight of federal operations and anticipating more "reasoning

Starting in the 70's, several events occurred that would have an everlasting impact on the agency:

- The environmental movement pushed to change the mission of the agency from that of "multiple use" to that of preservation.

- Increased cooperative relationships between the USDA Forest Service and its many state and local government cooperators resulted in wildland firefighters working side by side with structure firefighters.

- The need for more specialists resulted in the decimation of the "militia" of generalist employees who were used to staff fires.

In the 90's the Forest Service leadership became concerned with the dramatic increase in their cost as it related to the wildland/urban interface. They found themselves protecting developed areas as a result of "balancing of acres." They were being pressured by "on the ground firefighters" for training and equipment (such as self-contained breathing apparatus) so that they could properly protect structures.

All of this dictated that the Forest Service and other federal land management agencies develop a policy and plan to deal with this growing concern. The result was the Federal Wildland Fire Policy; a long overdue document, but one that is not well understood. The USDA Forest Service is concerned about the level of understanding within it's employee ranks. They are presently surveying their employees as to their understanding of this very important policy (See Appendix for a Summary of the Policy).

We don't fight structure fires!

The issue of federal firefighters being involved in the protection of structures was festering, but it came to a head in the late 80's when the press aired a sound-bite by a federal firefighter on a fire near Woodfords, California, who said, "we don't fight structure fires!" What he meant was that they don't fight structure fires in the way municipal fire departments do. To become structural firefighters would greatly increase training and equipment costs for the federal agencies (Figure 9).

At the same time, federal agency auditors began questioning the propriety of federal agencies cost-sharing the increasingly large bills for local government forces amassed to protect structures located outside federal jurisdiction, especially when the fire didn't start on federal land.

These cost concerns, coupled with increasing pressure to allow fire to resume its natural ecological role and other factors, lead to a major revision of Federal Wildland Fire Policy.

Current federal fire policy then calls for increasing reintroduction of wildfire into the ecosystem, consistent with both resource management and fire plans. It calls for property and resource protection needs to be assessed based on values at risk. It redefines the federal role in the wildland/urban interface to include wildland firefighting, hazard reduction, cooperative prevention and education, and technical assistance. It properly defines the ultimate responsibility for property protection in the interface to belong to state and local governments.
Thus, from the federal agencies' perspectives, all fires are certainly not to be immediately extinguished regardless of cost, and federal firefighters are not to be used in place of local government forces to fight structures fires (at least from the inside out). The policy does however, recommit the federal agencies to continued cooperative fire protection efforts with all partner agencies.

The problems encountered so far with the new federal fire policy have not been so much with the policy itself, but with its interpretation and implementation by local federal line officers. There are examples where USDA Forest Service line officers have informed cooperating agencies that federal forces will be withdrawn from a fire if structures are to be protected. Using the Federal Wildland Fire Policy as the authority for such an action is clearly outside the intent of the policy. While federal agency fire forces can and should be used as necessary to protect structures from encroaching wildfire (but not fighting interior structure

Figure 9. There is a difference between fighting structure fires and protecting a structure from a wildland fire. The firefighter entering the structure is properly trained and equipped. The firefighter protecting the structure is also trained and properly equipped. Each is in the right place--their roles are correct!

fires), the federal agencies will continue to resist having to absorb the costs (and certainly the full responsibility) of structure protection.

The primary problem with the Federal Fire Policy is it is open for any interpretation. It can justify federal involvement in the protection of structures, or it can justify the withdrawal of any federal forces on a fire where structures are threatened. What is needed is clarification from the Washington, D.C. level, clearly stating, in operational terms, what can and cannot be done under it. The policy is so important to so many entities, that the ambiguity that allows so many interpretations must be removed.

Federal Emergency Management Agency

FEMA
Several of the states have been involved with fires significant enough to generate FEMA reimbursement funding for suppression costs exceeding the floor costs.

Only five states said that they would change their approach to the wildland/urban interface fire problem if given FEMA dollars for initiatives. They cited initiating hazard reduction projects and adopting fire prevention programs such as FireWise, but were concerned about "the strings" that would be attached. The two primary recommendations the states had for proactive use of FEMA funds were mapping/preplanning and hazard reduction.

Are the bailouts helping? Probably not! Applying federal funds to help people rebuild their homes lost to a wildland fire, without strong fire safe regulations to provide ***ignition-resistant roofing*** and ***defensible space***, is merely perpetuating the problem.

The use of federal funds to "pay back" state and local government costs for fighting major fires tends to become a political excuse not to invest state and local funds in solutions to the fire problem.

Perhaps the FEMA funds would be more effective if applied *before* the fire, to build fuelbreaks, improve water supplies, train and equip local firefighters, and promote ***ignition-resistant roofs*** and ***defensible space*** around homes in the wildlands.

Wildland/Urban Interface

Forest Health

One of the areas of increasing concern in the West is forest health, meaning the overall well being of the forest as an ecosystem. Partially as a result of the exclusion of fire in the last half of the 20th Century, the forests of the west are very different than the ancient forests. The woods today contain many more trees per acre and much more brush undergrowth and slash (deadwood) than the forest primeval. Insects and disease have gained the upper hand, creating large stands of dead timber. On many privately owned forest lands in the west, a succession of profit-oriented ownerships has over logged and over grazed the land, resulting in weak stands of immature timber. In general, the woods of the west are not as healthy as they could or should be, given our knowledge of natural systems. Unfortunately, the free enterprise economic model of the U.S. encourages extensive, rather than *intensive* management of our forest resources.

A significant new term has crept into the wildland lexicon in the last few years:" *forest health."* This new term is an attempt to focus perspectives on the forest as an ecosystem made up of a multitude of components, each of which has a role in determining the overall vitality of the ecosystem.

While climate, water and soil are obvious factors in determining the type of vegetative cover, the presence and influence of a great variety of other factors can significantly influence the overall vigor or health of the ecosystem. For example, a lack of water during a period of drought may place the trees in a forest stand under stress, which could make them more susceptible to attacks from insects and diseases. Should an insect epidemic kill a large stand of trees, that forest is less healthy than it was (both biologically and financially). It also now is at great risk for a catastrophic wildfire, which could not only destroy the dead trees, but also carry on into the healthier portions of the forest, or into homes at the interface.

Grant Funding
The most popular solutions to the wildland/urban interface fire problem if federal grant funding was to be made available were public education, mapping/preplanning, supporting local initiatives, training volunteer firefighters, hazard reduction projects, demonstration projects, fuelbreaks, and home inspections, in that order. There was little support for tax incentives for homeowners, and a plea to eliminate federal agency pass-through costs ("skimming").

Fire is one factor in determining the overall health of a wildland ecosystem. Many native plant species are fire adapted, and thrive when occasional, low intensity fires move through their habitat, reducing competing plant species and destroying insect populations and disease vectors. Fire replaces mature brush with new growth that is more nutritious for browsing animals such as deer. Fire eliminates accumulations of dead and down materials, converting their components to essential nutrients that boost soil fertility.

During the past 80-90 years, we have evolved to a position of suppressing most forest (and other wildland) fires as a threat to our forest resources and associated private property values. This trend of excluding fire from the wildlands has been exaggerated by increasing development of wildland areas and the need to protect man's improvements from fire. One result of the successful fire suppression policy has been a tremendous increase in the available fuel volume (measured in tons/acre). Some estimates show that fuel volumes in our national forests are now 3-5 times greater than the historical average and that continuous blocks of heavy fuels cover 3-5 times as much area as before fire was excluded. This means that now wildfires are likely to be 3-5 times as difficult to put out and apt to become 3-5 times larger than in "the good old days."

Fuel Modification

While few of the state wildfire agencies have the authority to manage fire for resource benefit on private lands, several do so on state lands. Only five states (CA, CO, NM, NV, and UT) have protection from liability lawsuits, but eleven of the states have active prescribed fire programs. The most common prescribed fire objectives are slash disposal, hazard reduction, range improvement, timber stand improvement, pest control, and wildlife habitat improvement, in that order. About half of the states have the authority to establish fuelbreaks and/or firebreaks, but only with the permission of private landowners. Eleven states have the authority to initiate hazard reduction programs, frequently focused on slash disposal, and generally requiring cooperative agreements. Most of the states provide technical advice to private landowners who wish to undertake hazard reduction projects, but only half can provide operational support to such projects.

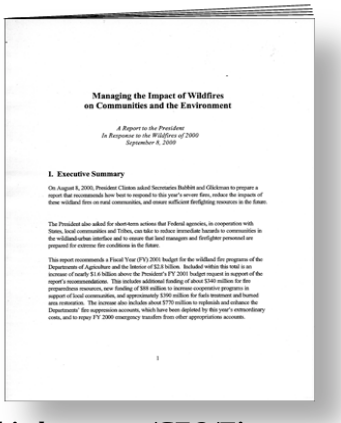
A chorus of voices is now calling for the reintroduction of fire into the ecosystem at levels that would improve forest health. We can anticipate a couple of problems with this concept: first, the fuel volumes will have to be reduced to keep fires controllable: second, the fuel accumulations will have to be broken into manageable blocks; and third, fire is *not* necessarily beneficial to all species. Careful planning of the timing, location, intensity, and duration of fire will be required to achieve maximum contributions to forest health without endangering threatened plant and animal species, and intermixed private property interests.

There is a role that fire management can play in improving forest health that will concurrently reduce the potential for major wildfires. State forestry agencies need to work with federal and private forest landowners in support of forest health initiatives, including selective logging, thinning, fuel reduction by prescribed fire, fuelbreaks, etc., especially in high fire hazard areas at the wildland/urban interface. One example of such a program is the Grand Canyon Forests Partnership, working to improve forest health and reduce fire danger in the wildland/urban interface around Flagstaff (AZ). For more information see www.gcfp.org.

To the extent that wise use of fire to remove hazardous fuel accumulations and contribute to forest health can be properly planned, funded, and executed, fire managers should get on the forest health bandwagon.

Managing the Impact of Wildfires on Communities and the Environment

On September 8, 2000, the White House published a report to the President, outlining a major Federal initiative on dealing with the buildup of fuels and the wildland/urban interface fire problem.



Managing the Impact of Wildfires on Communities and the Environment

A Report to the President
In Response to the Wildfires of 2000
September 8, 2000

I. Executive Summary

On August 8, 2000, President Clinton asked Secretaries Babbitt and Glickman to prepare a report that recommends how best to respond to this year's severe fires, reduce the impacts of these wildland fires on rural communities, and ensure sufficient firefighting resources in the future.

The President also asked for short-term actions that Federal agencies, in cooperation with States, local communities and Tribes, can take to reduce immediate hazards to communities in the wildland-urban interface and to ensure that land managers and firefighter personnel are prepared for extreme fire conditions in the future.

This report recommends a Fiscal Year (FY) 2001 budget for the wildland fire programs of the Departments of Agriculture and the Interior of $2.8 billion. Included within this total is an increase of nearly $1.6 billion above the President's FY 2001 budget request in support of the report's recommendations. This includes additional funding of about $340 million for fire preparedness resources, new funding of $88 million to increase cooperative programs in support of local communities, and approximately $390 million for fuels treatment and burned area rehabilitation. The increase also includes about $770 million to replenish and enhance the Departments' fire suppression accounts, which have been depleted by this year's extraordinary costs, and to repay FY 2000 emergency transfers from other appropriations accounts.

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www.whitehouse.gov/CEQ/Firereport.pdf

This report recommends a $1.6 billion budget increase in the USDA Forest Service and US Department of Interior budgets. Most of these funds are earmarked to cover costs incurred fighting fires this summer and to increase the Federal firefighting force. But, just over $73 millions is designated for State, Volunteer and Rural Fire Assistance programs.

Table 1
FY 2001 Funding Summary, USDA Forest Service and the US Department of the Interior

USDA Forest Service and the US DOI	FY 2000 Final	FY 2001 President's Budget	FY 2001 Additional Needs	FY 2001 Total Needs	FY 2001 House Action	FY 2001 Senate Action
			...Dollars in thousands...			
Fire Preparedness	$584,618	$586,433	$336,381	$922,814	$586,433	$586,683
Fire Operations	323,995	331,136	677,711	1,008,847	320,107	579,394
Emergency Fire Contingency	290,000	150,000	476,000	626,000	200,000	150,000
State Fire Assistance	23,929	30,006	42,994	73,000	25,000	28,042
Volunteer Fire Assistance	3,240	2,510	10,790	13,300	5,000	5,000
Rural Fire Assistance	0	0	10,000	10,000	0	0
Forest Health Management	62,075	62,842	12,000	74,842	63,794	63,383
Economic Action Programs	20,198	17,267	12,500	29,767	14,246	23,486
TOTAL	**$1,308,055**	**$1,180,194**	**$1,578,376**	**$2,758,570**	**$1,214,580**	**$1,435,988**

Rural Fire Assistance - This is a new program within the US Department of Interior directed at volunteer fire departments in small, rural communities.

State Fire Assistance - This $43 million increase includes $20 million for fuel reduction and $4 million for FireWise implementation. The actual unspecified increase to the States is about $25 million.

Volunteer Fire Assistance - This is an increase of over 500%.

Figure 10. This is Table 1 from the Presidential Report titled "Managing the Impact of Wildfires on Communities and the Environmental, dated September 8,2000. It outlines a $1.6 billion program to cover the extraordinary costs associated with the 2000 Fire Season and an increase in several programs that involve the States.

This requires the State Foresters to have plans on how this money should be distributed and used (Figure 10). On September 20th, Congress passed a $1.8 billion plan.

The three programs that directly effect the States are State Fire Assistance, Volunteer Fire Assistance and a new program within the US Department of Interior, Rural Fire Assistance. The States have been involved with the first two programs for years. The proposed State Fire Assistance budget has a general across-the-board increase of just over $24 million (about 100 percent over FY 2000), $20 million for "high priority forest management practices on lands to reduce fire risk and fuel loads," and $4 million for "fire education," presumably the FireWise program.

The Rural Fire Assistance program is new. The report says, "Rural fire district assistance in the Department of the Interior is a new program to provide technical and financial support to volunteer fire departments that protect communities with populations of less than 10,000. Emphasis is on areas intermingled with lands managed by the Interior Department (especially the Bureau of Land Management). For US Department of the Interior $10 million."

It will be interesting to see if the Department allocates these funds to the various State Foresters for distribution to the rural "fire districts" or develop a Federal to Rural program. After the Point Fire, where two volunteer firefighters were killed on a Bureau of Land Management fire, the Bureau proposed a program where they would use the money to have a direct relationship between rural volunteer fire organizations, excluding the States. This program was opposed at that time and should be now! The State Foresters should make it very clear that funding to the rural communities of this Nation should continue to go through the states -- just like the Volunteer Fire Assistance program managed by the USDA Forest Service.

Private Landowners and Industry

Any plan to help correct the problems of fuel loading buildup and the wildland/urban interface growth should include private landowners and the forest products industry.

Small Landowners

Since much of the wildland acreage in the west is in federal ownership, the federal land management agencies will probably assume a leadership role in forest health issues. Much of the wildland/urban interface area however, is in small private ownerships where forest health and hazard reduction

issues are much more complicated. Using prescribed fire to reduce fuel loading in a small drainage in a national forest is relatively easy to accomplish compared to trying to put together a hazard reduction burn in a rural subdivision with thirty owners of ten-acre parcels. The hodgepodge ownership patterns of much of the wildland/urban interface areas will require extensive preplanning and marketing to a variety of audiences to make prescribed fire an effective tool in restoring forest health.

Partnerships
The laundry list of potential partnerships for cooperation in solving the wildland/urban interface problem included insurance companies, local fire departments, local government, planners, builders, developers, homeowner's associations. Nobody mentioned corporations other than insurance companies or local civic clubs, both potential sources of project dollars.

Timber Companies

In much of the West, private timber companies own significant tracts of timberland. While fire exclusion has created forest health concerns in these areas also, management of these lands is based almost exclusively on an economic model, as opposed to the ecological model the Forest Service plans envision. Fuel accumulation and fire hazard on these lands vary proportionately with the economic success of the timber company. That is, timber companies with good profit margins can afford to invest more in hazard reduction. A trend in recent years is for these private timberlands to be consolidated under fewer larger companies than in the past, but bigger may not necessarily mean better financial or forest management. Many timber companies need economic incentives not currently available in the free market in order to invest significantly in hazard reduction, let alone be able to significantly improve overall forest health.

Prescribed Fire

The West has such large expanses of open wildlands with high and increasing fuel volumes that hazard reduction measures must take place on a large scale to be effective. Prescribed fire is a necessary management tool if fuel loading is ever to be significantly reduced in the western woods. Prescribed fire is cheaper per acre (at least at this time) than other available fuel reduction methods (mechanical clearing, chipping, etc.). Cheap is important, especially to private landowners who may not have the level of funding to address the fuels problem that Congress can make available to the federal land management agencies.

The two most significant roadblocks to successful use of prescribed fire for hazard reduction projects in the West are environmental regulations and litigation. In many instances, each separate project may require a full environmental impact report/assessment, which is time-consuming and

expensive (California has had success using a “program EIR” to cover all projects generically). Increasingly strict air pollution regulations, including protecting the “veiwshed” of National Parks, place further restrictions on when and how much burning can be conducted in any region. Prescribed burning can usually be done safely only in short intervals of the spring or fall (depending on fuel type), and usually requires light winds, which are not conducive to dispersing the smoke. Further complications arise if there is any chance that the area to be burned may contain any “threatened or endangered” species of flora or fauna. Finally, lawyers spring to the aid of landowners whose “valuable” property may suffer any damages from an escape, dramatically increasing agency costs. These factors have combined to reduce the amount of prescribed fire use in the West significantly. Certainly, the escape of a federal prescribed fire operation in New Mexico this year will be another stumbling block.

In order to utilize prescribed fire to its full potential in hazard reduction in the West, states are going to have to seek reasonable exemptions from overly strict environmental regulations, and provide protection from tort claim liability to those agencies that must manage prescribed fire. There are several pieces of legislation that the State Foresters may want to analyze and support. They are:

- **H.R. 236** by Representative James Rogan titled: *To exempt prescribed burning on National Forest System lands from regulation under the Clean Air Act.*

- **H.R. 1522** by Representative Helen Chenoweth-Hage, titled: *To safeguard communities, lives, and property from catastrophic wildfire by authorizing contracts to reduce hazardous fuels buildups on forested Federal lands in wildland/urban interface areas while also using such contracts to undertake forest management projects to protect non-commodity resources, and for other purposes.*

- **H.R. 1530** by Representative Mark Roley, titled: *To make forestry insurance plans available to owners and operators of private forest land, to encourage the use of prescribed burning on private forest land, and for other purposes.*

Other hazard reduction measures can be effective, but only on a smaller scale. Fuelbreaks and firebreaks can protect high hazard subdivisions and even small communities, but their maintenance requires use of herbicides, which may not be politically popular. Mechanical thinning and clearing can be effective in small areas, but are very expensive without financial incentives. Greenbelts can be built in to new developments to serve multiple duties as wildlife habitat, recreation space, and fuelbreaks.

National Fire Protection Association

The National Fire Protection Association (NFPA) is an international organization that develops fire protection standards. It has only been in the last several years that they moved from the "structure" firefighting arena to the wildland firefighting arena. The two NFPA standards that have direct impact on the wildland/urban interface fire problem are:

- Protection of Life and Property from Wildfire (NFPA 299). This standard outlines an analysis system, fuel modification planning, street and road standards, water supply, structural design and fire prevention measures.

- Standard for Wildland Fire Fighter Professional Qualifications (NFPA 1051). This standard outlines the basic qualifications for a wildland firefighter and officer. The new standard that will be issued in 2001 will include the qualifications for a wildland/urban fire specialist.

Insurance Industry Initiative

It is easy to say "what we need is the insurance industry to give the homeowner a break on insurance rates if they have a FireSafe home." This may be one of the incentives, but not all that has to be done. "Fire" is not the main concern the insurance industry has. Wind (hurricanes), water (floods) and earthquakes are at the top of their list. Fire is sixth on their list…and, except for "Oakland" sized fires, they have the losses covered by the premiums.

States need to work with representatives from the insurance industry to develop an understanding of this issue. If states can show insurance companies that they have correctly (and scientifically) diagnosed the extent of the wildland/urban interface problem, and can share maps and data that are useful to them, perhaps the insurance companies can be encouraged to develop premium reductions for FireSafe homes and to support local initiatives such as FireWise, FireSafe, etc.

Wildland/Urban Interface

Again, the two most important elements to structure survival are ***ignition-resistant construction*** and ***defensible space***. These are the elements we need to try to convince insurance companies to give credit for first.

Building Industry

Currently, there are no incentives for developers and/or builders to spend the extra money for the materials needed to make homes fire safe. Most homebuyers are ignorant of the factors that make homes fire safe.

Until homeowners are educated to the point that they begin to demand built-in fire safe features, or fire safe codes are adopted to require such features, builders will continue to follow the cheap path.

Local government planning and building officials still are not well educated in fire safe building and development standards.

Banking Industry Initiative

We need to be able to convince the banking industry that it is in the best financial interest of the lending community to provide low-interest loans to homeowners who wish to retrofit their homes with FireSafe roofing materials. The concept is simple, the smaller the chance of the house burning down, the greater the chance that the full mortgage will get paid off. While this is not a large chunk of the bank's business, it could be important to the long term financial health of the community to keep lots of houses from burning down. State and local fire agency officials need to meet with representatives of the lending community to begin dialog on this issue.

Recommendations

Whenever you take on a major task, it is best to have a plan and to do it in small steps. The hurdles involved in the wildland/urban interface fire problem did not arise over night, and will not be overcome quickly. And, the problem will never be solved if steps are not taken in a planned and organized manner.

The following recommendations are presented as a plan to address the problem in relatively small steps. Some of the recommendations are directed to the Council of Western State Foresters and the National Association of State Foresters. Some are directed toward individual states and communities. The goal is not to attempt too much, but to start down a path that facilitates change.

Initiatives and Solutions
The laundry list of incentives for homeowners to make their homes fire safe included insurance premium rebates, property tax rebates, development of the biomass industry, more stringent fines for violations, public recognition for compliance, operational support for projects, community block grants, roof retrofit cost-share programs, subsidized home improvement loan rates, and cost-sharing for hazard reduction or reroofing. Among statutory and regulatory solutions suggested were fire safe building construction, UBC and UFC, defensible space, require insurance premium rebates, mandatory water supply, adequate ingress and egress, and fuelbreaks around subdivisions. Surprisingly, three states recommended no new laws/ regulations.

Public Education

One of the biggest needs is to achieve broad scale understanding of the wildland/urban interface fire problem among the whole population so that they might generate enough political interest to overcome inertia. Public attitude drives what they will do to prepare for a fire, as well as drives any political action at all levels of government.

Any message must be in language they understand. Experts in any field tend to speak in technical terms, not terms understood by the average citizen.

■ ***Recommendation*** – That each state move as quickly as possible to implement the FireWise public education model. Funding should be targeted for development, distribution and training.

Federal Initiative

The potential for federal funding of various wildland/urban interface initiatives is high. There is the legislation following the Cerro Grande Fire, designating $120 million to the Departments of Agriculture and Interior for fuel modification on federal lands near the wildland/urban interface.

Wildland/Urban Interface

The $1.6 billion initiative developed by the President needs immediate attention. The State Foresters should develop proposals on how this expected funding would be used. The funding should NOT be simply divided by 50, it should be directed toward specific projects.

■ ***Recommendation*** – That a plan be developed to allocate any federal funding to specific projects in this order of priority. This plan should follow the recommendations of the States, but include items that increase the effeciency of initial attack and mobilization of fire forces. Some specific areas are:

- ***Public Education*** – To fund FireWise or other public education fire prevention projects.

- ***Fuels Treatment*** – Focus on fuel treatment projects that have a wildland/urban interface component and complement cooperative programs between federal/state/private entities.

- ***Initial Attack*** – Improve the level of initial attack through the use of rural volunteer fire departments by providing them more and better funding, training, and equipment.

- ***Extended Attack*** – Improve the capabilities of the states to assist local forces during this crucial time in the fire attack. A preplanned and organized transition from initial attack to extended attack will facilitate earlier control of major fires and reduce damages and suppression costs.

- ***Major Incident Management*** – Improve the capabilities of the State and Local fire authorities to manage major incidents without reliance on the federal teams.

- ***Mobilization*** – States need to establish authorities and procedures for effective mobilization of available local government resources to respond to major wildfires.

Recommended Priorities
The States were asked what would be their priorities for programs. These percentages were developed from their responses:

Public Educations	20%
Training Rural Firefighters	20%
Local Initiatives	15%
Mapping and Planning	15%
Hazard Reduction	10%
Fuel Breaks	10%
Demonstration Projects	5%
Home Inspections	5%

Wildland/Urban Interface

■ ***Recommendation*** -- That the Department of Interior funds for the new Rural Fire Assistance program be channeled through the States, in the same way the Forest Service allocates their Volunteer Fire Assistance funds.

Mapping the Wildland/Urban Interface Areas

Before you can begin to educate the public and planners and governmental leadership, you must define and delineate the wildland/urban interface areas within each state. The goal should be that the maps be of such detail that they would designate whether an individual parcel is in a hazardous zone or not. The maps should also be developed using ArcView or a compatible Geographic Information System database.

■ ***Recommendation*** – That each state map and assess the wildland/urban interface areas in the state and share this information with local planning agencies and the insurance industry.

Federal Fire Policy Clarification

The Federal Fire Policy is a necessary document, but it needs clarification so that its interpretation is limited to its intent.

■ ***Recommendation*** – That a list of specific questions and/or concerns be developed and sent to the appropriate federal agencies for clarification and interpretation. That the clarifications and interpretations then be distributed to all appropriate levels within the states and federal agencies.

Forest Health

Forest health is a technical term that means something to foresters and wildland fire managers. It means nothing to the general public. It is important that when attempting to remedy a hundred years of fire policy, that the thinking go beyond 30-feet of clearance, and include incentives for the small landowner, timber company and federal land management agency. Defensible space is vital, but the term implies that a firefighter will be necessary and present during the fire. The plan must include the reintroduction of fire to the forests and use other fuel-modification methods when appropriate.

■ ***Recommendation*** – That some simple explanations be developed that describe what forest health means for the layman.

Wildland/Urban Interface

■ ***Recommendation*** – That public education programs move beyond "defensible space" to include forest health issues.

■ ***Recommendation*** – That Congressional action be enlisted to support some exemptions from the Clean Air Act for prescribed fire.

Mobilization Checklist

Most of the states in the West do not have authorizing legislation to move local government firefighting forces statewide as needed. Even with proper authorization, there is also a need for a established system to:

1. Activate and mobilize the needed forces.
2. Provide Worker's Compensation and other liability insurance.
3. Provide logistical support to the responding forces.
4. Reimburse agencies for assistance that goes beyond mutual aid.

■ ***Recommendation*** — Each of the states should conduct a "self-evaluation" survey of their authorities, responsibilities, and capabilities to ensure that they are ready to move the necessary forces when needed.

Adoption of Urban-Wildland Interface Code

We know what makes a home FireSafe! There are several ways that codes, regulations and building standards can be developed and implemented. Each state or local entity will have to develop standards that are appropriate to their community. The Urban-Wildland Interface Code is the most comprehensive available. It can be adopted as a regulative code or as a model code.

■ ***Recommendation*** – That the Urban-Wildland Interface Code be used as the model code recommended by the state forestry agencies in the West.

Interstate Compact

Only seven of the seventeen states in the West are signatories to the Interstate Civil Defense and Disaster Compact.

Wildland/Urban Interface

■ ***Recommendation*** – That the ten states not signatories to the interstate compact take the appropriate actions to join the compact.

■ ***Recommendation*** – That an operations plan be developed for the movement of state personnel and equipment as authorized by the interstate compact. That each spring, this operating plan be updated and refined as necessary.

Major Incident Management Teams

The use of major incident management teams is becoming more and more important. The complexities of managing fires or other disasters is so complicated that a team approach is appropriate. The use of the federal teams has been the only option for some states. The federal teams are excellent at what they do, but sometimes do not adjust to the needs and wants of state or local officials. Establishing state teams is not a move away from cooperative programs with the various federal agencies, it is an augmentation of cooperation. There is enough work for all the qualified teams.

■ ***Recommendation*** – That each state develop their own major incident management teams, utilizing state, local and federal personnel.

Delegation Authority

All too often, when a federal team is requested to manage a state emergency, the team brings with it the policies and procedures of their "home agency." A letter of delegation is issued that allows the team to function on the incident. But, in most cases, the letter of delegation does not adequately spell out the expectations of the entity being served.

With the issuance of the Federal Fire Policy, structure protection issues have become more complicated. If a team is not specifically given the responsibility to protect structures they may not do so. All too often, the incident management team assumes they are to apply their agency's policies and procedures to the operation, rather than use the authorities, responsibilities and policies of the agency giving them authority to fight fire on their behalf. This is especially true on fires burning in multiple jurisdictions when the non-federal agencies are not able to assume their fair share of a true *unified command* operation. Lacking the full input provided in unified command, it is imperative that jurisdictional agencies utilizing the federal or interagency Incident Management Teams specify upfront in their

delegation of authority to the team, the authority, responsibility, and funding mechanism to be used to provide protection of structures from the encroaching wildfire.

■ ***Recommendation*** – Develop a standard letter of delegation to be used by the states with federal incident management teams. Insure that the delegation authority includes a statement that the team is to concern itself with structure protection or any other specific areas of local concern.

Use of Local Firefighting Forces

Each year, the forces of rural county fire departments, fire protection districts, and local volunteer fire companies make initial attack on thousands of wildland fires in the West. During major wildland fires, these same forces are called upon to protect the structures threatened when wildfires encroach into the wildland/urban interface. The majority of the local government firefighting forces lack the training, equipment, and communications to operate safely and effectively on major wildland fires.

■***Recommendation*** **–** That states assume a leadership role in improving the safety and effectiveness of local government firefighting forces on wildland fires, especially in the wildland/urban interface. States should provide more and better training, equipment, and communications capabilities to local fire forces.

■***Recommendation*** **–** The states must also begin to develop plans that will begin to phase-out the federal-excess property equipment and replace it with more up-to-date apparatus.

Wildland/Urban Interface

Appendix

Definitions

Before you can fully understand the wildland/urban interface fire problem, you must know the language and the terms. The following are some of the unique definitions associated with the problem:

Areas of Safe Refuge – an area of safe refuge is like a safety zone, a place where a person is safe from a fire. Structures can be constructed in such a way to provide a place of refuge during a wildland fire.

Dwelling Unit – is a house, home, apartment, etc. where humans reside. A motel or hotel room is not a dwelling unit, because the length of say is usually short-term.

Hazard – the degree of flammability of the fuels once a fire starts. This includes the **fuel** (type, arrangement, volume, condition, etc.), **topography** and **weather**.

Home or House – is usually a privately owned structure in which people live. It does not house more than one family.

Ignition-Resistant Construction – incorporates the use of materials and design that enables a structure to withstand ignition form radiant heat, fire brands or direct flame impingement.

Risk – the chance of a fire starting from any cause.

Structural Fire Protection – is defined as interior and exterior actions taken to suppress and extinguish a burning structure or improvement utilizing standard building fire protection methods, equipment and training (Figure 10). Structural fire suppression is generally the responsibility of a

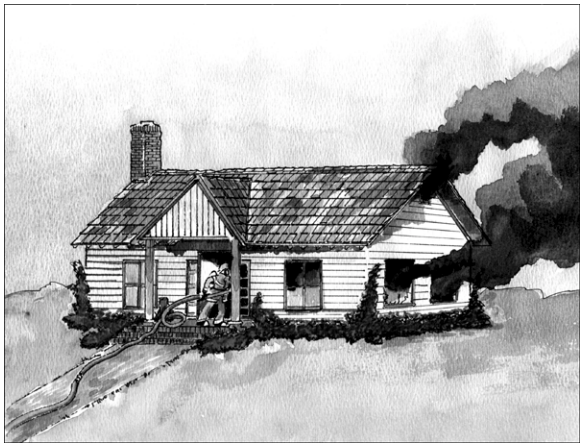

Figure 10. Structure fire protection usually involve the interior attack of a structure.

Wildland/Urban Interface

local government entity, although there are some locations in the West where there is currently no structural fire agency in place.

Structure – is a building, home, business, barn, etc., that is built within one foundation/ framework. An apartment building is a structure.

Structure Protection – to protect structures from the threat of damage from an advancing wildland fire (Figure 11). This normally does not include an attack on fire that is inside the structure. It involves the use of fire control lines (constructed or natural) and the extinguishment of spot fires near or on the structure. This protection can be provided by the rural and/or local government fire department firefighter and the wildland fire protection firefighter.

Figure 11. Structure protection is the protection of a structure from an advancing wildland fire. It normally does NOT include an interior attack.

Structures saved – a structure is considered saved if it is within the exterior boundaries of the fire or directly adjacent to the fireline, and did not burn down or suffer serious damage as a result of the wildfire.

Structures threatened – a structure is considered threatened if it is within the exterior boundaries of the fire, or within ¼-mile of the exterior boundary of the fire and within the fire behavior projection for the next 24-hours.

Suppression – taking specific actions to control and extinguish an unwanted wildland fire.

Wildfire Causes – there are three general causes of wildland fires, **natural** (lightning), **accidental** (debris burning, children with matches, etc.) and **intentional** (arson).

Wildland/urban interface fire – is a fire that **burning primarily in wildland fuels** that destroys or threatens several structures.

Wildland/Urban Interface

Wildland/Urban Interface Fire History

(A wildland/urban interface fire is defined as one that destroyed at least three structures and burned over 25 acres of wildland.)

State	Year	Fire Name	Acres Burned	Structures Lost	Deaths
Alaska					
	1996	Prator Lake	120	3	
		Miller's Reach #2	37,336	454	
Arizona					
	1983	Pretzer	200	3	
	1990	Dude	25,000	30	6
	1995	Oldt	100	14	
		Bagdad	200	4	
	1996	Points	26	3	
	1997	Kuyhendall	410	6	
California					
	1955	Humboldt/Siskiyou	152,245	13	
		Refugio	84,770	20	
	1956	East Highlands	15,330	5	1
		Sherwood	9,428	8	
		Newton	26,169	50	
		Hume	1,940	9	
	1960	Homstake	10,948	10	
	1961	Harlow	41,200	106	2
		Bel Air	6,090	484	
	1964	Hanley/Series	71,601	174	
		Weldon/Series	11,650	20	
		Coyote	67,000	94	1
	1965	Northern Cal Series	113,766	41	
		Suncrest	1,260	7	
	1967	Sence Ranch	17,431	5	
		Santa Susanna	25,000	10	
		Paseo Grande	48,639	61	
		Baliff	23,929	8	1
		Woodson	17,560	30	
	1968	Louis	1,327	5	
	1969	Walker	17,000	8	
	1970	Statewide Series	567,508	722	19
		Reche	4,168	3	
		Bear	53,100	54	
	1972	Swasey	1,933	8	
		Bradford	1,760	4	
	1973	Boulder	8,478	17	
	1975	Grundy	1,710	3	
		Pendleton	2,400	10	
	1976	Quarry	38,346	8	
		Jacksonville	5,307	3	
		Honey	1,482	3	
	1977	Sycamore	804	234	
	1978	Creighton Ridge	11,405	64	
		Mandeville Canyon	5,500	18	
	1979	Hesperia	1,525	25	1
		Northern Cal Series	3,200	7	
		Laurel Canyon	150	24	
		Bernardo	9,000	10	
	1980	Tower House	2,349	3	
		Riverside	500	5	
		Dry Flat	28,655	6	
		Turner	28,000	7	
		Indian	28,200	7	
		Lakeland	8,400	4	
		Stable	5,482	65	
		Summit/Series	41,472	355	
		Panorama	23,600	7	
		Kiowa	2,440	11	
	1981	Thunder	11,500	29	
		Atlas Peak	22,000	69	
		Flat	1,500	3	
		Rieche/Series	29,704	6	

Note: Fire History Data as of August 31, 2000. The daily NIFC report was the source for the 2000 data.

State	Year	Fire Name	Acres Burned	Structures Lost	Deaths
		Swall	1,900	3	
		Oat Mountain	17,500	9	
		Cow Mountain	25,534	4	
	1982	Gypsum	16,800	14	
		Daydon Haul	57,000	65	
		Dulzura	5,019	7	
	1983	Porta Costa Series	325	10	
	1985	Hidden Valley	1,250	20	
		Eight-Mile	462	13	
		Seco	1,954	3	
		Gorda Rat	55,889	8	
		Cherry	40,231	17	
		Las Pilitas	74,640	41	
		Pala	325	3	
		Wheeler	120,000	26	
		Miller	8,000	3	
		Deer	520	8	
		Delta	1,620	3	
		Lafayette	100	3	
		Lehr	200	64	
		Page Mill	100	13	
	1987	Dog Bar	362	9	
		Stanislaus Complex	144,762	28	
		Clark	37,530	4	
		Gulch	6,800	6	
		Yellow Complex	47,770	3	
		Glasgow	13,370	3	
		Salmon/St. Clair	8,600	35	1
		Post	546	3	
		Baldwin Hills	500	21	2
		Morse (Pebble Beach)	160	37	
	1988	Amador	600	3	
		Railroad	10,750	15	
		Mason	4,072	5	
		Orinda	15	7	
		Lake	10	4	
		Miller	38,600	7	
		49er	33,700	312	
		State 1807	4,738	5	
		Stagecoach		15	
		Rosa		4	
		Yucca	931	3	
		Fern	7,790	58	
		Preston	1,000	7	
		Geysers	352	7	
		PG E #19	8,648	3	
		Miller	10,000	18	
	1989	Kelly Ridge		4	
		Highway 26	400	9	
		Calaveras	425	4	
		Powerhouse	11,680	22	
		Olivas	813	3	
		Eagle	4,600	3	
		Poppet	1,328	3	
		Ortega	6,100	13	
		San Benito	52	7	
		Joshua	690	6	
		San Martin	375	17	
		Two Rock	161	7	
		Greenwood Series		159	
		Tuttletown	740	8	
	1990	Monterey	18	8	
		Paint	4,900	641	1
		Carbon Canyon	6,640	14	
		Bedford	490	20	
		Glendale	75	50	
		Cottonwood		5	
		A Rock	12,136	66	
		Pine	125,892	27	
		Long Gulch	2,100	3	

State	Year	Fire Name	Acres Burned	Structures Lost	Deaths
		Knoll	300	7	
	1991	Fiddle	20	3	
		Tunnel	1,600	2900	25
	1992	Borax	1,920	15	
		Jay	550	3	
		Maidu	675	10	
		Villa	6,700	19	
		Fawn	350	13	
		Fountain	63,960	636	
		Cleveland	24,580	26	2
		Moccasin	8,370	6	
		Clear	190	5	
		Idaho	50	4	
	1993	Greenmeadow	40,051	66	
		Kinneloa	5,715	149	1
		Stagecoach	546	8	
		Mill Creek	4,680	6	
		California	25,100	107	
		Ortega	21,392	15	
		Guejito	20,722	9	
		Laguna Canyon	14,808	366	
		Topanga	16,885	300	3
		Reppier	5,956	15	
		Old Coach	2,139	36	
	1994	Kelsey	860	33	
		Raulson	1,000	13	
		Bailey	7,000	8	
		Broens	1,650	4	
		Creek	442	3	
		Highway 41	48,531	37	
		Lakeland	2,400	8	
		Scout	3,023	9	
		Lucas	8,464	40	
		Hemet Complex	19,200	14	
	1995	Jenny	420	6	
		Sycamore	10,000	3	
		Warners	2,400	20	
		Riverside	5,000	6	
		Bluff	2,624	3	
		Vision	12,354	45	
		Lopez	1,985	4	
	1996	Ellis	43	6	
		State 837	653	5	
		Weber	360	4	
		State	165	3	
		Dove	930	3	
		Riverside	40	3	
		Pechanga	1,336	3	
		Gifford	31	3	
		PGE #8	80	5	
		Stumpfield	3,000	43	
		Lightning #29	7,000	20	
		Peachland	25	4	
		Highway 58	33,094	13	
		Riverside	1,210	6	
		Harmoney	8,592	110	
		Rincon	1,800	6	
		Calabasas	13,010	6	
	1997	Riverside	320	3	
		Grove	1,235	3	
		Calimesa	377	9	
		Priest	250	10	
		Wohlford	457	8	
		Pamela	25	3	
		Pauba	7,800	10	
		Wildwood	940	6	
		Poppet	1,500	5	
		William	5,810	85	
	1998	Juniper	6,000	89	
		Edna	28,164	5	1

State	Year	Fire Name	Acres Burned	Structures Lost	Deaths
		Taylor	2,160	5	1
		Bitterwater Valley	420	5	
	1999	Lowen	2,000	23	
		Dunstone	268	3	
		Bloomer #3	2,590	9	
		Musty #3	7		
		Willow	21,900	60	
		Canyon #4	2,580	230	
		Rumsey	3,015	6	
		Shockey	3,885	3	
		Oregon	280	5	
		Jones	26,202	264	
	2000	Manter	72,750	16	
		Berryessa	1,731	15	
		Morgan	3,316	3	
		Happy	5,500	3	
		Union	350	5	
Colorado					
	1989	Black Tiger	2,000	44	
	1990	Old Stage	2,000	10	
	1994	Hour Glass	1,275	13	
		Wake	3,846	3	
	1996	Buffalo Creek	10,000	10	
	1999	Monument	100	9	
	2000	Bobcat	10,600	22	
		High Meadow	10,927	51	
		Pony	5,240	4	
Hawaii					
	2000	Puu Kapu	4,500	3	
Idaho					
	1989	Lowman	46,000	25	
	1991	Hauser Lk Complex	1,700	5	1

State	Year	Fire Name	Acres Burned	Structures Lost	Deaths
	2000	Clear Creek	126,000	10	
		Burgdorf Junction	64,666	19	
		Fisher Springs	22,000	4	
		Lookout Point	4,000	3	
		Trail Creek	34,759	30	
		SCF Wilderness	171,560	22	
		North Fork Wilderness	14,506	5	
		Indian/Prospect	11,100	3	
		Morse	4,275	3	
Kansas					
Information is not available.					
Montana					
	1977	Pattee Canyon	1,200	7	
	1983	Baney Coulee	2,500	3	
	1984	Houghton Creek	12,061	3	
		Hawk Creek	180,508	44	1
	1988	Red Bench	14,000	24	
		Storm Creek	30,000	12	
		Canyon Creek	120,000	6	
		Whitehall	1,630	3	
	1991	Holter Lake	125	3	2
	1998	Shepard Mountain	30,000	34	
	1999	NE Corner	3,917	10	
		Fishel Creek	28,155	5	
		Anelope	7,240	20	
		Outlook	6,952	10	
	2000	Canyon Ferry	43,922	50	
		Fort Howes	55800	4	
		Average Bad Day	1,310	11	
		Monture/Spread Ridge	21,800	4	
		Hell Creek	750	3	
		Valley Complex	173,563	227	
		Thursday	750	3	

State	Year	Fire Name	Acres Burned	Structures Lost	Deaths
		Thursday	750	3	
		Blodget Trailhead	10,764	8	
		Gilger	640	3	
		Maloney Creek	72,000	12	
		Boulder Complex	12,604	9	
		Skalkaho Complex	64,794	4	
Nebraska					
	1999	Thedford	75,000	15	4
Nevada					
	1994	Crystal Peak	7,310	3	
	1996	Autumn Hills	3,800	4	
	1999	Spring Creek	200	2	
	2000	Coyote	15,000	3	
		South Cricket	65,000	5	
New Mexico					
	1974	Spring	14,500	45	
	1993	Burgett	5,350	8	
	1996	Hondo	7,651	32	
	2000	Cree	6,488	3	
		Scott Able	16,034	64	
		Manuelitas	1,410	4	
		Cerro Grande	47,650	350	
		Viveash	28,283	4	
North Dakota					
	1999	Gap	69,000	16	
Oregon					
	1975	Ten Mile Valley	232	4	
	1987	Bland Mountain	9,593	35	
	1988	Milepost 70	160	4	
	1990	Awbrey Hall	3,353	26	
	1994	Blackwell Road	65	14	
		Hull Mountain	7,990	44	
	1996	Wheeler Point	14,960	11	
		Skeleton	17,736	36	
	1998	Lone Pine	5,290	3	
	2000	East Complex	45,000	3	
South Dakota					
	1959	Deadwood	2,500	60	
	1988	Westberry Trails	3,840	57	
	2000	Flagpole Mountain	7,800	4	
		Jasper	82,600	3	
Utah					
	1990	Wasatch		43	2
	2000	Box Canyon	200	3	
Washington					
	1985	Barker Mountain	60,000	4	
	1987	Hangman Hills	1,500	24	
	1988	Dinkleman	50,000	3	
	1991	Firestorm 91	350,000	191	1
	1992	Castle Rock Canyon	5,400	24	
	1994	Chelan/Leavenworth	58,000	54	1
	1996	Bowie Road	3,020	7	
	1997	Red Lake	1,151	5	
	1998	Cleveland	118,500	14	
	2000	Rocky Hill	9,404	37	
		Goodnoe	4,800	3	
		Mule Dry	76,800	25	
		Eastside Complex	5,924	3	
Wyoming					
	1988	Clover-Mist	319,575	14	
		North Fork	531,182	7	

Wildfire Hazard Classification for Boulder County, CO

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Boulder County, Colorado:

Boulder County located 40 miles northwest of Denver, CO on the east side of the Colorado Rockies covers approximately 750 square miles. The county lands range from semi-arid grasslands and plains in the east through montane forests and alpine tundras in the west. Steep rugged canyons, strong Chinook and Bora winds, and semi-arid conditions characterize mountainous areas. Public open space, intermix with private landholdings in the western mountainous half of the county where fire protection is provided by 18 local fire protection districts.

The Problem:

The possibility of a wildfire is an ever-present danger in the County. Eighty years of fire suppression preceded by earlier European settler grazing have left the forests with vegetation densities 10 to 100 times their historic levels. This results in fires that are more intense and devastating than the previous historical norm. Combined with increased residential development and high recreation demands in the mountains, the potential for catastrophic wildfire has reached crisis levels.

The intermixing of residential structures with wildland vegetation creates a significant fire management problem. In one case, wildland fuels are partially dependent upon fire as part of their ecology. In the other case, structures are not compatible with a fire environment. This mixture of two different types of fuel with different tolerances for fire is the crux of the wildfire management problem in the urban wildland interface.

In the past few years, Boulder County has experienced several wildfires and the situation reached a crisis point in 1989, when the Black Tiger Fire consumed 44 homes and blackened 2,000 acres of forested land in the western part of the county.

The Response:

In 1990 the Boulder County Wildfire Mitigation Group (BCWMG) was formed consisting of members from public agencies along with private citizens. The group's mission was to determine and coordinate actions that could help minimize loss of life and property from wildfires.

By 1992, a technical team from the BCWMG began designing and developing the Wildfire Hazard Identification and Mitigation System (WHIMS). Using geographic data management and analysis technologies, WHIMS' goal is to identify wildfire hazards, educate homeowners, assist land managers, and assess the risks involved due to wildfires.

Wildland/Urban Interface

The Approach:

Lot boundaries and ownership information are extracted from the Assessor's parcel database. Topographic information is extracted from USGS digital elevation model data (DEM). Fuel type data were specifically mapped for the county, and parcel-specific hazard data are collected on-site using a specially designed WHIMS questionnaire.

Two levels of spatial focus are a part of the analysis. Broad level analysis occurs countywide and site-specific analysis is focused on individual parcels. The parcel analysis fully nests within the countywide broad analysis and is directly linked through the spatial (GIS) database.

An overall wildfire hazard assessment along with individual factor ratings are produced using a hazard-rating model (**WHINFOE)** that is based upon a standard wildfire behavior model (**BEHAVE**) and the expertise of wildfire behavior specialists. The **WHINFOE** model is a hierarchical model with 3 factor categories (Base Hazard, Passive Protection, and Active Protection categories) that group 7 primary information factors: The **Base Hazard** is the hazard due to the existence and characteristics of the 'burnable stuff'. This category is made up of the Topography and Fuels (County-wide & Parcel Specific) factor, the Building Construction and Design (Parcel Specific) factor, and the Landscaping within 150 feet of a structure (Parcel Specific) factor. **Passive Protection** evaluates Defensible Space, which if present decreases fire intensities allowing a structure to better withstand the passage of the flame front, or so that fire fighters can more easily protect the structure (Parcel Specific). **Active Protection** evaluates Accessibility, Fire Protection Response Time, and Water Availability (Parcel & Subdivision Specific). If present the Protection Categories contribute to a reduction in the Base Hazard.

The Results:

In districts where the parcel-based hazard questionnaires have been completed and evaluated, the WHIMS information has been valuable in raising homeowner awareness of the wildfire danger to their property. Several mitigation projects have been initiated and/or completed as a result of heightened wildfire hazard awareness within the county due to the efforts of the BCWMG and WHIMS.

Next Steps:

Acquire House Pad Locations so that structure focused proximity analysis can be performed within the GIS as opposed to parcel-aggregated evaluations. Such data would improve the analysis of topographic and fuels data relative to structure location on large parcels. Such data would also solve the multiple structures per parcel problem in the most efficient way.

A **dangerous topography evaluation** is part of the parcel-based evaluations, and is evaluated directly on site for each structure. It is desirable to conduct this evaluation as part of the countywide hazard classification. However, a dangerous topography data layer has not been developed as yet for the entire county. Plans to acquire this information are currently being developed.

Wildland/Urban Interface

The county is currently undertaking a **countywide risk 'first look' evaluation** where risk is the probability of an event occurring. That information will be combined with the hazard/values at risk classifications for a follow-on county-wide integrated hazard-risk evaluation to be used to guide planners in the site plan review process for new or remodel building permits.

Author Biographies

Claire M. Hay is a principal with the Wildfire Interface Group. She is a wildland-urban interface specialist and a remote sensing and GIS specialist. She has been involved in the Boulder County WHIMS project since 1992. She obtained her B.A. in Geography from the University of California, Berkeley, and her M.S. and Ph.D. in Forest Sciences from Colorado State University.

James H. Korte is a GIS Specialist for the Land Use Department at Boulder County, Colorado and has been there since 1989. He has been working with the county's WHIMS project since it's inception in 1992 as GIS Specialist. He obtained his B.S. degree in Geography at Pennsylvania State University in 1988.

Federal Wildland Fire Policy – A Summary

The challenge of managing wildland fire in the United States has dramatically increased in complexity and magnitude over the decades. Large wildfires now threaten millions of both public and private acres, particularly where vegetation patterns have been altered by development, land-use practices, and aggressive fire suppression. Potentially serious ecological deterioration is possible where fuel loads have become extremely high. In these areas, public and private values are at risk. To reduce the threat of these catastrophic fires, federal wildland fire policy was revised in 1995 and engages a proactive approach to managing fire.

Because wildland fire respects no boundaries, uniform policies and programs are essential, as well as strengthening cooperators' relationships. The Departments of the Interior and Agriculture, together with tribal and state governments and other jurisdictions, are responsible for the protection and management of natural resources on public lands. And, as firefighting resources become increasingly scarce, it is more important than ever to strengthen cooperative relationships.

The Federal Wildland Fire Management Policy and Program Review was chartered in 1994 by the Secretaries of the Interior and Agriculture to ensure that federal policies are uniform and programs are cooperative and cohesive. The review was conducted by the Forest Service, the Bureau of Land Management, the National Park Service, the U.S. Fish & Wildlife Service, and the Bureau of Indian Affairs. The National Biological Service, Environmental Protection Agency, National Weather Service, and FEMA also were involved.

The resulting report presents fundamental principles of fire management and recommends a set of federal wildland fire policies. Though the different missions of the agencies sometimes result in differences in operations, a cohesive set of federal fire policies improves the effectiveness and efficiency of fire management - and our ability to meet modern challenges posed by seasonal wildland fire conditions. Some of the key points in the policy include:

- Protection of human life is the first priority in wildland fire management. Once firefighters are committed to an incident, they are the number one priority. Property and resource values are the second priority, with management decisions based on values to be protected.

Wildland/Urban Interface

- Wildland fire, as a critical natural process, must be reintroduced into the ecosystem. Fire will be allowed to function as nearly as possible in its natural role to achieve the long-term goals of ecosystem health. Where wildland fire cannot be safely reintroduced because of hazardous fuel buildups, some form of pretreatment must be considered, particularly in wildland/urban interface areas.

- Wildland fire management decisions and resource management decisions go hand in hand and are based on approved Fire Management and land and resource management plans. Fire managers also have the ability to choose from the full spectrum of fire management options, from prompt suppression to allowing fire to function in its natural ecological role.

- The role of federal agencies in the wildland/urban interface includes wildland firefighting, hazard fuels reduction, cooperative prevention and education, and technical assistance. Primary responsibility rests at the state and local levels. Structural fire protection in the wildland/urban interface is the responsibility of tribal, state, and local governments.

- The Western Governors' Association will serve as a catalyst to involve state and local agencies and private stakeholders in achieving a cooperative approach to fire prevention and protection in the wildland/urban interface. Federal agencies must place more emphasis on educating internal and external audiences about how and why we use and manage wildland fire.

Our success depends upon four things: Every agency administrator must ensure that these policies are incorporated into all actions. Fire professionals must work with agency administrators to make the policies work on the ground. Managers and staffs must actively implement the recommendations and work with their constituents to ensure success. Every employee of every agency must also be committed to follow through on the ground.

Finally, agencies and the public must change their expectation that all wildfires can be controlled or suppressed. No organization, technology, or equipment can provide absolute protection when unusual fuel buildups, extreme weather conditions, multiple ignitions, and extreme fire behavior periodically come together to form catastrophic events.

Taken from the USDA Forest Service Home Page.

Wildland/Urban Interface

FireSafe SPOKANE

Prior to 1987, everybody in the Spokane (WA) fire community was “fat, dumb, and happy.” Few people had even considered the possibility that this large, rapidly growing metropolitan area of 360,000 in the piney woods of eastern Washington might have a wildland/urban interface fire problem.

Then came the Hangman’s Valley Fire! This fast-moving, wind-driven wildfire moved through a fuel bed of mostly Ponderosa Pine and annual grass (FBA Fuel Model 2) toward an upscale suburban subdivision that previous pre-fire plans had rated as not threatened, due to its protective ring of wide, green golf course fairways. Unfortunately, long-range spotting conditions laid down a barrage of firebrands on untreated wood shake roofs up to a mile ahead of the fire, and many beautiful homes were lost in one exciting afternoon.

Following this eye-opener, a group of players including area fire chiefs and other interested fire safety advocates began developing a package of proposed legislation that would establish the first statewide FireSafe regulations. This ambitious package included clearance requirements, minimum road standards, street sign and address standards, power line clearances, rated fire resistant roofing standards, and other built-in fire protection features already adopted by several other states or pulled from model fire codes. This first draft package was soundly rejected by the legislature, which clearly indicated it would not consider such sweeping reforms without strong representation on the committee from developers and builders.

Thus, a new larger committee was formed with significant representation from the planning, development, and building constituencies and began reconsidering the complexities of such comprehensive FireSafe regulations. In the meantime, time marched on.

In mid-October, 1991, the Spokane area experienced a wind event that started more than 104 wildland fires in one day. Conditions were already drier than normal, and sustained 60+ m.p.h. winds toppled trees into power lines, starting multiple vegetation fires all around the area. Downed trees and blowing dust and smoke made it difficult for various fire authorities to reach, size-up, and contain many of these wildfires. On the first day, at least 20 fires in the Spokane area reached “project fire” size, and homes were threatened simultaneously on several fronts. Area fire forces were strained beyond their limits, local authorities were slow to realize the scope of the “big picture”, and mutual aid

forces were slow to arrive due to travel problems created by the windstorm. By the time it was over, "Fire Storm '91 had burned more than 35,000 acres and destroyed 114 homes (see also *Fire Storm '91 Case Study* by the NFPA).

Following this disaster, several significant actions have been taken to improve the overall level of wildfire protection in the Spokane area:

- Spokane County Commissioners adopted the package of now more "user-friendly" FireSafe regulations the committee had long been working on.
- Area fire agencies consolidated their multiple dispatch centers into four regional interagency dispatch offices with linked communications.
- The radio communications system was reorganized to provide common command and tactical nets, as well as common frequencies for mutual aid forces.
- The state Fire Mobilization Plan was overhauled and mutual aid coordination improved.
- Interagency ICS wildland fire training classes were conducted.
- Interagency Incident Management teams were organized, including an Area Command Authority (ACA) support team to prioritize multiple incidents and allocate scarce resources.
- FireSafe SPOKANE was born.

Most of the wildfires in Fire Storm '91 were caused when the extremely high winds blew down power lines, or toppled trees across them. The electric utility companies were besieged by lawsuits brought by the many insurance companies who had covered lost homes. Eventually, some twenty fire lawsuits were combined into one class-action lawsuit that was finally settled out-of-court. The settlement provided $300,000 to develop a method to improve defensible space around vulnerable homes in the Spokane area.

To oversee this new effort, a non-profit corporation was formed with a five-member board of directors representing the electric utilities, the fire community, and the Washington Department of Natural Resources (WADNR), the statewide wildland fire authority. This board established the following mission statement for what has come to be FireSafe SPOKANE:

> ***To educate, facilitate, and coordinate local community efforts to improve defensible space around homes in the wildland/urban interface to the extent that both fire damages and suppression costs are reduced.***

FireSafe SPOKANE has recently hired its first permanent (part-time) executive director, who has completed a fire problem assessment and developed an action plan. Projects completed and being undertaken by this group include:

- Creating several demonstration FireSafe houses in cooperation with homeowners on a cost-share basis.
- Developing and distributing a *10 FireSafe Steps* educational brochure.
- Providing free voluntary home fire safe inspections upon request.
- Sponsoring a spring cleanup week with subsidized chipping, hauling, and dumping fees so that homeowners can more economically reduce their dooryard fuel beds.
- Working with homeowner/neighborhood associations to initiate and sustain fire safe awareness and FireSafe activities in critical areas.
- Developing a FireSafe film short to be shown in local theaters and in conjunction with the FireSafe-sponsored showing of “Feel the Heat” at the Imax Theater in Spokane.
- Working with WADNR to develop Fire Information Strike Teams (FIST) to emphasize the wildland/urban interface fire prevention message to the media during the “teachable moment” of coverage of a major fire.

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- Seeking additional funding from grants and/or corporate sponsorships to continue the program beyond its current three-year funding window.

While FireSafe SPOKANE has made some progress and has a plan in place to further their mission, the going hasn't been easy. Board members have come to realize that public apathy is rampant, cooperation isn't always easy to achieve, and funds are hard to come by. A significant "speed bump" may be a recent court case where a homeowner's association won a lawsuit against a homeowner who converted his wood shake roof to fire-resistant material in violation of the subdivision CC&Rs. Nevertheless, they remain committed to their mission statement and goals and are working hard to help protect the Spokane area from wildland fire.

For more information, contact: Ross Hesseltine, Executive Director, FireSafe SPOKANE, 11418 N. Dakota, Spokane, WA 99208. (509) 464-1086 www.firesafespokane.com

Wildland/Urban Interface

FIREFREE! BEND

Opportunity knocked twice in Bend, Oregon! Fortunately, sharp people at the Bend Fire Department were there to answer the door.

The first opportunity came in 1998, when representatives of SAFECO Corporation, a Seattle-based Fortune 500 insurance company, offered to donate some money to purchase a new piece of fire equipment to protect their investment in this wildland/urban interface community in central Oregon's high desert. Bend Fire Marshal Gary Marshall argued that instead of another piece of equipment, what the fire community really needed was funding to develop a public education program to create and maintain defensible space around homes in the piney woods.

Marshal Marshall (I couldn't resist that one) is a strong believer in individual responsibility; the opposite of the theory that government exists to do everything for everyone. He wanted to put the responsibility to protect homes from wildfire back on the homeowners and develop a major public education effort to get people to change their attitudes and behaviors about wildfire. His presentation impressed the SAFECO people and they agreed to provide initial funding of $75,000. A steering committee of interested people from the fire and business communities was formed to establish goals and objectives, and develop a strategy for the campaign.

The steering committee recognized that a professional product would probably produce better results than a homemade one, and put out requests for proposals from professional marketing firms interested in developing the educational program. They selected the RalstonGroup, a nationally known marketing firm that just happened to have relocated to Bend to escape the rat race of the big city. RalstonGroup then developed an extremely effective and professional multi-media campaign using the FireFree! logo and a "get in the zone" (i.e. defensible space) motto.

The objectives of the FireFree! program are to mitigate the loss of life and property caused by wildfires through public education; develop a program to foster and promote public education for wildfire safety; to change attitudes and behaviors toward wildfire safety and survival; and to establish a review and measurement

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process to assess the effectiveness of the program, and assist the insurance community and fire service in evaluating high fire hazard interface areas.

The program consists of brochures, multi-media advertising, speakers bureau, team leader training, and other materials focused on educating people of the need to create a minimum 30-foot defensible space around their homes. A professional quality video, starring a variety of local characters, captures people's interest and gets them thinking about the FireFree! message. The video was made available at local fire stations, video rental stores, and libraries.

This educational program culminates each spring in two FireFree! clean-up weekends where residents can recycle their yard trimmings at no charge at the local landfill. In its' first year, the project generated 9,102 cubic yards of combustible yard debris, most of which had to be cut, chipped, and hauled off the streets by employees and equipment from cooperating government agencies (ODF, BLM, FS, Deschutes County, etc.).

The first year results were so impressive that SAFECO increased funding to a total of $200,000 in addition to the time, materials, and equipment donated by dozens of corporate sponsors. Media outlets contributed matching funds to expand the advertising effort. Homeowner associations created task forces to perform work and raise funds to chip and/or haul their own debris. By the third year of the program, the clean-up weekends generated 10,860 cubic yards of material from 3,949 participating homeowners. The program has become self-sustaining to the point that the cooperating government agencies have been able to reduce their participation significantly, with the majority of the costs transferred back to the homeowners.

The FireFree! program has been a resounding success in Bend and is expanding. The Oregon State Fire Marshal has adopted the program statewide, and the City of Eugene has adopted the program.

PROJECT IMPACT

Opportunity knocked a second time when Fire Captain Peter Ribble of the Bend (OR) Fire Department was exploring the FEMA website looking for new ideas on fire safety programs and found FEMA's Project Impact grant program.

Project Impact is a federally funded grant program that provides funds to one community in each state each year to better prepare it to survive a large-scale disaster. This disaster resistant communities approach is most often focused on floods, earthquakes, tornadoes, hurricanes, etc. But Captain Pribble decided that the biggest threat to his community was a major wildfire. He completed and submitted a grant application that was approved.

Thus was born the Deschutes County Project Impact wildland/urban interface fire safety effort. FEMA provided initial funding of $300,000, with Deschutes County providing $100,000 in matching local funds. A 16-person steering committee was formed to oversee the project, and Captain Ribble was hired as the project coordinator.

The objectives of Project Impact in Deschutes County are to improve the efficiency of fire protection and the safety of residents in the wildland/urban interface by:

1. Supporting the FireFree! project and expanding it to countywide;
2. Developing additional means of ingress/egress (new roads) in targeted high-risk subdivisions;
3. Completing the rural addressing project by providing standardized reflective address signs to all residents; and
4. Completing the geo-coding of all addresses in the county to improve the accuracy of the GIS database used by planning and emergency services agencies.

By utilizing the business continuity approach to disaster planning, Project Impact has been able to attract several corporate sponsors. The project has built from an already well-established base of good cooperative relations among the fire agencies, and is working cooperatively with both FireFree! and Keep Oregon Green to spread the fire safety message in Deschutes County.

Other activities that may be included are expansion of an outdoor environmental classroom in Redmond, and a living forest classroom at the High Desert Museum in Bend.For more information, contact:Deschutes County Project Impact,63333 Highway 20 West,Bend, OR 97701 (541) 312-6008 E-Mail: peterr@Deschutes.org

Wildland/Urban Interface

GUAM

Of the U.S Pacific trust territories, only Guam replied to our wildland/urban interface fire problem questionnaire, and "Yes, Virginia, there is a" problem. We felt that Guam is so different, that it deserved its own section in this report.

Located some 3,700 miles west of Hawaii, Guam is on the other side of the International Date Line, and thus "where America's day begins." The island's 210 square miles consist of a northern limestone plateau rising to a southern chain of volcanic mountains which feature steep coastal cliffs to the east, but more gently sloping terrain to the west. The general elevation averages about 500 feet above sea level (and there is plenty of sea to go around, thank you), with the highest point being 1,334-foot Mt. LamLam.

Since the annual rainfall ranges from 90-100", and the temperatures run from 70 to 90 degrees, you would expect the vegetation to be tropical and lush, which it is, mostly. There is a distinct dry season from November – June, and some drier areas are covered in what most of us would think of as brushfields and grasslands. When periods of drought occur, there is plenty of fuel loading (30-40 tons per acre), and wildfire can become a serious problem. Much of the island is set aside in conservation reserves (i.e. natural wildland areas).

Guam is a self-governing organized unincorporated U.S. territory actively seeking commonwealth status, but politics being what they are, such legislation has languished in the Congress. In 1994, however some 3,200 acres of land were transferred to private ownership, thus creating the opportunity for "uncontrolled development". Currently some ten major villages have housing developments encroaching into the wildland, resulting in a moderate, but increasing wildland/urban interface fire problem. The Chamorro Land Trust Act gave each native islander a housing lot, some of which are in the wildland areas, and other affordable housing measures are resulting in a (by small island standards) building boom. The Forestry and Soil Resources Division's fire program is funded half by the government of Guam and half from State Fire Assistance funds administered by the Forest Service.

The Forestry and Soil Resources Division is authorized to fight wildland fires, providing both direct suppression and operational support to local fire agencies. FSRD also provides command and control, as well as coordination of the island mutual aid system, with resources available from the Guam Fire Department and the military (including water-dropping helicopters from the Navy). Like nearly everybody else in the West, they would like to improve coordination, communications, planning and training to achieve a more effective system. FSRD is actively involved in training of local forces that would respond to a wildland/urban interface fire problem, providing all facets of a comprehensive training program.

Guam has no codes or regulations aimed specifically at the wildland/urban interface fire problem, but does administer the 1994 edition of the Uniform Fire Code. They have mapped the interface areas, using ArcView software, and have contracted with the Bureau of Planning to provide the fuels, infrastructure, and housing layers of the puzzle.

Like many of the other western states, Guam indicated they would like to have funding for all of the initiatives listed in the questionnaire, except tax incentives to homeowners.

They have an active prescribed fire program, on state lands only, burning primarily for fire hazard reduction. They have a system of fuelbreaks established in the conservation areas. They are also using prescribed fire to attempt to convert the flashy grassland fuels to less flammable tree stands.

The El Nino climate phenomenon, which changes our "normal" fire weather all over the West, visits a drought upon Guam, which in 1998 resulted in the Toto-Tiyan complex of wildfires, which netted a $600,000 FEMA reimbursement. That year Guam had 1,950 wildland fires that burned 13,315 acres and lost one home (not bad for a tropical climate!). The occasional typhoon can also add significantly to the fuel loading problem.

Long term solutions favored by Guam included mapping/preplanning, hazard reduction, fuelbreaks/firebreaks, and a public education campaign to teach the concept of fire safe homes to residents. The FSRD has no evacuation policy, and evacuation authority lies with the state police and state emergency services authorities. They don't support the Australian no-evacuation policy, but do support homeowners purchasing fire tools and equipment.

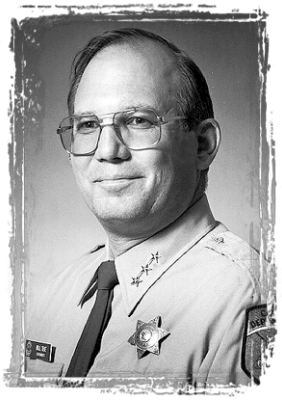
So far, probably because of a distinct shortage of national forests, the Federal Fire Policy has not had any impact on Guam, and they are not making any changes in their fire protection system to compensate for federal program changes.

If Congress were to make funding available, Guam FSRD would like to invest it in demonstration projects, hazard reduction, fuelbreaks, mapping/preplanning, public education, and in support of local initiatives. They believe that there would be opportunities to forge partnerships with the Department of Housing and Development, the local emergency services agency, and housing developers to better mitigate the wildland/urban interface fire problem. They have received a grant from FEMA's Hazard Mitigation Grant Program (HMGP) to initiate a fuelbreak/firebreak project to compartmentalize their wildland/urban interface fire problem target hazard areas.

About the Consultants

William C. Teie retired from the California Department of Forestry and Fire Protection (CDF) after a successful 34-year career. He worked up through the ranks from seasonal firefighter to Deputy Director for Fire Protection. In this position, he was responsible for all of the fire protection programs within CDF.

Chief Teie was very active in the California fire service. He was on several statewide boards and committees and was elected President of the California Fire Chiefs Association in 1986.



Chief Teie is also very active as a fire protection consultant. He is working with Rockwell International on the application of space and military technology to emergency management and operational support. In August 1996, Chief Teie was involved in the review of the 37,000-acre Miller's Reach Fire in Alaska for the Division of Forestry. He acted as a consultant for the State of Washington after their fire siege during the 1994-fire season and conducted an operational review for the Montana Department of State Lands. He was the fire protection expert used by OSHA in their report on the South Canyon fire tragedy in Colorado in July 1994.

He is the author of the ***Wildland Firefighting Fundamentals, Firefighter's Handbook on Wildland Firefighting,*** and ***Fire Officer's Handbook on Wildland Firefighting*** and has developed several other training and operational aids for the firefighter.

Brian F. Weatherford retired from CDF after a 35-year career that included fighting fires from Alaska to Mexico and from Montana to California. He rose through the ranks from firefighter to fire chief and at the time of his retirement commanded an organization including three county fire departments and two city fire departments with 62 fire stations, 88 engine companies and nearly 900 paid and volunteer firefighters.

He currently provides consulting services to local government agencies in the areas of fire protection planning, budget development, organizational theory, and management audits for specialized services, but only to the extent that these projects do not interfere with his primary avocation of fishing.

Wildland/Urban Interface

Report to the Governor

Colorado's Wildland Urban Interface

May 2001

Colorado State Forest Service

Colorado State University
Fort Collins, Colorado 80523-5060
(970) 491-6303
FAX: (970) 491-7736

May 25, 2001

The Honorable Bill Owens
Room 136, State Capitol
Denver, CO 80203

Dear Governor Owens:

On behalf of the *Interagency Wildland Urban Interface Working Group*, I would like to present our report on improving Colorado's response to wildland fire. This document, and the accompanying recommendations, represents the expertise and leadership of city, county, state, and federal firefighting agencies.

Wildland Urban Interface issues are complex and require a willingness to seek and implement collaborative solutions. The Working Group accepted this challenge and worked diligently over the past six months to examine many aspects of Colorado's approach to wildland fire preparedness, suppression, and mitigation.

The solutions outlined in the accompanying report will require increased state leadership and investment, but I believe we will be rewarded with better overall protection for Colorado's residents and natural resources.

The collaboration represented by this Working Group and their recommendations will help make Colorado a safer place.

Sincerely,

James E. Hubbard
Working Group Chair and State Forester

Working Group

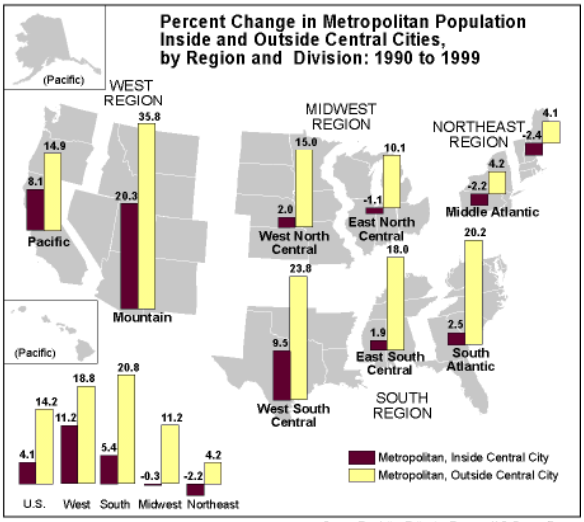
Jim Hubbard, Director, Colorado State Forest Service, Chairman • Greg Walcher, Director, Department of Natural Resources • Al Dyer, Dean, College of Natural Resources, Colorado State University • Tom Grier, Director, Office of Emergency Management • Suzanne Mercer, Director, Department of Public Safety • Ann Morgan, State Director, USDOI Bureau of Land Management • Rick Cables, Regional Forester, USDA Forest Service • T.Wright Dickinson, Moffat County Commissioner • Tom Stone, Eagle County Commissioner • Rick Sheehan, Jefferson County Commissioner • Fred Wegener, Park County Sheriff • Larry Donner, Boulder Fire Chief

Special thanks to: Carol Small, Jefferson County • Eric Bergman, Colorado Counties, Inc.• Bill Wallis, Bureau of Land Management • Paul Cooke, Division of Fire Safety • Colorado Insurance Industry • Paige Lewis, Colorado State Forest Service • Rich Homann, Colorado State Forest Service

Executive Summary

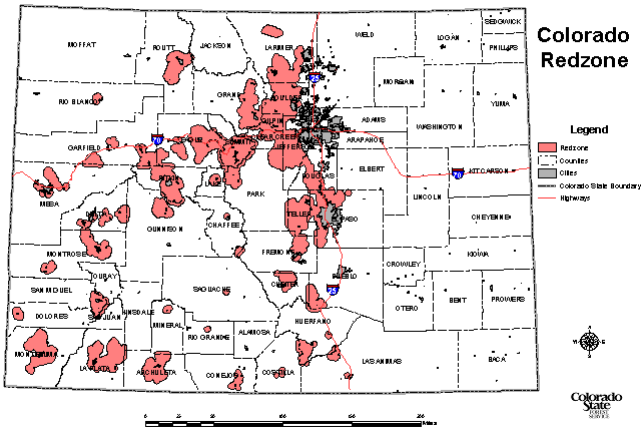
The risk of wildfire in Colorado's wildland-urban interface poses a daunting challenge to public safety, fiscal responsibility and natural resource integrity in the state. The 2000 fire season brought this challenge to the forefront of public attention when four wildland urban interface fires along Colorado's Front Range destroyed 74 structures and threatened thousands more, interrupted utility service, and impacted water and air quality. The cost to state coffers for suppressing these fires was a staggering $10.1 million, contributing to the most expensive wildfire season to date.

While these numbers are dramatic, they are not surprising. A century of aggressive fire suppression, combined with cycles of drought and changing land management practices, has left many of Colorado's forests unnaturally dense and ready to burn.



Source: Population Estimates Program, U.S. Census Bureau

At the same time, the state's record-setting growth has driven nearly a million people into the forested foothills of the Front Range and along the West Slope and central mountains – the same landscapes that are at highest risk for large-scale fire. This movement of urban and suburban residents into the wildland-urban interface (WUI) significantly increases the values-at-risk from wildland fire – the most critical of these being human life.



The cost of suppressing unnaturally large and destructive fires in the complicated environment of the WUI has pressed state and local resources beyond their capacity and has revealed complexities that are not adequately addressed by the existing system of interagency wildfire response.

Governor Bill Owens, recognizing the urgent need to more effectively address the WUI situation in Colorado, appointed a diverse working group of local, state, and

federal leaders to explore the current situation, identify opportunities for improvement, and make recommendations for change.

Over a six-month period, the Governor's Interagency Wildland Urban Interface Working Group identified several areas of concern:

- Wildfire suppression in the interface stretches the capability of response personnel in terms of safety, training, and equipment and challenges the ability of local and state governments to cover related costs. Interface protection also demands a higher level of interagency communication and coordination than currently exists.
- Mitigation of hazardous fuels in the interface is not occurring on a landscape scale, across ownerships. The implementation of planned mitigation projects is complicated by costs to private landowners, availability of a trained work force, compliance with federal requirements, and the lack of options for utilizing removed materials.
- Efforts to combat wildfire risk are complicated by a lack of awareness and/or support from local communities and the urban public.

Out of the working group's deliberations came the recognition that, in the wildland-urban interface, failure to prepare, communicate, and respond in an interagency manner could result in devastating consequences.

The time is ripe for the State of Colorado to step forward and provide the kind of leadership and coordination needed to ensure the best possible wildfire protection for its citizens.

Recommendations

The Governor's working group identified a total of 15 recommendations within the categories of preparedness and suppression, hazard mitigation, and public awareness. Those recommendations are summarized as follows:

1. **Strengthen Local Capacity in Wildland Fire Preparedness, Suppression, and Mitigation.**

   - Provide state-supported technical and cost-sharing assistance to counties for the development and implementation of expanded county Fire Management Plans.

   - Institute a consistent annual appropriation to provide for wildland-urban interface management needs and for a fuels mitigation cost-sharing program.

   - Develop a statewide wildland-urban interface training program for local fire service personnel.

- Establish a mechanism for the state to contribute to the Emergency Fire Fund (EFF).

2. **Enhance State Leadership and Coordination in Interagency Wildland Fire Response.**

   - Coordinate and fund the development and implementation of a statewide, county-by-county wildfire risk assessment.

   - Provide statutory clarification of wildland fire roles and responsibilities held by county sheriffs, fire protection districts, and related local response personnel.

   - Clarify in the *Colorado Interagency Cooperative Fire Protection Agreement* (Master Agreement) interagency roles and responsibilities for fire protection in the wildland urban interface.

   - Provide state-level support for expanded state participation in zone dispatch centers and in the extended attack phase of wildfire suppression.

   - Investigate and identify statewide protocols for radio communication across local, state, and federal jurisdictions.

   - Coordinate interagency implementation and allocation of funds related to the National Fire Plan, the Ten Year Comprehensive Strategy, and similar efforts.

3. **Improve Statewide Public Awareness Regarding the Role of Fire in Colorado Landscapes and Tools for Wildland Fire Prevention.**

   - Provide state leadership in developing and delivering coordinated interagency wildland fire messages to homeowners, landowners, land management agencies, the general public, and others.

   - Encourage the development of a professional outreach and information campaign to targeted audiences within the state.

Governor's Wildland-Urban Interface Working Group
Report

Background

The risk of wildfire in Colorado's wildland-urban interface (WUI) poses a daunting challenge to both public safety and fiscal responsibility in the state. The 2000 fire season brought this challenge to the forefront of public attention when four wildland urban interface fires along Colorado's Front Range destroyed 74 structures and threatened thousands more, interrupted utility service, and impacted water and air quality. The cost to state coffers for suppressing these fires was a staggering $10.1 million, contributing to the most expensive wildfire season to date.

The magnitude and urgency of Colorado's WUI problem is influenced by a number of factors. First, among these, is the state's record-setting growth, particularly in the foothills of the Front Range and along the Western Slope and I-70 corridor. The 2000 Census revealed that Colorado gained nearly 1 million people over the past decade, making the state third in the nation in terms of percentage gained. Of this growth, nearly 80 percent occurred in the ten counties along the Front Range, with the central mountain counties of Park, Eagle and Summit close behind.

The Colorado State Forest Service (CSFS) estimates that approximately 1/4th of the state's current population resides within the Red Zone, an area characterized by over 6 million acres of forest land at high risk for large-scale wildland fire. The majority of these residents moved to the mountains from urban and suburban neighborhoods, bringing with them little knowledge of fire's natural role in Colorado's ecosystems or of what they might do to protect themselves and their property.

Low-elevation ponderosa pine, Douglas fir and piZon-juniper woodlands provide the scenic backdrop to much of the state's interface expansion. Unfortunately, these landscapes are also at the highest risk of suffering a catastrophic wildfire. A century of aggressive fire suppression, combined with cycles of drought and changing land management practices, has left many of Colorado's forests unnaturally dense and susceptible to damage from insects, disease, and fire. Thick ladder fuels characterize many of these landscapes, providing an easy route for fire to climb from the forest floor to the trees' crowns.

Fires in the WUI are particularly dangerous to firefighters because of the complexity involved in suppressing wildfire around homes and communities. Local fire departments, both volunteer and paid, provide initial attack on most of the state's interface fires. These first responders arrive with an inconsistent range of training and equipment and are often unprepared for the combination of wildland and structural firefighting skills required in the interface. Firefighters are further challenged by subdivisions with inadequate access, lack of available water supply, and structures built with highly combustible materials.

Landowners and managers have several tools available to them to begin mitigating the wildfire risk on their property. The most common of these tools are thinning of dense trees and shrubs and the use of controlled, low-intensity fire, known as prescribed burning. Mitigation and risk reduction efforts achieve maximum effectiveness if they are carried out on a large-scale across ownership boundaries.

This kind of action involves bringing together many individuals and agencies, providing them with guidance and incentives to act, and facilitating a governing environment conducive to change. Such action is particularly complicated in western states like Colorado which are characterized by a checkerboard pattern of federal and non-federal land ownership.

Working Group / State's Role

Governor Bill Owens recognized the urgent need for Colorado to respond to the WUI in a manner that would improve the safety of firefighters and residents, enhance protection of valuable natural resources, and ensure responsible allocation of taxpayer funds.

In August of 2000, Gov. Owens issued an Executive Order charging a twelve member working group, consisting of local, state, and federal representatives, with the following mission:

- Assess and make recommendations on fire policies and funding priorities for implementation in the wildland urban interface;
- Assess and make recommendations on how to increase cooperation and coordination in the use of land management practices to mitigate fire danger in the interface;
- Enhance the involvement of diverse stakeholders, professionals, and decision-makers on fire policy matters;
- Focus on awareness programs, land use development policies, cooperation between landowners, local government and developers, and the sharing of knowledge and policies that increase public safety, reduce wildfire hazards, and achieve desired ecological goals in interface areas; and
- Identify barriers to mitigating wildland urban interface fire hazards and recommend solutions to overcome these barriers.

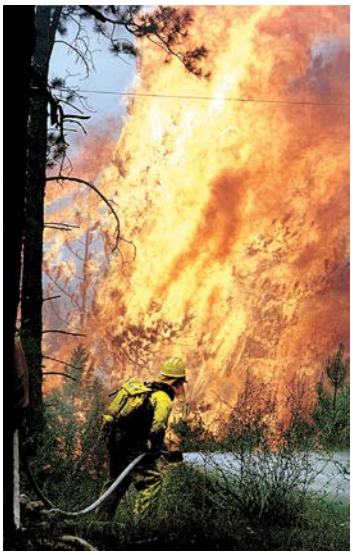
The Governor's Interagency Wildland-Urban Interface Working Group met from December 2000 through April 2001 to consider these and other issues central to interface protection in Colorado. The group identified several areas of concern in the state and developed recommendations, contained in this report, on those areas they felt would most benefit from the Governor's leadership.

Wildland Fire Preparedness and Suppression

A. Current Status

Response to wildland fire consists of two equally important components: *preparedness* and *suppression*. Preparedness involves activities such as interagency planning; formation of cooperative agreements; training of personnel; equipment maintenance and positioning; and extensive communication. It means knowing what values are at risk to wildfire and having the resources necessary to combat that risk at all levels.

Wildfire suppression is the mobilization of available resources in response to a wildland fire incident. The first phase of suppression, or initial attack, is generally provided by local fire departments, with back up from state or federal resources depending on where the incident occurs. If a wildfire escapes initial attack and continues burning over an extended period of time, personnel with specialized experience and training are called in to manage the fire. The effective transition of fire management from initial to extended attack is essential to both public and firefighter safety.



Although the concepts of preparedness and suppression appear straightforward, a number of complications can arise in the course of an incident. In Colorado, state statute gives county sheriffs the responsibility for managing wildland fire on non-federal land. The sheriff may transfer this duty to the State Forester if he or she feels an incident has exceeded local capacity.

Many communities have also formed fire protection districts (FPD) to respond to wildland fire within a smaller geographic area. Some of these communities believe the county sheriff only has jurisdiction over wildfires outside of FPDs. Most sheriffs disagree with this interpretation. Sorting out this local debate can be risky in the face of a fire.

Wildfire response in the state is coordinated through either local or interagency dispatch centers that track available personnel and resources and mobilize them to a site as needed. Complications arise when a fire in the interface requires people or resources

equipped for both structural and wildland fire protection. Most firefighters are prepared for one or the other scenario, but not both. In addition, when structural personnel are called out for an interface fire, crews from other jurisdictions must be brought in to provide backfill protection in their city or area of protection.

Some consensus on wildfire roles and responsibilities in the state is obtained through a chain of voluntary agreements. The state and federal agencies cooperate via a "master agreement" titled the *Colorado Interagency Cooperative Fire Protection Agreement*. The state also negotiates individual cooperative agreements with each county. Local fire departments may enter into mutual aid agreements, but there is no process in place to collect, track, or coordinate these local arrangements. Some counties and local departments also develop mobilization guides and/or Annual Operating Plans to supplement their fire response strategies. No counties currently have a comprehensive Fire Management Plan to bring all their wildfire-related activities and agreements together.

This series of cooperative agreements functions well until an on-the-ground incident reveals areas of conflict that were not adequately resolved during preseason negotiations. The federal responsibility for interface protection is one such issue, as is the authority of the county sheriff to represent fire protection districts in agreement negotiations.

Economic Impacts of Catastrophic Wildfire

Fire	Cost (estimates)	Acres
Davis Ranch	$111,900	125
Bobcat	$3,330,992	10,599
Hi Meadow	$5,298,067	10,800
Eldorado	$1,369,664	1,067

Another area with potential for conflict is the allocation of costs. Wildland-urban interface fires pose new challenges related to cost accountability and responsibility. They can become extraordinarily expensive because of the number and type of suppression resources required, and the values-at-risk. Suppression costs are generally shared by those responsible for the land on which the fire occurs. This distribution of financial responsibility is much less clear in the interface, where a variety of public and private values are threatened.

The incompatibility of radio equipment and frequencies used by individual fire response entities imposes further limitations on the ability of firefighters, incident managers, and agency leaders to communicate with each other.

Limited financial assistance is available for counties and local fire departments to help defray both suppression and preparedness costs. The CSFS, for example, administers a federal Volunteer Fire Assistance cost-sharing program that helps local firefighters obtain badly needed training and equipment. Requests for this assistance usually far exceed available dollars.

Counties provide for fire suppression costs that exceed local capacity through the Emergency Fire Fund (EFF). Participating counties pay an annual assessment to the fund, which covers the expenses of a member county once they have depleted their available suppression budget. The EFF is not adequate to cope with interface suppression costs and can be quickly depleted in a bad fire year. If the EFF is fully expended, additional costs are often covered by the State Emergency Disaster Fund or through an Executive Order.

Currently, no direct state assistance is available to strengthen local fire planning or preparedness efforts.

B. Recommendations

- **Improve Wildland Fire Response Capability at the Local Level**
  - Provide state-level technical and cost-sharing assistance to counties for the development and implementation of county Fire Management Plans.
  - Require all relevant entities within a county, including fire departments and fire protection districts, to sign an Annual Operating Plan (AOP).

- **Clarify Roles and Responsibilities Related to WUI Response**
  - Provide statutory clarification regarding the fire protection responsibilities delegated to county sheriffs versus those held by local fire protection districts.
  - Amend the statewide master agreement to include a clarification of interagency roles and responsibilities in the WUI.
  - Provide statutory clarification regarding the state's responsibility for reimbursing local suppression costs once the EFF is expended.

- **Enhance Statewide Tracking and Mobilization of Resources**
  - Expand state involvement in zone dispatch centers.
  - Clarify, in county Fire Management Plans, a process for backfilling of local firefighting personnel and resources that have been dispatched out of their jurisdiction.

Hazard Mitigation

A. Current Status

Fire needs oxygen, heat and fuel to spread across the landscape. The easiest of these factors to influence is the amount and distribution of vegetative

fuels. The primary tools used by land managers to reduce hazardous fuels in the interface are thinning and removal of dense trees and shrubs and the use of controlled, low-intensity fire, known as prescribed burning. The USDA Forest Service estimates that every dollar invested in prevention and mitigation activities can save up to $7 in future wildfire suppression costs.

Limited fuel mitigation projects have been implemented in Colorado by local, state, and federal land management agencies as well as private individuals. Boulder, Jefferson, Larimer, Summit, and Clear Creek Counties, for example, have wildfire mitigation programs that range from fuels reduction and prescribed burning on county-owned lands to assisting private landowners with similar actions on their own property. Some local governments have also adopted defensible space and emergency access requirements for new development in the interface.

The CSFS also works with local government, other state agencies, the federal government and private individuals to plan and implement risk reduction projects across jurisdictional boundaries.

Unfortunately, the majority of hazard mitigation projects in Colorado are contained within specific ownership or jurisdictional boundaries. The isolated nature of these projects means that wildfire risk is not reduced on a scale large enough to provide meaningful protection across a landscape. A homeowner's creation of defensible space will be less effective in the face of a raging fire if his or her neighbors have not taken complimentary action. Likewise, fuel reduction on non-federal land adjacent to a National Forest or Park will not provide the best level of protection if that reduction is not extended over the federal boundary.

The planning and implementation of cross-boundary projects requires the cooperation of a number of landowners. Several obstacles can frustrate these collaborative efforts, including:

- The lack of financial assistance to private landowners to help them participate in a large-scale project that will result in greater public than personal benefit;
- The time-consuming consultation and public-involvement processes required of federal land managers;

- The absence of local or community incentives to encourage defensible space and fire safe development; and

- The lack of a trained and available workforce to carry out fuel reduction on a large number of acres.

The effectiveness of hazard mitigation in Colorado is also limited by the lack of a consistent statewide assessment of wildfire risk. The state's Red Zone map identifies high-risk areas through a combination of data on population, number of structures, vegetative fuel type, and history of fire starts. While useful, this map is ultimately limited by the accuracy, extent and scale of the data on which it is based. Federal land management agencies have also assessed selected portions of their land, but these efforts are generally focused on wildfire risks outside the WUI zone. No system or protocol exists to consistently assess, map and develop a response to WUI fire risk across the state.

B. Recommendations

❑ Establish a Statewide Wildland Fire Risk Assessment

- Facilitate the development of consistent risk assessment data and mapping in each county.
- Provide technical assistance to counties in the application of risk assessment data.

❑ Increase County-Level Fire Mitigation Plans

- Assist counties in using risk assessments to prioritize areas for hazard mitigation.
- Encourage counties and local governments to develop and implement programs that promote defensible space and the use of fire-resistant building and landscaping materials.
- Provide state-funded cost-sharing assistance to private landowners within county prioritized areas for fuel reduction on their lands.
- Convene a state-level dialogue with insurance industry representatives regarding the role of insurance carriers in reducing risks associated with homes in the WUI.

- **Encourage Community Solutions to Workforce and Utilization Challenges**
  - Assist counties in identifying opportunities for local economic benefit through
    the use of local workers and the development of uses for vegetative material removed in hazard reduction projects.

Public Awareness

A. Current Status

The public's level of awareness regarding the causes and impacts of wildland fire can have a tremendous influence on the ultimate success of both suppression and mitigation efforts. If a local community understands and supports the need to reduce hazardous fuels, for example, projects are more likely to go forward in a timely and successful manner.

Support from local residents and government leaders can also facilitate increased individual and community action such as: creating defensible space around homes and structures; ensuring safe access for fire apparatus; establishing, training, and/or equipping of local fire departments; installing dry hydrants in subdivisions; or promoting the use of fire resistant building materials. All of these actions increase the chances that firefighters can safely control a wildland fire through initial attack and thereby limit damage to property and resources.

The need for public awareness extends beyond local communities to Colorado's urban area, for whom the wildland-urban interface is primarily a recreation zone. Actions taken to reduce wildfire risk on public lands, whether federal or non-federal, must have general concurrence and support from the public. It is also important for the public to understand that although mitigation efforts such as prescribed burning may have short-term impacts on visibility and air quality, they are designed to prevent the large-scale impacts that can result from a catastrophic wildland fire.

Many land management, fire protection, and/or disaster preparedness agencies in Colorado deliver some kind of fire awareness message. These education programs are not generally coordinated between agencies or levels of government, however, and have the potential to generate more confusion than understanding.

The Firewise program, which is aimed at interface homeowners and communities, is an example of a successful, standardized program that could be delivered consistently across the state. A similar kind of program or message is needed for city dwellers and recreational users of wildland and WUI areas.

B. Recommendations

- **Increase Consistent Use of Firewise Program Across Government Entities**
  - Provide state lead in coordinating the use of Firewise among Land management agencies and government entities at all levels.

- **Implement a Professional Marketing Effort to Targeted Audiences Regarding the Role of Fire in Colorado's Forests**
  - Provide state seed money and seek matching funds for projects through new and existing partners.

Next Steps

The time is ripe for the State of Colorado to step forward and provide the kind of leadership and coordination needed to ensure the best possible wildfire protection for its citizens. Through their deliberations, the Governor's Interagency Wildland Urban Interface Working Group determined that, with regard to the interface, failure to effectively prepare, communicate and respond to wildland fire in an interagency manner could result in devastating – and unacceptable -- consequences. The recommendations in this report are intended to help the state avoid such a result.

Due to the urgent nature of the interface situation, the Working Group advises that the Governor begin immediately to pursue implementation of this report. Many recommendations need further development and will require the active involvement of local, state, and federal agencies, as well as individual landowners and the public at large.

Fire in the WUI threatens lives, livelihoods, and valuable natural resources. The State of Colorado must act quickly and effectively to mitigate this threat.

Glossary

Annual Operating Plan: An annually updated document authorized by the appropriate officials for implementing the Interagency Cooperative Fire Protection Agreement in their respective areas of responsibilities.

Backfill (a.k.a. Move-up and Cover): Identifies a relocation of fire suppression resources from their established location to a temporary location to provide fire protection coverage for an initial attack response area.

Cooperator: Organized fire forces of other agencies, paid or volunteers, public or private, at the local, municipal, state, or federal level.

County: Employees, elected officials, and appointed officers of a county.

Emergency Fire Fund (EFF): A fund established and maintained through voluntary participation by counties, governed by a task force of county commissioners, sheriffs, and fire chiefs, administered and managed by the Colorado State Forest Service. EFF is funded by annual assessments to the participating counties. The fund provides financial assistance to participating counties at times when qualifying wildfires exceed the counties capacity.

Defensible Space: An area around homes or structures, either man-made or natural, where the vegetation is modified and maintained to slow the rate and intensity of an advancing wildland fire. Provides room for firefighters to work and helps protect the forest from becoming involved should a structure fire occur.

Dry Hydrant: A non-pressurized hydrant that provides a water source to firefighters. Requires equipment capable of drafting from the hydrant.

Fire Management: Activities and programs that include: the use of fire as a resource management tool, and protection of values from unwanted, uncontrolled wildfire.

Fire Management Plan: Statement, for a specific area, of fire policy, objective, and prescribed action; may include maps, charts, tables, and statistical data.

Fuels: combustible plant material, both living and dead, and combustible construction material that is capable of burning in a wildland situation.

ICS (Incident Command System): The common emergency incident management system used on any incident or event and tailored to fit the specific management needs of the incident/event. Includes "Colorado Incident Command System" at the local level.

Initial Attack Forces: Wildfire suppression resources of agencies initially dispatched to a fire in accordance with a pre-existing annual operating plan or mobilization guide.

Initial Attack Zone: An identified area in which predetermined resources would normally be the initial resource to respond to an incident.

Ladder Fuels: Fuels which provide vertical continuity between strata, thereby allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease.

Mitigation: Actions taken that lessen the risk to people, property, and resources from wildfire.

Mutual Aid: Assistance provided by a Supporting Agency at no cost to the Protecting Agency. Mutual aid is limited to those initial attack resources or move-up and cover assignments that have been determined to be appropriate and as each may be able to furnish and are documented in Annual Operating Plans. Sometimes called Reciprocal Fire Protection.

Preparedness: Activities before fire occurrence to ensure effective suppression action. Includes training, planning, procuring and maintaining equipment, development of fire defense improvements, and maintaining cooperative arrangements with other agencies.

Prescribed Fire: The planned and/or permitted use of fire to accomplish specific land management objectives.

Prevention: Activities directed at reducing the number of human-caused fires, including such items as public education, law enforcement, dissemination of information, engineering, and the reduction of hazards.

Protection Boundaries: Mutually agreed upon boundaries which identify areas of direct fire protection responsibility and are shown on maps in the annual operating plans.

Resources: All personnel, items of equipment and aircraft available for assignment of tasks.

Structure Protection: Protecting a structure from an advancing wildfire is usually through treatment or removal of fuels from around a structure but may include application of retardants, foams, cooling agents, wraps, etc. to the exterior of a structure. Specific direction for an incident comes from the agency administrator or line officer.

Suppression: All the work of confining and extinguishing a fire beginning with its discovery through the conclusion of the incident.

Thinning: A cultural treatment made to reduce stand density

Values-at-Risk: Includes property, structures, physical improvements, natural and cultural resources, community infrastructure, and economic, environmental, and social values.

Wildfire: Uncontrolled fire burning in forest, brush, prairie, or cropland fuels, or conflagrations involving such fuels and structures.

Wildland: Lands with few or no permanent improvements.

Wildland Fire: Any non-structural fire that occurs on wildland.

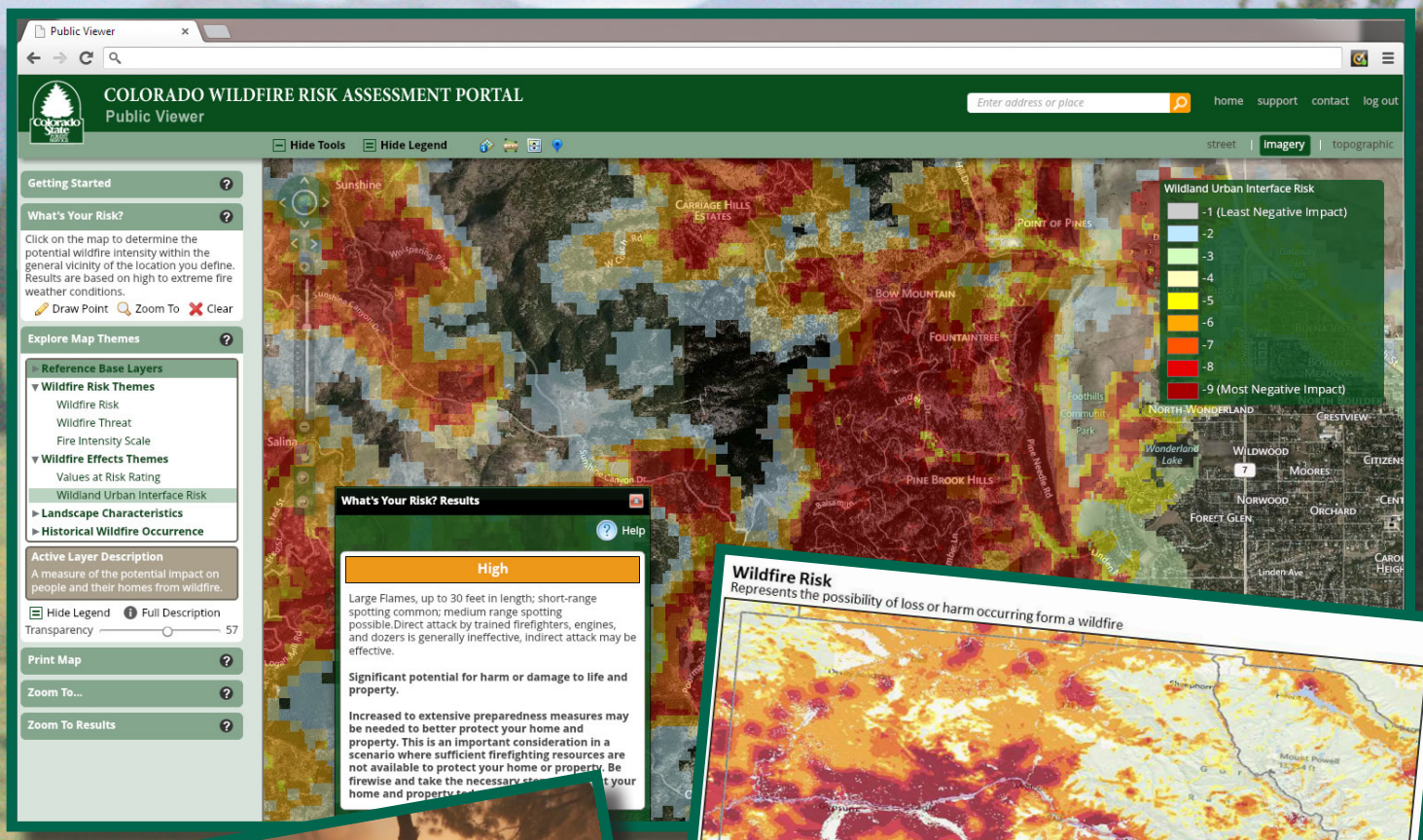
Wildland Urban Interface (WUI): Defined as the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

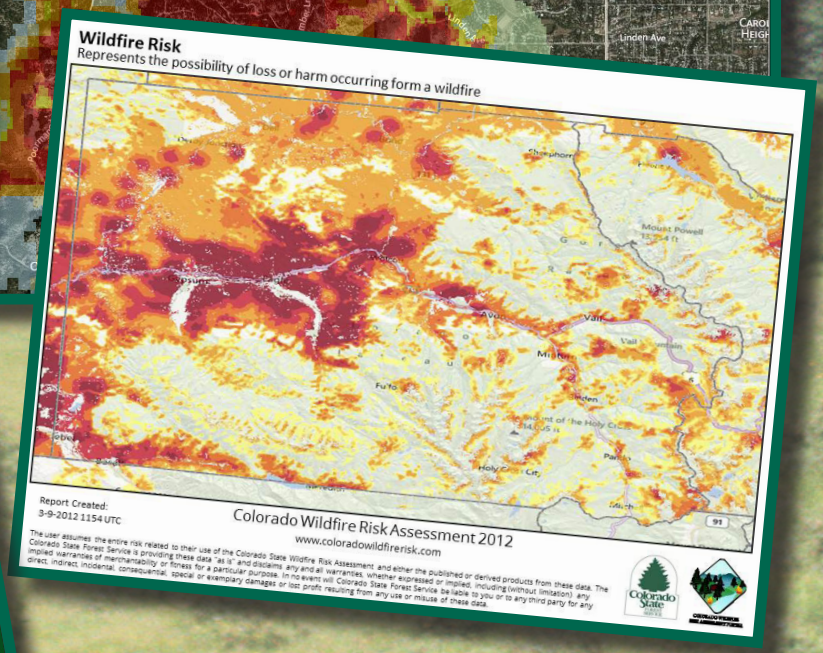
Colorado Wildfire Risk Assessment Portal (CO-WRAP)

COLORADO WILDFIRE RISK ASSESSMENT PORTAL

Colorado State FOREST SERVICE

CO-WRAP is a web-mapping tool that provides access to statewide wildfire risk assessment information. Through CO-WRAP, wildfire mitigation/prevention planners and interested citizens can generate maps and download data and reports that describe defined project areas or areas that may require additional planning.





The Portal

The Colorado Wildfire Risk Assessment Portal (CO-WRAP) provides a consistent set of scientific results for wildfire mitigation and prevention planning in Colorado.

It also:

- Creates public awareness about wildfire risk
- Provides state and local planners with information to support mitigation and prevention efforts
- Identifies areas that may require additional planning related to wildfire mitigation projects
- Assists in the development of Community Wildfire Protection Plans (CWPPs)
- Complements forest stewardship and forest management plans
- Informs decision-making at local and state levels

Public and Professional Viewers

CO-WRAP features two viewers, one for planning professionals and one for interested citizens.

The Public Viewer:

- Provides interested citizens a simple-to-use tool that allows them to explore wildfire risk
- Quickly generates maps and wildfire risk ratings for specific locations

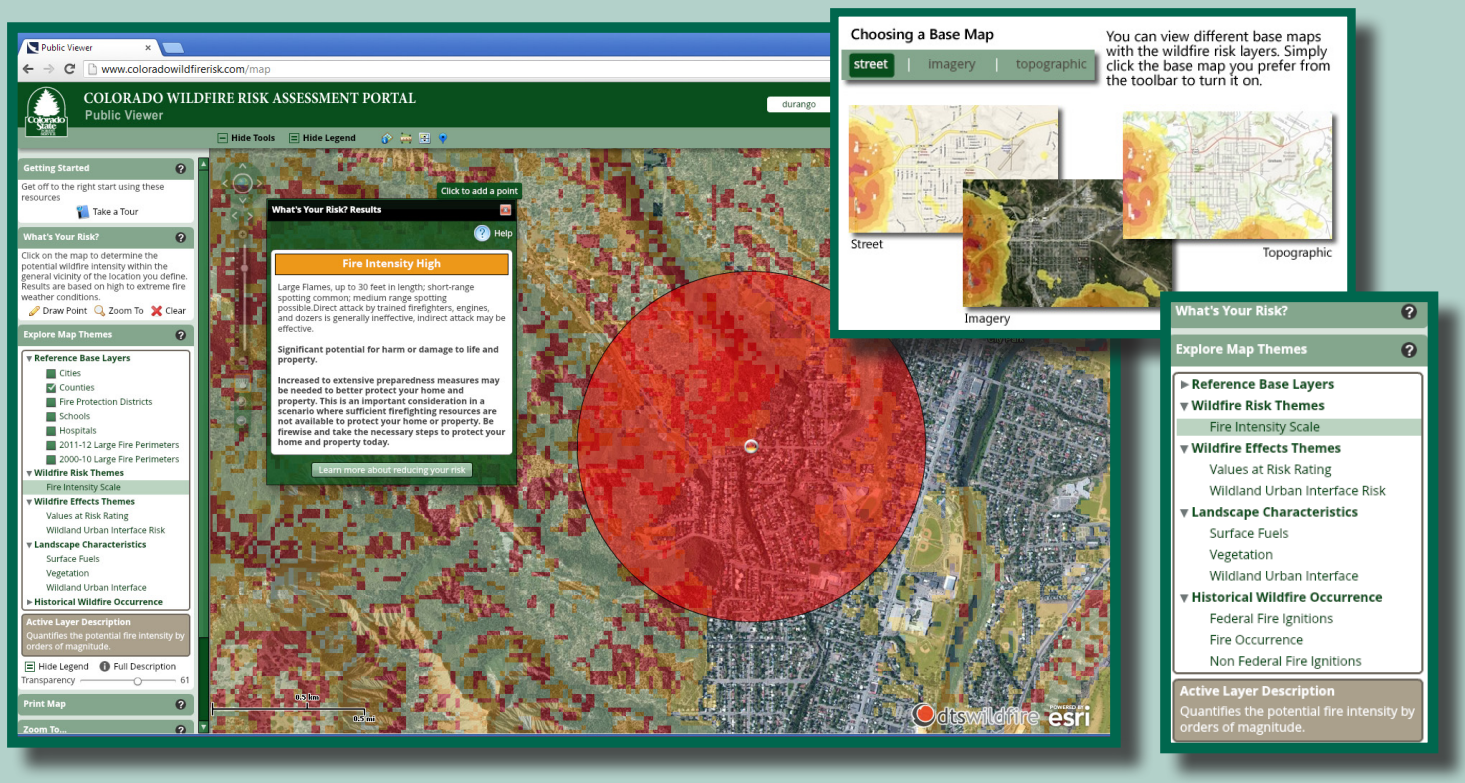
The Professional Viewer:

- Is tailored for use by professional planners and state, Fire Protection District and county staff
- Generates maps and detailed risk summary reports that include:
  - Risk statistics for defined project areas
  - Maps, charts, tables, photos and text that describe project areas

In addition, optional templates are available for:

- Community wildfire protection plans
- Forest stewardship plans

To access the CO-WRAP website, go to www.ColoradoWildfireRisk.com. For more information about wildfire mitigation education, go to the CSFS website at http://csfs.colostate.edu.



COLORADO STATE FOREST SERVICE
CO-WRAP: Q&A

MARCH 13, 2013

- **What is CO-WRAP, and what is its primary use?**
  CO-WRAP is an acronym for the Colorado Wildfire Risk Assessment Portal. The Colorado State Forest Service (CSFS) created CO-WRAP as an online mapping tool that will help decision makers, community leaders, professional planners and interested citizens determine wildfire risk and where forest management actions can achieve the greatest impact to reduce that risk.

- **Why was CO-WRAP created?**
  The CO-WRAP tool was created to inform the public, community leaders, decision makers and professional planners about wildfire risks so that they can take actions to reduce these risks.

- **Who is CO-WRAP intended for?**
  CO-WRAP is intended for two audiences: the general public and decision makers/professional planners, who may include land managers, county planners, community leaders, forestry contractors, fire mitigation professionals and county commissioners. The public viewer provides a simple-to-use tool that allows users to explore wildfire risk and generate maps for specific locations, while the professional viewer provides access to data, tools and detailed risk summary reports for use in wildfire protection and forest stewardship plans.

- **Where does the information in CO-WRAP come from? Does it use recent information?**
  CO-WRAP uses the best-available data. It utilizes historic and current datasets, applies scientific methods and modeling, and makes the data available in a format useful to decision makers and private citizens.

- **Is the information provided by CO-WRAP, including wildfire risk, applicable to my own individual homesite?**
  The data presented in CO-WRAP are of a broad spatial nature, with a level of detail based on 30-by-30-meter pixels. To put that in context, the smallest area that can be assigned a value using CO-WRAP is an area approximately the size of a quarter-acre lot. Due to this level of detail, CO-WRAP should be used only as the first step toward assessing the wildfire risk for a single property, and an expert should be contacted to assess the property itself. You can locate a forester at your local CSFS district office at www.csfs.colostate.edu.

- **Does CO-WRAP determine exactly where wildfire mitigation/forest management work needs to be completed to protect communities from wildfire?**
  CO-WRAP provides a starting point for exploring wildfire risks, but site planning based on CO-WRAP reports should involve interaction with local fire departments, forestry professionals and fuels mitigation specialists who may conduct field surveys and obtain more detailed data to support preparedness planning activities.

- **How often are the data in CO-WRAP updated?**
  CO-WRAP uses the best available datasets for each of its map layers. No data are updated automatically or more frequently than once per year. CO-WRAP is not an appropriate tool for determining real-time wildfire or ignition risks for a specific date or season.

- **Is there anything CO-WRAP should not be used for?**
  The data presented in CO-WRAP are of a broad spatial nature, with a level of detail based on 30-by-30-meter pixels. Thus CO-WRAP is not intended for homesite-level assessments without the additional input of an expert. Also, CO-WRAP should not be used for "real-time" wildfire risk assessments based on the specific day or time of year a user is logging in.

- **Does CO-WRAP work all over Colorado, or only in some parts of the state?**
  CO-WRAP is applicable throughout the entire state, in all vegetation types.

- **Do I need an account/password to use CO-WRAP?**
  No password or special access code is required to use the public viewer on CO-WRAP. To use the professional viewer, however, permission must be granted by the CSFS CO-WRAP administrator, per the instructions on the website.

- **What's the best first step in learning how to use CO-WRAP?**
  The CSFS strongly recommends all new users take a short tutorial when first accessing the web portal. This can be done by clicking "Getting Started" on the top of the left navigation bar, and then clicking "Take a Tour."

- **When I use the "What's Your Risk?" tool to click on the map, what does this mean?**
  This feature examines potential wildfire intensity for a selected point on the map. When determining this risk for a specific location, CO-WRAP takes into account not only conditions at the exact location being selected, but to some degree also includes the surrounding area up to a half-mile away from the chosen point. Thus a home in an urban subdivision may rank as high risk if bordering dense wildland forests, while a home in close proximity to heavy brush may display only a moderate risk if the larger surrounding area is mostly low-risk agricultural or urbanized land.

- **I'm accessing CO-WRAP using Internet Explorer and keep encountering problems. What do you recommend?**
  CO-WRAP works best when accessed using the web browsers Google Chrome and Mozilla Firefox. Try accessing the site through these browsers instead.

- **CO-WRAP indicates that my mountain community has a low wildfire risk. Does that mean I don't need to worry?**
  Every community in Colorado within or adjacent to any area with wildland fuels (i.e., forests, grasslands, shrublands) has some level of risk from wildfire. Although a community may have a low risk rating compared to higher-risk areas in the state, it does not mean wildfire risk should be ignored. You can contact a professional forester to better understand your local wildfire risk, and learn more about what you can do to reduce that risk.

- **When I click on the different map themes, how do I know what the colors mean?**
  Below "Explore Map Themes" on the left navigation bar, click the option to "Show Legend." A legend for the current map layer you are viewing will appear in the upper right corner of the screen.

- **Are there explanations for the different map themes in the public viewer? How do I know what "Values at Risk" and "Fire Intensity Scale" mean?**
  Under "Explore Map Themes" in the left navigation bar, a brief description of the active map layer appears in a brown box under "Active Layer Description."

- **How do I access CO-WRAP? And who can I talk to for more information about the wildfire risk on my own property?**
  To access the CO-WRAP website, go to www.ColoradoWildfireRisk.com. More information about protecting homes and communities from wildfire is available at Colorado State Forest Service district offices or the CSFS website: http://csfs.colostate.edu.

- **Where can I learn more about how to best use CO-WRAP?**
  Technical questions and professional viewer requests should be directed to CSFS_CO-WRAP@mail.colostate.edu.

4 - Lower North Fork Wildfire Commission Final Report

Report to the Colorado General Assembly

Lower North Fork Wildfire Commission

Prepared by

The Colorado Legislative Council
Research Publication No. 619
December 2012

Lower North Fork Wildfire Commission

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December 2012

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This report and additional resource materials are available on line at:

http://www.colorado.gov/lcs/LowerNorthForkWildfireCommission

Introduction

Background. On the afternoon of March 26, 2012, a catastrophic wildfire burned about 1,400 acres south of Conifer in rural Jefferson County, resulting in 3 fatalities, 27 residences destroyed or substantially damaged, and $11.3 million in private property damages. Based on a report issued by an independent review team convened by Governor John Hickenlooper and Colorado State University President Tony Frank, embers from a prescribed burn are believed to have ignited the wildfire, which was labeled the Lower North Fork wildfire. The prescribed burn was coordinated by state officials, and was initiated on land owned by the Denver Water Board on March 22, 2012. The board contracts with the state to conduct prescribed burns on many of its properties. The independent review team identified four factors contributing to the escape of the controlled burn and conversion to wildfire, with one factor, a rapidly escalating wind event including gusts to 55 miles per hour at ground level, acting as "...the catalyst that finally set the outcome into motion...". The state spent about $6.6 million on efforts to extinguish the wildfire.

Response to wildfire. In response to the Lower North Fork wildfire and its impacts, the Colorado state government took the following actions[1]:

- Governor John Hickenlooper signed an executive order (D 2012 005) on March 27, 2012, activating the Colorado National Guard to assist in fighting the wildfire in response to a request for assistance from the Jefferson County Sheriff's Office. The order also activated the state's emergency action plan, requiring state agencies to take action as requested by the Division of Emergency Management and Colorado State Forest Service;

- the Lieutenant Governor signed an executive order (D 2012 006) on March 28, 2012, immediately suspending prescribed or controlled fire activities by state agencies pending a review of agency protocols for such fires;

- the Governor signed an executive order (D 2012 007) on March 30, 2012, declaring the Lower North Fork Wildfire a state disaster emergency. The executive order continued state action initiated under Executive Order D 2012 005, authorized the expenditure of $3.5 million for fire suppression efforts related to the fire, and directed certain state agencies to seek federal funding for the disaster emergency;

- on April 16, 2012, following receipt of the report issued by the independent review team investigating the Lower North Fork Wildfire, the Governor and Colorado State University President Tony Frank convened a review team to conduct a thorough examination of the state's emergency response capabilities, and to make recommendations to improve the state's response to fires and protect people and property. The review team recommended that the prescribed fire and wildfire management portions of the Colorado State Forest Service within Colorado State University be moved into the Department of Public Safety's Division of Fire Safety, and that the Division of Emergency Management within the Department of Local Affairs be moved into the Department of Public Safety;

- the General Assembly adopted, and the Governor signed, House Bill 12-1283, creating

[1]All documents referenced in this section are available in Commissioners' binder materials online: http://1.usa.gov/TneTdk

a single point of authority for wildfires and consolidating the state's homeland security and emergency management functions in the Department of Public Safety;

- Executive Order D 2012 008, signed by the Governor on April 19, 2012, continued the disaster emergency, authorized the expenditure of $365,000 in state funds to reimburse local governments for response and recovery efforts associated with the fire, and directed the Division of Emergency Management to further assist individuals and local governments in securing federal funding to help recover from the fire. The executive order also authorized the Department of Human Services to use Temporary Assistance for Needy Families money to assist victims of the wildfire, and authorized the Departments of Local Affairs and Human Services to assist those displaced by the fire with temporary housing;

- On June 14, 2012, the Governor signed an executive order (D 2012 015) banning open burning in Colorado, with some exeptions, in response to the high number of wildfires experienced by the state;

- the General Assembly adopted, and the Governor signed, House Bill 12-1352, creating the Lower North Fork Wildfire Commission;

- the General Assembly adopted, and the Governor signed, House Bill 12-1361, which amended the Colorado Governmental Immunity Act to waive sovereign immunity in legal actions against the state arising from a prescribed fire started or maintained by the state or any of its employees on or after January 1, 2012, allowing the victims of the Lower North Fork wildfire to seek damages from the state based on a claim of negligence; and

- On October 12, 2012, the Governor signed an executive order (D 2012 042) authorizing the expenditure of $1.3 million for wildfire preparedness activities in the area of the Lower North Fork wildfire, including removing hazardous trees from properties affected by the fire and felling burned trees for mulching or removal to reduce hazardous fuels.

Ongoing litigation. On or about July 2, 2012, a lawsuit was commenced in Jefferson County District Court by a group of five insurance companies that have insured losses in the Lower North Fork. The insurance companies' claims are based on their subrogation rights to claims of their insureds. They initially asserted three claims for relief: negligence, for which the state's immunity was retroactively waived in House Bill 12-1361; inverse condemnation, which is a constitutionally based claim; and trespass, for which no waiver of immunity applies because it is a tort that does not rest on negligence. The plaintiff insurance companies subsequently agreed to dismiss their trespass claim. The lawsuit was originally filed against the Colorado State Forest Service and the Colorado State University, but the plaintiff insurance companies subsequently amended their complaint to name only the Colorado Department of Public Safety (DPS), in accordance with House Bill 12-1283, which consolidated state homeland security functions into a new Division of Homeland Security and Emergency Management within DPS. In the amended complaint, a sixth insurance company joined the plaintiff group.

In response to the insurance companies' lawsuit, the state filed an interpleader petition to join all Lower North Fork claimants, conceding liability for negligence claims from the Lower North Fork fire that come under the waiver of Section 24-10-106.1, C.R.S., and tendering the $600,000 per occurrence cap amount on tort claims. The state's interpleader action seeks to allow all claimants to share in a distribution of the state's self-insurance fund available to pay claims, and this is a prerequisite to petitioning the State Claims Board for a recommendation to the General

Assembly to pay additional compensation. All insurance company claimants have been served with process in the case, and as of December 13, 2012, the Department of Law is working at getting all claimant residents and homeowners served with process. At this point, most respondents have been served or have agreed to waive service of process, and a few have filed responses to the interpleader modeled after the insurance companies' amended complaint. An additional group of insurance companies, including State Farm and the USAA group of insurance companies, have filed a response to the interpleader that raises similar claims to the original insurance companies' claims and joins the Denver Water Board as an additional defendant.

While the Department of Public Safety has conceded liability for claims under state law, the state intends to vigorously defend against claims asserted under other theories of liability, including the pending claims for inverse condemnation. A status conference was held by Judge Dennis Hall on November 26, 2012, at which the Department of Law reported on efforts to serve all parties, and potential additional claims were discussed. The next status conference in the case is scheduled to be held on January 25, 2013, and the state expects to be able to show that all parties have been served and that the case is at issue.

Commission Charge

Pursuant to House Bill 12-1352, the Lower North Fork Wildfire Commission is charged with investigating, reporting findings, and making recommendations for legislative or other action on matters related to the Lower North Fork wildfire, which resulted from a prescribed burn in March 2012, near Conifer in Jefferson County. The commission is composed of two members of the Senate, one appointed by the President of the Senate and one appointed by the minority leader; two members of the House of Representatives, one appointed by the Speaker of the House and one appointed by the minority leader; and the executive director of the Colorado Department of Public Safety. The commission is to investigate the following specific matters identified by the bill:

- causes of the wildfire;
- the impact of the wildfire on the affected community;
- the loss of life and financial devastation incurred by the community;
- the loss of confidence by the community in the response to the emergency by governmental bodies at all levels; and
- measures to prevent the occurrence of a similar tragedy.

The bill requires the commission to submit a report to certain legislative committees of reference by December 31, 2012, containing findings and recommendations for legislative or other action. The bill allows dissenting opinions to be appended to the report. The intent of this report is to satisfy the statutory reporting requirement in House Bill 12-1352; no dissenting opinions are appended to this report.

Commission Activities

The commission met five times from June to September 2012. At three of the meetings, the commission heard presentations from, and engaged in discussion with, representatives of various entities involved in emergency response, wildfire issues, and forest health, as well as representatives knowledgeable on issues associated with the Lower North Fork wildfire. These entities included:

- the Nature Conservancy;
- the Office of Emergency Management and the Division of Fire Prevention and Control within the Colorado Department of Public Safety;
- the Colorado Department of Law;
- the Colorado Department of Local Affairs;
- the Governor's Office of State Planning and Budgeting;
- the Air Pollution Control Division within the Colorado Department of Public Health and Environment;
- Colorado State University's Warner College of Natural Resources and Colorado Forest Restoration Institute;
- the Colorado 9-1-1 Resource Center;
- municipal utilities; and
- local emergency responders.

During a meeting held on August 13, 2012, the commission toured the property on which the prescribed burn that resulted in the wildfire was conducted, and also toured residential properties that were destroyed by the wildfire. After the tour, the commission held a public hearing at Conifer High School concerning the wildfire and its impacts. This hearing lasted just over three hours, and all who wished to speak were given the opportunity. Members of the Lower North Fork community also prepared a presentation for the commission.[2] The remaining two meetings were spent on organizational activities, considering draft legislation, and discussing the commission's reporting requirement. Seven bills were drafted at the request of the commission, including one that was drafted as an amendment to another draft bill, and four bills were ultimately approved. Additionally, the commission made eight non-legislative recommendations. Topics discussed during commission meetings and recommendations made by the commission are discussed below.

Additional resource materials from all commission meetings are available online at:

http://www.colorado.gov/lcs/LowerNorthForkWildfireCommission

Wildfire Management

Forest health. The front range includes a variety of forested communities, including the ponderosa and lodgepole pine forests that dominate the area of the Lower North Fork wildfire. The commission received a variety of reports on forest health, and at their August 13 meeting heard

[2] Kuehster Road Homeowners' Presentation: http://1.usa.gov/WZcqsS

testimony regarding the importance of regular disturbance to forests.[3] Historically, repeated fires have been a source of disturbance, but the use of fire suppression since early in the twentieth century has resulted in more trees, leaving more needles and wood materials on the ground. Disease and insects, such as the mountain pine beetle, are other sources of disturbance. Wildfire mitigation is important to water providers like Denver Water because of the negative effects of wildfires on watersheds.[4] In the past, fires have led to flooding, harming water supplies and water treatment systems. Fires have also resulted in erosion, sending high levels of sediment into reservoirs.

Commission recommendation. Bill B creates the Wildfire Matters Review Committee which, if approved by the General Assembly, will meet annually as an interim committee to address forest health issues in the context of wildfires and wildfire mitigation.

Prescribed burns. Prescribed burns are used to clear fuels from an area to make the area less likely to burn in the event of a wildfire. When applied to forest lands, prescribed burns also serve to prepare sites for forest regeneration, improve wildlife habitat, control insects and disease, and perpetuate fire-dependent ecosystems. Prescribed burns are one of several tools that can be used to modify forest vegetation and reduce fire risk, including thinning of trees, mechanical chipping, and mastication. These treatments are often used in combination with each other. The commission heard testimony at their August 13 and August 22 meetings about the importance of prescribed burns as a wildfire mitigation tool, as well as about the dangers of prescribed burns, particularly when they escape. The commission also received a prescribed fire planning and procedures guide from the U.S. Forest Service, and a detailed review of the prescribed fire that led to the Lower North Fork wildfire.[5]

The state's duties concerning prescribed burns and other wildfire resources were transferred to the Department of Public Safety, Division of Fire Prevention and Control, by House Bill 12-1283. Prior to this legislation, prescribed burns were managed at the state level by the Colorado State Forest Service.

Commission recommendations. Prescribed burns are further regulated under the state's Smoke Management Program, administered by the Department of Public Health and Environment, Air Pollution Control Division, to address visibility and public health concerns associated with air quality. These regulations do not directly address fire safety or forest health. Permits are issued with conditions in mind, but go/no-go decisions are not made on a day-to-day basis. Recommendation #7 addresses the Smoke Management Program.

The commission heard testimony at its September 5 meeting that additional legislation to create a framework for the prescribed burning program in the Division of Fire Prevention and Control may be appropriate, as House Bill 12-1283 provided limited instruction and modification of existing statutes related to wildfire activities. Bill A requires the Division of Fire Prevention and Control to implement a prescribed burning program, including minimum standards for conducting

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[3]Role of Fire in Front Range Forests, Mike Babler, The Nature Conservancy, presentation: http://1.usa.gov/RWdPij Forest Health, Prescribed Burns, and the Wildland Urban Interface, Tony Cheng, Colorado Forest Restoration Institute, presentation: http://1.usa.gov/VkxvrS

[4]Denver Water's presentation to the commission: http://1.usa.gov/VbdXGU

[5]Lower North Fork Prescribed Fire, Prescribed Fire Review (Bass Report): http://1.usa.gov/UcwSjZ

prescribed burns, processes for certifying prescribed burn managers, and policies related to wildfires resulting from the escape of prescribed burns.

Wildfire mitigation in the wildland-urban interface. Areas where homes and forest meet are called the wildland-urban interface (WUI). WUI areas exist throughout Colorado. In addition to threatening homes and lives in these areas, wildfires can damage infrastructure and water resources. The commission heard about the need for mitigation efforts by landowners in the WUI to help protect their property when wildfires occur. Such efforts include clearing defensible space around homes.

Commission recommendations. Because land use in Colorado is regulated at the local level, not all WUI areas require mitigation efforts or specific building code standards. The commission discussed ways to encourage local governments to implement codes specific to the WUI. Recommendation #6 addresses WUI codes.

The current state income tax incentive for wildfire mitigation activities will expire after tax year 2013. This incentive is a deduction from taxable income of up to $2,500 per year, which provides a maximum reduced tax burden of $107.50 per taxpayer, per year, based on Colorado's 4.3 percent flat tax rate. Approximately 500 people per year have claimed the deduction since 2009.

The commission also noted that the bonding authority of the Colorado Water Resources and Power Development Authority for forest health projects has not been specifically used since being enacted by Senate Bill 08-221, but several governmental agencies have recently expressed interest in issuing bonds for forest health projects. Under current law, this bonding authority is repealed as of July 1, 2013. Bill C extends both the tax incentive and the bonding authority.

Wildfire and forest health funding. Several bills have established the current framework for state funding of forest health, training of fire personnel, and other wildfire preparedness activities. Among the most signficant sources of state funding, Senate Bill 06-096 provided an annual transfer of $3.3 million from federal mineral lease revenue to the Wildfire Preparedness Fund, and Senate Bill 11-238 extended funding to the Wildfire Preparedness Fund until June 30, 2014. Recent legislation (House Bill 12-1032) also extended until June 30, 2018, severance tax-based funding for forest health activities. Currently, the operational account of the severance tax trust fund annually provides $1.0 million to the Forest Restoration Program Cash Fund and $1.5 million to the Healthy Forests and Vibrant Communities Fund. Most significant state funding streams and financial incentives related to wildfire preparedness are set to expire by 2018.

Commission recommendations. Recommendations #4, #6, and #8 address funding concerns for wildfire issues and forest health. Recommendation #4 encourages consistent funding for the Federal Land Assistance, Management, and Enhancement (FLAME) Act, which is intended to provide funding to the U.S. Forest Service and the Department of Interior to be used for emergency wildland fire suppression costs. Recommendation #6 encourages consistent funding for wildfire preparedness at the state level, beyond federal mineral lease revenues. Finally, Recommendation #8 seeks continuous spending authority for Colorado Correctional Industries to fund its State Wildland Inmate Fire Team (SWIFT) program, which uses inmate teams to help fight wildfires.

Emergency Management

Emergency notification. In Colorado, 911 and emergency notification systems are administered and delivered by the state's 57 local 911 authorities. Local jurisdictions are authorized under state law to collect a surcharge on telephone services, including wireless services, the revenues from which are remitted directly to local 911 authorities. Within statutory limits, the authorities are then able to decide how to spend their surcharge revenues.

Emergency notification systems, or reverse-911, are an authorized use of 911 surcharge funds, but local authorities are not required to purchase them. As a result, these systems, which are used to notify residents of emergency situations, are provided by a number of different vendors, with each system offering different features and limitations. When a notification must be sent to an area spanning multiple jurisdictions, as can be the case with large wildfires, different notification systems are not integrated. In addition, emergency notification systems are limited by the decreasing use of land line technology. While traditional land lines are included automatically, residents must proactively register their cellular phone numbers and addresses with the local government in order to receive emergency notifications by cellular phone. The systems are then only able to use the registered address in determining where an individual is located, rather than their physical location at any moment.

Commission recommendation. At its August 13 meeting, the commission heard testimony regarding the limitations of emergency notification in Colorado.[6] Recommendation #9 addresses some of these limitations.

Emergency response. The commission reviewed the role of state government during a wildfire response. House Bill 12-1283 created the Division of Fire Prevention and Control (DFPC) in the Department of Public Safety, with a mission to safeguard the public through widfire preparedness, response, suppression, coordination, and management, among the DFPC's duties. The same bill also reorganized emergency management agencies in Colorado state government, consolidating other functions in the Division of Homeland Security and Emergency Management (DHSEM) under the Department of Public Safety.

Generally, evacuation, suppression, and other fire response functions are initially the responsibility of a local fire department or fire protection district. Currently, the DHSEM is charged with developing a statewide all-hazards resource mobilization plan. This plan is intended to facilitate communication and provide resources across jurisdictions, including funding and the allocation of other assets in the event of disasters and other large-scale emergencies and incidents. The commission heard testimony from officials in the Department of Public Safety that the current resource mobilization model is not working for the initial response to wildfire, often involving significant delays in obtaining firefighting assets. For example, national interagency dispatch centers operate on a "first-in, first-out" basis, with no assessment of priority or proximity when allocating available firefighting assets. The commission heard testimony at its August 22 meeting about Washington state's model, where an administrative mechanism is provided for early mobilization of emergency resources.

If a fire exceeds local capacity, the local agency may request resources within the scope of mutual aid agreements with other local agencies or seek resources from state and federal

[6] Emergency Communications Overview, Daryl Branson, 9-1-1 Resource Center, presentation: http://1.usa.gov/RWe3WG

authorities. The state provides financial assistance to agencies situated in participating counties from the state Emergency Fire Fund, and federal assistance may be available from the Federal Emergency Management Agency (FEMA) through a Fire Management Assistance Grant. Under current law, the Governor's declaration of a disaster is required before certain state and federal resources are available for wildfire response.

Commission recommendations. The commission and representatives from the Department of Public Safety discussed financial constraints and operational concerns that result from the current emergency resource mobilization structure in Colorado. Bill D addresses the mobilization of resources in wildfire response, clarifying the Department of Public Safety's role and establishing a method for governmental entities to seek reimbursement for providing disaster assistance across jurisdictions. Recommendation #1 addresses emergency response concerns by encouraging coordination among local fire districts.

State government liability. State and local government agencies in Colorado may defend negligence and other tort claims on the basis of limited immunity under the Colorado Governmental Immunity Act (CGIA). The CGIA caps damage recoveries at $150,000 for the claim on any individual party and a total recovery of $600,000 for any single occurrence.

House Bill 12-1361 amended the CGIA to specifically waive sovereign immunity in legal actions against the state arising from a prescribed fire started or maintained by the state or any of its employees on or after January 1, 2012. To maintain an action against the state related to a prescribed fire, the injured party must prove negligence on the part of the state. Under the bill, the CGIA was also expanded to allow potential recoveries from the state above the statutory limits, when the State Claims Board (SCB) recommends that the General Assembly adopt legislation authorizing payment above those limits. After considering the interests of fairness, the public interest, and the interests of the state, the SCB may recommend an additional payment for recovery above the limits established in the CGIA, to be paid from the General Fund. This recommendation may not include payment of noneconomic losses or losses covered by insurance or any other source.

Civil litigation continues between the victims of the Lower North Fork wildfire and the state over compensation for losses. Claims against the state were due to the Attorney General's Office by September 25, 2012, and 132 claims were received, including 16 from insurance companies and other corporate entities. Due to the legal nature of the claims, the settlement process could be lengthy.

Commission recommendation. Outside of the exception provided under House Bill 12-1361, the state's cap on damage recovery remains in effect. Recommendation #2 addresses raising the liability cap.

Summary of Commission Legislative Recommendations

As a result of the commission's activities, the following bills are recommended to the Colorado General Assembly.

Bill A — Prescribed Burn Program in the Division of Fire Prevention and Control. Bill A creates the Colorado Prescribed Burning Act, requiring the Division of Fire Prevention and Control to conduct rulemaking and adopt standards for prescribed burning in the state, including the consideration of alternative fuel reduction strategies and the presence of qualified state officials to supervise, and to establish standards for the training and certification of prescribed burn managers. The bill further defines the role of the Division of Fire Prevention and Control in the Department of Public Safety, as created by House Bill 12-1283, including coordination of multiagency initiatives to reduce fuel loads and conduct a formal review following the escape of a prescribed fire.

Bill B — Wildfire Matters Review Committee. Bill B creates an interim committee to review state policies addressing wildfire prevention and mitigation, with sufficient scope to examine forest health, emergency management, and other issues relating to wildfires. Under the bill, ten members of the General Assembly, five members from the House of Representatives and five members from the Senate, must meet as the Wildfire Matters Review Committee at least once in each legislative interim until 2017. By July 1, 2013, three majority party members and two minority party members are to be appointed from each chamber to serve two-year terms. Existing legislative agency staff must provide assistance to the committee, with cooperation from the Department of Public Safety, the Colorado State Forest Service, and other state and local agencies. The bill contains a five-year sunset provision.

Bill C — Extend Wildfire Mitigation Financial Incentives. Bill C extends the sunset date of two current state statutes that provide financial assistance for wildfire mitigation activities. For tax years 2014 through 2024, Section 1 of the bill provides a deduction from taxable income of one-half the actual costs of certain wildfire mitigation measures performed on the property of the taxpayer, up to a $2,500 deduction per year. Eligible wildfire mitigation measures include the creation of a defensible space around structures and fuel reduction. The bill does not require eligible mitigation measures to be preapproved by a community wildfire protection plan, as required under current statute for tax years 2009 through 2013. Section 2 of the bill extends from July 1, 2013, to July 1, 2023, the authorization of the Colorado Water Resources and Power Development Authority to issue up to $50 million in bonds for the watershed protection and forest health projects of government agencies.

Bill D — All-hazards Resource Mobilization and Reimbursement. Bill D requires that the director of the Division of Homeland Security and Emergency Management in the Department of Public Safety develop a statewide resource mobilization plan, providing for distribution of funding and allocation of other assets in the event of disasters and other large-scale emergencies and incidents. Under the resource mobilization plan, standard procedures will be established for resource mobilization, allocation, deployment, tracking, accounting, demobilization, and integration with the Colorado state emergency operations plan. The bill provides that the Governor or a local emergency manager may request the mobilization of state resources, and that the state will provide personnel for a unified command in such incidents.

Commission Recommendations

In addition to the bills recommended by the commission, the commission makes the following recommendations as a result of its activities. Recommendations were made by members of the commission and edited by staff. Support from a majority of commission members was required for inclusion in the report. Not all recommendations received unanimous support from the commission.

Recommendation #1: Concerning coordination among fire districts. The commission recommends that, if an ongoing legislative interim committee related to wildfire prevention and mitigation is created, coordination among adjacent fire districts may warrant further study. In addition to mutual aid agreements to coordinate a response to a fire, the commission believes the personnel of the fire district may be more effective if they have more joint training with personnel who work or volunteer for an adjacent fire district. This may include coordinating equipment positioning and clarifying responsibilities for an escaped prescribed burn. In addition, the commission recommends that the legislature explore whether county sheriffs have sufficient authority to conduct the wildfire-related activities for which they are responsible.

Recommendation #2: Concerning raising the liability cap. The commission believes it is time to explore raising the Colorado Governmental Immunity Act's current cap on damage recoveries. The tragedy of the Lower North Fork wildfire illustrates the inadequacy of the current cap, which is $600,000 for any single occurrence, regardless of the number of victims and damages from state negligence. While governmental entities must protect their budgets from being overly exposed to private claims for damages, given that many incidents of negligence for which immunity has been waived have the potential to injure many people, the commission believes it is time to explore raising the liability cap. Colorado's cap is obsolete and has forced the victims of the fire into an uncertain process of seeking compensation for their losses from the State Claims Board and the legislature. Claims for damages from governmental negligence should not require such an arduous process, and payment should not be subject to the political process.

Recommendation #3: Concerning wildland-urban interface and local land use regulations. The commission recommends that incentives or other encouragement be provided for counties to adopt land use regulations for development in wildland-urban interface areas that address accessibility, defensible space, fire resistant building materials, and water supply for fire protection. The commission acknowledges that financial incentives may not be budgetarily possible right away, but should be attempted as soon as possible.

County land use regulations provide an opportunity to proactively address wildland fire issues before structures are built in wildland-urban interface (WUI) areas. Currently, some Colorado counties have requirements for buildings constructed near wildland areas, while others do not. Regulations governing building materials, siting, emergency vehicle access, evacuation routes, on-site storage of water for fire suppression, vegetation control, and other topics that are addressed by the Wildland-Urban Interface Code are controlled locally. Some, but not all, insurance companies require defensible space as a condition for insuring property in the WUI. This variation results in differences in vulnerability to wildfire from jurisdiction to jurisdiction. Large property damage claims affect insurance premiums for everyone in Colorado, and expensive firefighting efforts are borne by all taxpayers. Land use regulations are locally controlled because most of the impacts are purely local. But some aspects of land use development transcend jurisdictional boundaries, and put other people's lives and safety at risk.

Recommendation #4: Concerning the federal FLAME Act. The commission encourages Congress to provide adequate funding and to fully implement the Federal Land Assistance, Management, and Enhancement Act (the FLAME Act).

In 2009, Congress passed the FLAME Act. This legislation established a supplemental funding source for catastrophic emergency wildland fire suppression activities on Department of the Interior (DOI) and U.S. Forest Service (USFS) lands. It also requires the Secretary of the Interior and the Secretary of Agriculture to develop a cohesive wildland fire management strategy. In October of 2009, President Obama signed the FLAME Act into law with overwhelming support from the House and Senate. The FLAME Act represents an important change in the funding mechanism for wildland fire suppression. One of the cornerstones of the FLAME Act was the establishment of two FLAME Funds, one each for USFS and DOI, to be used for emergency wildland fire suppression costs.

In passing the FLAME Act, Congress intended to fully fund the USFS and DOI's suppression needs while eliminating the need to transfer monies from other agency programs to fund emergency wildland fire suppression expenses. The practice of transferring funds from non-fire programs for suppression has undermined the ability of the agencies to implement other important programs, such as hazardous fuels mitigation. To date, Congress has not appropriated adequate funding to fully implement the FLAME Act.

Recommendation #5: Concerning 911 capabilities. The commission encourages the General Assembly to engage emergency management services providers, local governments, and other stakeholders as determined by those most affected by the operation and management of the 911 services to consider the benefits and drawbacks of establishing a centralized, compatible reverse-911 system.

The commission believes, based on its hearings, that there are unmet needs relating to emergency wildfire response. Among those is the difficulty some 911 systems have in determining which areas should be contacted when an evacuation notice is issued. There is no uniformity in the 911 databases across different jurisdictions, and some databases do not allow easy tailoring of the evacuation area to the area threatened by an approaching wildfire. In addition, many people only have a land line on file with the entity that issues the notice, so they will not be notified if they are not home. Authority over 911 calls and responses is local. Citizens should be encouraged to become more involved in their 911 authority and ensure it will perform when necessary. The commission also believes that there may be a need for the state to establish some minimum capabilities for reverse-911 services to ensure that the system provides reliable evacuation notices, fulfilling the expectations of the people served by the systems.

The adequacy of 911 services as a warning system for wildfire is highly variable throughout the state. Local 911 agencies may or may not elect to procure reverse-911 services through a contractor. Databases used for reverse-911 are updated irregularly, and are commonly limited to land line phone connections or telecommunications customers associated with a local address. Providers of 911 services are not governed by uniform standards that would ensure that individuals could consistently rely on local emergency services for notifications or up-to-date information in the event of a wildfire or other emergency situation.

Recommendation #6: Concerning a consistent revenue source for wildfire suppression. The commission recommends that a consistent source of funding for wildfire preparedness and suppression activities, other than federal mineral lease revenues, be identified.

Options that should be considered for wildfire preparedness and suppression activities include: dedicating a portion of existing insurance premium tax collections; dedicating a portion of lottery receipts (particularly if keno is implemented in the state); and enacting a "fire protection surcharge" on water billing, to be transmitted by water purveyors to the state.

The Division of Fire Prevention and Control (DFPC), within the Department of Public Safety, is responsible for managing wildfires that exceed the capability of local governments, upon the request of local authorities, or when wildfires threaten to become state emergencies or disasters. This statutory duty is primarily funded from the Wildfire Preparedness Fund, which is currently appropriated funding from federal mineral lease revenues.

The Wildfire Preparedness Fund was authorized by the 2006 legislature through Senate Bill 06-096, which also appropriated funding for FY 2005-06 through FY 2009-10. Senate Bill 11-238 extended the annual transfer of $3.25 million by the Department of Local Affairs to the DFPC for two years beginning July 1, 2012.

Recommendation #7: Concerning air emission permits. The commission supports increased flexibility in burn permit guidelines when fire risk is low, as in winter months, which will allow for more appropriate action to reduce existing wildfire hazards and loss of life and property. Burn permits (for prescribed burns, slash piles, etc.) are regulated by the Air Quality Control Division of the Colorado Department of Public Health and Environment. Generally, air quality regulation favors burn permit emissions on days when winds will be sufficient to disperse, as opposed to concentrating, smoke. Seasonal guidelines for air quality also disfavor burning when fire risk is low in winter months.

Recommendation #8: Concerning funding for the SWIFT Program. The commission recommends that continuous spending authority be given to Colorado Correctional Industries (CCi) within the Department of Corrections (DOC) to outfit and administer State Wildland Inmate Fire Team (SWIFT) crews. The spending authority for SWIFT crews is offset by cash proceeds the state receives from local, regional, state, and federal agencies. Colorado's wildland fire activity has been widely variable over the last several years. Continuous spending authority for the SWIFT crews would enhance the state's ability to more quickly and effectively respond and react to wildland fires.

Following the 2000 fire season, CCi began forming a wildland fire team to provide crew support and assistance on wildland fires within Colorado. CCi operates the SWIFT crews, which are housed at various correctional facilities in Colorado. The SWIFT program officially began in 2002 with a single crew and grew to three crews by 2004. CCi has since added full-time fuels and trail construction crews that supplement the program as well. These crews are particularly active in the mitigation and removal of trees impacted by the pine and spruce beetle epidemic. One of the SWIFT crews' largest advantages operationally is that they can provide for at least one crew on a year-round basis while most crews are available only between May and October. Early season fires, such as the Lower North Fork incident, are becoming more typical in Colorado and the SWIFT crews are the primary resource for those incidents until the federal crews are activated in late spring. Comparing the costs of SWIFT crews to a similarly typed federal or private crew saves the taxpayers of Colorado almost $5,000 per crew a day. The SWIFT crews are self-sufficient and come with supervisors, basic tools and equipment, and transportation. To ensure that the crews function well, the personnel train together and are maintained as crews throughout the year. They

are available year-round for assistance with non-fire, woods-related programs and projects. Each crew generally consists of about 20 men. Training a crew typically takes up to three weeks, but can be done faster in smaller groups. The DOC generally trains each crew once annually in the spring, with a target date for availability for assignment on March 1.

At the current time, spending authority for CCi is extremely tight, particularly in the areas of operating expenses and inmate pay, which are heavily impacted by the SWIFT program. As such, adding additional crews can be difficult because spending decisions within CCi must generally be made by comparing the viability of the program to business models of other programs that might be competing for the same spending authority. Further, CCi must evaluate how each of its six separate lines of spending authority would be impacted. With continuous spending authority for SWIFT crews, decisions to expand or contract the number and activity of crews would be based on community needs both temporary and long-term, rather than on the availability of exempt spending authority under the Taxpayer Bill of Rights. The recent drought, extreme heat, and a destructive and deadly wildland fire season have brought renewed attention to the significant resources required to respond to the state's often unpredictable fire demand.

Resource Materials

Meeting summaries were prepared for each commission meeting and contain all handouts provided to commissioners. The summaries of meetings and attachments are available at the Division of Archives, 1313 Sherman Street, Denver (303-866-2055). The listing below contains the dates of committee meetings and the topics discussed at those meetings. Meeting summaries and audio are also available on the commission's website at:

http://www.colorado.gov/lcs/LowerNorthForkWildfireCommission

Meeting Date and Topics Discussed

June 29, 2012

- Review of commission charge

August 13, 2012

- Forest health and prescribed burns
- Emergency management and communication
- Fire behavior and the Lower North Fork Fire
- Tour and public hearing

August 22, 2012

- Lessons from the Four Mile Canyon Fire
- Emergency response and mobilization in Washington state
- Fire provisions in House Bill 12-1283
- Prescribed burns and air quality regulations
- Methods of watershed protection
- Colorado forest health and prescribed burns in the wildland-urban interface

September 5, 2012

- Funding for wildfires and forest health
- Timber industry and forest health legislation
- Past legislation concerning forest health and wildfire preparedness

September 25, 2012

- Final action on draft legislation
- Discussion of final report

Resource Materials Available on Commission Website

The following resource materials, provided to the Lower North Fork Wildfire Commission, are available on the commision's website:

http://www.colorado.gov/lcs/LowerNorthForkWildfireCommission

Where appropriate, links to specific materials are provided throughout this report.

Materials from August 13, 2012, meeting:

- Emergency Communications Overview from Daryl Branson, Colorado 9-1-1 Resource Center
- Role of Fire in Front Range Forests Presentation by Mike Babler, The Colorado Nature Conservancy
- Interoperable Communications Presentation from Jack Cobb, Office of Emergency Management
- Briefing to the Commission at the Conifer Public Hearing

Materials from August 22, 2012, meeting:

- Boulder County Presentation
- Elk Creek Fire Chief Bill McLaughlin Presentation
- Colorado Department of Public Safety Director Paul Cooke Presentation
- Air Pollution Control Division Presentation
- Denver Water Presentation
- Colorado Forest Restoration Institute Presentation

Additional commission materials:

- Binder Materials Received by Commission Members:
  - ✓ Colorado Forest Maps
  - ✓ 2012 State Forest Service Wildfire Preparedness Plan
  - ✓ 2011 Report on the Wildfire Preparedness Fund
  - ✓ 2010 Front Range Fuels Treatment Partnership Report
  - ✓ 2010 State Wildfire Mitigation Plan
  - ✓ National Fire Plan Funding from The Wilderness Society
  - ✓ Lower North Fork Prescribed Fire, Prescribed Fire Review (Bass Report)

- ✓ Governor Hickenlooper's Review Team Report Concerning Review and Recommendations on State Prescribed Fire Practice Following the LNF Fire
- ✓ Investigation Report From the Jefferson County Sheriff's Office Concerning the LNF Fire (Section 1)
- ✓ BLM Report Concerning the Origin and Cause of the LNF Fire
- ✓ Colorado Forest Insect and Disease Map
- ✓ 2011 Colorado Forest Health Report
- ✓ Bark Beetle Information
- ✓ Federal Forest Service Prescribed Fire Planning and Procedures Guide
- ✓ 2012 Report on Forest Fire and Wildfire Protection from the Congressional Research Service
- ✓ WUI Maps
- ✓ 2000 Fire In The West Report to The Council of Western State Foresters
- ✓ 2001 Report to Governor: Colorado's Wildland-Urban Interface
- ✓ News Articles on the LNF Wildfire
- ✓ Executive Orders Concerning the LNF and Colorado Wildfires
- ✓ House Bill 12-1352 Concerning the LNF Wildfire Commission
- ✓ House Bill 12-1361 Concerning prescribed fires and the Governmental Immunity Act
- ✓ Memorandums concerning the LNF and Past Legislation On Forest Health and Wildfires
- ✓ Glossary

- ♦ BLM Wildland Fire Investigation, Origin and Cause of the Lower North Fork Prescribed Fire
- ♦ Lower North Fork Prescribed Fire, Prescribed Fire Review (Bass Report)
- ♦ Jefferson County Sheriff's Office Report of the Lower North Fork Prescribed Fire
- ♦ Review and Recommendations: Enhancing Fire Response and Management in Colorado State Government
- ♦ Colorado Smoke Management Program Evaluation
- ♦ Recommendations Regarding Colorado's Smoke Management Program

First Regular Session
Sixty-ninth General Assembly
STATE OF COLORADO

BILL A

LLS NO. 13-0115.01 Kate Meyer x4348 **SENATE BILL**

SENATE SPONSORSHIP

Roberts and Nicholson,

HOUSE SPONSORSHIP

Gerou and Levy,

Senate Committees **House Committees**

A BILL FOR AN ACT

101 **CONCERNING THE CREATION OF A PRESCRIBED BURNING PROGRAM**
102 **UNDER THE DIVISION OF FIRE PREVENTION AND CONTROL IN THE**
103 **DEPARTMENT OF PUBLIC SAFETY, AND, IN CONNECTION**
104 **THEREWITH, SPECIFYING THE POWERS AND DUTIES OF THE**
105 **DIVISION AND ITS DIRECTOR WITH RESPECT TO THAT PROGRAM.**

Bill Summary

(Note: This summary applies to this bill as introduced and does not reflect any amendments that may be subsequently adopted. If this bill passes third reading in the house of introduction, a bill summary that applies to the reengrossed version of this bill will be available at http://www.leg.state.co.us/billsummaries.)

Lower North Fork Wildfire Commission. The bill creates the

"Colorado Prescribed Burning Act", which:

- Requires the division of fire prevention and control (division) in the department of public safety to implement a prescribed burning program (program);
- Authorizes the director of the division (director) to promulgate rules to implement the program and instructs the director to conduct rulemaking with regard to certain program provisions, including the adoption of standards that will constitute the minimum criteria for prescribed burns conducted in the state and the processes for certifying persons as prescribed burn managers;
- Empowers the division to enter into multiagency agreements for fuel reduction initiatives; and
- Establishes policies related to wildfires or potential wildfires resulting from the escape of prescribed fires.

The bill makes conforming amendments as follows:

- **Section 4** of the bill relocates, and makes nonsubstantive changes to, certain defined terms relating to the division and prescribed burning. As a result of these relocations, **section 3** makes technical amendments.
- House Bill 12-1283 transferred fire and wildfire prevention, suppression, response, and risk-mitigation duties, including duties relating to prescribed burning, from the state forest service to the division. **Sections 8 and 9** update statutes that contain obsolete allusions to the state forest service with respect to implementation authority over prescribed burning.
- **Sections 10, 11, 12, and 13** make conforming amendments to reflect the renaming of the firefighter, first responder, and hazardous materials responder certification fund to the firefighter, first responder, hazardous materials responder, and prescribed fire training and certification fund.

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1 *Be it enacted by the General Assembly of the State of Colorado:*

2 **SECTION 1. Short title.** This act shall be known and may be
3 cited as the "Colorado Prescribed Burning Act".

4 **SECTION 2. Legislative declaration.** (1) The general assembly
5 hereby finds, determines, and declares that:

6 (a) Forest land constitutes significant economic, biological, and
7 aesthetic resources of statewide importance;

(b) Colorado's ever-increasing population situates urban development directly adjacent to fire-prone forest lands;

(c) Wildfires threaten public health and safety and can cause catastrophic damage to public and private resources, including clean air, clean water, fish and wildlife habitat, timber resources, forest soils, scenic beauty, recreational opportunities, economic and employment opportunities, and structures and other improvements;

(d) Prescribed burning, which reduces naturally occurring vegetative fuels within a variety of ecosystems, including forests and grasslands, reduces the risk and severity of major wildfire, thereby lessening the threat of fire and the resulting loss of life and property in those areas, including as follows:

(I) When applied to forest lands, prescribed burning serves to reduce hazardous accumulations of fuels, prepare sites for both natural and artificial forest regeneration, improve wildlife habitat, control insects and disease, and perpetuate fire-dependent ecosystems;

(II) When prescribed burning is used to manage fuels in wildland-urban interface areas, it substantially reduces the threat of damaging wildfire in urban communities; and

(III) Prescribed burning promotes resource enhancement when used on private as well as local, state, and federally owned public use lands such as parks, forests, and wildlife refuges; and

(e) Therefore, prescribed burning is a resource protection and land management tool that benefits the safety of the public, Colorado's forest-related resources, the environment, and the economy of the state.

(2) The general assembly further finds and declares that, as Colorado's population continues to grow, a variety of competing interests have placed limitations on prescribed burn activity, thus reducing the

aforementioned benefits to the state and its citizens.

(3) The general assembly therefore:

(a) Acknowledges the natural role of fire in forests and other ecosystems, and finds and declares it is in the public interest to use fire as a management tool, under controlled conditions, to reduce the threat of wildfires by maintaining healthy forests and reducing high risk levels of vegetative fuel;

(b) Finds that it is in the public interest to establish and maintain a complete, cooperative, and coordinated wildfire protection and suppression program for the state; and

(c) Declares that the purpose of this act is to authorize and promote the safe, effective, and appropriate use of prescribed burning for community protection, forest health, and environmental and wildlife management purposes, while ensuring that best efforts are undertaken with respect to precautionary measures to assist in confining the fires to a predetermined area.

SECTION 3. In Colorado Revised Statutes, 24-33.5-1201, **amend** (1) (a) as follows:

24-33.5-1201. Division of fire prevention and control - creation - public school construction and inspection section - health facility construction and inspection section - legislative declaration. (1) (a) There is hereby created within the department the division of fire prevention and control. ~~referred to in this part 12 as the "division".~~ The head of the division is the director of the division of fire prevention and control. ~~referred to in this part 12 as the "director".~~ The executive director shall appoint the director pursuant to section 13 of article XII of the state constitution. ~~The executive director shall appoint~~ Only those persons meeting the qualifications described in paragraph (b) of this subsection

(1) ARE ELIGIBLE FOR APPOINTMENT.

SECTION 4. In Colorado Revised Statutes, 24-33.5-1202, **amend** (3.4), (3.5), (3.7), and (8); and **add** (3.6), (3.8), (3.9), (8.3), and (8.4) as follows:

24-33.5-1202. Definitions. As used in this part 12, unless the context otherwise requires:

(3.4) ~~"Cross-connection control device" means an installation, device, or assembly located between the water supply and fire suppression piping to prevent the undesirable reversal in the flow of water from a real or potential source of contamination back to the potable water supply. A cross-connection control device is also referred to as a back flow preventer~~ "CONTROLLED AGRICULTURAL BURN" MEANS A TECHNIQUE USED IN FARMING TO CLEAR THE LAND OF ANY EXISTING CROP RESIDUE, KILL WEEDS AND WEED SEEDS, OR REDUCE FUEL ACCUMULATION AND DECREASE THE LIKELIHOOD OF A FUTURE FIRE.

(3.5) ~~"Emergency fire fund" means the emergency fire fund created in section 24-33.5-1220 that was first established in 1967 with voluntary contributions from counties and the Denver water board; administered by a nine-person committee composed of county commissioners, sheriffs, fire chiefs, and the director; and used for the purpose of paying costs incurred as a result of controlling a wildfire by any of parties contributing moneys to the fund, in accordance with the intergovernmental agreement for participation in the Colorado emergency fire fund~~ "CROSS-CONNECTION CONTROL DEVICE" MEANS AN INSTALLATION, DEVICE, OR ASSEMBLY LOCATED BETWEEN THE WATER SUPPLY AND FIRE SUPPRESSION PIPING TO PREVENT THE UNDESIRABLE REVERSAL IN THE FLOW OF WATER FROM A REAL OR POTENTIAL SOURCE OF CONTAMINATION BACK TO THE POTABLE WATER SUPPLY. A

CROSS-CONNECTION CONTROL DEVICE IS ALSO REFERRED TO AS A BACK FLOW PREVENTER.

(3.6) "DIRECTOR" MEANS THE DIRECTOR OF THE DIVISION.

(3.7) ~~"Fire department" means the duly authorized fire protection organization of a town, city, county, or city and county, a fire protection district, or a metropolitan district or county improvement district that provides fire protection~~ "DIVISION" MEANS THE DIVISION OF FIRE PREVENTION AND CONTROL IN THE DEPARTMENT OF PUBLIC SAFETY CREATED IN THIS ARTICLE.

(3.8) "EMERGENCY FIRE FUND" MEANS THE EMERGENCY FIRE FUND CREATED IN SECTION 24-33.5-1220 THAT WAS FIRST ESTABLISHED IN 1967 WITH VOLUNTARY CONTRIBUTIONS FROM COUNTIES AND THE DENVER WATER BOARD; ADMINISTERED BY A NINE-PERSON COMMITTEE COMPOSED OF COUNTY COMMISSIONERS, SHERIFFS, FIRE CHIEFS, AND THE DIRECTOR; AND USED FOR THE PURPOSE OF PAYING COSTS INCURRED AS A RESULT OF CONTROLLING A WILDFIRE BY ANY OF THE PARTIES CONTRIBUTING MONEYS TO THE FUND, IN ACCORDANCE WITH THE INTERGOVERNMENTAL AGREEMENT FOR PARTICIPATION IN THE EMERGENCY FIRE FUND.

(3.9) "FIRE DEPARTMENT" MEANS THE DULY AUTHORIZED FIRE PROTECTION ORGANIZATION OF A TOWN, CITY, COUNTY, OR CITY AND COUNTY, A FIRE PROTECTION DISTRICT, OR A METROPOLITAN DISTRICT OR COUNTY IMPROVEMENT DISTRICT THAT PROVIDES FIRE PROTECTION.

(8) ~~"Principal" means an individual having a position of responsibility in any entity acting as a fire suppression contractor, including but not limited to any manager, director, officer, partner, owner, or shareholder owning ten percent or more of the stocks of any such entity~~ "MASTICATED FUELS" MEANS FUELS, SUCH AS BRUSH, SMALL-DIAMETER TREES, AND SLASH, THAT HAVE BEEN GROUND OR CHEWED INTO SMALL

PIECES OF WOODY MATERIAL THROUGH A MECHANICAL WILDLAND FUELS TREATMENT PROCESS, AND GENERALLY LEFT TO CARPET THE GROUND, FORMING A RELATIVELY DENSE, COMPACT LAYER OF WOODY MATERIAL.

(8.3) "PRESCRIBED BURNING" MEANS THE APPLICATION OF FIRE, IN ACCORDANCE WITH A WRITTEN PRESCRIPTION FOR VEGETATIVE FUELS, UNDER SPECIFIED ENVIRONMENTAL CONDITIONS WHILE FOLLOWING APPROPRIATE PRECAUTIONARY MEASURES THAT ENSURE PUBLIC SAFETY AND THAT IS CONFINED TO A PREDETERMINED AREA TO ACCOMPLISH PLANNED FIRE OR LAND MANAGEMENT OBJECTIVES. THE TERM EXCLUDES CONTROLLED AGRICULTURAL BURNS.

(8.4) "PRINCIPAL" MEANS AN INDIVIDUAL HAVING A POSITION OF RESPONSIBILITY IN ANY ENTITY ACTING AS A FIRE SUPPRESSION CONTRACTOR, INCLUDING ANY MANAGER, DIRECTOR, OFFICER, PARTNER, OWNER, OR SHAREHOLDER OWNING TEN PERCENT OR MORE OF THE STOCKS OF ANY SUCH ENTITY.

SECTION 5. In Colorado Revised Statutes, 24-33.5-1203, **add** (1) (t) as follows:

24-33.5-1203. Duties of division. (1) The division shall perform the following duties:

(t) IMPLEMENT A PRESCRIBED BURNING PROGRAM, INCLUDING CONDUCTING FUEL REDUCTION INITIATIVES, SUCH AS PRESCRIBED BURNING OR MECHANICAL OR CHEMICAL TREATMENT, ON ANY AREA OF WILDLAND WITHIN THE STATE THAT THE DIRECTOR REASONABLY DETERMINES IS SUSCEPTIBLE TO WILDFIRE. SUCH INITIATIVES SHALL BE CONDUCTED IN COOPERATION AND AGREEMENT WITH LOCAL, STATE, OR FEDERAL AGENCIES, OR PRIVATE PERSONS OR CONCERNS, PURSUANT TO SECTIONS 24-33.5-1217 AND 24-33.5-1217.7.

SECTION 6. In Colorado Revised Statutes, 24-33.5-1217,

amend (2) introductory portion, (3), and (4); and **add** (5), (6), (7), (8), (9), and (10) as follows:

24-33.5-1217. Prescribed burning program - training and certification of prescribed burn managers - rules - fees. (2) The TRAINING AND CERTIFICATION standards adopted under this section shall:

(3) ~~Nothing in this section requires~~ ON AND AFTER DECEMBER 1, 2013, a ~~user of~~ prescribed fire ~~to~~ MUST be ATTENDED BY A PERSON certified by the division PURSUANT TO THIS SECTION AND RULES PROMULGATED THERETO OR OTHERWISE AUTHORIZED UNDER SECTION 24-33.5-1217.5 (1) (c).

(4) ~~As used in this section, unless the context otherwise requires:~~ THE DIRECTOR, BY RULE, SHALL ESTABLISH A FEE AT AN AMOUNT SUFFICIENT TO RECOVER ALL DIRECT COSTS THAT THE DIVISION INCURS IN PROVIDING TRAINING TO AND PROCESSING APPLICATIONS FOR PERSONS SEEKING CERTIFICATION AS CERTIFIED PRESCRIBED BURN MANAGERS PURSUANT TO THIS SECTION. THE FEES SO COLLECTED SHALL BE DEPOSITED INTO THE FIREFIGHTER, FIRST RESPONDER, HAZARDOUS MATERIALS RESPONDER, AND PRESCRIBED FIRE TRAINING AND CERTIFICATION FUND CREATED IN SECTION 24-33.5-1207.

~~(a) "Controlled agricultural burn" means a technique used in farming to clear the land of any existing crop residue, kill weeds and weed seeds, or reduce fuel buildup and decrease the likelihood of a future fire.~~

~~(b) "Natural ignition fires" mean wildland fires that are ignited by lightning or some other natural source.~~

~~(c) "Prescribed burning" means the application of fire, in accordance with a written prescription for vegetative fuels, under specified environmental conditions while following appropriate~~

~~precautionary measures that ensures public safety and that the fire is confined to a predetermined area to accomplish planned fire or land management objectives. The term excludes controlled agricultural burns.~~

(5) (a) THE DIRECTOR, IN CONSULTATION WITH THE COLORADO STATE FOREST SERVICE AS DESCRIBED IN PART 3 OF ARTICLE 31 OF TITLE 23, C.R.S., AND IN ACCORDANCE WITH ARTICLE 4 OF THIS TITLE:

(I) MAY ADOPT ANY SUCH RULES AS THE DIRECTOR DEEMS NECESSARY TO ADMINISTER THE PRESCRIBED BURNING PROGRAM; AND

(II) SHALL ADOPT RULES AND STANDARDS:

(A) PERTAINING TO THE TRAINING AND CERTIFICATION OF PRESCRIBED BURN MANAGERS, INCLUDING TRAINING COMPONENTS; APPLICATION PROCESSES; QUALIFICATION FOR AND TERMS AND DURATIONS OF CERTIFICATION; TYPES OF CERTIFICATION, IF APPLICABLE; GROUNDS AND PROCESSES FOR RENEWAL, SUSPENSION, AND REVOCATION OF CERTIFICATIONS; AND TRAINING, CERTIFICATION, AND RENEWAL FEES; AND

(B) FOR THE USE OF PRESCRIBED BURNING OCCURRING ON STATE LANDS OR CONDUCTED BY STATE AGENCIES ON PRIVATE LANDS, PURSUANT TO SECTION 24-33.5-1217.5.

(b) THE RULES AND STANDARDS PROMULGATED PURSUANT TO SUB-SUBPARAGRAPH (B) OF SUBPARAGRAPH (II) OF PARAGRAPH (a) OF THIS SUBSECTION (5) CONSTITUTE THE MINIMUM STANDARDS FOR ALL PRESCRIBED BURNING CONDUCTED IN THE STATE, EXCEPT FOR PRESCRIBED BURNING CONDUCTED BY AN AGENCY OF THE FEDERAL GOVERNMENT.

(6) (a) SUBJECT TO THE PROVISIONS OF PARAGRAPH (c) OF THIS SUBSECTION (6), THE DIRECTOR MAY ENTER INTO AN AGREEMENT WITH AN OWNER OR OTHER PERSON HAVING LEGAL CONTROL OF PROPERTY LOCATED WITHIN ANY WILDLAND, INCLUDING A PUBLIC AGENCY WITH REGULATORY OR NATURAL RESOURCE MANAGEMENT AUTHORITY OVER

1 ANY SUCH PROPERTY, FOR THE USE OF PRESCRIBED BURNING OR OTHER
2 HAZARDOUS FUEL REDUCTION CONSISTENT WITH THIS ARTICLE TO
3 PREVENT HIGH-INTENSITY WILDLAND FIRES BY REDUCING THE VOLUME
4 AND CONTINUITY OF WILDLAND FUELS OR TO ACHIEVE OTHER GOALS,
5 INCLUDING FOREST IMPROVEMENT, CONSISTENT WITH THIS ARTICLE.
6 (b) THE DIRECTOR SHALL NOT ENTER INTO AN AGREEMENT FOR
7 PRESCRIBED BURNING PURSUANT TO PARAGRAPH (a) OF THIS SUBSECTION
8 (6) UNLESS THE DIRECTOR FIRST DETERMINES THAT THE PUBLIC BENEFITS
9 REASONABLY ESTIMATED TO BE DERIVED FROM THE PRESCRIBED BURNING
10 PURSUANT TO THE AGREEMENT WILL BE EQUAL TO OR GREATER THAN THE
11 REASONABLY FORESEEABLE DAMAGE THAT COULD RESULT FROM THE
12 PRESCRIBED BURNING.
13 (c) (I) WHERE AN AGENCY OF THE FEDERAL GOVERNMENT
14 ASSUMES PRIMARY RESPONSIBILITY FOR CONDUCTING A PRESCRIBED BURN
15 IN THE STATE, NEITHER THE AGENCY NOR ANY OTHER AGENCY OF THE
16 FEDERAL GOVERNMENT IS REQUIRED TO COMPLY WITH THE RULES AND
17 STANDARDS PROMULGATED PURSUANT TO SUB-SUBPARAGRAPH (B) OF
18 SUBPARAGRAPH (II) OF PARAGRAPH (a) OF SUBSECTION (5) OF THIS
19 SECTION.
20 (II) IF THE DIRECTOR HAS ENTERED INTO AN AGREEMENT WITH AN
21 AGENCY OF THE FEDERAL GOVERNMENT AS OF THE EFFECTIVE DATE OF
22 THIS SECTION OF THE TYPE DESCRIBED IN PARAGRAPH (a) OF THIS
23 SUBSECTION (6), NOTHING IN THIS SECTION SHALL BE CONSTRUED TO
24 REQUIRE A NEW AGREEMENT OR MODIFICATION OF AN EXISTING
25 AGREEMENT.
26 (7) (a) THE DIVISION SHALL COOPERATE WITH AND PROVIDE
27 ADVISORY SERVICES TO ANY PERSON DESIRING TO USE PRESCRIBED
28 BURNING, THE OBJECTIVE OF WHICH IS THE PREVENTION OF

1 HIGH-INTENSITY WILDLAND FIRES, WATERSHED MANAGEMENT,
2 VEGETATION MANAGEMENT, FOREST IMPROVEMENT, WILDLIFE HABITAT
3 IMPROVEMENT, OR ANY OTHER OBJECTIVE THAT IS DEEMED TO BE IN THE
4 PUBLIC INTEREST, OR ANY COMBINATION OF SUCH OBJECTIVES.
5 (b) THE DIVISION SHALL PROVIDE INFORMATION AND TECHNICAL
6 ASSISTANCE TO UNITS OF LOCAL GOVERNMENT, UPON REQUEST FROM THE
7 LOCAL GOVERNMENT, CONCERNING PRESCRIBED BURNING.
8 (c) THE DIVISION MAY PROVIDE STANDBY FIRE PROTECTION TO ANY
9 PERSON USING PRESCRIBED BURNING IN A MANNER DEEMED TO BE IN THE
10 PUBLIC INTEREST, TO SUCH EXTENT AS PERSONNEL, FIRE CREWS, AND
11 FIREFIGHTING EQUIPMENT ARE REQUESTED AND AVAILABLE.
12 (8) THE DIVISION SHALL, SUBJECT TO SUFFICIENT FUNDING,
13 INSTITUTE A PUBLIC INFORMATION CAMPAIGN TO PROMOTE TO THE
14 GENERAL PUBLIC THE BENEFITS OF PRESCRIBED BURNING.
15 (9) NOTHING IN THIS ARTICLE GRANTS THE DIVISION AUTHORITY
16 OVER ANY HAZARDOUS FUEL REDUCTION OTHER THAN PRESCRIBED
17 BURNING. FOREST HEALTH, FOREST IMPROVEMENT, VEGETATION AND
18 WATERSHED MANAGEMENT, AND HAZARDOUS FUEL REDUCTION OTHER
19 THAN PRESCRIBED BURNING REMAIN RESPONSIBILITIES VESTED IN THE
20 STATE FOREST SERVICE.
21 (10) NOTWITHSTANDING ANY OTHER PROVISION OF LAW:
22 (a) IN PERFORMING THE DUTIES ASSIGNED TO HIM OR HER UNDER
23 SUBSECTIONS (5) AND (6) OF THIS SECTION, THE DIRECTOR SHALL CONSULT
24 WITH THE COLORADO STATE FOREST SERVICE AS DESCRIBED IN PART 3 OF
25 ARTICLE 31 OF TITLE 23, C.R.S.
26 (b) THE PRESCRIBED BURNING STANDARDS ADOPTED BY THE
27 DIRECTOR PURSUANT TO SUB-SUBPARAGRAPH (B) OF SUBPARAGRAPH (II)
28 OF PARAGRAPH (a) OF SUBSECTION (5) OF THIS SECTION SHALL BE

CONSISTENT WITH EXISTING LAWS AND PROCESSES THAT BAN, REGULATE, OR HAVE DEVELOPED RECOMMENDATIONS CONCERNING OPEN BURNING, INCLUDING SECTIONS 18-13-109, 18-13-109.5, 23-31-312, 23-31-313 (6) (a) (II) AND (6) (a) (III), 25-7-106 (7) AND (8), 25-7-123, 29-20-105.5, AND 30-11-124, C.R.S.

(c) NOTHING IN THIS SECTION OR SECTION 24-33.5-1217.5, 24-33.5-1217.7, OR 24-33.5-1217.9 SHALL BE CONSTRUED TO AFFECT THE AUTHORITY OF A COUNTY GOVERNMENT TO DEVELOP OR ADMINISTER AN OPEN BURNING PERMIT SYSTEM FOR THE PURPOSE OF SAFELY DISPOSING OF SLASH IN ACCORDANCE WITH THE PROVISIONS OF SECTION 30-15-401 (1) (n.5), C.R.S.

SECTION 7. In Colorado Revised Statutes, **add** 24-33.5-1217.5, 24-33.5-1217.7, and 24-33.5-1217.9 as follows:

24-33.5-1217.5. Minimum prescribed burning standards. (1) THE PRESCRIBED BURNING STANDARDS ADOPTED BY THE DIRECTOR PURSUANT TO SECTION 24-33.5-1217 (5) (a) (II) (B) MUST, AT A MINIMUM:

(a) ENSURE THAT PRESCRIBED BURNING IS THE CONTROLLED APPLICATION OF FIRE TO VEGETATIVE FUELS UNDER SPECIFIED ENVIRONMENTAL CONDITIONS IN ACCORDANCE WITH A WRITTEN PRESCRIPTION PLAN, WHICH PLAN:

(I) IS DESIGNED TO CONFINE THE FIRE TO A PREDETERMINED AREA;

(II) IS DESIGNED TO ACCOMPLISH PLANNED LAND MANAGEMENT OBJECTIVES; AND

(III) CONFORMS TO THIS ARTICLE AND THE RULES AND STANDARDS ADOPTED IN ACCORDANCE WITH THIS ARTICLE;

(b) INCLUDE INFORMATION ON PLANNING, PREPARING, AND IMPLEMENTING SAFE, EFFECTIVE PRESCRIBED BURNING, WHICH INFORMATION:

1 (I) IS BASED ON, AND USES AS A MINIMUM STANDARD, THE
2 "INTERAGENCY PRESCRIBED FIRE PLANNING AND IMPLEMENTATION
3 PROCEDURES GUIDE", AS AMENDED, PUBLISHED BY THE NATIONAL
4 WILDFIRE COORDINATING GROUP, OR BY ANY SUCCESSOR GROUP; AND
5 (II) CONTAINS SPECIFIC CRITERIA WITH RESPECT TO MASTICATED
6 FUELS;
7 (c) REQUIRE AT LEAST ONE PERSON, WHO MUST BE EITHER
8 CERTIFIED BY THE DIVISION AS A PRESCRIBED BURN MANAGER OR
9 QUALIFIED BY NATIONAL WILDFIRE COORDINATING GROUP STANDARDS AS
10 A PRESCRIBED BURN BOSS AT THE LEVEL COMMENSURATE WITH THE
11 COMPLEXITY OF THE BURN, TO BE PRESENT ON SITE:
12 (I) DURING THE CONDUCT OF THE PRESCRIBED BURN; AND
13 (II) (A) UNTIL THE FIRE IS ADEQUATELY CONFINED TO
14 REASONABLY PREVENT ESCAPE OF THE FIRE FROM THE AREA INTENDED TO
15 BE BURNED; OR
16 (B) UNTIL THE PRESCRIBED BURNING IS COMPLETED AND ALL FIRE
17 IS DECLARED TO BE OUT;
18 (d) ESTABLISH APPROPRIATE GUIDELINES FOR SIZE OF BURNING
19 CREWS SUFFICIENT TO:
20 (I) CONDUCT THE BURN IN ACCORDANCE WITH THE PRESCRIPTION
21 PLAN; AND
22 (II) PROVIDE ADEQUATE PROTECTION FOR THE SAFETY OF PERSONS
23 AND OF ADJACENT PROPERTY;
24 (e) EVALUATE ALTERNATIVES TO PRESCRIBED BURNING, SUCH AS
25 MECHANICAL TREATMENT, AND GUIDE THE USER THROUGH THE SAFE AND
26 PRUDENT APPLICATION OF PRESCRIBED BURNING, WHEN IT IS DETERMINED
27 TO BE AN APPROPRIATE METHOD; AND
28 (f) SET FORTH REQUIREMENTS FOR RECORDKEEPING, TIMELY

NOTIFICATION TO ADJACENT LAND OWNERS AND LOCAL AUTHORITIES, AND PUBLIC INFORMATION CAMPAIGNS.

(2) ALL USERS OF PRESCRIBED FIRE SHALL COMPLY WITH THE APPLICABLE PROVISIONS OF THE "COLORADO AIR POLLUTION PREVENTION AND CONTROL ACT", PART 1 OF ARTICLE 7 OF TITLE 25, C.R.S., AND ITS IMPLEMENTING REGULATIONS, AND SHALL OBTAIN A PERMIT FOR PRESCRIBED FIRE PURSUANT TO SECTION 25-7-123, C.R.S.

(3) THE RULES AND STANDARDS ADOPTED BY THE DIRECTOR MUST BE PROMULGATED IN CONSULTATION WITH THE COLORADO STATE FOREST SERVICE AS DESCRIBED IN PART 3 OF ARTICLE 31 OF TITLE 23, C.R.S., THE COLORADO PRESCRIBED FIRE COUNCIL, OR AN ANALOGOUS SUCCESSOR ORGANIZATION, AND OTHER SUBJECT MATTER EXPERTS AS THE DIRECTOR DEEMS APPROPRIATE. IN PROMULGATING SUCH RULES AND STANDARDS, THE DIRECTOR SHALL CONSIDER THE CURRENT STATE OF RESEARCH AND BEST MANAGEMENT PRACTICES FOR PRESCRIBED BURNING.

24-33.5-1217.7. Multiagency agreement for cooperative use of prescribed fire - rules - gifts, grants, and donations. (1) THE DIRECTOR MAY ENTER INTO A MASTER AGREEMENT WITH LOCAL, STATE, OR FEDERAL LAND MANAGEMENT AGENCIES TO CONDUCT JOINT PRESCRIBED BURNING OPERATIONS ON WILDLANDS AND FEDERAL LANDS WHERE THE DIRECTOR DETERMINES THAT THE OPERATIONS SERVE THE PUBLIC INTEREST AND ARE BENEFICIAL TO THE STATE. THIS MASTER AGREEMENT SHALL BE KNOWN AS THE "MULTIAGENCY AGREEMENT FOR COOPERATIVE USE OF PRESCRIBED FIRE" AND MUST ESTABLISH GUIDELINES FOR THE COOPERATIVE MANAGEMENT OF JOINT PRESCRIBED BURNING OPERATIONS.

(2) THE MASTER AGREEMENT ENTERED INTO PURSUANT TO THIS SECTION MUST REQUIRE THE COMPLETION OF A PROJECT AGREEMENT FOR EACH INDIVIDUAL PRESCRIBED BURN, WHICH PROJECT AGREEMENTS MUST

1 INCLUDE THE FOLLOWING:

2 (a) A LIST OF ALL PARTICIPANTS IN THE AGREEMENT;

3 (b) A JOINT PRESCRIBED BURN PLAN;

4 (c) THE PROJECT COSTS TO BE ASSUMED BY EACH PARTICIPANT;

5 (d) A SUMMARY OF THE BENEFITS THAT EACH PARTICIPANT WILL

6 RECEIVE; AND

7 (e) AN APPORTIONMENT OF EACH PARTICIPANT'S SUPPRESSION

8 COSTS IN THE EVENT A WILDFIRE RESULTS FROM THE PROJECT.

9 (3) (a) THE MASTER AGREEMENT MUST PROVIDE THAT THE

10 FEDERAL GOVERNMENT BEARS THE COSTS OF PROJECTS CONDUCTED ON

11 WILDLANDS UNDER THE JURISDICTION OF THE FEDERAL GOVERNMENT.

12 (b) THE DIRECTOR MAY WAIVE OR MODIFY THE COST-SHARING

13 REQUIREMENTS OF THIS SECTION IF THE FUNDING SOURCE PROHIBITS

14 COST-SHARING REQUIREMENTS.

15 (4) THE DIRECTOR SHALL ADOPT STANDARDS THAT MUST BE USED

16 TO DETERMINE THE STATE'S SHARE OF PROJECT COSTS PURSUANT TO

17 SUBSECTION (3) OF THIS SECTION AND TO DETERMINE, PURSUANT TO

18 SUBSECTION (1) OF THIS SECTION, WHETHER THE PUBLIC BENEFITS OF A

19 POTENTIAL JOINT PRESCRIBED BURNING OPERATION WILL EQUAL OR

20 EXCEED THE REASONABLY FORESEEABLE DAMAGE THEREFROM.

21 (5) ANY CONTRACT ENTERED INTO PURSUANT TO THIS SECTION

22 CONDUCTED ON STATE LANDS OR PRESCRIBED BURNING MANAGED BY THE

23 DIVISION MUST DO ALL OF THE FOLLOWING:

24 (a) VEST IN THE DIRECTOR THE FINAL AUTHORITY TO DETERMINE

25 THE TIME DURING WHICH WILDLAND FUEL AND STRUCTURAL FIRE HAZARDS

26 MAY BE BURNED TO MINIMIZE THE RISK OF ESCAPE OF A FIRE SET IN A

27 PRESCRIBED BURNING OPERATION AND TO FACILITATE MAINTENANCE OF

28 AIR QUALITY;

1 (b) CLEARLY STATE THE OBLIGATION OF EACH PARTY TO THE
2 CONTRACT TO PROVIDE, MAINTAIN, AND REPAIR EQUIPMENT AND INDICATE
3 THE NUMBER OF EACH TYPE OF EQUIPMENT TO BE PROVIDED AND THE
4 DURATION OF ITS AVAILABILITY;
5 (c) DESIGNATE AN OFFICER OF THE DIVISION AS THE BURN BOSS
6 WITH FINAL AUTHORITY TO APPROVE AND AMEND THE PLAN AND FORMULA
7 APPLICABLE TO A PRESCRIBED BURNING OPERATION, TO DETERMINE THAT
8 THE SITE HAS BEEN PREPARED AND THE CREW AND EQUIPMENT ARE READY
9 TO COMMENCE THE OPERATION, AND TO SUPERVISE THE WORK
10 ASSIGNMENTS OF DEPARTMENTAL EMPLOYEES AND ALL PERSONNEL
11 FURNISHED BY THE PERSON CONTRACTING WITH THE DEPARTMENT UNTIL
12 THE PRESCRIBED BURNING IS COMPLETED AND ALL FIRE IS DECLARED TO
13 BE OUT;
14 (d) SPECIFY THE DUTIES OF, AND THE PRECAUTIONS TAKEN BY, THE
15 PERSON CONTRACTING WITH THE DIVISION AND ANY PERSONNEL
16 FURNISHED BY THAT PERSON;
17 (e) PROVIDE THAT ANY PERSONNEL FURNISHED BY A PERSON
18 CONTRACTING WITH THE DIVISION TO ASSIST IN ANY ASPECT OF SITE
19 PREPARATION OR PRESCRIBED BURNING SHALL BE AN AGENT OF THAT
20 PERSON FOR ALL PURPOSES OF WORKERS' COMPENSATION; AND
21 (f) SPECIFY THE TOTAL COSTS OF THE PRESCRIBED BURNING
22 OPERATION OR OTHER HAZARDOUS FUEL REDUCTION AND THE PRO RATA
23 SHARE THEREOF FOR EACH PARTY TO THE CONTRACT.
24 (6) ALL MONEYS RECEIVED BY THE DIVISION PURSUANT TO THIS
25 SECTION SHALL BE CREDITED TO THE WILDFIRE PREPAREDNESS FUND
26 CREATED IN 24-33.5-1226 (4) (a).
27 **24-33.5-1217.9. Escaped prescribed fires.** (1) IF A PRESCRIBED
28 FIRE EXCEEDS THE CONTROL CAPABILITY OF AVAILABLE RESOURCES, THE

FIRE IS DEEMED TO BE ESCAPED AND CONTINGENCY ACTIONS SHALL BE TAKEN IMMEDIATELY TO BRING THE ESCAPE UNDER CONTROL.

(2) THE DIVISION SHALL CONDUCT OR CAUSE TO BE CONDUCTED A FORMAL REVIEW FOLLOWING ESCAPE OF A PRESCRIBED FIRE. THE PURPOSE OF THE REVIEW IS TO IDENTIFY THE FACTORS THAT CONTRIBUTED TO THE ESCAPE, INCLUDING COMPLIANCE WITH POLICY REQUIREMENTS, IN AN EFFORT TO REDUCE THE OCCURRENCE OR PREVENT FUTURE ESCAPES.

(3) WILDFIRES BURNING UNCONTROLLED ON FORESTED, BRUSH, OR GRASSLAND AREAS THAT POSE A HAZARD TO LIFE AND PROPERTY CONSTITUTE A PUBLIC NUISANCE. EMPLOYEES OR AGENTS OF THE DIVISION HAVE THE RIGHT TO ENTER LAND TO CONTROL, SUPPRESS, OR INVESTIGATE WILDFIRES WITHOUT LIABILITY FOR TRESPASS.

(4) IN ORDER TO PREVENT HIGH-INTENSITY OR CATASTROPHIC WILDLAND FIRES, LOCAL, STATE, OR FEDERAL FIREFIGHTERS MAY ENTER LANDS AND CONSTRUCT FIRE LINES OR FIRE BREAKS TO PREVENT FURTHER SPREAD OF WILDFIRES, WITHOUT LIABILITY.

SECTION 8. In Colorado Revised Statutes, 18-13-109, **amend** (2) (b) introductory portion and (2) (b) (III) as follows:

18-13-109. Firing woods or prairie. (2) (b) The following activities ~~shall~~ DO not ~~be~~ CONSTITUTE offenses under this subsection (2):

(III) LAWFULLY CONDUCTED prescribed or controlled ~~fires conducted with written authority from the state forester~~ BURNS;

SECTION 9. In Colorado Revised Statutes, 23-31-313, **amend** (6) (a) (II) as follows:

23-31-313. Healthy forests - vibrant communities - funds created - repeal. (6) **Community watershed restoration.** (a) In order to support communities and land managers in moving from risk reduction to long-term ecological restoration so that the underlying condition of

Colorado's forests supports a variety of values, particularly public water supply and high-quality wildlife habitat, the forest service shall:

(II) Facilitate and work collaboratively with THE DIVISION OF FIRE PREVENTION AND CONTROL, landowners, local governments, including conservation districts created pursuant to article 70 of title 35, C.R.S., and county noxious weed program administrators and other appropriate parties, including any electric, gas, and water utilities in the affected area, to design ~~and safely implement~~ prescribed fire projects and to encourage increased responsible use of prescribed fire as a tool for restoring healthy forest conditions consistent with programs established pursuant to section 25-7-106 (7) and (8), C.R.S., AND SECTION 24-33.5-1217, C.R.S. The forest service shall emphasize providing training and technical assistance for landowners, local communities, and state agencies.

SECTION 10. In Colorado Revised Statutes, 24-33.5-1204, **amend** (3) as follows:

24-33.5-1204. Voluntary education and training program - voluntary certification of firefighters, first responders, and hazardous materials responders - advisory board. (3) The advisory board shall meet as determined necessary by the chairperson or the director. The members of the advisory board shall receive no compensation but shall be reimbursed for necessary travel and other expenses actually incurred in the performance of their official duties. The expenses shall be paid from the firefighter, first responder, ~~and~~ hazardous materials responder, AND PRESCRIBED FIRE TRAINING AND certification fund created in section 24-33.5-1207.

SECTION 11. In Colorado Revised Statutes, 24-33.5-1205, **amend** (1) (g) as follows:

24-33.5-1205. Duties of the director and the advisory board.

(1) The director has the following duties relating to the voluntary firefighter, first responder, and hazardous materials responder certification programs and the fire service education and training program:

(g) To establish fees for the actual direct and indirect costs of the administration of the firefighter, first responder, and hazardous materials responder certification programs, which fees shall be assessed against any person participating in such programs. All fees collected shall be credited to the firefighter, first responder, ~~and~~ hazardous materials responder, AND PRESCRIBED FIRE TRAINING AND certification fund created in section 24-33.5-1207.

SECTION 12. In Colorado Revised Statutes, 24-33.5-1207, **amend** (1) as follows:

24-33.5-1207. Firefighter, first responder, hazardous materials responder, and prescribed fire training and certification fund - created. (1) All moneys received by the director pursuant to the coordination and administration of the firefighter, first responder, ~~and~~ hazardous materials responder, AND PRESCRIBED FIRE TRAINING AND certification programs and all interest earned on the moneys shall be deposited in the state treasury in the firefighter, first responder, ~~and~~ hazardous materials responder, AND PRESCRIBED FIRE TRAINING AND certification fund, which fund is hereby created, and the moneys shall be used, subject to annual appropriations by the general assembly, for the purposes set forth in this part 12 and shall not be deposited in or transferred to the general fund of the state of Colorado or any other fund.

SECTION 13. In Colorado Revised Statutes, 24-33.5-1211, **amend** (4) as follows:

24-33.5-1211. Inspector certification. (4) The director of the

division shall establish a fee to cover the actual direct and indirect costs of processing applications and issuing and renewing certifications pursuant to this section. Certification fees collected by the division shall be credited to the firefighter, first responder, ~~and~~ hazardous materials responder, AND PRESCRIBED FIRE TRAINING AND certification fund created in section 24-33.5-1207.

SECTION 14. Safety clause. The general assembly hereby finds, determines, and declares that this act is necessary for the immediate preservation of the public peace, health, and safety.

First Regular Session
Sixty-ninth General Assembly
STATE OF COLORADO

BILL B

LLS NO. 13-0116.01 Bob Lackner x4350 **SENATE BILL**

SENATE SPONSORSHIP

Nicholson and Roberts,

HOUSE SPONSORSHIP

Levy,

Senate Committees **House Committees**

A BILL FOR AN ACT

101 **CONCERNING THE CREATION OF A PERMANENT INTERIM COMMITTEE**
102 **OF THE GENERAL ASSEMBLY TO REVIEW MATTERS RELATING TO**
103 **WILDFIRES IN THE STATE.**

Bill Summary

(Note: This summary applies to this bill as introduced and does not reflect any amendments that may be subsequently adopted. If this bill passes third reading in the house of introduction, a bill summary that applies to the reengrossed version of this bill will be available at http://www.leg.state.co.us/billsummaries.)

Lower North Fork Wildfire Commission. The bill creates the wildfire matters review committee as an interim committee of the general assembly (committee) to address wildfire prevention and mitigation and to review and propose legislation relating to such matters. The committee

is required to meet at least once during the interim of each year to review and to propose legislation or other policy changes relating to wildfire prevention and mitigation and all related matters. The bill authorizes the committee to consult with experts in all fields relating to wildfire prevention and mitigation as may be necessary to achieve the committee's objectives. All personnel of any state agency or political subdivision of Colorado involved in wildfire prevention and mitigation, including the Colorado department of public safety and the Colorado state forest service, are required to cooperate with the committee and with any persons assisting the committee in carrying out its duties.

Membership of the committee consists of 10 members of the general assembly, equally divided between members of the house and senate. The bill specifies the manner in which the appointments are to be made and additional requirements relating to the service of members of the committee.

The interim committee is repealed on July 1, 2018.

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1 *Be it enacted by the General Assembly of the State of Colorado:*

2 **SECTION 1.** In Colorado Revised Statutes, **add** part 16 to article
3 3 of title 2 as follows:

4 PART 16

5 WILDFIRE MATTERS REVIEW COMMITTEE

6 **2-3-1601. Legislative declaration.** (1) THE GENERAL ASSEMBLY
7 FINDS, DETERMINES, AND DECLARES THAT:

8 (a) WILDFIRES ARE A PART OF THE NATURAL CYCLE OF
9 COLORADO'S FORESTS, YET INCREASINGLY POSE A SEVERE THREAT TO
10 HUMAN LIFE AND PROPERTY;

11 (b) PEOPLE ARE ATTRACTED TO THE FOREST AND MOUNTAIN AREAS
12 OF THE STATE AND INCREASINGLY CHOOSE TO MAKE THEIR HOMES IN
13 WHAT IS KNOWN AS THE "WILDLAND URBAN INTERFACE", WHERE
14 WILDLAND AREAS MEET RESIDENTIAL DEVELOPMENT;

15 (c) FOR MANY YEARS NOW, RESIDENTIAL AREAS IN NUMEROUS
16 PARTS OF THE STATE ARE REGULARLY THREATENED BY A CLOSE

1 PROXIMITY TO WILDFIRES AND, TRAGICALLY, DURING THE SPRING AND
2 SUMMER OF 2012, COLORADO WILDFIRES RESULTED IN THE LOSS OF LIFE
3 AND EXTENSIVE PROPERTY DAMAGE, INCLUDING THE DESTRUCTION OF
4 HOMES AFFECTING THOUSANDS OF PEOPLE;
5 (d) SINCE WILDFIRES CAUSE ANNUAL HARM TO MANY AREAS OF
6 THE STATE AND THOSE RESIDING IN SUCH AREAS, WILDFIRE PREVENTION
7 AND MITIGATION IS A MATTER OF EXTREME IMPORTANCE THROUGHOUT
8 THE STATE AND AN ISSUE DEMANDING CRITICAL ATTENTION FROM THE
9 GENERAL ASSEMBLY ON A REGULAR BASIS.
10 (2) THE PURPOSE OF THIS PART 16 IS TO PROVIDE A PERMANENT
11 INTERIM COMMITTEE AS A FORUM THROUGH WHICH THE GENERAL
12 ASSEMBLY REVIEWS STATE POLICIES AND RESOURCES ADDRESSING
13 WILDFIRE PREVENTION AND MITIGATION AND THE SUCCESSFUL
14 IMPLEMENTATION AND EXECUTION OF SUCH POLICIES. IN CREATING A
15 PERMANENT INTERIM COMMITTEE TO ADDRESS MATTERS RELATING TO
16 WILDFIRES, THE GENERAL ASSEMBLY INTENDS THAT ISSUES RELATING TO
17 WILDFIRE PREVENTION AND MITIGATION RECEIVE SUFFICIENT LEGISLATIVE
18 SCRUTINY AND PUBLIC PARTICIPATION.
19 **2-3-1602. Wildfire matters review committee - creation -**
20 **repeal.** (1) TO ADDRESS WILDFIRE PREVENTION AND MITIGATION AND TO
21 REVIEW AND PROPOSE LEGISLATION RELATING TO SUCH MATTERS, THE
22 WILDFIRE MATTERS REVIEW COMMITTEE IS HEREBY CREATED, AND IS
23 REFERRED TO IN THIS PART 16 AS THE "COMMITTEE". THE COMMITTEE
24 SHALL MEET AT THE CALL OF THE CHAIR AT LEAST ONCE DURING THE
25 INTERIM OF EACH YEAR TO REVIEW AND TO PROPOSE LEGISLATION OR
26 OTHER POLICY CHANGES RELATING TO WILDFIRE PREVENTION AND
27 MITIGATION AND ALL RELATED MATTERS, INCLUDING, WITHOUT
28 LIMITATION, PUBLIC SAFETY AND FOREST HEALTH ISSUES. THE COMMITTEE

1 MAY CONSULT WITH EXPERTS IN ALL FIELDS RELATING TO WILDFIRE
2 PREVENTION AND MITIGATION AS MAY BE NECESSARY TO ACHIEVE THE
3 OBJECTIVES OF THIS PART 16. ALL PERSONNEL OF ANY STATE AGENCY OR
4 POLITICAL SUBDIVISION OF COLORADO INVOLVED IN WILDFIRE
5 PREVENTION AND MITIGATION, INCLUDING THE COLORADO DEPARTMENT
6 OF PUBLIC SAFETY AND THE COLORADO STATE FOREST SERVICE, SHALL
7 COOPERATE WITH THE COMMITTEE AND WITH ANY PERSONS ASSISTING THE
8 COMMITTEE IN CARRYING OUT ITS DUTIES PURSUANT TO THIS SECTION.
9 (2) THE COMMITTEE CONSISTS OF TEN MEMBERS OF THE GENERAL
10 ASSEMBLY SELECTED AS FOLLOWS:
11 (a) FIVE MEMBERS FROM THE SENATE, THREE APPOINTED BY THE
12 PRESIDENT OF THE SENATE AND TWO APPOINTED BY THE MINORITY LEADER
13 OF THE SENATE;
14 (b) FIVE MEMBERS FROM THE HOUSE OF REPRESENTATIVES, THREE
15 APPOINTED BY THE SPEAKER OF THE HOUSE OF REPRESENTATIVES AND
16 TWO APPOINTED BY THE MINORITY LEADER OF THE HOUSE OF
17 REPRESENTATIVES.
18 (3) APPOINTING AUTHORITIES SHALL MAKE THEIR ORIGINAL
19 APPOINTMENTS TO THE COMMITTEE NOT LATER THAN JULY 1, 2013. TERMS
20 OF SERVICE ON THE COMMITTEE ARE FOR TWO YEARS. THE TERMS OF
21 ORIGINAL APPOINTEES TO THE COMMITTEE TERMINATE ON THE CONVENING
22 DATE OF THE FIRST REGULAR SESSION OF THE SEVENTIETH GENERAL
23 ASSEMBLY. THEREAFTER, THE TERMS OF MEMBERS OF THE COMMITTEE
24 TERMINATE ON THE CONVENING DATE OF THE FIRST REGULAR SESSION OF
25 THE GENERAL ASSEMBLY NEXT FOLLOWING THEIR APPOINTMENT OR
26 REAPPOINTMENT, AND ALL SUBSEQUENT APPOINTMENTS OR
27 REAPPOINTMENTS ARE MADE AS SOON AS PRACTICABLE AFTER SUCH
28 CONVENING DATE. INCUMBENT MEMBERS MAY BE REAPPOINTED TO THE

1 COMMITTEE. THE PERSON MAKING THE ORIGINAL APPOINTMENT OR
2 REAPPOINTMENT SHALL FILL ANY VACANCY BY APPOINTMENT FOR THE
3 REMAINDER OF AN UNEXPIRED TERM. MEMBERS SERVE AT THE PLEASURE
4 OF THE APPOINTING AUTHORITY AND CONTINUE IN OFFICE UNTIL A
5 SUCCESSOR IS APPOINTED, AS APPLICABLE.
6 (4) THE COMMITTEE SHALL SELECT A CHAIR AND VICE-CHAIR FROM
7 AMONG ITS MEMBERSHIP AND PRESCRIBE ITS OWN RULES OF PROCEDURE.
8 (5) MEMBERS OF THE COMMITTEE SERVE WITHOUT
9 COMPENSATION; EXCEPT THAT EACH MEMBER IS ENTITLED TO BE
10 REIMBURSED FOR NECESSARY EXPENSES IN CONNECTION WITH THE
11 PERFORMANCE OF HIS OR HER DUTIES AND RECEIVES THE SAME PER DIEM
12 AS OTHER MEMBERS OF INTERIM COMMITTEES IN ATTENDANCE AT
13 MEETINGS.
14 (6) EXISTING EMPLOYEES OF THE LEGISLATIVE SERVICE AGENCIES
15 SHALL PROVIDE ANY STAFF ASSISTANCE REQUIRED BY THE COMMITTEE
16 WITHIN EXISTING APPROPRIATIONS.
17 (7) THIS PART 16 IS REPEALED, EFFECTIVE JULY 1, 2018.
18 **SECTION 2. Safety clause.** The general assembly hereby finds,
19 determines, and declares that this act is necessary for the immediate
20 preservation of the public peace, health, and safety.

First Regular Session
Sixty-ninth General Assembly
STATE OF COLORADO

BILL C

LLS NO. 13-0119.01 Esther van Mourik x4215 **HOUSE BILL**

HOUSE SPONSORSHIP

Gerou and Levy,

SENATE SPONSORSHIP

Roberts and Nicholson,

House Committees **Senate Committees**

A BILL FOR AN ACT

101 **CONCERNING THE EXTENSION OF FINANCIAL INCENTIVES FOR**
102 **WILDFIRE MITIGATION.**

Bill Summary

(Note: This summary applies to this bill as introduced and does not reflect any amendments that may be subsequently adopted. If this bill passes third reading in the house of introduction, a bill summary that applies to the reengrossed version of this bill will be available at http://www.leg.state.co.us/billsummaries.)

Lower North Fork Wildfire Commission. Section 1 of the bill continues an income tax deduction for a landowner who performs wildfire mitigation measures on private land in a wildland-urban interface area. **Section 2** of the bill continues the authority of the Colorado water resources and power development authority to issue bonds for the

purposes of funding watershed protection and forest health projects.

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1 *Be it enacted by the General Assembly of the State of Colorado:*

2 **SECTION 1.** In Colorado Revised Statutes, 39-22-104, **add** (4)
3 (n.5) as follows:

4 **39-22-104. Income tax imposed on individuals, estates, and**
5 **trusts - single rate - definitions - repeal.** (4) There shall be subtracted
6 from federal taxable income:

7 (n.5) (I) (A) FOR INCOME TAX YEARS COMMENCING ON OR AFTER
8 JANUARY 1, 2014, BUT PRIOR TO JANUARY 1, 2025, AN AMOUNT EQUAL TO
9 FIFTY PERCENT OF A LANDOWNER'S COSTS INCURRED IN PERFORMING
10 WILDFIRE MITIGATION MEASURES IN THAT INCOME TAX YEAR ON HIS OR
11 HER PROPERTY LOCATED WITHIN THE STATE; EXCEPT THAT THE AMOUNT
12 OF THE DEDUCTION CLAIMED IN AN INCOME TAX YEAR SHALL NOT EXCEED
13 TWO THOUSAND FIVE HUNDRED DOLLARS OR THE TOTAL AMOUNT OF THE
14 LANDOWNER'S FEDERAL TAXABLE INCOME FOR THE INCOME TAX YEAR FOR
15 WHICH THE DEDUCTION IS CLAIMED, WHICHEVER IS LESS.

16 (B) IN THE CASE OF TWO INDIVIDUALS FILING A JOINT RETURN, THE
17 AMOUNT SUBTRACTED FROM FEDERAL TAXABLE INCOME SHALL NOT
18 EXCEED TWO THOUSAND FIVE HUNDRED DOLLARS IN ANY TAXABLE YEAR.
19 IN THE CASE OF A MARRIED INDIVIDUAL WHO FILES A SEPARATE RETURN,
20 ONLY ONE INDIVIDUAL IN THE MARRIAGE MAY CLAIM THE DEDUCTION
21 SPECIFIED IN THIS PARAGRAPH (n.5).

22 (C) IN THE CASE OF REAL PROPERTY OWNED AS TENANTS IN
23 COMMON, THE DEDUCTION ALLOWED PURSUANT TO THIS PARAGRAPH (n.5)
24 SHALL ONLY BE ALLOWED TO ONE OF THE INDIVIDUALS OF THE OWNERSHIP
25 GROUP.

1 (II) A LANDOWNER WHO PERFORMS WILDFIRE MITIGATION
2 MEASURES ON HIS OR HER REAL PROPERTY LOCATED WITHIN THE STATE
3 MAY CLAIM THE DEDUCTION AUTHORIZED BY THIS PARAGRAPH (n.5) IF THE
4 WILDFIRE MITIGATION MEASURES ARE PERFORMED IN A WILDLAND-URBAN
5 INTERFACE AREA.
6 (III) FOR PURPOSES OF THIS PARAGRAPH (n.5):
7 (A) "COLORADO STATE FOREST SERVICE" MEANS THE COLORADO
8 STATE FOREST SERVICE IDENTIFIED IN SECTION 23-31-302, C.R.S.
9 (B) "COSTS" MEANS ANY ACTUAL OUT-OF-POCKET EXPENSE
10 INCURRED AND PAID BY THE LANDOWNER, DOCUMENTED BY RECEIPT, FOR
11 PERFORMING WILDFIRE MITIGATION MEASURES. "COSTS" DO NOT INCLUDE
12 ANY INSPECTION OR CERTIFICATION FEES, IN-KIND CONTRIBUTIONS,
13 DONATIONS, INCENTIVES, OR COST SHARING ASSOCIATED WITH
14 PERFORMING WILDFIRE MITIGATION MEASURES. "COSTS" DO NOT INCLUDE
15 EXPENSES PAID BY THE LANDOWNER FROM ANY GRANTS AWARDED TO THE
16 LANDOWNER FOR PERFORMING WILDFIRE MITIGATION MEASURES.
17 (C) "LANDOWNER" MEANS ANY OWNER OF RECORD OF PRIVATE
18 LAND LOCATED WITHIN THE STATE, INCLUDING ANY EASEMENT,
19 RIGHT-OF-WAY, OR ESTATE IN THE LAND, AND INCLUDES THE HEIRS,
20 SUCCESSORS, AND ASSIGNS OF SUCH LAND, AND SHALL NOT INCLUDE ANY
21 PARTNERSHIP, S CORPORATION, OR OTHER SIMILAR ENTITY THAT OWNS
22 PRIVATE LAND AS AN ENTITY.
23 (D) "WILDFIRE MITIGATION MEASURES" MEANS THE CREATION OF
24 A DEFENSIBLE SPACE AROUND STRUCTURES; THE ESTABLISHMENT OF FUEL
25 BREAKS; THE THINNING OF WOODY VEGETATION FOR THE PRIMARY
26 PURPOSE OF REDUCING RISK TO STRUCTURES FROM WILDLAND FIRE; OR
27 THE SECONDARY TREATMENT OF WOODY FUELS BY LOPPING AND
28 SCATTERING, PILING, CHIPPING, REMOVING FROM THE SITE, OR PRESCRIBED

1 BURNING; SO LONG AS SUCH ACTIVITIES MEET OR EXCEED ANY COLORADO
2 STATE FOREST SERVICE STANDARDS OR ANY OTHER APPLICABLE STATE
3 RULES.
4 (IV) THIS PARAGRAPH (n.5) IS REPEALED, EFFECTIVE JANUARY 1,
5 2026.
6 **SECTION 2.** In Colorado Revised Statutes, 37-95-112.5, **amend**
7 (5) as follows:
8 **37-95-112.5. Watershed protection and forest health projects**
9 **- repeal.** (5) This section is repealed, effective ~~July 1, 2013~~ JULY 1, 2023.
10 Such repeal shall not nullify, abrogate, alter, or otherwise affect any
11 extant obligations under this article at the time of the repeal.
12 **SECTION 3. Safety clause.** The general assembly hereby finds,
13 determines, and declares that this act is necessary for the immediate
14 preservation of the public peace, health, and safety.

First Regular Session
Sixty-ninth General Assembly
STATE OF COLORADO

BILL D

LLS NO. 13-0120.01 Kate Meyer x4348 **HOUSE BILL**

HOUSE SPONSORSHIP

Gerou, Levy

SENATE SPONSORSHIP

Nicholson and Roberts,

House Committees **Senate Committees**

A BILL FOR AN ACT

101 **CONCERNING STATEWIDE ALL-HAZARDS RESOURCE MOBILIZATION,**
102 **AND, IN CONNECTION THEREWITH, CLARIFYING THE POWERS**
103 **AND DUTIES OF THE DEPARTMENT OF PUBLIC SAFETY WITH**
104 **RESPECT TO THE STATEWIDE ALL-HAZARDS RESOURCE**
105 **MOBILIZATION PLAN AND SPECIFYING HOW MOBILIZED ENTITIES**
106 **RECEIVE REIMBURSEMENT FOR EXPENSES INCURRED BY**
107 **RENDERING ASSISTANCE.**

Bill Summary

(Note: This summary applies to this bill as introduced and does not reflect any amendments that may be subsequently adopted. If this bill passes third reading in the house of introduction, a bill summary that applies to the reengrossed version of this bill will be available at

http://www.leg.state.co.us/billsummaries.)

Lower North Fork Wildfire Commission. Currently, the office of emergency management (office) in the division of homeland security and emergency management (division) in the department of public safety (department) is charged with developing a statewide all-hazards resource mobilization plan (plan) to facilitate the interjurisdictional provision of disaster emergency assistance during disasters. The bill clarifies the duties of the office, the director of the office, and executive director of the department with respect to such plan and establishes the means by which mobilized governmental entities may seek reimbursement for costs incurred by rendering interjurisdictional disaster assistance.

Be it enacted by the General Assembly of the State of Colorado:

SECTION 1. In Colorado Revised Statutes, **amend** 24-33.5-705.4 as follows:

24-33.5-705.4. All-hazards resource mobilization system - creation - plan - duties - reimbursement for expenses incurred by mobilized entities - eligibility - definitions - legislative declaration. (1) (a) ~~The office of emergency management shall prepare a statewide resource mobilization system to provide for the allocation and deployment of resources in the event of a disaster or local incident that requires more resources than those available under any existing interjurisdictional or mutual aid agreement~~ THE GENERAL ASSEMBLY HEREBY FINDS, DETERMINES, AND DECLARES THAT THE STATEWIDE ALL-HAZARDS RESOURCE MOBILIZATION SYSTEM, WHICH PROVIDES FOR EFFICIENT MOBILIZING, TRACKING, ALLOCATING, AND DEMOBILIZING EMERGENCY RESOURCES AND ENSURES THAT A REQUESTING UNIT OF GOVERNMENT RECEIVES PROPER EQUIPMENT AND QUALIFIED PERSONNEL, IS NECESSARY TO PROVIDE RESOURCES TO ANY EMERGENCY INCIDENT BEYOND LOCAL CAPABILITIES AND THUS NECESSARY TO PROTECT LIFE, PROPERTY, THE ENVIRONMENT, AND CULTURAL AND ECONOMIC

RESOURCES. THE GENERAL ASSEMBLY FURTHER FINDS AND DECLARES THAT THE NEED TO ENSURE THAT THE STATE IS ADEQUATELY PREPARED AND ABLE TO ADDRESS LARGE-SCALE EMERGENCIES AND DISASTERS REQUIRES A MECHANISM TO REIMBURSE STATE AGENCIES, TRIBAL GOVERNMENTS, AND LOCAL JURISDICTIONS THAT RESPOND TO REQUESTS FOR HELP FROM OTHER JURISDICTIONS IN TIMES OF NEED. IT IS THEREFORE NECESSARY TO:

(I) FORMULATE THE POLICY AND ORGANIZATIONAL STRUCTURE FOR LARGE-SCALE MOBILIZATION OF EMERGENCY RESOURCES IN THE STATE THROUGH CREATION OF A STATEWIDE ALL-HAZARDS RESOURCE MOBILIZATION SYSTEM;

(II) ESTABLISH THE MEANS BY WHICH STATE AGENCIES AND TRIBAL AND LOCAL JURISDICTIONS MAY BE REIMBURSED FOR EXPENSES THEY INCUR WHEN MOBILIZED BY THE EXECUTIVE DIRECTOR PURSUANT TO THE MOBILIZATION PLAN; AND

(III) PROVIDE A PROCEDURE TO REIMBURSE A HOST JURISDICTION WHEN IT HAS EXHAUSTED OR WILL EXHAUST ALL OF ITS OWN RESOURCES AND THE RESOURCES OF ITS LOCAL MUTUAL AID NETWORK AVAILABLE UNDER A MUTUAL AID OR INTERJURISDICTIONAL AGREEMENT.

(b) IN ACCORDANCE WITH SECTION 24-33.5-713, IT IS THE INTENT OF THE LEGISLATURE TO ENCOURAGE POLITICAL SUBDIVISIONS TO ENTER INTO MUTUAL AID AND OTHER INTERJURISDICTIONAL AGREEMENTS. SUCH AGREEMENTS PRODUCE ENHANCED EMERGENCY RESPONSE AND ARE THUS ESSENTIAL TO PROTECTING THE PUBLIC PEACE, SAFETY, HEALTH, AND WELFARE, INCLUDING THE LIVES AND PROPERTY, OF THE PEOPLE OF THE STATE OF COLORADO.

(2) ~~The resource mobilization system created pursuant to subsection (1) of this section shall be developed in coordination with~~

~~appropriate federal, tribal, state, local government, and private sector agencies and organizations. The system shall include mobilization procedures and may include provisions for reimbursement of costs.~~ AS USED IN THIS SECTION, UNLESS THE CONTEXT OTHERWISE REQUIRES:

(a) "DIRECTOR" MEANS THE DIRECTOR OF THE OFFICE OF EMERGENCY MANAGEMENT CREATED IN SECTION 24-33.5-705.

(b) "EMERGENCY MANAGER" MEANS THE DIRECTOR OR COORDINATOR OF THE LOCAL OR INTERJURISDICTIONAL DISASTER AGENCY, AS DESCRIBED IN SECTION 24-33.5-707 (4), OR OTHER PERSON, IDENTIFIED PURSUANT TO SECTION 24-33.5-707 (6), RESPONSIBLE FOR LOCAL OR INTERJURISDICTIONAL DISASTER PREPAREDNESS AND RESPONSE.

(c) "HOST JURISDICTION" MEANS THE JURISDICTION HAVING AUTHORITY OVER THE DISASTER OR EMERGENCY.

(d) "INCIDENT COMMAND SYSTEM" HAS THE MEANING SET FORTH IN SECTION 29-22.5-102 (3), C.R.S.

(e) "JURISDICTION" MEANS STATE AND TRIBAL AUTHORITIES AND COUNTY, CITY, CITY AND COUNTY, TOWN, SPECIAL DISTRICT, OR OTHER POLITICAL SUBDIVISIONS OF THE STATE.

(f) "MOBILIZATION" MEANS THE PROCESS OF PROVIDING, UPON REQUEST AND SUBJECT TO AVAILABILITY, EMERGENCY RESOURCES BEYOND THOSE AVAILABLE THROUGH EXISTING INTERJURISDICTIONAL OR MUTUAL AID AGREEMENTS IN RESPONSE TO A REQUEST FROM A JURISDICTION IN WHICH AN EMERGENCY OR DISASTER SITUATION OR LOCAL EMERGENCY INCIDENT THAT HAS EXCEEDED OR WILL EXCEED THE CAPABILITIES OF AVAILABLE LOCAL RESOURCES. THE TERM INCLUDES THE REDISTRIBUTION OF RESOURCES EITHER TO DIRECT EMERGENCY INCIDENT ASSIGNMENTS OR TO ASSIGNMENT IN COMMUNITIES WHERE RESOURCES ARE NEEDED TO PROVIDE COVERAGE WHEN THOSE COMMUNITIES'

1 RESOURCES HAVE BEEN MOBILIZED TO ASSIST OTHER JURISDICTIONS.
2 (g) "MOBILIZATION PLAN" MEANS THE STATEWIDE ALL-HAZARDS
3 RESOURCE MOBILIZATION PLAN DEVELOPED AND UTILIZED PURSUANT TO
4 THIS SECTION.
5 (h) "MOBILIZATION SYSTEM" MEANS THE STATEWIDE
6 ALL-HAZARDS RESOURCE MOBILIZATION SYSTEM CREATED UNDER THIS
7 SECTION, WHICH SYSTEM INCLUDES THE MOBILIZATION PLAN AND THE
8 TECHNOLOGY AND PERSONNEL NECESSARY TO MOBILIZE RESOURCES
9 ACCORDING TO THE PLAN.
10 (i) "MUTUAL AID" MEANS EMERGENCY INTERAGENCY ASSISTANCE
11 RENDERED PURSUANT TO AN AGREEMENT BETWEEN THE JURISDICTIONS
12 RENDERING AND RECEIVING ASSISTANCE.
13 (j) "NONHOST JURISDICTION" MEANS A JURISDICTION PROVIDING
14 DISASTER OR EMERGENCY RESPONSE RESOURCES TO A HOST JURISDICTION.
15 (k) "UNIFIED COMMAND" HAS THE MEANING SET FORTH IN SECTION
16 29-22.5-102 (8), C.R.S.
17 (3) **Powers and duties.** (a) THE DIRECTOR SHALL DEVELOP AND
18 MAINTAIN A STATEWIDE ALL-HAZARDS RESOURCE MOBILIZATION PLAN
19 THAT SETS FORTH PROCEDURES FOR MOBILIZATION, ALLOCATION,
20 DEPLOYMENT, COORDINATION, TRACKING, COST ACCOUNTING, AND
21 DEMOBILIZATION OF RESOURCES DURING DISASTERS AND OTHER
22 LARGE-SCALE EMERGENCIES AND LOCAL INCIDENTS THAT REQUIRE MORE
23 RESOURCES THAN THOSE AVAILABLE UNDER ANY EXISTING
24 INTERJURISDICTIONAL OR MUTUAL AID AGREEMENT. IN DEVELOPING THE
25 MOBILIZATION PLAN, THE DIRECTOR SHALL CONSULT WITH AND SOLICIT
26 RECOMMENDATIONS FROM THE HOMELAND SECURITY AND ALL-HAZARDS
27 SENIOR ADVISORY COMMITTEE CREATED IN SECTION 24-33.5-1614 AND
28 OTHER APPROPRIATE REPRESENTATIVES OF STATE, TRIBAL, AND LOCAL

1 GOVERNMENTAL AND PRIVATE SECTOR EMERGENCY MANAGEMENT
2 ORGANIZATIONS. THE DIRECTOR SHALL ENSURE THAT THE MOBILIZATION
3 PLAN IS CONSISTENT WITH, AND INCORPORATED INTO, THE COLORADO
4 STATE EMERGENCY OPERATIONS PLAN.
5 (b) THE EXECUTIVE DIRECTOR, OR HIS OR HER DESIGNEE, IS
6 RESPONSIBLE FOR MOBILIZING RESOURCES FROM STATE AND NONHOST
7 JURISDICTIONS, IN ACCORDANCE WITH THIS SECTION AND THE
8 MOBILIZATION PLAN, WHEN THE EXECUTIVE DIRECTOR OR HIS OR HER
9 DESIGNEE DETERMINES IT IS NECESSARY TO DO SO TO PROTECT LIFE,
10 PROPERTY, THE ENVIRONMENT, AND CULTURAL AND ECONOMIC
11 RESOURCES.
12 (c) THE DIRECTOR, OR HIS OR HER DESIGNEE, SHALL SERVE AS
13 STATE RESOURCE COORDINATOR WHEN THE MOBILIZATION PLAN IS
14 IMPLEMENTED.
15 (4) **Mobilization.** (a) (I) THE EXECUTIVE DIRECTOR, OR HIS OR
16 HER DESIGNEE, MAY ORDER MOBILIZATION PURSUANT TO THIS SECTION
17 ONLY IF HE OR SHE RECEIVES A REQUEST TO DO SO FROM THE GOVERNOR
18 OR FROM AN EMERGENCY MANAGER.
19 (II) AN EMERGENCY MANAGER MAY REQUEST MOBILIZATION ONLY
20 IF THE REQUEST IS IN RESPONSE TO A LARGE-SCALE EMERGENCY,
21 DISASTER, OR OTHER LOCAL INCIDENT THAT EXCEEDS OR WILL EXCEED THE
22 CAPABILITIES OF AVAILABLE LOCAL RESOURCES AND THOSE RESOURCES
23 AVAILABLE THROUGH EXISTING MUTUAL AID AGREEMENTS.
24 (III) UPON RECEIVING A REQUEST FOR MOBILIZATION AND FINDING
25 THAT THE LOCAL JURISDICTION HAS EXHAUSTED OR WILL EXHAUST ALL
26 AVAILABLE RESOURCES, THE EXECUTIVE DIRECTOR OR HIS OR HER
27 DESIGNEE SHALL DETERMINE WHETHER MOBILIZATION IS THE APPROPRIATE
28 RESPONSE TO THE EMERGENCY OR DISASTER. IF SO, THE EXECUTIVE

1 DIRECTOR SHALL MOBILIZE NONHOST JURISDICTIONS UNDER THE
2 MOBILIZATION PLAN.
3 (b) UPON AND FOR THE DURATION OF MOBILIZATION:
4 (I) THE STATE RESOURCE COORDINATOR AND ASSIGNED STAFF
5 SHALL SERVE JOINTLY WITH THE COMMANDER OF THE HOST JURISDICTION'S
6 DISASTER AGENCY UNDER UNIFIED COMMAND TO COMMAND THE
7 MOBILIZATION EFFORT CONSISTENT WITH THE INCIDENT COMMAND
8 SYSTEM AND MOBILIZATION PLAN AND PROCEDURES;
9 (II) ALL RESOURCES, INCLUDING THOSE OF THE HOST JURISDICTION
10 AND THOSE OF NONHOST JURISDICTIONS THAT RESPONDED EARLIER UNDER
11 AN EXISTING INTERJURISDICTIONAL OR MUTUAL AID OR OTHER
12 AGREEMENT, MUST BE MOBILIZED;
13 (III) PURSUANT TO THE MOBILIZATION PLAN, THE HOST
14 JURISDICTION'S DISASTER AGENCY RESOURCES ARE THE STATE
15 MOBILIZATION RESOURCES UNDER THE UNIFIED COMMAND OF THE STATE
16 RESOURCE COORDINATOR AND THE COMMANDER OF THE HOST
17 JURISDICTION AND SHALL BE ADMINISTERED CONSISTENT WITH THE
18 MOBILIZATION PLAN AND INCIDENT COMMAND SYSTEM PROCEDURES; AND
19 (IV) ANY LIMITS ON OR EXEMPTION FROM LIABILITY TO WHICH THE
20 JURISDICTIONS PROVIDING RESOURCES IN RESPONSE TO A MOBILIZATION
21 EFFECTED UNDER THIS SECTION ARE ENTITLED UNDER LAW APPLY AS
22 THOUGH THE JURISDICTIONS WERE OPERATING UNDER THEIR NORMAL
23 STATUTORY AUTHORITIES WITHIN THEIR JURISDICTIONAL BOUNDARIES.
24 (c) THE EXECUTIVE DIRECTOR, IN CONSULTATION WITH THE STATE
25 RESOURCE COORDINATOR AND LOCAL COMMANDER, SHALL DETERMINE
26 WHEN MOBILIZATION IS NO LONGER REQUIRED AND, AT THAT TIME, SHALL
27 DECLARE THE END TO THE MOBILIZATION.
28 (5) **Reimbursement.** (a) THE DIRECTOR, IN CONSULTATION WITH

THE OFFICE OF STATE PLANNING AND BUDGETING CREATED IN SECTION 24-37-102, SHALL DEVELOP PROCEDURES TO FACILITATE REIMBURSEMENT TO STATE AGENCIES AND JURISDICTIONS FROM APPROPRIATE FEDERAL AND STATE FUNDS WHEN STATE AGENCIES AND JURISDICTIONS ARE MOBILIZED BY THE EXECUTIVE DIRECTOR PURSUANT TO THE MOBILIZATION PLAN. THE DIRECTOR SHALL ENSURE THAT THESE PROCEDURES PROVIDE REIMBURSEMENT IN AS TIMELY A MANNER AS POSSIBLE.

(b) (I) IN ORDER TO BE ELIGIBLE FOR SUPPORT UNDER THE MOBILIZATION PLAN, A JURISDICTION MUST BE PARTICIPATING IN AN INTERJURISDICTIONAL OR MUTUAL AID AGREEMENT ENTERED INTO PURSUANT TO THIS PART 7.

(II) ALL MOBILIZED NONHOST JURISDICTIONS ARE ELIGIBLE FOR EXPENSE REIMBURSEMENT FROM THE TIME OF THE MOBILIZATION DECLARATION THROUGH DEMOBILIZATION.

(6) (a) NOTHING IN THIS SECTION LIMITS THE POWERS OF THE GOVERNOR DURING A DISASTER UNDER 24-33.5-704.

(b) EXCEPT AS EXPRESSLY PROVIDED IN THIS SECTION, NOTHING IN THIS SECTION LIMITS THE ELIGIBILITY OF ANY NONHOST JURISDICTION FOR REIMBURSEMENT OF EXPENSES INCURRED IN PROVIDING RESOURCES FOR MOBILIZATION.

(c) NOTHING IN THIS SECTION PRECLUDES A STATE OR LOCAL GOVERNMENTAL ENTITY FROM SEEKING PUBLIC ASSISTANCE FUNDING PURSUANT TO THE FEDERAL "ROBERT T. STAFFORD DISASTER RELIEF AND EMERGENCY ASSISTANCE ACT", AS AMENDED, 42 U.S.C. SEC. 5121 ET SEQ.

SECTION 2. In Colorado Revised Statutes, 24-33.5-713, **amend** (1) as follows:

24-33.5-713. Mutual aid. (1) THE OFFICE OF EMERGENCY

1 MANAGEMENT SHALL ENCOURAGE AND ASSIST political subdivisions not
2 participating in interjurisdictional arrangements pursuant to this part 7
3 ~~nevertheless shall be encouraged and assisted by the office of emergency~~
4 ~~management~~ to ~~conclude~~ ENTER INTO suitable arrangements for furnishing
5 mutual aid in coping with disasters. The arrangements ~~shall~~ MUST include
6 provision of aid by persons and units in public employ AND, WHENEVER
7 POSSIBLE, SHOULD BE WRITTEN WITHOUT STATED LIMITATIONS AS TO
8 RESOURCES AVAILABLE, TIME, OR AREA.
9 **SECTION 3. Safety clause.** The general assembly hereby finds,
10 determines, and declares that this act is necessary for the immediate
11 preservation of the public peace, health, and safety.

5 - Articles of Interest

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Article published Feb 6, 2013

Beetles multiply in Southwest Colorado

Spruce forests infestation expected to get worse

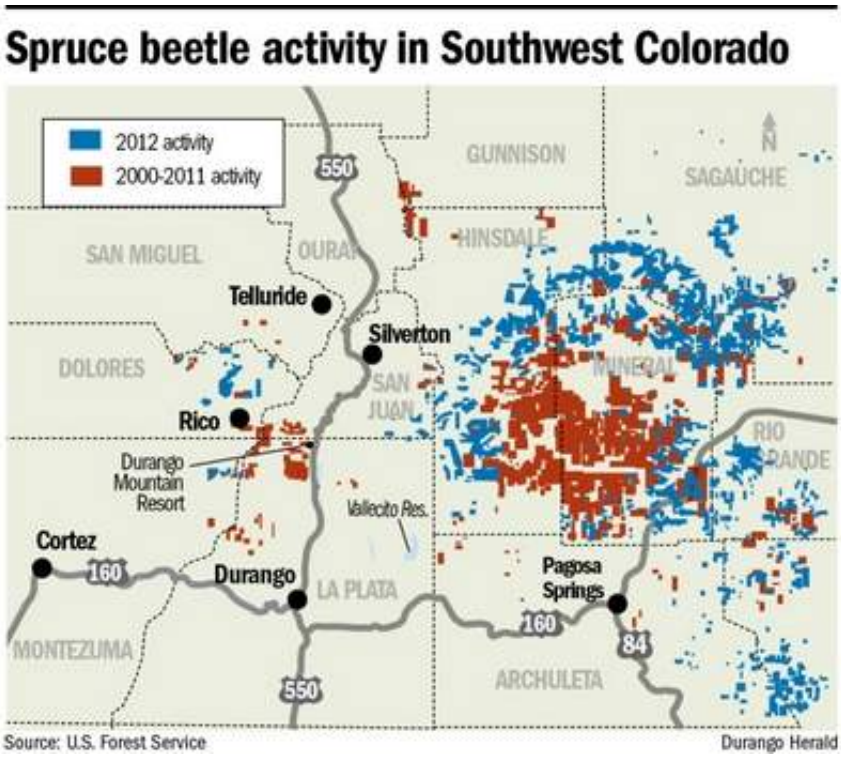

Photo by:

By Joe Hanel Herald staff writer

An outbreak of spruce beetles exploded across the forests of Southwest Colorado last year, according to the results of an aerial survey released Wednesday.

The outbreak will erase some of the region's high-altitude stands of trees for many decades.

"The forest is ripe for the beetle to move through," said Bob Cain, a U.S. Forest Service entomologist.

The drought, dense stands of mature trees and warm winters all make for ideal conditions for the beetles, which bore into trees to feed and lay eggs.

The size of the active outbreak more than doubled in a year. The annual study found spruce beetles active on 311,000 acres, including 183,000 acres that weren't detected in the 2011

survey. The outbreak has covered more than 1,400 square miles since it began in 1996.

“Even our acre numbers we get from the aerial survey don’t really capture it,” Cain said.

Infected trees often take a couple years to die, so the infestation will look even more widespread by next year, Cain said. Beetles grow to adulthood inside trees and then take off to infect new trees. The flight in 2012 was “enormous,” according to the aerial survey report.

On the bright side, Cain said, many spruce forests are mixed with subalpine fir, which are not affected by the spruce beetles.

But spruce trees regrow slowly. Where the beetles hit stands of pure spruce, most people won’t live long enough to see mature trees return to the site.

Although Colorado has several pockets of spruce beetle outbreaks, the hardest-hit areas are in the Rio Grande, San Juan and Gunnison national forests. The most visible outbreak is along Wolf Creek Pass, but there are even bigger infestations in the Weminuche and La Garita wilderness areas and around the town of Creede.

The U.S. Forest Service and Colorado State Forest Service cooperate on the annual survey. Officials from both agencies used the survey’s release to promote increased logging in beetle-infected areas.

“The spruce beetle epidemic in our high-elevation forests demonstrates the breadth and complexity of issues affecting Colorado’s forests,” said Joe Duda, director of the Colorado State Forest Service, in a prepared statement. “Active forest management and a viable forest products industry will allow landowners and land-management agencies to expand forest treatments on lands available for management while reducing wildfire risk and protecting important natural resources and infrastructure.”

But logging remains controversial. Environmental groups including Rocky Mountain Wild won a lawsuit in early 2012 to prevent logging on 3,500 acres of spruce in Rio Grande National Forest.

Josh Pollock of Rocky Mountain Wild said the beetles are a natural part of the ecosystem, and land managers need to carefully pick the areas they will log, with an emphasis on protecting human settlements.

“Let’s be cautious about having an increase in beetle-killed trees be a reason for harvesting trees deep into the backcountry,” Pollock said.

Elsewhere in Colorado, the mountain pine beetle outbreak slowed noticeably in 2012.

The pine beetle has claimed 3.4 million acres of lodgepole and ponderosa pine since 1996, but the infestation expanded by just 31,000 acres last year, mostly near Fort Collins.

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ASPEN Business JOURNAL

Wednesday, February 20, 2013

Science

High-elevation forest mortality continues as spruce surpasses lodgepole

High-elevation forest mortality continues as spruce surpasses lodgepole

J.D. Thomas

As the mountain pine beetle epidemic tapers off after killing much of Colorado's lodgepole forests, it has been surpassed by another epidemic in the upper-elevation forests.

"For the first time in recent years, the acreage impacted by spruce beetle surpassed that of the mountain pine beetle," said interim State Forester Joe Duda in the 2012 *Report on the Health of Colorado's Forests* released Feb. 20. Aerial imagery conducted by the Colorado State Forest Service and the U.S. Forest Service's Rocky Mountain Region indicate a total of 311,000 acres of active spruce infestation, while the mountain pine beetle continues to be active on 264,000 acres of ponderosa, lodgepole and limber pine forests.

While most of the spruce beetle infestation was centered in southern Colorado, other high-elevation tree species in the state continue to suffer, as witnessed by the lodgepole die-off and increased mortality in sub-alpine fir. Bark beetles get much of the credit, but some experts believe the time has come to recognize climate change as the real driver in the situation.

"The effects of climate change are verified to be more extreme at higher altitudes," said University of Colorado researcher Scott Ferrenberg, a Ph.D. in entomology and evolutionary biology. "And the signal for climate change at tree level is very strong."

At Colorado State University, Forest Ecology Professor Dan Binkley said it was "reasonable" to blame climate change for the forest mortality, but the age of trees and general climate variation are also easy culprits. "We should always expect our forest to change," he said.

Bark beetles do the vast majority of the killing in high-elevation tree species, but Ferrenberg and fellow evolutionary biologist Jeffry Mitton believe that climate warming increases the beetles' range and effectiveness, which is amplified in the high-elevation forests.

In a study public in the American Society of Naturalists in May of 2012, Ferrenberg and Mitton established that some pine beetles broods in western Boulder County were able to create two life cycles a year, instead of one -- an evolutionary adaptation directly linked to climate change, they said.

And while the mean temperature at a 10,000-foot weather station on Niwot Ridge used for the study has only risen one degree Celsius (about two degrees Fahrenheit) over the past four decades, that has meant a great deal more time for bark beetles to be active, Ferrenberg said.

"The number of days below freezing has dropped dramatically," he said. "Essentially temperatures that used to be the norm in May have now shifted forward to April. Bark beetles that historically would have emerged in June can now get out in May."

Colorado is a great study in the effect of climate change on high elevation forests, Ferrenberg said, but these same changes are being seen around the globe. Certainly cycles of insect infestations in forests are natural, but not for most tree species above 8,000 feet to be hit so hard and at the same time.

Mitton noted that the elevation gain for distribution of the mountain pine beetle ought to be concern enough.

"Certainly 25 years ago, the mountain pine beetle did not get above 9,000 feet," Mitton said. "Now we're seeing infestation in limber pine at 11,000 feet, and the horrible thing is we think they favor limber pine.

Ferrenberg said that spruce beetles, which have very similar life cycles to that of the mountain pine beetle, are reacting to the very same climate change, with predictable consequence. The same might also be said about Western Balsam Bark Beetle affecting sub-alpine fir, he said, though that situation is also complicated by a root fungus.

Traditionally, foresters have also thought of infestations within tree species as consequence of one insect population, but Ferrenberg said there is a great deal of genetic differences within mountain pine beetles, for instance. "In British Columbia (where the mountain pine beetle has decimated a forested area about the size of Wyoming) they found six or seven distinct variations," he said.

Ferrenberg said that genetic variation is probably also present in Colorado's bark beetles, meaning that it isn't just one population gaining hold and gathering steam, but several distinct populations reacting to the same climate trends that allow them to flourish.

"I doubt a pine beetle from Grand County would recognize a pine beetle from Larimer County (by pheromone secretion)," he said. That evolutionary distinction may also explain why mountain pine beetles that evolved in the higher elevation lodgepole on the eastern slope haven't been more devastating to the lower-elevation ponderosa pine.

In fact, in 2012 active infestation of mountain pine beetle in ponderosa pine forests dropped for the first time in three years, to 170,000 total acres, with almost all of the damage in Larimer County north of the Big Thompson River, according to the forest health report.

However, the spread of mountain pine beetle in Larimer County was also slowed by the High Park Fire, which burned 80,000 acres of trees in an area the beetles had very much taken hold in the ponderosa pine, according to the report. And the mountain pine beetle may have just run through its natural cycle, as well.

"Infestations in both lodgepole and ponderosa pine forests also declined in areas along the central Front Range in Boulder, Clear Creek and Gilpin counties, and south of the I-70 corridor, despite the presence of a substantial number of susceptible host trees," the report states.

Regardless of what is causing the high-elevation tree mortality, Duda said there is really only one way for the state forest service to move forward on the problem: with improved stewardship and forest management.

"We aren't experts in climate change," Duda said. "But whether the climate is stable or changing we do believe that active forest management can create more resiliencies in our forests."

U.S. Sen. Mark Udall, D-Colo., who has also commented on climate change as being a likely driver of insect epidemics in Colorado forest, joined him in that belief.

“Our forests are one of the most important economic drivers and renewable resources our state has, and we need them healthy to help Colorado thrive. As the insect epidemics continue to spread across our Western forests, it's clear that we need to address the problem more intensely and effectively, especially coupled with last year’s record-breaking wildfires and severe drought,” Udall said.

“Our forests need our help to combat the effects of climate change and the ongoing drought. I will continue to fight for adequate funding for our forest-management agencies to help them protect our public safety and strengthen our forest-management capabilities, while working with the traditional and biomass timber industries to support local jobs in beetle-kill and wildfire-risk areas."

Colorado wildfire task force tackles building in burn zones

By Bruce Finley The Denver Post The Denver Post
Posted:

DenverPost.com

A Colorado task force on Monday got down to developing unprecedented limits for building homes in burn zones after the Black Forest fire raised concerns — again — that risks and costs are becoming too great.

Fees assessed on people who choose to live in forests, mandatory disclosure of wildfire risks before home sales and tougher building codes are among measures that members of Gov. John Hickenlooper's Task Force on Wildfire Insurance and Forest Health are considering.

The destruction of 502 structures and two fatalities in Black Forest gives "a cruel illustration" of the need for a smarter approach, said Barbara Kelley, director of the Colorado Department of Regulatory Affairs, leading the 18-member group.

They include deputy state forester Joe Duda, who pointed to rapid construction of houses in forests. Colorado's 1 million or so acres of residentially developed forests is projected to increase to 2.1 million acres by 2030, Duda said.

"If we don't get our arms around this problem now, it's going to run away from us," Duda said. "Now is the time."

Hickenlooper launched the task force in January to find environmentally sensitive ways to improve forest health and limit the destruction by wildfires. Last year, Colorado faced costs topping $40 million in dealing with wildfires that destroyed hundreds of homes.

Task force members, ranging from insurance industry representatives to state air and natural resources officials, are planning a field trip to talk with firefighters.

They're refining recommendations that Kelley said should be done by the end of summer, providing direction for the state and its lawmakers. These emerging recommendations would:

• Establish tougher building codes to increase the safety of homes in forests and ensure defensible space — more precisely defined — around structures.

• Create a state-run insurance program to help cover losses in designated high-risk burn zones — without burdening city residents. "Insurance is going to have to play a critical role in this process," Kelley said.

• Require assessments of wildfire risk and disclosure before home sales — based on state and county maps for structures in the burn zones.

• Allow more controlled burns in high-risk areas to improve forest health and try to make wildfires less catastrophic. Colorado Department of Public Health and Environment officials have proposed to relax smoke management requirements to enable more burns — in exchange for better public notice and education efforts to minimize exposure to smoke and increased air

monitoring to determine impact.

• Require homeowners in burn zones to pay fees to help offset costs of protecting their structures. In California, a fee of $150 assessed on properties in burn zones raised $90 million for dealing with wildfires.

Task force members on Monday discussed concerns that today's system essentially subsidizes living in forests.

"By making insurance affordable to all, are we actually encouraging development in high-risk areas?" Kelly Campbell, vice president of state government relations for Property Casualty Insurers Association of America, said in a presentation. "The premiums don't reflect the risk."

The Black Forest fire has destroyed a mix of older homes, including homesteads that likely weren't insured, and high-value newer homes, said John Bissett, president of JM Weston Homes.

Evacuated from his own home in Black Forest, Bissett told the task force that homebuilder staffers have conducted an analysis of structures destroyed in the fire and found that more than half were built more than 13 years ago. "Neighborhoods that were fairly new survived better than neighborhoods that were older," as a result of safer modern construction, Bissett said.

Task force members plan to give Hickenlooper a status report by the end of June. The task force will then give recommendations to Hickenlooper and lawmakers interested in addressing the broad problems resulting from people building in burn zones, Kelley said.

"We want something other than a nice, cocktail table report," Kelley said.

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Colorado fire updates

These are the latest conditions on wildfires around Colorado as of Monday:

• The Ward Gulch fire burned 485 acres three miles north of Rifle Gap Reservoir. The fire was first reported Friday at 11:30 a.m. and has not grown significantly since that day, according to a post on inciweb.org. The fire was 60 percent contained Monday, according to the site. The cause of the fire is believed to be lightning, officials said.

• The Big Meadows fire in Rocky Mountain National Park remained at an estimated 604 acres and was 95 percent contained, according to a post on inciweb.org

Closures continue for the Onahu Trail, the Green Mountain Trail and the lower Tonahutu Trail, according to the National Park Service website.

All major roads and facilities in Rocky Mountain National Park remain open, as are Grand Lake and Estes Park, according to the park site.

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CLARIFICATION: According to Colorado Department of Regulatory Affairs director Barbara Kelley, the state-run insurance program described in the story would be patterned after the National Flood Insurance Program. Colorado's Task Force on Wildfire Insurance and Forest Health is not aiming for a broad, all-encompassing insurance program, she said.

Explosive and expensive wildfires in Colorado becoming "new normal"

By Jeremy P. Meyer The Denver Post The Denver Post
Posted:

DenverPost.com

As gathering smoke from the Black Forest fire grew into a massive column north of Colorado Springs on Tuesday afternoon after the fire exploded, El Paso County Sheriff Terry Maketa couldn't shake the feeling of déj… vu.

Just short of a year before, Colorado Springs was traumatized when the Waldo Canyon fire blew out of the forest and into a subdivision west of downtown on June 26, destroying 346 homes and killing two people. The Waldo Canyon fire held the title of being the most destructive in state history.

Until Black Forest.

"I just kept thinking to myself, this cannot be happening to our community twice in one year," Maketa said.

It's incomprehensible that a wildfire would occur at almost exactly the same time of year, on the outskirts of the same city, being fought by the same people.

But this is the new normal, said Frederick "Skip" Smith, Colorado State University professor and head of the Warner College of Natural Resources' Department of Forest and Rangeland Stewardship.

More people are moving into forested areas that are becoming increasingly overgrown. And persistent drought conditions have made the likelihood of destructive wildfires a near certainty, Smith said. All it takes is a spark.

"You have the perfect storm for these sorts of events that are catastrophic and will have these huge consequences," said Smith, who is proposing a new center for the university that would look for solutions.

Things must change, he said, and they will.

"We're not going to live with it," Smith said. "The costs are too great. The amount of money that we spend for fire suppression is huge and not sustainable. And continuing to put young people at risk to fight fires is not something we want to do."

Insurance damage estimates from last year's Waldo Canyon and High Park fires totaled nearly $450 million, making it the most expensive wildfire season in state history. The U.S. Forest Service spent more than $56 million fighting those two fires. It is unclear what the costs of the Black Forest fire will be.

Already, it is the most destructive in state history, leveling 483 homes as of Saturday afternoon and killing two people who were trying to escape.

These fires are significant not because of their sizes but where they have occurred.

As of Saturday, the Black Forest fire was 15,500 acres but in a heavily wooded forest where 13,000 people live.

Waldo Canyon was 18,247 acres, but most of that fire chewed through forest until it blew into the Mountain Shadows subdivision one afternoon, destroying hundreds of homes over 1,516 acres.

"Fire is a natural part of the environment, but the ones that get attention are the ones that burn close to urban areas," said Ed Delgado, meteorologist with the National Interagency Fire Center in Boise. "The Waldo Canyon fire wasn't a big fire by the standards last year. We had a 600,000-acre fire in southeast Oregon and a 300,000-acre fire not far from there last year. But they were grass fires in the wilderness and high desert and only affected a small number of people."

The Hayman fire in 2002, still Colorado's largest at 138,114 acres, burned mostly in forest land. It destroyed 133 structures, but most of those were secondary mountain homes.

Smith from CSU said there has been a change. More people are populating wildland areas, which he says is a byproduct of the Internet and people able to telecommute and not have to live so close to their work.

"It's beautiful, convenient and easy to do," he said.

The Forest Service says some 32 percent of U.S. housing units and a tenth of all land with housing are in the wildland-urban interface — the area in which homes are built near or in areas vulnerable to wildland fire. And that number is expect to increase.

"There is going to have to be some rethinking of how we approach living in these risky environments," Smith said. "It's going to mean we are going to have to do a better job of designing these communities and making them defensible in the face of the certainty that these fires are going to happen."

Smith said that will include building homes that don't ignite as easily, having infrastructure for firefighters, escape routes for homeowners, mitigation requirements and revising building codes.

In Colorado, the number of homes in the wildfire "red zone" increased to 556,000 in 2010 from 464,000 in 2000, according to an analysis by Burt Hubbard of the I-News Network.

The Colorado State Forest Service even created an interactive Web feature for people to find out whether their addresses are at risk.

Growth in the wildland-urban interface is projected to increase by 300 percent in the next two decades, said Joe Duda, the state's interim forester.

"We are working diligently to get the message out and help people understand," Duda said. "It's a personal responsibility, and it's a community issue. Will you allow new construction and new development without requiring maintenance of the forest?"

A fire in the densely wooded Black Forest has long been feared, said Colorado state district forester Larry Long.

"The biggest problem down there are the trees are growing too close together," he said. "People didn't move there to cut down trees. The density is three to four times what it should be."

But fire suppression and lack of thinning has made the forest too thick. Long said ideally the trees should be 15 to 20 feet apart.

"They need to take about half of the trees out and then come back and take another third out," Long said. "It would be a stark contrast to what it is now. But that is a healthy forest. It looks very nice. It gets parklike."

Gary and Freddie Stone moved from California to Black Forest six years ago, building their dream home for a life amid the ponderosa pines. Last year's Waldo Canyon fire was a wake-up call, they said. They got all of their important items together in case they needed a quick escape and did "everything they could to mitigate" near the home.

As of Friday night, their home was still standing, Freddie said. But her husband's shop with antique cars did not survive.

"Every tree is black. The ground is black. It looks like a war zone," she said after being escorted back into the neighborhood. "Our neighbors to the north lost their home. And neighbors to the south lost their home. I think the firemen did everything they could to save the houses. My heart goes out to them."

Chris Schenck has had to live through it twice.

Last year, his family's home in the Parkside neighborhood of Mountain Shadows was destroyed. For nine months he lived with his mother and stepfather north of Black Forest before moving back to a newly constructed house just two months ago.

On Wednesday, his mother and stepfather were evacuated and are living with him in Mountain Shadows.

"It's déj… vu flipped around," he said. "It's been rough. They are glued to the TV, trying to find out about their house. To be honest with you, there are a lot of dead trees and stuff that doesn't get cleaned up. This area is so dry."

Chuck Fowler, who is rebuilding a home on Majestic Drive that was incinerated in the Waldo Canyon fire, said he cannot believe the fires are back.

"I am sitting here just completing my own personal property scope of loss a year after Waldo Canyon," he said. "I am doing that in the context of looking out my patio door to a sky full of smoke. It's kind of tough on the psyche."

Fowler is going to sell his house. He doesn't want to return to Mountain Shadows. He feels deep empathy for those to the north.

"It makes me sick," he said. "Thinking what lays ahead for these people is hard. And as a community, to have to go through this again. ... We're probably getting pretty good at something we really don't want to be doing. That is the great irony here."

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Staff writer Jordan Steffen contributed to this report.

PBS NEWSHOUR

The Morning Line

Your Daily Dispatch From the NewsHour Politics Team

ANALYSIS AIR DATE: July 2, 2013

Hotter Temps, Long-Term Drought, Development Drive Fire Problems in the West

SUMMARY

How do weather conditions, land use and forestry practices play a role in sparking wildfires nationwide? Judy Woodruff speaks to author and journalist Michael Kodas ,who has been covering the deadly wildfire in Prescott, Ariz., about fire risks and whether the latest fatalities will affect firefighting policy in the future.

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Transcript

JUDY WOODRUFF: In light of the fires out West, many questions are being asked about weather conditions, land use, forestry practices and what role they play.

Michael Kodas is an author and journalist whose been covering the wildfire in Prescott. His book, "Megafire," is due out next year. I spoke with him a short time ago.

Michael Kodas, welcome to the NewsHour.

First of all, how is the climate in which these wildfires are occurring changing?

MICHAEL KODAS, Author/Journalist: Well, we have seen a pretty distinct increase in temperatures throughout most of the West and particularly here in Arizona.

A recent report identified Arizona as having more warming than any other of the 50 states in the United States. And we have also seen a pretty prevalent and deep drought throughout most of the West that has lasted in some areas for many years. And those really affect the fuels that drive these fires.

WATCH: Firefighters Who Perished in Arizona Faced High Heat, 'One of the Hardest' Tasks

JUDY WOODRUFF: So you're saying that the combination of the two is having an effect. You also talked to us about conditions in the community, the fact that more people are building homes into areas that were previously all forests.

MICHAEL KODAS: Yes.

Development is a big part of what's driving our fire problem. We have, you know, thousands of people moving into forested and flammable landscapes. And that adds fuel to the forest, the houses, the propane tanks and things like that. But it also brings a lot of sparks into the landscape. There's all kinds of starts of fire that occur when people move into the forests, you know, from everything from sparks from vehicles on roads to arcing power lines to serve those communities.

JUDY WOODRUFF: And one of the other elements you talked to us about, Michael Kodas, was the role that the policy that the United States has in the way it treats forests.

MICHAEL KODAS: Yes.

Well, we have been putting out fires in the United States for more than a century. We have been putting out forest fires. The problem is that, in many landscapes, that has made future fires worse. Every time you put out a fire, you usually end up leaving that fuel in the forest. So if you have a landscape that normally had fires come through it every, say, 30 years, and you put out fires in that landscape for a century, then you have three times more fuel in that forest.

And that fuel is affected by the climate and dries out. And the fires that result are much hotter and much faster, both because the fuels can be much dryer and in a much warmer place and because there's much more fuel to burn.

JUDY WOODRUFF: So how much longer -- people talk about the fire season. How does the length of the season today compare to what it was?

MICHAEL KODAS: That's been one of the more dramatic changes, particularly in Colorado, where I live. Because we have seen, you know, a warmer and dryer climate, the mountains get less snow during the winter. And that snow melts off much earlier in the season. Normally, the snowpack

on high mountains is kind of a reservoir that trickle irrigates for us, you know, into the summer.

But now the snowpack melts off much earlier. These forests dry out much earlier. And so we see fires much earlier in the season. In Colorado, we had a deadly wildfire in March of last year. And we had firefighters that got burned over in the winter of last year.

At the other end of the season, we also see fires starting much later in the season, in autumn. And we even had a fire in Rocky Mountain National Park that burned right through the winter.

JUDY WOODRUFF: So, when you put some of these things together, the changing climate, the weather conditions you described, the fact that people are building into forested areas, the policy toward fires themselves, what does it all add up to in terms of what this country faces?

MICHAEL KODAS: Well, we have both, you know, far more flammable forests in many of our forested landscapes.

And particularly here in the Southwest, we see a distinct increase in wild fire deaths. That's been scientifically documented for more than a decade now. And we also have a lot more people at risk. And that really complicates firefighting policy.

The federal government has been trying to put fire back into these landscapes for many years, but it's very difficult when you have communities around these forests now. Prescribed burn policies are very difficult to implement, both because they can be dangerous to communities and they affect air quality. And thinning projects are incredibly expensive, to send people have to cut out excess fuel out of these forests.

So we end up with kind of a vicious circle of many more people at risk in the forest and the risks in those forests increasing.

JUDY WOODRUFF: We see some of the people there behind you who have come to remember the firefighters who died on Sunday. Michael Kodas, what effect do you think their deaths may have on firefighting policy, if any?

MICHAEL KODAS: Well, I think this will have an effect.

It seems like every decade or two decades, we have an event where a number of firefighters, and often very good, the elite firefighters, perish in a single event. The fire on Storm King Mountain in Colorado back in 1994 was an event like that. And I think it will cause federal officials to look over our safety policies and the way that we go about fighting fires and try to ensure that this kind of tragedy doesn't happen again.

One worry is that with fire regimes changing and with the nature of forest fires changing, you know, are our safety policies keeping up with the way that the hazard is developing?

JUDY WOODRUFF: Based on what you see in the community, how are they dealing with this today?

MICHAEL KODAS: Well, this is a very tight-knit community. And it's important to point out that we have a lot of Hot Shot crews in the United States, but this was the only one that was really part of a city fire department.

So it wasn't just, you know, the traditional Hot Shots, where you really just knew them for their work fighting fires up in the mountains. But these guys were really tied closely to the community, to the other firefighters who worked on protecting houses. And it was one really very tight-knit community.

Some of these firefighters come from families with a history of this kind of service, so I think it's been really devastating to the community.

JUDY WOODRUFF: Michael Kodas joining us from Prescott, Ariz., thank you.

*Michael Kodas was in Arizona reporting for **OnEarth**, a publication that focuses on the environment.*

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6 comments 0

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Newest Community Share

William Stephenson Colorado • 8 days ago

This is a national security issue. I agree with the President. In the sixteenth century the Protestant and Jewish people were not part of the "Flat Earth Society". There is no reason they should be misinformed about science or corrupted by Babylon in their stewardship NOW. Its a combination of Solar cycle ,orbital tilt, tundra fires AND the unfortunate introduction of MASSIVE AMOUNTS of CARBON into our atmosphere since the industrial revolution 1648 ad.(5th Trumpet)

1 Reply Share ›

Russell Cook → William Stephenson Colorado • 7 days ago

Of course you meant to say "massive amounts of carbon dioxide into our atmosphere", an important distinction. But exactly which 'tundra fires' are you referring to? And are you aware of skeptic science reports citing peer-reviewed science journal-published papers (e.g. http://www.nipccreport.org/rep...) which say the IPCC has not conclusively made its case that human-induced greenhouse gases are the primary driver of global warming?

And are you not aware that the current "Flat Earth Society" is a tongue-in-cheek organization where you can buy gag T-shirts with their motto on it?

And are you certain it is not you who is misinformed, considering you may be a longtime NewsHour watcher who might be completely unaware of the skeptic science side of the issue entirely as a result of the NewsHour not indicating that a plausible opposition to the issue exists?

Reply Share ›

William Stephenson Colorado → Russell Cook • 7 days ago

Might be misinformed but I Trust NCAR. From what I gather there are 4 causes of climate warming, as I stated. In the 16th century there was a group who subscribed to the Copernican view and a group of skeptics with plenty of peer review who insisted the planets rotated around earth.. ergo the Presidents parable of A flat earth political stance. they were right about the moon. REVELATION 6: 9-15, I think the skeptics are right about the orbital deviation and there is a solar cycle effect...but the graphs of CO_2 and heat are persuasive. Every progressive view in history has been Red Baited...and yes been watching News Hour every day since 1976..Long nights in Anchorage with P B S to light and delight the mind .I will always be thankful for the socialist conspiracy to fund educational TV

Reply Share ›

William Stephenson Colorado • 8 days ago

This is a real potential crisis which we need take seriously and don't politicize . We must prepare for the 22 year drought cycle as we approach solar minima. Malachi 4: Rev.18

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Matthew Brooks • 9 days ago

"X. tenax is an important part of the fire ecology of regions where it is native. It has rhizomes which survive fire that clears dead and dying plant matter from the surface of the ground. The plant thrives with periodic burns and is often the first plant to sprout in a scorched area."

http://en.wikipedia.org/wiki/X...

http://i.imgur.com/kHnCKM7.jpg

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Russell Cook • 9 days ago

Leave it to Mother Jones journalist Michael Kodas not to tell NewsHour viewers that the wintertime Rocky Mtn National Park fire was started from an illegal campfire and that it was left to burn because of its sheer inaccessibility: http://inciweb.org/incident/32...

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People living in 'red zone' mull task force ideas

6:52 PM, Jul 3, 2013

EVERGREEN - Watching fires burn through overgrown forests this season, claiming lives and homes in Colorado, Al and Jan Buenning think back to warnings they got years ago.

"We moved here from Wisconsin in 1987," Jan Buenning said. "Our neighbor who used to work for the Forest Service said, 'oh, you're moving to Evergreen, Colorado? That's just a fire waiting to happen.'"

The couple lives in what's called the "wildland urban interface," or what's more conversationally referred to the "red zone," the portion of Colorado where potentially dangerous forest meets populations.

This year, the couple has already helped house friends who were evacuated from their homes nearby.

You don't have to sell the Buennings on the idea that our forests could use some thinning.

Fire managers would like to do a lot more fire prevention work, but thinning forests costs money.

A state wildfire task force appointed by Gov. John Hickenlooper, D-Colo., is thinking about a special property tax for red zone homes to pay for it, but would Al and Jan vote for such a tax?

"I would," Al said. "If it were spent directly for that purpose and not to build more bureaucracy."

"I don't like big government and more taxes," Jan added. "But I do believe that people should be responsible for what affects their lives."

In principle, the Buennings think it's fair to make people in the red zone bear the burden for the red zone's problems, but taxes are never a sure bet at the ballot box.

Most of the area around Al and Jan's house is cleaned up, but they do have a few problem trees right up against the home.

"I don't have an answer for that," said Al. "They shouldn't be that close quite frankly."

Al says he'd be okay with having authorities point out problems with his defensible space and bug him to remedy them.

They bought this house a year ago, and nobody in authority made an issue out of defensible space.

"The home inspector might tell you about faulty plumbing or mold over here, but they'll never say 'you've got some real problems with fire here,'" Al said.

Al and Jan are happy that the task force is thinking about tightening county codes to deal with fire mitigation, or tying mitigation more closely to homeowners insurance.

A little nudge and some good advice could go a long way.

Another idea the task force has it to require home sellers to do the mitigation work before they can transfer the title of the home, so the new owner can move without wondering if there are issues.

If somebody needs to sell a house because they've hit hard times, though, that could put them in a tough spot financially.

It's one of the many issues the task force has left to navigate.

Link between beetle kill and forest fires draws closer look

By Kevin Vaughan and Burt Hubbard I-News at Rocky Mountain PBS Boulder Daily Camera
Posted:

DailyCamera.com

Colorado's 4.3 million acres of beetle-decimated forests represent a catastrophe in the making during another devastating wildfire season.

Or do they?

That is the conventional wisdom as another summer unfolds with destructive blazes that have left skies along the Front Range choked with smoke, but the reality is not so simple.

"The issue is not will beetle-kill forests burn -- they certainly will," said Monica Turner, a University of Wisconsin professor who has done extensive research of wildfires in the West. "The question is, are they burning worse -- more severely -- than if the forest was green?"

And the answer to that question is a matter of ongoing scientific debate, wrapped in factors that include the amount of time that has passed since the beetles did their damage, the number of trees that survived the infestation, other species of plants in the area and weather patterns.

"This is a field of study that we just don't have all the answers for," said Matt Jolly, a researcher at the Missoula Fire Sciences Laboratory in Montana whose work has looked extensively at the way plants burn in wildfires.

Once-green hills, now painted red

Anyone who has spent any time in the Colorado high country has seen the damage done by mountain pine beetles -- vast swaths of formerly green forested hills painted red, or gray, by dying and dead trees.

The most recent count by the Colorado State Forest Service showed 3.35 million acres affected by the mountain pine beetle and 924,000 acres attacked by a different bug, the spruce beetle.

An I-News examination of state maps found that hundreds of thousands of those acres are in the so-called "red zones" -- the high-fire danger areas primarily along Colorado's Front Range and up the Interstate 70 corridor. State officials use a number of factors to determine what constitutes a red zone, including development (primarily homes), the type of vegetation in the area and the slope of the land.

So as the West Fork Complex fires continue to burn in the beetle-kill pocked forests of southwest Colorado, and as the state reels from blazes like the ones that destroyed 511 homes in the Black Forest, it's tempting to look at all the dying, dead and decaying trees attacked by beetles and conclude that massive wildfires pose a real threat to all affected areas sooner or later.

Not so fast, according to some of those who have dedicated years to studying the ways that trees and other vegetation burn in wildfires.

Today's forests are vastly different than those of previous centuries. A century of aggressive firefighting efforts have left many areas overgrown and choked with downed and dead trees. Added to that, development has left many forested areas peppered with homes and parts of the West are experiencing prolonged, even historic drought. So the propensity for big, destructive fires is a near constant. Those conditions fuel blazes known as "crown fires," which burn through the tops of the trees as if they were torches, spreading rapidly and generating tremendous heat.

Those massive, fast-moving fires -- like the Black Forest blaze last month north of Colorado Springs, where some beetle-kill trees were present -- make for mesmerizing television and are the subject of extensive research.

Turner and researcher Jesse Logan, a former U.S. Forest Service scientist and college professor, are among those who believe that beetle-kill forests go through a predictable cycle -- one in which they are at times much less-volatile than green forests. It starts with a beetle infestation, and it will take three or four years for the bugs to inflict all the damage they will on a section of forest. The trees in that stage turn red -- and there's little dispute those needles are highly combustible. But over the next couple years, the needles fall to the ground and begin to decompose.

"The overall trend would be that immediately after trees are killed and they still have all those fine fuels, needles in particular, on the tree, then it's highly flammable, probably more flammable than a green forest," Logan said. "But after those needles fall and that can be, like in lodgepole, a couple years after the tree is killed, then the standing forest is actually less likely to lead to a crown fire than a green forest."

The reason? Green needles contain oils that are highly flammable.

But that strange juxtaposition -- that green, seemingly healthy forests might burn with more fury than dead ones -- is difficult for many people to comprehend.

"I think that one of the reasons that this seems counter-intuitive to people in terms of its affect on fire is that when we burn a fire in our fireplace, we put dead logs in there -- we don't put green branches," Turner said. "But in a forest fire it's those green needles that are extremely flammable, and that's what gives you the amounts of fuel up in the canopy in the forest and its conductivity."

Forces of nature we can't control

One of the difficulties in getting answers is that it has been difficult to build realistic fire models to examine the effect of beetle-kill trees. At the same time, studies that have looked at actual fires in beetle-kill areas are still in the review process, and the results have not been made public.

Still, Jolly, the Montana researcher, cautioned against assuming that a forest will be less burnable six years after being hit by beetles because the trees no longer have their needles. His research has shown that dead, red needles burn faster and hotter than green ones -- but that's only part of the reason for being circumspect.

"It's just not that simple," he said. "A standing gray tree, particularly one like a spruce, will have a lot of really, really fine dead branches. It may not have needles, but it will have those fine branches that will also burn and support a crown fire."

In addition, even areas with heavy beetle-kill have some trees that survive, and many have other kinds of trees mixed in among those that die.

And then there's another huge factor: the combination of weather and climate.

Logan pointed to the massive Yellowstone fires of 1988, which took down every kind of forest -- beetle-kill and green alike.

"It all burned, just because conditions were so volatile," he said. "In any situation, what's driving it is fuel -- you've got to have fuel. And the fuel can be green, red, gray, or gray on the ground, and if the weather conditions are right, and you get a lightning strike or some idiot with a match, it's going to go. And if the weather conditions are like they've been in Colorado these past few years, or like they were in '88, it's going to go big, regardless of what anybody can do.

"As humans, we have this idea that we can control nature, and we often can -- we turn on the air conditioner and things like that. But these are forces of nature you're not going to control."

I-News is the public service journalism arm of Rocky Mountain PBS. For more information: inewsnetwork.org. Contact Kevin Vaughan at 303-446-4936 or kvaughan@inewsnetwork.org.

Man's homeowner insurance cancelled because he lives in brush fire area in southeast Aurora

Colorado seeing trend of cancellations

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Posted: 07/08/2013
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- Jaclyn Allen | Email Me

Aurora, Colo. - An Aurora man's homeowners insurance policy is being canceled because his insurance company says he lives in a "brush fire area" in southeast Aurora.

Chris Spears takes pride in his roses and his home.

"I've never filed a claim. My insurance is paid on time," said Spears.

So when he got this letter from Sentry Insurance Saturday, cancelling his policy because the company said he is in a "brush fire area," he was burned up.

"I do my job to protect my home, and I pay my dues, and I feel like that's just all for naught," said Spears. "They're not doing their job to protect me. They're getting rid of me."

His development backs to a small greenbelt with a winding creek, but he has had the same insurance for years and said it is only a problem now because of major payouts to wildfire victims.

In recent months, 7NEWS has been tracking similar trends in Colorado, from skyrocketing insurance premiums to people in mountain communities being dropped out of the blue.

Carole Walker, a spokeswoman for the state insurance industry, said the insurance industry is under pressure because of the wildfires, and people in high-risk areas will have to find high-risk carriers.

"We have over 200 insurance companies that sell insurance, so people likely can shop and find insurance somewhere else. This is still a competitive market," said Walker.

Spears is shopping around, but said if homeowners in suburban neighborhoods like his are considered high-risk, no one's policy is safe.

"There are three fire stations within three miles in each direction from here. There's a fire hydrant in front of my house," said Spears. "I was baffled. I didn't understand."

Spears said he received another letter in the mail from Sentry the same day thanking him for renewing his auto insurance.

He said that's not going to happen -- he will take all his policies to another carrier, although he rates may end up nearly doubling.

7NEWS' attempts to contact Sentry Insurance were unsuccessful Sunday.

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Black Forest fire caused $85 million in damage to homes, assessor says

By Sadie Gurman The Denver Post The Denver Post
Posted:

DenverPost.com

Last month's Black Forest fire caused more than $85 million in damage, a number that is sure to rise as El Paso County assessors tally the devastation to outbuildings, commercial structures and trees.

The blaze that started June 11 destroyed 486 homes — fewer than the sheriff's department's initial estimate of 511 — and damaged 37, county assessor Mark Lowderman said Tuesday.

The fire — which killed two people and charred more than 14,000 acres, also caused $85,444,052 in damage to homes, Lowderman said in announcing the completion of the first of four parts of the Black Forest assessment. Sixteen members of his office, who have been working full-time on the fire, must now put dollar amounts to lost outbuildings, commercial structures and, perhaps most costly, trees. A treeless lot sells for about 30 percent less than one with pristine trees, and buyers will pay about 15 percent less for a lot with damaged trees, Lowderman said.

"We will probably have to review Black Forest in a year or two because we have no guarantee that those trees that were damaged are going to make it," he said.

The assessor's office came up with its totals after on-site inspections of 2,400 parcels.

"It could have been a lot worse," Lowderman said.

His office has not yet begun to estimate the "stigma," or the impact on the values of homes that were untouched by the blaze. Those numbers could take years to pinpoint.

"Only time will tell," Lowderman said.

Authorities continue to investigate the cause of the fire, which killed a married couple, Marc Allen Herklotz, 52, and his wife, Robin Lauran Herklotz, 50. The sheriff's office, which said the fire's cause was not natural, has executed search warrants and conducted interviews.

Lt. Jeff Kramer said Tuesday that investigators are awaiting the results of some lab tests before they can move forward.

"They're making progress," he said.

Sadie Gurman: 303-954-1661, sgurman@denverpost.com or twitter.com/sgurman

INSURANCE JOURNAL

View this article online: http://www.insurancejournal.com/news/west/2013/07/09/297914.htm

Insurance Group: Colorado's Black Forest Fire Likely to Top $100M

The official count on total insured losses from the Black Forest Fire in Colorado should be released soon, and the single most destructive wildfire in the state's history is likely to exceed $100 million – marking two years in a row the area has experienced fires on such a massive scale, according to the Rocky Mountain Insurance Information Association.

Insured loss estimates for the fire are in the works as adjusters continue hammering out the numbers for a fire that destroyed more than 500 homes, RMIIA officials said Tuesday.

The $100 million figure is far from being a stretch, and may be well on the conservative side, considering county assessors told the Denver Post newspaper on Tuesday that the fire caused more than $85 million in damage. The fire killed two people and burned more than 14,000 acres, causing $85,444,052 in damage to homes, El Paso County Assessor Mark Lowderman told the Post.

However, when adding in damages to outbuildings, living expenses and other losses from the fire, the figure should far exceed that estimate, according to RMIIA Executive Director Carole Walker.

"It will likely reach upwards of $100 million in insured losses," Walker said. "It is our most destructive wildfire in state history with the number of homes."

Walker said a preliminary snapshot is due soon, and possibly the numbers could be released around the time of next week's one-year anniversary of the Waldo Canyon Fire, which was previously Colorado's most devastating and costly wildfire.

Walker wouldn't commit to a specific time frame for releasing the loss figures, saying there are several insurance companies collecting data and noting "it was a large scale fire."

She did say insurance carriers have been able to commit more resources to dealing with the aftermath of the Black Forest fire, unlike last year when two major fires occurred in Colorado back-to-back along with a hail storm that wreaked more than $321 million in insured losses on the state.

"At least that's our only large scale event that we have right now," Walker said of the Black Forest fire. "What was unique and devastating about the Waldo Canyon fire was it was a city

neighborhood. It was an urban fire. With the Black Forest fire you have a more rural area. I think you have a wider range of types of homes. Everything from single-family dwellings that are decades old to large horse properties."

RMIIA recently updated insured damage estimates for both the Waldo Canyon and High Park Fires. The back-to-back fires combined for a total of $567.4 million in losses from 7,941 homeowner and auto claims. The previous combined insured losses were estimated at $449.7 million.

The Waldo Canyon fire accounted for 6,648 claims adding up to $453.7 million, and the High Park Fire insured loss estimate is now $113.7 million from 1,293 homeowner and auto claims, according to RMIIA.

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The Black Forest Fire has attracted insurance pros — for better and worse

Adjusting expectations

by J. Adrian Stanley

The flier called it a "Town Hall Meeting for Black Forest Fire Residents."

But this wasn't a town hall in the traditional sense. No elected official or governmental staff member was scheduled to speak. El Paso County officials, in fact, say they had nothing to do with meetings scheduled for earlier this month at La Foret Conference Center, nor did any nonprofit, or even an insurance company.

Rather, the "town halls" were put on by Florida-based Loss Analytics, a private company offering "public adjusters" paid to represent disaster victims to their insurance companies. (Loss Analytics did not return phone calls seeking comment. A La Foret spokesperson says his staff originally thought the meetings were being hosted by a nonprofit.)

Public adjusters — who work on behalf of victims, as opposed to "insurance adjusters" or "claims adjusters," who work for insurance companies — tend to flock to disaster areas, eager to sign up clients who will fork over a percentage of their insurance claim in exchange for services. At times, adjusters host meetings that victims may mistake for official affairs, a practice that's drawn criticism.

"There are people [who hold meetings] that have been reported to insurance commissioners," says County Commissioner Darryl Glenn, not speaking specifically of Loss Analytics.

In fact, back in November, the Denver Post did an exposé on public adjusters targeting victims of the Waldo Canyon Fire. It mainly focused on Pete Romero, a public adjuster who ran a nonprofit on the side that held meetings locally to "help" victims. Romero defended his nonprofit, but others quoted in the article saw it as a less-than-honest way to drum up business.

Glenn says some Waldo victims feel they were ripped off by such adjusters, often due to excessive fees or poor service. And he's worried about a repeat in Black Forest.

Sorting it out

After Waldo, the city set up Colorado Springs Together, a nonprofit dedicated to helping those who had suffered losses. While it offered some meetings on insurance, the group refused to host United Policyholders, a well-known nonprofit that has provided assistance to disaster victims nationwide.

"What we've tried to do is kind of keep a distance, avoid getting in the middle of the policyholder-insurance discussion," executive director Bob Cutter said at the time.

El Paso County has had to strike a similar balance since the Black Forest Fire. Glenn says that early on, Commissioner Peggy Littleton wanted to organize a meeting with people in the insurance/adjusting business. But the Board of County Commissioners decided to stick to meetings featuring government experts and United Policyholders representatives.

Amy Bach, executive director of United Policyholders, says she's often concerned about for-profit businesses trying to "masquerade" themselves.

"It's black and white," she says. "You're either in business to make a profit — and just flat out admit it — or you're in business as a nonprofit."

Bach says that ultimately, victims need to be their own advocates. "It's absolutely heartbreaking that there are business people that think it's OK to deceive disaster victims to get business," she says. "But wake up and smell the coffee — that's the modern world."

Not all bad

Of course, Bach notes, if some public adjusters are rotten, that doesn't mean they all are.

In some cases, ethical, qualified public adjusters can be invaluable. For one thing, they can attend meetings with insurance providers, read contracts, organize claims, and take phone calls. A good adjuster can't act as a lawyer, but will be well-schooled in insurance-policy intricacies, and able to pinpoint exactly how much money is due to the homeowner and advocate for every cent.

That said, Bach believes many people can get a fair settlement from their insurance company on their own. She adds that people ought to try to handle the situation themselves — or at least allow a few weeks to pass after a disaster — before they seek an adjuster.

If they do, Bach says, they should look for one who's bonded and licensed. (The Colorado Division of Insurance should reveal any complaints and the status of the license.) She also finds local adjusters to often be a better choice, and recommends homeowners ask for at least two recent references.

Bach's also a fan of the Rocky Mountain Association of Public Insurance Adjusters, a trade group created to bring more rules and standards to Colorado public adjusters. President Scott deLuise (who is also the president and CEO of Matrix Business Consulting in Broomfield), says group members already meet the strict ethical standards that will become law in 2014, due to state legislation pushed for by the Association.

"When we formed the organization we immediately started working with the Colorado Division of Insurance to reform public adjuster laws because of what happened in Waldo Canyon," he says, noting that Colorado's existing regulations are lax.

DeLuise says he was saddened to hear of unethical practices during that fire, especially because he believes public adjusters can be wonderful advocates for victims. In fact, when he was a college student, an arsonist burned down his fraternity house. He hired a public adjuster to help him settle the claim, and was so impressed by his work that he bought the man's business. He's

been a public adjuster ever since.

"I would say one out of 20 homeowners gets through the insurance process without pulling their hair out," he says, adding, "We help people."

— stanley@csindy.com

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A Painful Mix of Fire, Wind and Questions

The Yarnell Hill fire burned on June 30, around the time when officials believe the fire expanded. Matt Oss

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By FERNANDA SANTOS and JACK HEALY PUBLISHED: JULY 6, 2013 178 COMMENTS

PRESCOTT, Ariz. — They trained their eyes on the mountain that smoldered in the distance as they carved a path through a forest choked by fire and drought. The ground crackled underfoot. Packs sagged from their backs, heavy with the gear frontline firefighters must carry: pickaxes, temperature gauges, spades, radios, plenty of water.

Down in the valley, a village burned. “This is pretty wild,” one of the firefighters, Andrew Ashcraft, wrote in a text message to his wife, Juliann, at 2:02 p.m. that Sunday as the team continued its fateful march through the wilderness.

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Three minutes later and 130 miles away, a meteorolog Service office in Flagstaff spotted trouble on the radar: thunderstorms and dangerous winds heading toward the firefighters. He picked up the phone and alerted the fire's dispatch center. Officials at the center transmit information by radio to the firefighters. The meteorologist called the center again at 3:30 p.m., repeating his warning.

It is unclear at this point whether the firefighters ever received those messages.

At 3:19 p.m., Mr. Ashcraft sent another message to his wife: "I would love some rain over here."

Ms. Ashcraft never heard from her husband again.

Andrew Ashcraft, one of the Granite Mountain Hotshot firefighters, took this photo of the growing Yarnell Hill fire while the crew ate lunch, hours before he and most of his team were killed. Andrew Ashcraft/Juliann Ashcraft, via Associated Press

All but one of the 20 members of the team, a highly skilled fire suppression squad known as the Granite Mountain Hotshots, lost their lives that day in the mountains 32 miles southwest of Prescott. In the week since, amid tears and tributes, a question has weighed over this shaken community: how could they have died?

"It had to have been a perfect storm," said Wade Ward, a firefighter and a spokesman for the Prescott Fire Department who was close to the men. "They were very cautious, very conservative, and they were very skilled."

Investigators are now beginning the task, which will take months, of unraveling how a routine afternoon of cutting fire lines along the edge of a community threatened by flames turned into the deadliest day for wilderness firefighters in 80 years. What caused the tragedy is still unknown. But in recent years, fires like the one that engulfed the Granite Mountain Hotshots have become more frequent and more dangerous, straining the men on the front line and the logistical infrastructure that stands behind them.

Communication Concerns

The New York Times

The Granite Mountain Hotshots spent the weeks before the Yarnell Hill fire, as the blaze that killed them is known, fighting a wildfire in New Mexico and another one in the Prescott National Forest, just northwest of their fire station in town.

Doce, as the Prescott blaze was called, had been a difficult fire, both for the crews battling it and the dispatchers trying to track the movements and needs of aircraft, engines and hundreds of firefighters. As the Hotshots

carried their chain saws to Doce's western edge, dispatchers faced serious technical challenges. Telephone calls were being disconnected or were not going through. A computerized system that helps the dispatchers track crews was "giving all kinds of error messages," a frustrated dispatcher said in a report logged on June 18 by the National Interagency Fire Center, a multiagency logistical support center.

"The problem is never taken seriously and never completely resolved for the long term," the dispatcher wrote. "This has been an ongoing problem and happens EVERY time we have an incident. It is unacceptable! We need to remain at a high operational level 365 days out of the year."

Communication problems made up half of the complaints reported to the interagency fire center last year, according to a study by the National Wildfire Coordinating Group, which manages programs, policies and training for wilderness firefighting. In the last two months alone, wilderness firefighters and Forest Service employees across the West repeatedly complained about problems with communications, in some cases pleading that malfunctions be fixed before something terrible happened.

Another common complaint was that firefighters were being pushed beyond exhaustion or were being asked to work in unsafe conditions.

At a wildfire in Idaho last year, a crew of Hotshots from Montana refused to join others fighting it, saying that proper safety procedures like extinguishing even the smallest pieces of burning wood were being ignored. The crew's supervisor told the commander at the scene that he would not engage his men "because we have standards and protocols we need to follow," according to the account he gave to the interagency center.

The next day, a 20-year-old firefighter, Anne Veseth, was killed by a falling tree.

It is too early to tell if any of these problems were a factor in the deaths of the 19 Hotshots fighting the Yarnell Hill fire. Investigators emphasize that they are at the very start of what will be an exhaustive examination of the events that led up to the deaths.

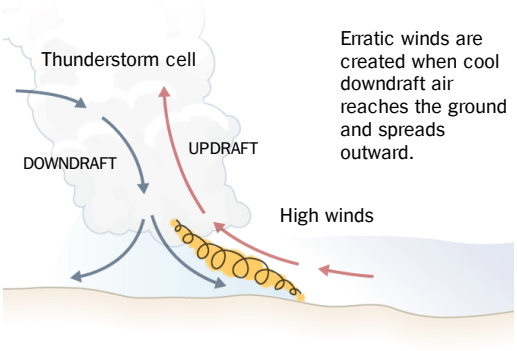
"I am not aware of any communication issues on June 30," said Randall Eardley, a spokesman for the National Interagency Fire Center. "But that is something the investigation team will certainly look into."

Carl Schwope, a fire operations section chief on the Yarnell Hill fire, said on Wednesday that fire commanders had posted two radio repeaters — combination receiver-transmitters that improve low radio signals — atop the mountains near the fire to help relay signals into valleys and ravines.

The repeaters were installed on Monday and Tuesday, Mr. Schwope said, after the Hotshots were already dead. (A team of federal agencies took control of the fire's operations on Monday, after it was elevated to a Type 1 incident, a category reserved for the biggest or most complex fires. The designation had been made on Sunday before the thunderstorms materialized on the radar, but it took time for the team to assemble.)

Mr. Schwope, a member of the new command team, said he did not know anything about the lines of communication for the Granite Mountain Hotshots that Sunday. He said, however, that crews were taught not to confront a fire if they could not talk to their command centers.

The Granite Mountain Hotshots certainly knew the dangers of battling fires along canyons and ridges layered with dry chaparral and brittle oak brush, where afternoon thunderstorms can change the way the wind blows and the flames travel in a matter of minutes. Hotshots are wilderness firefighters, known for exhaustive training, punishing standards for physical fitness and ability to work under difficult conditions far from roads. As one of 110 such teams across the country, they were used to mountain hikes carrying 40 pounds of gear and 16-hour shifts in harsh conditions, chopping brush to cut fire lines on the hardened ground.



The New York Times

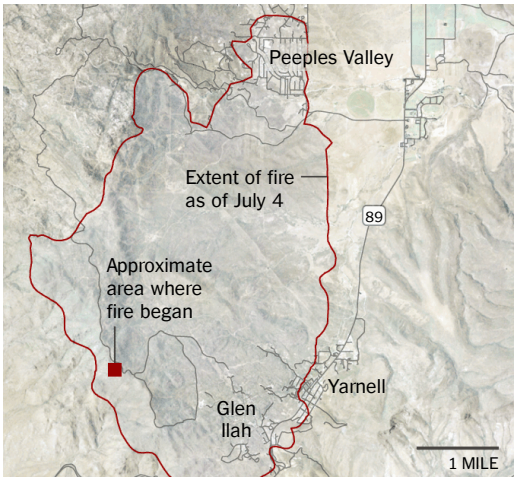
They also knew how to manage risk, officials said. Like other teams working the fire, they received daily briefings at the start of their shifts about fire and weather patterns and the conditions of the terrain. They designated one member a lookout, someone to keep an eye on the way the fire behaved from afar and to warn them of any sudden changes.

Whenever the Hotshots rolled toward a blaze in their hulking red and white Ford fire buggies, they knew to pick escape routes and safety zones.

Growing Dangers

Experts say that wildfires across the West are becoming increasingly dangerous and unpredictable adversaries. They are burning bigger today than they were 30 years ago, a result of persistent drought and overgrown vegetation, which have led to longer and hotter fire seasons. To make matters worse, budgets for managing forests to reduce risk have been cut or siphoned off to help cover the increased cost of fire suppression.

This winter, a fire continued to burn inside Rocky Mountain National Park even after the snows arrived. And as development pushes deeper into the wild, fire experts say, more houses will be destroyed and more firefighters will be put at risk trying to protect homes and residents from the flames.



The area around the Yarnell Hill fire had not burned in about 40 years. Dried and thick in some spots, the vegetation there was ready to ignite at the first spark.

A bolt of lightning struck at 5:30 p.m. on Friday, June 28,

The New York Times

west of State Highway 89 between the old gold-mining villages of Yarnell and Peeples Valley here in central Arizona. It was a small fire at first, 200 acres. By Sunday, it had grown tenfold, and the flames were heading straight toward Peeples Valley. The Granite Mountain Hotshots went to fight it, marching into the hills in stifling heat.

Sudden Shift in Winds

Firefighters at the Yarnell Hill blaze on Sunday spoke with awe at how the winds suddenly swung around like a sailboat's boom, lifting tents, swaying portable toilets and rattling grounded air tankers. In Yarnell, residents who had been given three hours to evacuate were forced to pack up and leave in 30 minutes when the wind, as Adria Shayne, 52, described it, "did a horseshoe and came right onto us."

The thunderstorm rolled over the fire scene at midafternoon, though most of the rain it brought evaporated before it hit the ground, creating a mass of cool air that sank and spread in different directions. This weather phenomenon, known as a thunderstorm outflow, can cause severe winds.

Satellite images are from the National Oceanic and Atmospheric Administration. Analysis of the weather patterns was provided by Daniel T. Lindsey of NOAA and Scott Bachmeier of the University of Wisconsin-Madison. Haeyoun Park and Graham Roberts/The New York Times

Brian Klimowski, the meteorologist in charge of the National Weather Service office in Flagstaff, where the warning calls about the thunderstorm came from on Sunday, said the area's jagged topography would "significantly affect" the way the outflow

winds behaved and would most likely alter the trajectory of the flames.

Until the thunderstorm's arrival, Sunday had been a normal day for the Granite Mountain Hotshots. They stopped for lunch around 2 p.m., about the time Ms. Ashcraft sent her husband a text message telling him that she had gone swimming with the children and that their oldest son, Ryder, had spoken very well in church that morning.

"I'm really proud of him," Mr. Ashcraft replied.

The team was a tight brotherhood within the brotherhood of the Prescott Fire Department. The oldest was Eric Marsh, 43, the crew's supervisor and an avid outdoorsman. The youngest were just 21.

There were Robert Caldwell, 23, and his cousin Grant McKee, 21, who planned to work as a Hotshot for just one season and then devote himself to becoming a paramedic. There was Wade Parker, 22, who followed his father's footsteps into firefighting. There was Mr. Ashcraft, 29, whose love for his job was outweighed only by his love for his family.

"I remember when he left that morning, we both felt kind of defeated," Ms. Ashcraft said. "He wanted to finish out this season strong and then think about when he might change to a profession that's a little more family-friendly."

As the thunderstorm approached, the men were digging a trench near the Glen Ilah subdivision southwest of Yarnell, trying to protect its homes.

The final movements of the Granite Mountain Hotshots were based on interviews with officials and photographs. Time-lapse photographs of the fire were taken by Matt Oss. Hannah Fairfield, Jeremy White and Karen Yourish/The New York Times

Perched on higher ground, Brendan McDonough, the lone survivor and the lookout that day, radioed the team to say he no longer felt safe at his post given the drastic change in the weather. He took to his escape route, a trench dug by a bulldozer. Mr. Ward, the Fire Department spokesman, said that when Mr. McDonough looked back, the spot where he was standing had been overtaken by flames.

At 4:47 p.m., dispatchers managing the deployment of equipment and personnel to the fire heard an aircraft pilot say over the radio that the Granite Mountain Hotshots had deployed their emergency shelters, which are meant to protect them from smoke and intense heat but not flames.

To any wilderness firefighter, the shelters are a last resort.

About an hour later, when the smoke had dissipated, a helicopter crew from the Arizona Department of Public Safety landed nearby, and a medic hiked in to confirm that the worst was true.

That night, as relatives gathered in a middle-school auditorium in Prescott to hear the news, a group of firefighters stood vigil over the bodies. The next morning, the 19 men were carried one by one out of the mountains where they had met their end.

SLIDE SHOW | 8 PHOTOS

The Search for Clues

Investigators are now beginning the task, which will take months, of unraveling how a routine afternoon of cutting fire lines turned into the deadliest day for wilderness firefighters in 80 years.

Dan Frosch and Ian Lovett contributed reporting.

A version of this article appeared in print on July 7, 2013, on page A1 of the New York edition with the headline: A Painful Mix Of Fire, Wind And Questions.

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Colorado's Black Forest Fire Could Top $100M in Insured Losses

BY ANYA KHALAMAYZER, PROPERTYCASUALTY360.COM
July 11, 2013 • Reprints

Although official loss numbers have not yet been released for Colorado's Black Forest Fire, the state's insurance association says the record-setting blaze may cost insurers more than $100 million.

"Adjusters have been in the process of compiling losses for several weeks now, and with about 486 homes burned according to El Paso County, it certainly is the most destructive in [state] history in terms of structures burned in one fire," Carole Walker, executive director of the Rocky Mountain Insurance Information Association (RMIIA), tells *PC360*. "Initial estimates show that damage can be upwards of $100 million in losses."

On Tuesday, El Paso County assessor Mark Lowderman told the Denver Post that the fire, which started on June 11, burned more than 14,000 acres, caused about $85 million in damage to homes. The total was given after the assessor's office conducted on-site inspections of 2,400 parcels.

According to news sources, there are about 200 large and small companies selling homeowner's insurance in Colorado. Walker says that typical claims will include partial and total property loss, additional living expenses (ALE), content replacement and smoke damage. She says that while Colorado is more accustomed to widespread and costly hailstorm damage that involves vehicle and roof replacement, wildfires are "more personally devastating."

The estimate comes a little more than a year after the anniversary of the Waldo Canyon Fire, Colorado's previously most-damaging fire. The fire, combined with its sister High Park Fire, both of which occurred in late June 2012, caused a combined $567.4 million in insured losses- about $117 million more than initially estimated last year.

The Waldo Canyon Fire, the costlier of the two, triggered 6,648 homeowner and auto claims, and the High Park Fire triggered 1,293 claims.

"[The Black Forest Fire] is somewhat different to the Waldo Canyon Fire, which was unique to Colorado; while most of our large-scale fires occur in mountainous areas, this affected city blocks and left what looked like tornado damage, with some structures untouched and others burned to their foundation," says Walker. "The Black Forest Fire damaged decades-old single-family dwellings and many outbuildings containing horses and barns."

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Anya Khalamayzer is Assistant Editor of Risk for *PropertyCasualty360-National Underwriter*. Khalamayzer graduated from CUNY Baruch College after intensive internships with Time Out New York Kids and Crain's Investment News. Keenly interested in environmental science, music and the arts, her articles have been published in Gotham Gazette, Wonkster blog and Ear to Mind magazine. She can be reached at akhalamayzer@sbmedia.com.

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INSURANCE JOURNAL

View this article online: http://www.insurancejournal.com/news/west/2013/07/11/298234.htm

Wildfires, Hail Take Toll on Colorado Homeowners Insurance

It's safe to say there's a lot going on in the homeowners insurance scene in Colorado, where homeowners insurance rates are likely to be on the rise for some time.

Insured losses from the recently doused Black Forest fire should easily exceed $100 million, making it the third time in four years that losses from wildfires went over that mark. Last year saw the state's fourth most costly hail storm wreak in excess of $321 million in damage, and those hail storms follow several years in which the state has been treated to hail events that have put insured losses well into the hundred-millions.

Then in May the Homeowners Insurance Reform Act of 2013 was signed by Colorado Gov. John Hickenlooper. The act allows wildfire victims more time to make claims, it enables the opportunity for increased living expenses, it requires mandatory policy updates every two years and it mandates that policies be written in plain language.

Colorado Gov. John Hickenlooper (AP Photo)

That's one among several ongoing government steps to address rising rates and tighter underwriting standards in place by Colorado insurers, but there are those who worry the new regulations combined with the increased catastrophe losses are part of a growing problem facing Colorado homeowers and agents who say they are struggling to write insurance in an increasing number of areas in the state.

"I think rates in Colorado are going to go up significantly over the next several years," said Shane Christley, a personal lines producer with Denver-based Van Gilder Insurance Corp.

Christley believes those hikes will be driven by losses from the wildfires and storms that plagued the state over the last several years, and by the act as well.

For Carole Walker, executive director of the Rocky Mountain Insurance Information Association, it has been a busy handful of years for her and her members.

She said that while it's not uncommon for Colorado to experience hail storms each year that result in $100 million-plus in damage, when the plague of wildfires the state has experienced in recent years is added to the mix, "it's starting to play itself out."

"Unfortunately we have been in cycle of catastrophes," she said. "Unfortunately, in Colorado, we are seeing homeowners insurance premiums rise at a higher rate than we are nationally."

Averages vary widely, but according to the National Association of Insurance Commissioners, an average homeowners premium of $926 in 2010 ranked Colorado as 18th highest in the nation.

More recently, an Insurance Research Council study issued last fall shows that for first time Colorado now ranks among the top 10 states with catastrophe-related claims. Catastrophe related claims as a percentage of all claims in the state in 2011 was 39 percent, and it was 50 percent in 2010 and 64 percent in 2010, the report shows. The average claim severity, while on the rise nationally, rose 258 percent in Colorado to $7,819 from 1997 to 2011.

The Colorado Division of Insurance has been reporting recent filings by homeowners insurers that reflect roughly a 15 percent overall increase in premiums.

"There are some people who we know are experiencing double-digit increases," Walker said.

Driving those increases is six-year run of extremely bad weather, bad luck, or both.

By RMIIA's count: In 2008 an EF3 tornado and hail storm struck Windsor in May causing $206.9 million in insured losses; in 2009 three major storms totaled for $1.4 billion in insured losses; the Fourmile Canyon fire northwest of Boulder in 2010 resulted in $217 million in insured losses; a July hail storm across the Colorado Front Range in 2011 is credited with $164 million in insured losses; the Waldo Canyon and High Park fires of 2012 combined for a total of $567 million in losses, and the hail storm in June of that year caused $321 million in insured losses.

"It's year-over-year of having these large scale losses," Walker said, adding those losses have made it less than profitable to be a homeowners insurer in Colorado, she said.

As an example she offered up 2009, considered the state's worst year in terms of insured losses.

"Two-thousand-nine was Colorado's most costly catastrophe season," Walker said. "Three major storms caused $1.4 billion in insured losses. That year insurers paid out about $1.69 for every dollar in premiums they took in in Colorado. Year-after-year, insurers have had years in which they paid out more claims than they took in in premiums."

For agents like Christley the wildfires have made their job much more difficult, especially when they clients who live in or around a high fire danger area.

"It makes it a little bit more difficult to place that business," Christley said. "I worry at some point where people in those areas won't be able to get coverage any longer and have to go into the substandard market where they pay more."

Christley added: "I see Colorado being similar to Florida. How they're looked at for hurricanes, we're going to

be looked at the same way in terms of hail damage and fire."

The rising premiums are already getting close scrutiny from the government. Hickenlooper in January signed an executive order creating the Task Force on Wildfire Insurance and Forest Health. The topics being tackled by the task force include reviewing issues regarding insurance coverage on the 2012 wildfires, including replacement costs for homes, relocation assistance, accounting for lost personal property, the timing of insurance benefits and exploring how to give policyholders a better understanding of insurance coverage.

The task force has also considered calling for a state fund of sorts to help broaden the availability of homeowners insurance in Colorado.

Having such a state fund is not an idea Walker is a big fan of, as she believes it could further reduce insurers' appetite for writing in Colorado.

"We've still been able to keep insurers in this market," she said. "That is the key. By allowing them to compete and adequately adjust premiums, we can keep them there."

The Homeowners Insurance Reform Act is another effort by government to address the problems created by the losses that have recently been experienced in the state.

Most of the provisions won't be effective till Jan. 1, 2014, and they are viewed largely as positives in that they require insurers to offer additional living expenses and plainer language in policies – also many of the carriers already offer coverages mandated by the act.

However, there is still concern that any type of regulation can negatively impact carriers that area already coping with consecutive losing years in Colorado.

"There are still some concerns that the act will put pressure on premiums," Walker said. "For legislators it was an attempt to put into statute best practices, but there are some requirements for an expansion in coverage in there that could affect what we pay for insurance."

Many of the carriers that Christley of Van Gilder works with already have coverage options in place that reflect what's required in the act, but some of the provisions of the act will likely take up time and resources for companies that need to make some adjustments, he said.

"We're able to create some better solutions for people, but I really see it causing some heartburn for the big box carriers with cookie-cutter coverage who beat each other up for price," Christley added.

Aside from some of the possible ramifications of the act, Chirstely said he doesn't mind it too much.

"I think if anything it's just that much more education," he said. "We'll have to teach policyholders more about their policies.

In fact, more education is exactly what's needed in high fire risk areas, where much of the pressure in premiums is being seen, according to Walker, who said the biggest emphasis from insurers lately has been on more mitigation.

More insurance companies are requiring mitigation, such as requiring homeowners to create defensible space, moving potential fuels away from the home and ensuring emergency vehicle road access, she said.

"We are seeing companies weigh their risks in those wildfire areas and trying to manage that on a case-by-case basis," Walker said. "On a case-by-case basis, companies have gotten stricter about properties they're willing to insure in the case of wildfire risks."

Christley echoed Walker's sentiments about insurers' willingness for certain high fire areas and for homeowners

with anything but a stellar claims history.

Christley recently worked with a client who bought a condominium in Aspen who was seeking insurance, but after striking out in the standard markets he was forced to take the client to wholesaler Burns & Wilcox to find insurance, because his client was buying in a higher risk area and had two previous claims.

“They’re becoming so risk adverse for homeowners in Colorado that we’re having to take our clients to the substandard market,” said Christley, who specializes in the middle to affluent markets – $300,000 up to the low seven figures.

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Black Forest fire insurance claims nearing $300 million

By Aldo Svaldi The Denver Post The Denver Post
Posted:

DenverPost.com

The Waldo Canyon fire in 2012 remains the state's most destructive wildfire in dollar terms, despite the larger number of structures lost in last month's Black Forest fire.

So far, the Black Forest fire has generated 3,630 claims worth $292.8 million on home and auto insurance policies, according to an initial count released Monday by the Rocky Mountain Insurance Information Association.

That lags the 6,648 claims costing $453.7 million from the Waldo Canyon fire, which destroyed 347 structures versus 486 in the Black Forest fire.

"Insured losses have so much to do with where a fire occurred and what type of properties were in that area," said Carole Walker, executive director of the RMIIA.

The Black Forest fire hit a more rural area containing a wide range of homes, ranging from high-end spreads worth millions to dilapidated cabins.

The Waldo Canyon fire focused its wrath on the denser Mountain Shadows subdivision, where a majority of homes were in the $300,000 to $400,000 range, according to City-Data.com

Property owners have a year to file claims against their policies, and just as they did after the Waldo Canyon and High Park fires, claims from the Black Forest fire are expected to rise in coming months.

The value of claims from the Waldo Canyon fire rose 28.7 percent from the preliminary estimate to a year after the fire. The updated losses on the High Park fire were $113.7 million, a 17.1 percent increase from the initial tally.

Walker said insurers think they have heard from those customers facing a total loss in Black Forest by now, given that they need reimbursement for living expenses.

If the Black Forest fire generates a similar increase in claim value that the Waldo Canyon fire did one year out, then claims would come in around $376.7 million. That would rank it as the second most destructive wildfire in state history in dollar terms.

Compared to last year, the expectation is that both homeowners and insurers are better prepared to handle the catastrophic losses.

Walker said so far there haven't been many complaints filed with the Colorado Division of Insurance over how Black Forest fire claims are being handled.

One area of contention could be the value of landscaping. Although homeowners may consider trees an important contributor to a property's overall value, they aren't covered at replacement cost.

Some insurers provide a flat rate for landscaping, while some pay a small percentage of overall value of the structure, often with a cap on each individual tree or plant.

"Generally it is not a large amount," Walker said.

Aldo Svaldi: 303-954-1410, asvaldi@denverpost.com or twitter.com/aldosvaldi

Print - Study: Colorado has soft wildfire regulations | 9news.com

Study: Colorado has soft wildfire regulations

10:15 PM, Jul 16, 2013

DENVER - A **new study by the University of Colorado-Denver** finds that Colorado has some of the softest rules when it comes to wildfire safety.

The finding comes at a time when the state is re-thinking how it reduces danger in forest neighborhoods, still reeling from the destruction a second fire season.

Colorado's running list of deadly fires took the lives of eight people this year and last, destroying more than 1,000 homes.

This year's Black Forest Fire destroyed nearly 500 homes, becoming the single most destructive fire in state history in terms of property damage.

To protect neighborhoods, fire managers preach defensible space, which homeowners can create by clearing vegetation from buildings.

However, treatment only works if it's applied to entire neighborhoods and the forest around them.

"If you have half of the members of the community who are doing everything they can to mitigate against wildfire, and the other half could care less, you're all going to go up in flames if a big fire comes," said Lloyd Burton, author of the CU Denver study.

Burton's study found that western states approach that problem differently.

He found that California and Oregon have the strongest laws. They have statewide fire standards that can be enforced on homeowners.

Colorado is in the group of states with the softest laws. We leave the option to set and enforce fire prevention rules up to local government.

That same model is used in New Mexico and Arizona, where 19 firefighters died this year.

"Nearly all the civilian and firefighter fatalities have occurred in local option states," the study concluded.

That doesn't translate into an effort to toss out the concept of local control in Colorado.

"I don't think it's necessary for the state to come in and say we're going to impose one building code on the entire state," said Gov. John Hickenlooper (D-Colorado.)

Hickenlooper has consistently said he doesn't want to take authority away from local governments, but a **wildfire task force** he formed is thinking about writing statewide standards.

It seems almost certain those standards will be optional.

"My bias is that we should deliver best practices to the counties, and that commission is a great place to figure out what is a carrot, what is a stick," Hickenlooper said.

That middle ground "carrot and stick" approach would make Colorado more like Utah and Nevada, which have had success with fire standards that aren't forced on people, but encouraged with strong incentives.

Colorado is mulling options that vary from financial incentives to encourage homeowners to clean up vegetation on their properties-to liability for the cost of firefighting on properties that haven't been improved to standards.

"It's all a question of what we call the body politic," Burton said. "What do we and do we not want government to do on our behalf?"

As of yet, it's unclear what exact changes Colorado is willing to make, but the conversation is underway and it could lead to new laws next year.

The governor's wildfire task force will hold its next meeting on July 29, which should be one of its last before submitting recommendations for changes to state laws and recommendations.

Wildfires Will Worsen, And Further Strain The Forest Service

by **CHRISTOPHER JOYCE**

July 18, 2013 4:22 PM

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All Things Considered **4 min 8 sec**

Tom Tingle/AP

The deaths of 19 firefighters near Yarnell, Ariz., this summer have focused a lot of attention on just how bad wildfire has become in the West. And research predicts the situation is going to get worse.

Over the past decade, the region has seen some of the worst fire seasons on record. In addition to lives lost, the fires have cost billions in terms of lost property and in taxpayer money spent fighting the blazes.

Ray Rasker, an economist who lives in the fire country of southwestern Montana, tracks fire records the way other economists study business cycles or commodity prices. He's seen a disturbing trend.

First, he says, "the fires are twice as large, they're burning twice as long, and the season is starting earlier and ending later." Second: More homes are being built right next to national forests, and when

those forests burn, firefighters have to defend those homes.

> "The fires are twice as large, they're burning twice as long, and the season is starting earlier and ending later.
>
> *- Ray Rasker, executive director, Headwater Economics*

And Rasker, who is the executive director of Headwaters Economics, noticed that when it's unusually warm, things get worse. In Montana, when it's just one degree warmer than average, 35 percent more land burns. That costs money.

"The really interesting thing is that when the average summertime temperature is just one degree Fahrenheit warmer, the cost of defending these homes doubles," he says. Rasker says these numbers are similar in California and Oregon.

He notes that about 84 percent of the private land around national forests is open to development, versus 14 percent of surrounding land that's already built up with housing developments, resorts and vacation homes. With an improving economy, and no restrictions on where people can build, he's worried.

"We're on a growth trajectory that is very scary," he says. "And you know, if we think it's expensive and dangerous now, we're just now seeing the very beginnings of how big this problem is going to be very soon."

Already, the firefighting portion of the Forest Service's budget is higher than ever. "In 2012 [the share of budget] was over 47 percent," says David Cleaves, the service's climate and fire expert. That's tripled over the past decade or so.

Cleaves says it's not a crisis now, but "economically, and in a policy sense, you could call it a crisis in the future." That's because more money that goes to firefighting means there's less money available for prevention.

"We're burning many times as much acreage as we burned in the past," says Elizabeth Reinhardt, assistant director for fire management for the Forest Service. "And also we have many times more large fires. So when you have individual fires that cost $30 million and $50 million and $10 million, then if you just have a few more of them, all of a sudden you're gobbling up your budget."

John Wark/AP

Nowadays, the U.S. Forest Service has less money to spend on trimming back or burning undergrowth and trees to prevent bigger fires in the future. Estimates put the area of forest that needs fire prevention work performed on it at over 200 million acres, but the service is only able to treat about 3 million acres a year.

One solution is to let some natural fires burn longer instead of putting them out right away. That gets rid of built-up fuel, and it's cheaper than mechanically thinning forests or doing prescribed burns. But this tactic isn't popular with homeowners nearby.

"So many of the places where we have fire are near where people live," says Reinhardt. "Or, say it's early in the fire season and you have months of fire season ahead of you, and you just don't feel like you can take the risk of having a big fire out there in the backcountry."

And climate scientists don't expect things to improve on their own. Over the past century, average global temperature has gone up more than one degree Fahrenheit. Scientists say climate change is likely to keep pushing temperatures up.

Climate scientist Anthony Westerling explains that in the West, heat dries up the land. Think of a bathtub, he says. "The more you warm it up, the more the moisture is leaving the bathtub. It's coming out as steam off the top." When combined with drought, high heat increases the "vapor pressure deficit" — the potential the atmosphere has to suck moisture out of the ground. Under those conditions, trees and grass and bushes turn into dry tinder.

Westerling works at the University of California in Merced but he's been watching the Rocky Mountains a lot. He says spring is coming earlier, and it's hotter. Many forests there are near their heat and drought limit.

A decade of wet weather could turn things around, he says, but he adds that computer models show a rockier long-term trend. "By the time you get to mid-century in the northern Rockies, temperatures in most years and droughts in most years are far more extreme than the most extreme historical events."

And that will mean more firefighting, especially if people continue to build homes and subdivisions in fire-prone regions.

Darrell Spangler/AP

Economist Ray Rasker says that's likely to continue if communities and developers who decide to build are not paying for their fire protection. "They don't bear the full cost of that decision," Rasker says. "The cost is borne by the federal taxpayer, by the rest of us."

Instead, he says, "part of the calculation should be whether the local government can afford their share of the firefighting costs." If they can't pay, he says, then they shouldn't allow more development in fire-prone areas.

And Rasker says there are ethical as well as economic reasons to limit development near forests — the lives of firefighters are at stake.

"It's a tough thing to see people go in, to have to risk their lives" to defend structures in towns that have been evacuated, he says. "Empty

structures."

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THE WALL STREET JOURNAL.
WSJ.com

U.S. NEWS | Updated July 24, 2013, 7:36 p.m. ET

Fighting Fire Before It Starts

Officials Push Landowners to Clear Brush and Take Other Protective Measures

By ERICA E. PHILLIPS and ANN ZIMMERMAN

Associated Press

Prescott firefighter Wade Ward stands this week at the site where 19 firefighters died battling the Yarnell Hill, Ariz., wildfire on June 30.

YARNELL, Ariz.—Many of the modest homes that once rested against a backdrop of rocky hills here are now mere concrete foundations, a few free-standing brick chimneys and piles of melted corrugated metal. But some say they could have been spared if more homeowners had cleared brush on their property.

The Yarnell Hill fire, which overtook this town late last month, took the lives of 19 elite firefighters from nearby Prescott's fire department and destroyed nearly 20% of the community's 600 homes.

Earlier

First Texts, Then Silence in Tragic Blaze
7/3/2013

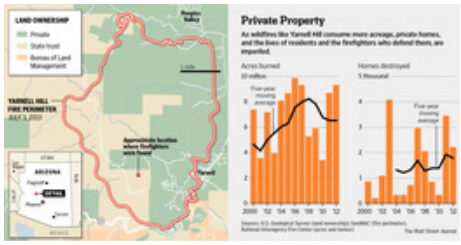
Sudden Turn in Flames Doomed Firefighters
7/2/2013

Darrell Willis, chief of Prescott's wildland firefighting division, said Tuesday the dead firefighters' goal was to protect "life and property." They died traversing rocky terrain and high chaparral en route to Yarnell, where Mr.

Willis said he believes they were planning to help protect burning homes.

As the West experiences another brutal fire season, local and federal officials are trying to boost efforts to clear brush from public lands. But much of the potential fire hazard is actually on privately owned lands. The Yarnell fire was largely fueled by brush on private lands: Of the total area burned, about 69%, or 5,694 acres, was privately owned, according to a report last week by the Pacific Biodiversity Institute, a conservation-research group based in Washington state.

Houses surrounded by so-called defensible space—cleared brush and trimmed trees—mostly escaped destruction, the report shows. But only 11% of the residents in the community took such preventive measures, a pattern that other fire-prone areas like Colorado are trying to reverse.



The National Fire Protection Association, an advocacy group that organizes efforts to secure property from the threat of fire, has seen a surge in interest since the Arizona firefighters' deaths and the Colorado fire last month that destroyed more than 400 homes, said program manager Molly Mowery.

The group's Firewise Communities program, which is co-sponsored by the U.S. Forest Service, the Interior Department and the National Association of State Foresters, lays out simple fire-mitigation plans for homeowners. Presently, 930 communities nationwide have implemented the program's standards.

Still, fire officials say persuading landowners to take preventive measures hasn't been an easy sell. Many homeowners enjoy the look of vegetation, even if it's flammable, and appreciate the privacy it affords. For others, particularly retirees on fixed incomes, the costs and physical demands of brush-clearing can be prohibitive.

Paul Ohlenbusch, a 73-year-old former professor, lives in a retirement community north of Austin, Texas, an area plagued by drought for several years. To protect his home from possible wildfires, he keeps his house gutters free of leaves and twigs, clears tree limbs from the roof and trims shrubs at least six inches from the house. While he tries to persuade neighbors to do the same, he said, "Many of them are in denial."

Speaking to reporters Tuesday at the site where the firefighters died, Mr. Willis said he hopes a lesson will be learned from the tragedy. "If all the communities across the Western United States had a priority on defensible space, if they were taking care of the property," Mr. Willis said, "we wouldn't have to put firefighters between homes."

The recent study of the Yarnell Hill fire found 89% of homes and other structures in Yarnell had been "in direct contact with trees or shrubs" before the fire. Of those, 30% burned, compared with only 5% of structures the institute determined were "fire-safe"—or "not in contact with trees, shrubs or foliage that could act as fuel."

As helpful as brush clearing and other defensive measures can be, said Arlon Rice, chairman of the Yarnell Fire Department's board, nothing can guarantee that the most extreme fires will spare a given home, as wind-driven flames and embers can leap large distances.

Kevin Boness, an Arizona district forester who worked on command operations during the Yarnell Hill fire, said, "There's only so much the government can do to protect private land."

That's particularly true in communities like Yarnell that aren't close to large forests, where thick foliage and underbrush can easily ignite. In rocky terrain, where chaparral and brush rises only 10 to 12 feet high, Mr. Boness said, "the expectation is that [a fire] won't be as dramatic."

According to the Yarnell Fire Department, 31% of the structures that were destroyed in the fire were uninsured. Other states are also at high risk for wildfires. A 2012 CoreLogic study of 13 Western states for insurers showed that California, Texas and Colorado had the largest number of homes at high risk.

After last year's record-setting wildfires in Colorado, Gov. John Hickenlooper created a task force to consider legislative measures to minimize fire risk and destruction in the state, where about three-quarters of development in forests is on private property. The task force is considering recommending legislation that would give the government the power to force homeowners who live in burn zones to mitigate fire risk, such as clearing flammable vegetation.

Most large insurance carriers in Colorado now require homeowners in high-fire-risk areas to create defensible space around their homes. "But insurance can't be the only answer," said Carol Walker, executive director of the Rocky Mountain Insurance Information Center.

During last month's devastating fire in Colorado, about 60% of the buildings survived in the communities where mitigation was widespread, said Bob Harvey, the fire chief of Black Forest.

The severity of this year's fire season, which has only just begun in California, has driven several communities around the country to undertake their own programs.

Write to Erica E. Phillips at erica.phillips@wsj.com and Ann Zimmerman at ann.zimmerman@wsj.com

A version of this article appeared July 25, 2013, on page A3 in the U.S. edition of The Wall Street Journal, with the headline: Fighting Fire Before It Starts.

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6 - Executive Orders, Legislation and Memos

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John W. Hickenlooper
Governor

B 2013-001

EXECUTIVE ORDER

Creating an Advisory Committee to the Director of the Division of Fire Prevention and Control on Wildland Fire and Prescribed Fire Matters

Pursuant to the authority vested in the Office of the Governor of the State of Colorado and, in particular, pursuant to Article IV, Section 2, of the Colorado Constitution, I, John W. Hickenlooper, Governor of the State of Colorado, hereby issue this Executive Order creating the Governor's Advisory Committee to the Director of the Division of Fire Prevention and Control on Wildland Fire and Prescribed Fire Matters.

I. Background and Purpose

For those Colorado residents living in the wildland-urban interface, there is increasing concern of disastrous wildfire. Slash and burn pile operations in this area will reduce the risk of devastating wildfires, in addition to helping firefighters control such outbreak when they do occur. These fuel treatment activities not only reduce wildfire potential, but work to increase the heath of forests, by thinning forest strands and eliminating weak and diseased trees. Weaker trees that remain in the forest are prone to insect attacks and disease.

In order to best serve the residents on the wildland-urban interface and promote the health and wellbeing of our forests, slash pile burning remains the least expensive and most effective method of removing slash. This procedure is conducted with caution and consideration, as projects are planned months and sometimes years in advance. This advisory committee will work to ensure continued safety and protection for residents on the wildland-urban interface, while promoting the health and longevity of our state's natural forests through properly regulated pile burnings.

II. Declaration and Directives

The Wildland and Prescribed Fire Advisory Commission is hereby created to advise the Director of the Division of Fire Prevention and Control on wildland fire and prescribed fire matters. The advisory committee will work to improve Colorado's approach to forest health and to develop a long-term strategy for sustaining vital resources.

III. Membership and Organization

A. For the purposes of advising the Director of the Division of Fire Prevention and Control on all matters pertaining to wildfire preparedness, response, suppression, coordination, or management, and prescribed fire, there is hereby created in the Division an advisory committee to the Director, to be known as the Wildland and Prescribed Fire Advisory Commission and referred to herein as the "advisory committee".

B. The advisory committee shall consist of twelve principal members, ten of which shall be appointed by the Director from individuals designated by and representing each of the following organizations or subject-matter areas:

1. Colorado Counties, Inc.
2. Colorado Emergency Managers Association;
3. Colorado Municipal League;
4. Colorado Prescribed Fire Council;
5. Colorado Professional Fire Fighters Association;
6. Colorado State Fire Chiefs Association;
7. Colorado State Fire Fighters Association;
8. County Sheriffs of Colorado;
9. The nonprofit conservation community; and
10. The Chairperson of the Emergency Fire Fund Committee or their designee.

C. Each of the ten principal organizations or subject-matter areas may also designate an alternate member to represent the organization in meetings of the advisory committee; who shall be a non-voting member, except in the absence of the principal, voting member.

D. There shall also be two principal member positions that shall be non-designated for future appointment by the Director from stakeholder groups or organizations that have yet to be identified.

E. The advisory committee shall also consist of the following non-voting members:

1. Director of the Division of Homeland Security and Emergency Management, or their designee;
2. State Forester, Colorado State Forest Service, or their designee;
3. Colorado State Fire Management Officer, Bureau of Land Management, or their designee;
4. Director of Safety, Fire and Aviation Management, U.S. Forest Service, Rocky Mountain Region, or their designee;

F. The advisory committee has the following duties relating to wildfire preparedness, response, suppression, coordination, or management, and prescribed fire:

1. To advise the director on the development of the wildfire preparedness plan required by section C.R.S. § 23-31-309(3)(a);
2. To advise the director regarding resources, technical support, and training needed by fire departments and counties in order to adequately address wildfire risks; and
3. To advise the director on the adoption of prescribed fire standards and training and certification standards for users of prescribed fire.

G. The advisory committee shall annually elect from its members a chairperson and a secretary.

H. The advisory committee shall meet as determined necessary by the chairperson or the Director of the Division of Fire Prevention and Control.

I. The members of the advisory committee shall receive no compensation nor shall they be reimbursed for travel or other expenses incurred in the performance of their duties.

III. Duration

This Executive Order shall remain in force until modified or rescinded by a subsequent Executive Order.

GIVEN under my hand and the Executive Seal of the State of Colorado this thirtieth day of January, 2013.

John W. Hickenlooper
Governor

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John W. Hickenlooper
Governor

B 2013-002

EXECUTIVE ORDER

Creating the Task Force on Wildfire Insurance and Forest Health

Pursuant to the authority vested in me under Article IV, Section 2, of the Colorado Constitution and the laws of the State of Colorado, I, John W. Hickenlooper, Governor of the State of Colorado, hereby issue this Executive Order creating the Task Force on Wildfire Insurance and Forest Health.

I. Background and Purpose

More than 25 percent of Colorado's population lives in the so-called wildland-urban interface, the area where homes intermingle or are in proximity to forested lands. It is estimated that 40 percent of new residential development in the state is at risk to the threat of wildfire. Through decades of experience with destructive fire and scientific study, there are a variety of actions and strategies that can be undertaken to help reduce the loss from wildland fires and thereby protect communities, first responders and investment from wildfire.

The 2012 wildfire season has taken a devastating toll on Colorado residents, tragically killing six people directly and burning more than 600 homes and the personal property housed therein. While the claims and rebuilding process continues, preliminary damage estimates now total $449.7 million from insurance claims that include smoke damage, additional living expenses, damaged and destroyed homes, as well as damage to personal belongings and vehicles. This Task Force will look at how to best protect citizens who live in the wildland-urban interface and protect Colorado's landscape, which is a critical element of the state's economic health.

Issues have arisen regarding insurance coverage for property damaged by the fires that occurred in 2012. These issues include the replacement costs for destroyed homes, relocation assistance for evacuated residents and those who lost homes, accounting for lost personal property, and the timing of insurance benefits. These experiences present an opportunity to explore potential insurance products that can be tailored specifically to areas like the wildland-urban interface that present special natural hazards. In so doing, insurance coverage can help incentivize actions, practices and policies that can lead to reduced losses and better understanding of coverage by policyholders.

Providing such insurance coverage would also promote state and local activities that would promote forest health and reduce wildland fire threats. These could include vegetation treatment activities

around homes (defensible space) and on nearby and surrounding forest lands (fuels treatment projects), the availability of emergency resources (firefighting equipment) and services (access to homes for emergency vehicles), and fire retardant building materials. Implementation of these sorts of activities, practices and policies could be factored into insurance underwriting decisions so as to help incentivize wise planning and stewardship and reduce loss of life and property.

II. Declaration and Directives

A. The Task Force on Wildfire Insurance and Forest Health (Task Force) is hereby created to identify and reach agreement on ways to encourage activities, practices and policies that would reduce the risk of loss in wildland-urban interface areas and provide greater customer choice and knowledge of insurance options.

B. The issues that the Task Force shall address include, but not be limited to:

1. Environmentally sensitive ways to improve forest health and sustainability in order to limit future wildfire exposure;
2. The availability of firefighting resources and coordination;
3. Ways to maintain and protect water quality and watersheds;
4. Building and other development activities and requirements in the wildland-urban interface; and
5. Maintaining a healthy insurance marketplace to protect against financial loss from wildfire.

C. The Task Force shall explore any and all options that address the preceding issues and help clarify and/or better coordinate the local and state regulatory jurisdictions. Such options examined shall include, but are not limited to:

1. The tailoring of insurance products for residents in the wildland-urban interface and other natural hazard prone areas;
2. Utilization of local government liaisons and local jurisdiction designees regarding forest management and development in the wildland-urban interface;
3. State training workshops for local jurisdiction representatives;
4. Memorandums of agreement, intergovernmental agreements, and letters of cooperation and consent between the state and local jurisdictions;
5. Changes to existing laws or regulations; and
6. Suggested new laws and regulations.

III. Membership

A. The Task Force shall be chaired by the Executive Director of the Colorado Department of Regulatory Agencies.

B. The Task Force shall be comprised of the following members:

1. The Colorado Commissioner of Insurance;
2. One designee of the Division of Homeland Security and Emergency Management and one designee of the Division of Fire Prevention and Control;
3. Two designees each from the Colorado Department of Natural Resources and the Colorado State Forest Service, respectively;
4. One designee from the U.S. Forest Service with specific expertise in forest health;
5. Two designees from the property and casualty insurance industry, specifically, from the American Insurance Association and the Property Casualty Insurers Association of America;
6. One designee from a non-governmental conservation organization;
7. One designee of the Colorado Municipal League;
8. One designee of the Colorado Bankers Association;
9. One designee of the Colorado Mortgage Lenders;
10. One designee of the Colorado Home Builders Association;
11. One designee of Colorado Counties, Inc.;
12. One designee of the Colorado Water Congress; and
13. Two designees of the Department of Public Health and Environment, of which one shall be experienced in water quality issues and one shall be experienced in air quality issues.

IV. Duration

This Executive Order shall continue in existence until the Task Force reports its recommendations and findings to the Governor, the Speaker of the House of Representatives, and the President of the Senate no later than July 1, 2013, unless rescinded or modified by further Executive Order.

GIVEN under my hand and the Executive Seal of the State of Colorado, this thirtieth day of January, 2013.

John W. Hickenlooper
Governor

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John W. Hickenlooper
Governor

D 2013-002

EXECUTIVE ORDER

Amending Executive Order D 2012-006, Regarding Suspending Prescribed or Controlled Fire Pending Review of Protocols

Pursuant to the authority vested in the Governor of the State of Colorado and, in particular, pursuant to Article IV, Section 2 of the Colorado Constitution, I, John W. Hickenlooper, Governor of the State of Colorado, hereby issue this Executive Order amending Executive Order D 2012-006.

I. Background and Purpose

On March 28, 2012, pursuant to Article IV, Section 13, C.R.S. § 23-31-308, based on a finding of extreme fire danger, we issued Executive Order D 2012-006 suspending prescribed or controlled fire on state or private lands pending review of agency protocols for prescribed or controlled fire. The suspension applied to all state lands as well as state agencies that apply prescribed or controlled fire on non-state lands under contracts or agreements with other entities. At the time, Colorado was experiencing unseasonably high temperatures and dry conditions which led to a number of wildfires across the State.

Although weather conditions across Colorado have changed over the recent months, for those Colorado residents living in the wildland-urban interface, there is still concern of disastrous wildfire. Slash and burn pile operations in this area will reduce the risk of devastating wildfires, in addition to helping firefighters control such outbreak when they do occur. These fuel treatment activities not only reduce wildfire potential, but work to increase the heath of forests, by thinning forest strands and eliminating weak and diseased trees. Weaker trees that remain in the forest are prone to insect attacks and disease.

In order to best serve the residents on the wildland-urban interface and promote the health and wellbeing of our forests, slash pile burning remains the least expensive and most effective

method of removing slash. This procedure is conducted with caution and consideration, as projects are planed months and sometimes years in advance. This Division of Fire Prevention and Control will work to ensure continued safety and protection for residents on the wildland-urban interface, while promoting the health and longevity of our State's natural forests through properly regulated pile burnings.

II. Declaration and Directives

A. Executive Order D 2012-006 (State-wide suspension on prescribed or controlled fires) is hereby amended to allow for the resumption of slash pile burnings under controlled conditions.

B. Slash pile burn operations conducted by state agencies or on state lands shall follow the new guidelines and procedures established by the Division of Fire Prevention and Control to ensure that all such burns are conducted in a safe and effective manner.

C. The Division of Fire Prevention and Control shall observe the following minimum guidelines for prescribed pile fires:

1. Ignition of piles shall occur only on days when there is adequate snow cover and the Colorado Air Pollution Control Division has determined that weather conditions are appropriate for burning because good smoke dispersal can be achieved;
2. Piles shall be ignited as early in the morning as possible and operations will cease before sunset;
3. Fire suppression resources shall be on site when piles are burned; and
4. Pile burns shall occur only after proper notification of residents of potentially affected areas and local government officials.

III. Duration

This Executive Order shall remain in effect until rescinded or modified by Executive Order. In all other respects, Executive Order D 2012-006 shall remain in full force and effect as originally promulgated.

GIVEN under my hand and the Executive Seal of the State of Colorado this thirtieth day of January, 2013.

John W. Hickenlooper
Governor

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D 2013-008

EXECUTIVE ORDER

Implementing the Wildfire Preparedness Plan for 2013 and Designating Monies in the Wildfire Preparedness Fund for Wildfire Preparedness Activities

Pursuant to the authority vested in the Governor of the State of Colorado and, in particular, pursuant to article IV, section 2 of the Colorado Constitution and C.R.S. § 24-33.5-1226(4)(b) of the Colorado Revised Statutes I, John W. Hickenlooper, Governor of the State of Colorado, hereby issues this Executive Order implementing the 2013 Wildfire Preparedness Plan and designating monies in the Wildfire Preparedness Fund for wildfire preparedness activities.

I. Background and Purpose

C.R.S. § 24-33.5-1226(3)(a) requires the Director ("Director") of the Division of Fire Prevention and Control ("Division") to develop an annual Wildfire Preparedness Plan, in collaboration with the County Sheriffs of Colorado, the Colorado State Fire Chiefs' Association, the Director of the Office of Emergency Management and the Adjutant General.

The Wildfire Preparedness Plan shall be designed to address the following:

(1) The amount of aerial firefighting resources necessary for the state of Colorado at times of high and low wildfire risk;
(2) The availability of appropriate aerial firefighting equipment and personnel at times of high fire risk to respond to a wildfire;
(3) The availability of state wildfire engines and staffing of the engines at different levels of wildfire risk;
(4) The availability of state inmate wildfire hand crews at different levels of wildfire risk; and
(5) A process for ordering and dispatching aerial firefighting equipment and personnel that is consistent with, and supportive of, the statewide mobilization plan prepared pursuant to C.R.S. § 24-33.5-705.4.

The Wildfire Preparedness Plan shall also provide recommendations on the use of the Wildfire Preparedness Fund created in C.R.S. § 24-33.5-1226(4)(a).

The Director prepared the Wildfire Preparedness Plan for 2013 as required by law and submitted it to the Governor and General Assembly on December 20, 2012. The plan was identified as "Provisional" because the Division had not yet completed the fire aviation plan and the plan for the staffing of state wildfire engines for 2013.

Subsequently, the Division completed its analysis of the costs of the 2012 fire season, the financial resources available for the 2013 fire season, and considered the State's preparedness needs. In collaboration with the County Sheriffs of Colorado, the Colorado State Fire Chiefs' Association, the Director of the Office of Emergency Management and the Adjutant General, the Director prepared and submitted a "Final" Wildfire Preparedness Plan for 2013 on March 29, 2013.

II. Declaration and Directives

A. The Division is hereby directed to implement the Wildfire Preparedness Plan for 2013 and carry out the wildfire preparedness activities identified therein.

B. The Division shall use the monies in the Wildfire Preparedness Fund to implement and carry out the wildfire preparedness activities identified in the 2013 Wildfire Preparedness Plan, as is necessary.

III. Duration

This Executive Order shall expire upon issuing an Executive Order or Proclamation implementing the Wildfire Preparedness Plan for 2014, or upon rescission by subsequent Executive Order.

GIVEN under my hand and the Executive Seal of the State of Colorado this eleventh day of June, 2013.

John W. Hickenlooper
Governor

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John W. Hickenlooper
Governor

D 2013-009

EXECUTIVE ORDER

Declaring a Disaster Emergency
Due to the Royal Gorge Fire in Fremont County

Pursuant to the authority vested in the Governor of the State of Colorado and, in particular, pursuant relevant portions of C.R.S. § 28-3-104 and relevant portions of the Colorado Disaster Emergency Act, C.R.S. § 24-33.5-701, *et seq.*, I, John W. Hickenlooper, Governor of the State of Colorado, hereby issue this Executive Order declaring a state of disaster emergency due to the Royal Gorge Fire in Fremont County, Colorado and making resources available to fight the fire and address the disaster emergency.

I. Background and Purpose

The Governor is responsible for meeting the dangers to the state and people presented by disasters. The Colorado Disaster Emergency Act defines a disaster as "the occurrence or imminent threat of widespread or severe damages, injury or loss of life or property resulting from any natural cause or cause of human origin, including but not limited to . . . fire." C.R.S. § 24-33.5-703(3).

On June 11, 2013 at 1256 hours, the Royal Gorge Fire was reported south of the Royal Gorge Bridge and Arkansas River. This wind-driven fire quickly grew in size and intensity, prompting the evacuation of 190 homes and subsequently the Colorado Territorial Correctional Facility. The fire started on the south side of river and spotted to the north side. All available firefighting resources were committed to firefighting and structural protection.

At approximately 1420 hours the Fremont County Sheriff determined that the fire exceeded the ability of the county and other local resources to contain and extinguish the fire and requested transfer of the fire to the State of Colorado under the Emergency Fire Fund (EFF) provisions.

Because the fire was increasing in intensity and rapidly spreading, the Governor's Authorized Representative (GAR) notified Federal Emergency Management Agency (FEMA) at 1448 hours that the Royal Gorge fire could threaten such destruction as would constitute a major disaster and assistance under the Fire Management Assistance Grant (FMAG) Program may be requested.

At 1526 hours the Division of Fire Prevention and Control completed its assessment and determined that the fire met the criteria for EFF designation. The EFF request was approved by the Governor at 1530 hours on June 11, 2013.

At 1630 hours the Division of Fire Prevention and Control completed its assessment and determined that the fire met the criteria for making a request for federal assistance under the FMAG Program. The GAR submitted the request to FEMA at 1648 hours. FEMA notified the GAR at 2059 hours that the request was approved.

II. Declaration and Directives

A. The Royal Gorge Fire constitutes a disaster emergency under C.R.S. § 24-33.5-704. My order of June 11, 2013 at 1604 hours, declaring a disaster emergency is hereby memorialized by this Executive Order and shall have the full force and effect of law as if it were contained within this Executive Order.

B. The State Emergency Operations Plan is hereby activated. All State departments and agencies shall take whatever actions may be required and requested by the Director of the Office of Emergency Management, including provision of appropriate staff and equipment as necessary.

C. Pursuant to C.R.S. § 24-33.5-706(4), the funds in the Disaster Emergency Fund are hereby found insufficient to pay for fire suppression efforts related to the Royal Gorge Fire. Therefore, it is ordered that $4,500,000 be transferred into the Disaster Emergency Fund from the General Fund appropriation in Fiscal Year 2012-13 to the Controlled Maintenance Trust Fund. It is further ordered that $4,500,000 from the Disaster Emergency Fund is encumbered to pay for the fire suppression, response, and recovery effort related to the Royal Gorge Fire since its inception.

   Included in the specified amount is $195,000 for recovery related to this disaster. These funds may be used to pay for disaster recovery resources as approved by the Director of the Office of Emergency Management to assist with state and local government costs incurred during and as a result of the current disaster emergency, including costs incurred by non-profit organizations on behalf of local government entities. The Director of the Colorado Office of Emergency Management is hereby authorized and directed to allocate the funding to the appropriate agencies and execute awards, purchase orders or other mechanisms to effect the allocation of the funds. These funds shall remain available for this purpose for eighteen months from the date of this Executive Order, and any unexpended funds shall remain in the Disaster Emergency Fund.

D. My verbal orders activating the National Guard and authorizing the utilization of National Guard assets to fight the Royal Gorge Fire and enforce the laws of the State of Colorado as provided in C.R.S. § 28-3-104 are hereby memorialized by this Executive Order and shall have the full force and effect of law as if they were contained within this Executive Order.

E. The Colorado Department of Public Safety is authorized and directed to coordinate application to the federal government for funds available for reimbursement and to coordinate application for any other funds available related to this disaster emergency.

III. Duration

This Executive Order shall expire thirty days from June 11, 2013, unless extended further by Executive Order, except that the funds described in paragraph II(C) above shall remain available for the described purposes for eighteen months from the date of this Executive Order.

GIVEN under my hand and the Executive Seal of the State of Colorado this twelfth day of June, 2013.

John W. Hickenlooper
Governor

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John W. Hickenlooper
Governor

D 2013-010

EXECUTIVE ORDER

Declaring a Disaster Emergency
Due to the Black Forest Fire in El Paso County

Pursuant to the authority vested in the Governor of the State of Colorado and, in particular, pursuant relevant portions of C.R.S. § 28-3-104 and relevant portions of the Colorado Disaster Emergency Act, C.R.S. § 24-33.5-701, *et seq.*, I, John W. Hickenlooper, Governor of the State of Colorado, hereby issue this Executive Order declaring a state of disaster emergency due to the Black Forest Fire in El Paso County, Colorado and making resources available to fight the fire and address the disaster emergency.

I. Background and Purpose

The Governor is responsible for meeting the dangers to the state and people presented by disasters. The Colorado Disaster Emergency Act defines a disaster as "the occurrence or imminent threat of widespread or severe damages, injury or loss of life or property resulting from any natural cause or cause of human origin, including but not limited to . . . fire." C.R.S. § 24-33.5-703(3).

On June 11, 2013, shortly before 1400 hours, the Black Forest Fire was reported to local authorities near Shoup Road and Highway 83 in El Paso County. This wind-driven fire was quickly growing in size and intensity, prompting the mandatory evacuation of 500 homes. All available firefighting resources were committed to firefighting and structural protection.

At approximately 1411 hours the El Paso County Sheriff determined that the fire would exceed the ability of the county and other local resources to contain and extinguish it and requested the response of the Division of Fire Prevention and Control.

Based on size up information that the fire was increasing in intensity and rapidly spreading, the Governor's Authorized Representative (GAR) notified Federal Emergency Management Agency (FEMA) at 1439 hours that the Black Forest Fire could threaten such destruction as would constitute a major disaster and assistance under the Fire Management Assistance Grant (FMAG) Program may be requested.

At 1600 hours the El Paso County Sheriff requested transfer of the fire to the State of Colorado under the Emergency Fire Fund (EFF) provisions. At 1651 hours the Division of Fire Prevention and Control completed its assessment and determined that the Black Forest Fire met the criteria for EFF designation. The EFF request was approved by the Governor at 1720 hours on June 11, 2013.

At 1700 hours the Division of Fire Prevention and Control completed its assessment and determined that the Black Forest Fire met the criteria for making a request for federal assistance under the FMAG Program. The GAR submitted the request to FEMA at 1710 hours. FEMA notified the GAR at 2059 hours that the request was approved, effective 2050 hours.

II. Declaration and Directives

A. The Black Forest Fire constitutes a disaster emergency under C.R.S. § 24-33.5-704. My verbal order of June 11, 2013 at 1720 hours, declaring a disaster emergency is hereby memorialized by this Executive Order and shall have the full force and effect of law as if it were contained within this Executive Order.

B. The State Emergency Operations Plan is hereby activated. All State departments and agencies shall take whatever actions may be required and requested by the Director of the Office of Emergency Management, including provision of appropriate staff and equipment as necessary.

C. Pursuant to C.R.S. § 24-33.5-706(4), the funds in the Disaster Emergency Fund are hereby found insufficient to pay for fire suppression efforts related to the Black Forest Fire. Therefore, it is ordered that $5,500,000 be transferred into the Disaster Emergency Fund from the General Fund appropriation in Fiscal Year 2012-13 to the Controlled Maintenance Trust Fund. It is further ordered that $8,000,000 from the Disaster Emergency Fund is encumbered to pay for the fire suppression, response, and recovery effort related to the Black Forest Fire since its inception.

   Included in the specified amount is $195,000 for recovery related to this disaster. These funds may be used to pay for disaster recovery resources as approved by the Director of the Office of Emergency Management to assist with state and local government costs incurred during and as a result of the current disaster emergency, including costs incurred by non-profit organizations on behalf of local government entities. The Director of the Colorado Office of Emergency Management is hereby authorized and directed to allocate the funding to the appropriate agencies and execute awards, purchase orders or other mechanisms to effect the allocation of the funds. These funds shall remain available for this purpose for eighteen months from the date of this Executive Order, and any unexpended funds shall remain in the Disaster Emergency Fund.

D. My verbal orders activating the National Guard and authorizing the utilization of National Guard assets to fight the Black Forest Fire and enforce the laws of the State of Colorado as provided in C.R.S. § 28-3-104 are hereby memorialized by this Executive Order and shall have the full force and effect of law as if they were contained within this Executive Order.

E. The Colorado Department of Public Safety is authorized and directed to coordinate application to the federal government for funds available for reimbursement and to coordinate application for any other funds available related to this disaster emergency.

III. Duration

This Executive Order shall expire thirty days from June 11, 2013, unless extended further by Executive Order, except that the funds described in paragraph II(C) above shall remain available for the described purposes for eighteen months from the date of this Executive Order.

GIVEN under my hand and the Executive Seal of the State of Colorado this twelfth day of June, 2013.

John W. Hickenlooper
Governor

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John W. Hickenlooper
Governor

D 2013-011

EXECUTIVE ORDER

Declaring a Disaster Emergency
Due to the Klickus Fire in Huerfano County

Pursuant to the authority vested in the Governor of the State of Colorado and, in particular, pursuant relevant portions of C.R.S. § 28-3-104 and relevant portions of the Colorado Disaster Emergency Act, C.R.S. § 24-33.5-701, *et seq.*, I, John W. Hickenlooper, Governor of the State of Colorado, hereby issue this Executive Order declaring a state of disaster emergency due to the Klickus Fire in Huerfano County, Colorado and making resources available to fight the fire and address the disaster emergency.

I. Background and Purpose

The Governor is responsible for meeting the dangers to the state and people presented by disasters. The Colorado Disaster Emergency Act defines a disaster as "the occurrence or imminent threat of widespread or severe damages, injury or loss of life or property resulting from any natural cause or cause of human origin, including but not limited to . . . fire." C.R.S. § 24-33.5-703(3).

On June 11, 2013, at about 1530 hours, the Klickus Fire was reported by the Huerfano County Sheriff to the Division of Fire Prevention and Control approximately 5 miles west of La Veta. This wind-driven fire was quickly growing in size and intensity, prompting the mandatory evacuation of 3 homes. All available firefighting resources were committed to firefighting and structural protection.

The Huerfano County Sheriff determined that the fire exceeded the ability of the county and other local resources to contain and extinguish it and requested the transfer of the fire to the State of Colorado under the Emergency Fire Fund (EFF) provisions.

At 1854 hours the Division of Fire Prevention and Control completed its assessment and determined that the Klickus Fire met the criteria for EFF designation. The EFF request was approved by the Governor at 1900 hours on June 11, 2013.

II. Declaration and Directives

A. The Klickus Fire constitutes a disaster emergency under C.R.S. § 24-33.5-704. My order of June 11, 2013 at 1900 hours, declaring a disaster emergency is hereby memorialized by this Executive Order and shall have the full force and effect of law as if it were contained within this Executive Order.

B. The State Emergency Operations Plan is hereby activated. All State departments and agencies shall take whatever actions may be required and requested by the Director of the Office of Emergency Management, including provision of appropriate staff and equipment as necessary.

C. Pursuant to C.R.S. § 24-33.5-706(4), it is ordered that $150,000 from the Disaster Emergency Fund is encumbered to pay for the fire suppression, response, and recovery effort related to the Klickus Fire since its inception. The Director of the Office of Emergency Management is hereby authorized and directed to allocate the funding to the appropriate government agencies and execute awards, purchase orders or other mechanisms to effect the allocation of the funds. These funds shall remain available for this purpose for eighteen months from the date of this Executive Order, and any unexpended funds shall remain in the Disaster Emergency Fund.

D. My verbal orders activating the National Guard and authorizing the utilization of National Guard assets to fight the Klickus Fire and enforce the laws of the State of Colorado as provided in C.R.S. § 28-3-104 are hereby memorialized by this Executive Order and shall have the full force and effect of law as if they were contained within this Executive Order.

E. The Colorado Department of Public Safety is authorized and directed to coordinate application to the federal government for funds available for reimbursement and to coordinate application for any other funds available related to this disaster emergency.

III. Duration

This Executive Order shall expire thirty days from June 11, 2013, unless extended further by Executive Order, except that the funds described in paragraph II(C) above shall remain available for the described purposes for eighteen months from the date of this Executive Order.

GIVEN under my hand and the Executive Seal of the State of Colorado this twelfth day of June, 2013.

John W. Hickenlooper
Governor

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John W. Hickenlooper
Governor

D 2013-012

EXECUTIVE ORDER

Declaring a Disaster Emergency Due to the Big Meadows Fire in Grand County and Authorizing use of the National Guard

Pursuant to the authority vested in the Governor of the State of Colorado and, in particular, pursuant to relevant portions of C.R.S. § 28-3-104, and relevant portions of the Colorado Disaster Emergency Act, C.R.S. § 24-33.5-701, *et seq.*, I, John W. Hickenlooper, Governor of the State of Colorado, hereby issue this Executive Order declaring a disaster emergency due to the Big Meadows Fire in Rocky Mountain National Park in Grand County and authorizing the National Guard to assist to fight the fire and address the disaster emergency.

I. Background and Purpose

The Governor is responsible for meeting the dangers to the state and people presented by disasters. The Colorado Disaster Emergency Act defines a disaster as "the occurrence or imminent threat of widespread or severe damages, injury or loss of life or property resulting from any natural cause or cause of human origin, including but not limited to . . . fire." C.R.S. §24-33.5-703(3).

On June 10, 2013, lightning started the Big Meadows Fire in Rocky Mountain National Park. On June 11 and 12, 2013, extreme fire weather conditions caused the fire to grow in size from less than 10 acres to over 400 acres. Due to the fire growth, firefighters are now deployed in steep, rugged terrain with limited vehicle access. On the evening of June 12, 2013, the Type II Incident Management Team assuming management of this fire requested a Colorado National Guard helicopter for rescue and/or medivac, if necessary, during this incident, starting on June 13, 2013. I verbally approved this request with a limit of three days.

II. Declaration and Directives

A. The Big Meadows Fire constitutes a disaster emergency under C.R.S. § 24-33.5-704. My verbal order of June 12, 2013, declaring a disaster emergency and authorizing three days use of the National Guard is hereby memorialized by this Executive Order and shall have the full force and effect of law as if it were contained within this Executive Order.

B. The State Emergency Operations Plan is hereby activated. All State departments and agencies shall take whatever actions may be required and requested by the Director of the Office of Emergency Management, including provision of appropriate staff and equipment as necessary.

C. Pursuant to C.R.S. § 24-33.5-706(4), it is ordered that $15,000 from the Disaster Emergency Fund is encumbered to pay for the use of the National Guard helicopter. The actual cost of the National Guard helicopter and personnel will be reimbursed to the Disaster Emergency Fund by the Federal Government. The Director of the Office of Emergency Management is hereby authorized and directed to allocate the funding to the appropriate government agencies and execute awards, purchase orders or other mechanisms to effect the allocation of the funds. These funds shall remain available for this purpose for eighteen months from the date of this Executive Order, and any unexpended funds shall remain in the Disaster Emergency Fund.

III. Duration

This Executive Order shall expire thirty days from June 12, 2013, unless extended further by Executive Order, except that the funds described in paragraph II(C) above shall remain available for the described purposes for eighteen months from the date of this Executive Order.

GIVEN under my hand and the Executive Seal of the State of Colorado this thirteenth day of of June, 2013.

John W. Hickenlooper
Governor

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John W. Hickenlooper
Governor

D 2013-013

EXECUTIVE ORDER

Declaring a Disaster Emergency Due to the East Peak Fire in Huerfano and Las Animas Counties

Pursuant to the authority vested in the Governor of the State of Colorado and, in particular, pursuant to relevant portions of C.R.S. § 28-3-104, relevant portions of the Colorado Disaster Emergency Act, C.R.S. § 24-33.5-701, *et seq.*, and Colorado Constitution article IV, Section 13, I, John W. Hickenlooper, Governor of the State of Colorado, hereby issue this Executive Order declaring a state of disaster emergency due to the East Peak Fire in Huerfano and Las Animas Counties, Colorado and making resources available to fight the fire and address the disaster emergency.

I. Background and Purpose

The Governor is responsible for meeting the dangers to the state and people presented by disasters. The Colorado Disaster Emergency Act defines a disaster as "the occurrence or imminent threat of widespread or severe damages, injury or loss of life or property resulting from any natural cause or cause of human origin, including but not limited to . . . fire." C.R.S. §24-33.5-703(3).

On June 19, 2013, shortly before 2000 hours, the East Peak Fire was reported to state authorities near the Boy Scout Ranch in the Spanish Peaks area of Huerfano County. This wind-driven fire was quickly growing in size and intensity, prompting the mandatory evacuation of the Boy Scout Ranch and area homes. All available firefighting resources were committed to firefighting and structural protection.

At approximately 2100 hours the Huerfano County Sheriff determined that the fire would exceed the ability of the county and other local resources to contain and extinguish it and requested the response of the Division of Fire Prevention and Control. The Huerfano County Sheriff requested transfer of the fire to the State of Colorado under the Emergency Fire Fund (EFF) provisions. At 2145 hours the Division of Fire Prevention and Control completed its assessment and determined that the East Peak Fire met the criteria for EFF designation. The EFF request was approved by the Lieutenant Governor at 2202 hours on June 19, 2013.

On June 20, 2013 at approximately 0915 hours, the Huerfano County Sheriff requested National Guard Helicopters for suppression assistance. The Lieutenant Governor verbally approved this request and the use of two National Guard Helicopters at approximately 0925 hours.

At approximately 1200 hours, the East Peak Fire extended into Las Animas County. At 1247 hours, the Division of Fire Prevention and Control requested that Las Animas County be added to the EFF designation. The Governor verbally approved this request at approximately 1319 hours.

On June 20, 2013 by approximately 1300 hours, the fire continued to significantly increase in size to over 2,000 acres with some structures at the Boy Scout Ranch destroyed and the evacuation zone increased to east from the Town of La Veta to Interstate 25 and from the City of Walsenburg south to the Huerfano County line. Based on size up information that the fire was increasing in intensity and rapidly spreading, the Governor's Authorized Representative (GAR) notified Federal Emergency Management Agency (FEMA) at approximately 1330 hours that the East Peak Fire could threaten such destruction as would constitute a major disaster and assistance under the Fire Management Assistance Grant (FMAG) Program may be requested.

At approximately 1400 hours the Division of Fire Prevention and Control completed its assessment and determined that the East Peak Fire met the criteria for making a request for federal assistance under the FMAG Program and the GAR submitted the request to FEMA. FEMA notified the GAR on July 21, 2013, at 1259 hours that the request was approved.

At approximately 1540 hours, on July 20, 2013, the Spanish Peaks Regional Medical Center contacted the Governor's Office and requested approval to move the pharmacy to an alternate location if the Medical Center evacuated. The Governor verbally approved this request at 1546 hours.

II. Declaration and Directives

A. The East Peak Fire constitutes a disaster emergency under C.R.S. § 24-33.5-704(4). The Lieutenant Governor's verbal order of June 19, 2013, at 2202 hours, declaring a disaster emergency is hereby memorialized by this Executive Order and shall have the full force and effect of law as if it were contained within this Executive Order.

B. The State Emergency Operations Plan is hereby activated. All State departments and agencies shall take whatever actions may be required and requested by the Director of the Office of Emergency Management, including provision of appropriate staff and equipment as necessary.

C. Pursuant to C.R.S. § 24-33.5-706(4), it is ordered that $3,000,000 from the Disaster Emergency Fund is encumbered to pay for the fire suppression, response, and recovery effort related to the East Peak Fire since its inception.

   Included in the specified amount is $195,000 for recovery related to this disaster. These funds may be used to pay for disaster recovery resources as approved by the Director of the Office of Emergency Management to assist with state and local government costs incurred during and as a result of the current disaster emergency, including costs incurred by non-profit organizations on behalf of local government entities. The Director of the Office of Emergency Management is hereby authorized and directed to allocate the funding to the appropriate government agencies and execute awards, purchase orders or other mechanisms to effect the allocation of the funds. These funds shall remain available for this purpose for eighteen months from the date of this Executive Order, and any unexpended funds shall remain in the Disaster Emergency Fund.

D. The Lieutenant Governor's verbal orders activating the National Guard and authorizing the utilization of National Guard assets to fight the East Peak Fire and enforce the laws of the State of Colorado as provided in C.R.S. § 28-3-104 are hereby memorialized by this Executive Order and shall have the full force and effect of law as if they were contained within this Executive Order.

E. The Colorado Department of Public Safety is authorized and directed to coordinate application to the federal government for funds available for reimbursement and to coordinate application for any other funds available related to this disaster emergency.

F. My verbal order approving the movement of the Spanish Peaks Regional Medical Center, including pharmaceuticals, to an alternate facility is hereby memorialized by this Executive Order and shall have the full force and effect of law as if they were contained within this Executive Order. The provisions of Title 12, Article 42.5, Part 1, and the corresponding Board of Pharmacy Rules and regulations pertaining to the authorized persons, outlets and orders for the compounding, dispensing and delivery of any drug are hereby suspended for the purpose of rapidly distributing medications to actual or potential victims of the current fire emergency and evacuated area in Huerfano and Las Animas Counties. A hospital outlet is authorized to transfer its prescription drug inventory to a distribution site outside the hospital as required by the Executive Director or Chief Medical Officer of the Colorado Department of Public Health and Environment (CDPHE) or the director of a local health department.

G. I am suspending state requirements regarding licensed health facility bed capacities and configuration for facilities accepting patients from evacuated facilities. Such facilities shall notify the CDPHE of bed number changes at their earliest convenience within 72

hours. I am also suspending Colorado EMS provider certification for personnel directly in support of wildfire suppression operations in the State of Colorado who hold current EMS provider certification from any state or territory in the United States until this executive order expires, unless extended as provided in Section III.

III. Duration

This Executive Order shall expire thirty days from June 19, 2013, unless extended further by Executive Order, except that the funds described in paragraph II (C) above shall remain available for the described purposes for eighteen months from the date of this Executive Order.

GIVEN under my hand and the Executive Seal of the State of Colorado this twenty-first day of June, 2013.

John W. Hickenlooper
Governor

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D 2013-014

John W. Hickenlooper
Governor

EXECUTIVE ORDER

Extending Authorization of Availability of Funds for Multiple Wildfires that occurred in Colorado during 2011 and 2012

Pursuant to the authority vested in the Governor of the State of Colorado and, in particular, pursuant to relevant portions of the Colorado Disaster Emergency Act, C.R.S. § 24-33.5-701, *et seq.*, and specifically C.R.S. § 24-33.5-704, I, John W. Hickenlooper, Governor of the State of Colorado, hereby issue this Executive Order extending the availability of funds to pay costs associated with the disaster emergencies due to wildfires that occurred in Colorado during 2011 and 2012.

I. Background and Purpose

In 2011 and 2012, Colorado experienced extraordinary wildfire seasons due to dry conditions and high temperatures. In this time period, over twenty-five wildfires required a declaration of a disaster emergency. These wildfires resulted in a record breaking number of fatalities and damage to homes, forest land, and agricultural assets. On July 1, 2012, the Colorado State Forest Service fire-management functions for command and control were transferred from Colorado State University to the Colorado Department of Public Safety. Currently, there is a vacancy in the position assigned to review federal invoices for fires.

Due to the aforementioned circumstances, the final payments for 2011 and 2012 fires will not be completed prior to the expiration dates in the associated Executive Orders. This Executive Order extends the expiration dates of the previously approved funding for these wildfires.

Specifically this Executive Order extends the funding for the following wildfires and their associated Executive Orders:

- Purgatoire – D 2011-015
- Bear – D 2011-015
- Navajo – D 2011-021
- Brice – D 2011-022
- Shell Fire Complex – D 2011-022
- Mesa de Maya – D 2011-022
- Duckett – D 2011-023

- Track – D 2011-024
- Lower North Fork – D 2012-007 and D 2012-008
- Hewlett – D 2012-011 and D 2012-012
- Stuart Hole – D 2012-017
- Springer – D 2012-018
- Weber – D 2012-021
- Flagstaff – D 2012-023 and D2012-038
- Pine Ridge – D 2012-025
- Bull Basin – D 2012-032
- Powell Complex – D 2012-034
- Wetmore – D 2012-044 and D 2012-045
- Roatcap – D 2012-046

II. Declaration and Directives

In addition to the declarations and directives contained in the Executive Orders cited above, I declare and direct, as follows:

A. I extend the funding in the Disaster Emergency Fund provided in the cited Executive Orders until January 31, 2014, to facilitate final payments of the expenses associated with these wildfires. The Division of Fire Prevention and Control and the Division of Homeland Security and Emergency Management are authorized and directed to allocate the funding to the appropriate resources as may be appropriate and permitted by law.

B. Any unexpended funds remaining after final payments or on February 1, 2014, whichever occurs first, will be allocated as provided in the original Executive Orders previously cited.

III. Duration

The funds made available in the original Executive Orders cited shall remain available until January 31, 2014, and in all other respects the cited Executive Orders shall remain in full force and effect as originally promulgated.

GIVEN under my hand and the Executive Seal of the State of Colorado this twenty-first day of June, 2013

John W. Hickenlooper
Governor

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John W. Hickenlooper
Governor

D 2013-015

EXECUTIVE ORDER

Amending the Declaration of a Disaster Emergency Due to the Big Meadows Fire in Grand County and Authorizing use of the National Guard

Pursuant to the authority vested in the Governor of the State of Colorado and, in particular, pursuant to relevant portions of C.R.S. § 28-3-104, and relevant portions of the Colorado Disaster Emergency Act, C.R.S. § 24-33.5-701, *et seq.*, I, John W. Hickenlooper, Governor of the State of Colorado, hereby issue this Executive Order amending Executive Order D 2013-012 declaring a disaster emergency due to the Big Meadows Fire in Rocky Mountain National Park in Grand County and authorizing the National Guard to assist to fight the fire and address the disaster emergency.

I. Background and Purpose

The Governor is responsible for meeting the dangers to the state and people presented by disasters. The Colorado Disaster Emergency Act defines a disaster as "the occurrence or imminent threat of widespread or severe damages, injury or loss of life or property resulting from any natural cause or cause of human origin, including but not limited to . . . fire." C.R.S. §24-33.5-703(3).

On June 10, 2013, lightning started the Big Meadows Fire in Rocky Mountain National Park. On June 11 and 12, 2013, extreme fire weather conditions caused the fire to grow in size from less than 10 acres to over 400 acres. Due to the fire growth, firefighters are now deployed in steep, rugged terrain with limited vehicle access. On the evening of June 12, 2013, the Type II Incident Management Team assuming management of this fire requested a Colorado National Guard helicopter for rescue and/or medevac, if necessary, during this incident, starting on June 13, 2013. I verbally approved this request with a limit of three days.

On June 15, 2013, the Incident Management Team requested an extension of use of the National Guard helicopter and I verbally approved this request. This Executive Order documents that approval and amends Executive Order D 2013-012 declaring a disaster emergency due to this fire.

II. Declaration and Directives

In addition to the declarations and directives contained in Executive Order D 2013-012, I declare and direct that paragraphs II (A) and II (C) of Executive Order D 2013-012 are hereby amended to read as follows:

A. The Big Meadows Fire constitutes a disaster emergency under C.R.S. § 24-33.5-704. My verbal order of June 12, 2013, declaring a disaster emergency and authorizing three days use of the National Guard is hereby amended by this Executive Order to include my verbal authorization of June 15, 2013, to use the National Guard through June 19, 2013, is hereby memorialized and shall have the full force and effect of law as if it were contained within this Executive Order.

C. Pursuant to C.R.S. § 24-33.5-706(4), it is ordered that $50,000 from the Disaster Emergency Fund is encumbered to pay for the use of the National Guard helicopter. The actual cost of the National Guard helicopter and personnel will be reimbursed to the Disaster Emergency Fund by the Federal Government. The Director of the Office of Emergency Management is hereby authorized and directed to allocate the funding to the appropriate government agencies and execute awards, purchase orders or other mechanisms to effect the allocation of the funds. These funds shall remain available for this purpose for eighteen months from the date of this Executive Order, and any unexpended funds shall remain in the Disaster Emergency Fund.

III. Duration

This Executive Order shall expire thirty days from June 19, 2013, unless extended further by Executive Order, except that the funds described in paragraph II(C) above shall remain available for the described purposes for eighteen months from the date of this Executive Order.

GIVEN under my hand and the Executive Seal of the State of Colorado this twenty-first day of of June, 2013.

John W. Hickenlooper
Governor

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John W. Hickenlooper
Governor

D 2013-016

EXECUTIVE ORDER

Amending the Declaration of Disaster Emergency Due to the Royal Gorge Fire in Fremont County, Colorado.

Pursuant to the authority vested in the Governor of the State of Colorado and, in particular, pursuant to relevant portions of the Colorado Disaster Emergency Act, C.R.S. § 24-33.5-701, *et seq.*, I, John W. Hickenlooper, Governor of the State of Colorado, hereby issue this Executive Order amending Executive Order D 2013-009 declaring a state of disaster emergency due to the Royal Gorge Fire in Fremont County, Colorado.

I. Declaration and Directives

In addition to the declaration and directives contained in Executive Order D 2013-009, I declare and direct that paragraph II(C) of Executive Order D 2013-009 is hereby amended and replaced to read:

C. Pursuant to C.R.S. § 24-33.5-706(4), the funds in the Disaster Emergency Fund are hereby found insufficient to pay for fire suppression efforts related to the Royal Gorge Fire. Therefore, it is ordered that $1,500,000 be transferred into the Disaster Emergency Fund from the General Fund appropriation in Fiscal Year 2012-13 to the Controlled Maintenance Trust Fund. It is further ordered that $1,500,000 from the Disaster Emergency Fund is encumbered to pay for the fire suppression, response, and recovery effort related to the Royal Gorge Fire since its inception.

Included in the specified amount is $195,000 for recovery related to this disaster. These funds may be used to pay for disaster recovery resources as approved by the Director of the Office of Emergency Management to assist with state and local government costs incurred during and as a result of the current disaster emergency, including costs incurred by non-profit organizations on behalf of local government entities. The Director of the Colorado Office of Emergency Management is hereby authorized and directed to allocate the funding to the appropriate agencies and execute awards, purchase orders or other mechanisms to effect the allocation of the funds. These funds shall remain available for this purpose for eighteen months from

the date of this Executive Order, and any unexpended funds shall remain in the Disaster Emergency Fund.

II. Duration

Executive Order D 2013-009 remains in full force and effect as originally promulgated. This Executive Order shall remain in effect until amended or rescinded by executive order. The funds described in paragraph II(C) above shall remain available for the purposes described in Executive Order D 2013-009 for eighteen months beginning June 11, 2013 - the date of the verbal Executive Order memorialized by Executive Order D 2013-009.

GIVEN under my hand and the Executive Seal of the State of Colorado this twenty-fourth day of June, 2013.

John W. Hickenlooper
Governor

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John W. Hickenlooper
Governor

D 2013-017

EXECUTIVE ORDER

Declaring a Disaster Emergency Due to the West Fork Fire Complex in Mineral, Rio Grande, and Hinsdale Counties

Pursuant to the authority vested in the Governor of the State of Colorado and, in particular, pursuant to relevant portions of C.R.S. § 28-3-104 and relevant portions of the Colorado Disaster Emergency Act, C.R.S. § 24-33.5-701, *et seq.*, I, Joseph A. Garcia, Lieutenant Governor of the State of Colorado, hereby issue this Executive Order declaring a state of disaster emergency due to the West Fork Fire Complex in Mineral, Rio Grande, and Hinsdale Counties, Colorado and making resources available to fight the fire and address the disaster emergency.

I. Background and Purpose

The Governor is responsible for meeting the dangers to the state and people presented by disasters. The Colorado Disaster Emergency Act defines a disaster as "the occurrence or imminent threat of widespread or severe damages, injury or loss of life or property resulting from any natural cause or cause of human origin, including but not limited to . . . fire." C.R.S. §24-33.5-703(3).

On June 5, 2013, lightning started the West Fork Fire on the San Juan National Forest in Mineral County. By June 14, 2013, the West Fork Fire grew to approximately 30 acres and the Windy Pass Fire also ignited and grew to approximately 3 acres across Highway 160 from the West Fork Fire near Windy Pass. By June 16, 2013, the West Fork Fire grew to approximately 1,747 acres and the Windy Pass Fire grew to 108 acres. The San Juan National Forest combined the fires to form the West Fork Fire Complex and ordered a National Incident Management Organization Team to manage the fire.

On June 20, 2013, extreme fire weather conditions caused the West Fork Fire Complex to grow to over 29,000 acres and cross over the Continental Divide into the Rio Grande National Forest

and Rio Grande County. This resulted in a mandatory evacuation east of the Continental Divide to the town limits of South Fork, Colorado and the voluntary evacuation of the town of South Park. Because of continuing fire growth, the Town of South Park received a mandatory evacuation order at 0600 hours on June 21, 2013. All available firefighting resources were committed to firefighting and structural protection.

On June 20, 2013, at approximately 2000 hours, the Mineral and Rio Grande Counties Sheriffs determined that the fire had extended from the San Juan and Rio Grande National Forests and would exceed the ability of the counties and other local resources to contain and extinguish it and requested the response of the Division of Fire Prevention and Control. The Mineral and Rio Grande Counties Sheriffs requested transfer of the fire to the State of Colorado under the Emergency Fire Fund (EFF) provisions.

At approximately 2345 hours, the Division of Fire Prevention and Control completed its assessment and determined that the West Fork Fire Complex met the criteria for EFF designation. However, EFF funds were exhausted from previous fires. Therefore, a disaster emergency was requested and approved by the Governor at 0004 hours on June 21, 2013, effective at 0100 hours on June 21, 2013, as requested by the Division of Fire Prevention and Control.

On June 19, 2013, lightning caused the Papoose Fire to ignite on the Rio Grande Forest northwest of the West Fork Fire in Hinsdale County. On June 20, 2013, the United States Forest Service decided to add the Papoose Fire to the West Fork Fire Complex. On June 21, 2013, extreme fire weather conditions caused the Papoose Fire to grow to over 4,000 acres.

On the afternoon of June 21, 2013, the Hinsdale County Sheriff determined that the Papoose Fire had extended from the Rio Grande National Forest and would exceed the ability of the county and other local resources to contain and extinguish it and requested the response of the Division of Fire Prevention and Control. The Hinsdale County Sheriff requested transfer of the Papoose Fire to the State of Colorado under the Emergency Fire Fund (EFF) provisions.

At approximately 1630 hours, the Division of Fire Prevention and Control completed its assessment and determined that the Papoose Fire met the criteria for EFF designation. However, EFF funds were exhausted in previous fires. Therefore, a disaster emergency was requested and approved by the Governor at 1701 hours, effective at 1400 hours on June 21, 2013, as requested by the Division of Fire Prevention and Control.

Based on size up information that the West Fork Fire Complex was increasing in intensity and rapidly spreading and that the Mayor of the Town of South Fork issued a mandatory evacuation order effective at 0600 hours on June 22, 2013, the Alternate Governor's Authorized Representative (GAR) notified the Federal Emergency Management Agency (FEMA) at approximately 2147 hours on June 20, 2013, that the West Fork Fire Complex could threaten such destruction as would constitute a major disaster and assistance under the Fire Management Assistance Grant (FMAG) Program may be requested.

On June 21, 2013, the Division of Fire Prevention and Control completed its assessment and determined that the West Fork Fire Complex, including the Papoose Fire, met the criteria for making a request for federal assistance under the FMAG Program. The Alternate GAR submitted the request to FEMA the afternoon of June 21, 2013. FEMA notified the GAR at 1636 hours that the request for the entire West Fork Fire Complex including the Papoose Fire was approved.

In non-emergency circumstances, C.R.S. § 25-3.5-203(1)(b) requires a person providing emergency medical services in Colorado must possess a certification issued by the Colorado Department of Public Health and Environment.

During the continuance of any state of disaster, the Governor is authorized by C.R.S. § 24-33.5-704(7)(a) to suspend the provisions of any regulatory statute or the regulations of any state agency if strict compliance with the provisions of the statute or regulation would in any way "prevent, hinder, or delay necessary action in coping with the emergency."

II. Declaration and Directives

A. The West Fork Fire Complex constitutes a disaster emergency under C.R.S. § 24-33.5-703(3). My verbal order of June 21, 2013, at 0004 hours, declaring a disaster emergency effective at 0100 hours on June 21, 2013, is hereby memorialized by this Executive Order and shall have the full force and effect of law as if it were contained within this Executive Order. My verbal order of June 21, 2013, at 1636 hours, declaring a disaster emergency for the Papoose Fire effective on June 21, 2013, at 1400 hours, and concurring with the USFS action to add the Papoose to the West Fork Fire Complex is hereby memorialized by this Executive Order and shall have the full force and effect of law as if it were contained within this Executive Order.

B. The State Emergency Operations Plan is hereby activated. All State departments and agencies shall take whatever actions may be required and requested by the Director of

the Office of Emergency Management, including provision of appropriate staff and equipment as necessary.

C. Pursuant to C.R.S. § 24-33.5-706(4), the funds in the Disaster Emergency Fund are found to be insufficient to pay for fire suppression efforts related to the West Fork Fire Complex. Therefore, it is ordered that $3,000,000 be immediately transferred into the Disaster Emergency Fund from the General Fund appropriation in Fiscal Year 2012-13 to the Controlled Maintenance Trust Fund. It is further ordered that this $3,000,000 is encumbered to pay for the fire suppression, response, and recovery effort related to the West Fork Fire Complex since its inception.

D. It is further ordered that, no earlier than July 1, 2013, $9,500,000 be transferred into the Disaster Emergency Fund from the General Fund appropriation in Fiscal Year 2013-2014 to the Controlled Maintenance Trust Fund. This $9,500,000 from the Disaster Emergency Fund shall be encumbered to pay for the fire suppression, response, and recovery effort related to the West Fork Fire Complex occurring on or after July 1, 2013.

E. Included in the specified amount is $195,000 for recovery related to this disaster. These funds may be used to pay for disaster recovery resources as approved by the Director of the Office of Emergency Management to assist with state and local government costs incurred during and as a result of the current disaster emergency, including costs incurred by non-profit organizations on behalf of local government entities. The Director of the Office of Emergency Management is hereby authorized and directed to allocate the funding to the appropriate government agencies and execute awards, purchase orders, or other mechanisms to effect the allocation of the funds. These funds shall remain available for this purpose for eighteen months from the date of this Executive Order, and any unexpended funds shall remain in the Disaster Emergency Fund.

F. The National Guard is activated and authorized to fight the West Fork Fire Complex and enforce the laws of the State of Colorado as provided in C.R.S. 28-3-104.

G. The Colorado Department of Public Safety is authorized and directed to coordinate application to the federal government for funds available for reimbursement and to coordinate application for any other funds available related to this disaster emergency.

H. Due to the extent of this and other wildfires, and as provided in C.R.S. § 24-33.5-704(7)(a), the requirement for Colorado emergency medical services provider certification for personnel directly in support of wildfire suppression operations in the State of Colorado is suspended for providers that hold current emergency medical services provider licensure or certification in good standing from the National Registry of Emergency Medical Technicians or any state or territory in the United States until this executive order expires, unless extended as provided in Section III.

I. I authorize a 90-day extension of any accrued leave expiring on June 30, 2013, for any state employee working in any manner with any of the wildfire disaster emergencies since June 1, 2013.

III. Duration

This Executive Order shall expire thirty days from June 21, 2013, unless extended further by Executive Order, except that the funds described in paragraph II (C) above shall remain available for the described purposes for eighteen months from the date of this Executive Order.

IV. Lieutenant Governor

I am executing this Executive Order pursuant to the Colorado Constitution, Article IV, Section 13(5) as Governor John W. Hickenlooper is currently traveling outside of the State of Colorado.

GIVEN under my hand and the Executive Seal of the State of Colorado this twenty-sixth day of June, 2013.

Joseph A. Garcia
Lieutenant Governor

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John W. Hickenlooper
Governor

D 2013-018

EXECUTIVE ORDER

Declaring a Disaster Emergency Due to the Lime Gulch Fire in Jefferson County

Pursuant to the authority vested in the Governor of the State of Colorado and, in particular, pursuant to relevant portions of C.R.S. § 28-3-104 and relevant portions of the Colorado Disaster Emergency Act, C.R.S. § 24-33.5-701, *et seq.*, I, John W. Hickenlooper, Governor of the State of Colorado, hereby issue this Executive Order declaring a state of disaster emergency due to the Lime Gulch Fire in Jefferson County, Colorado and making resources available to fight the fire and address the disaster emergency.

I. Background and Purpose

The Governor is responsible for meeting the dangers to the state and people presented by disasters. The Colorado Disaster Emergency Act defines a disaster as "the occurrence or imminent threat of widespread or severe damages, injury or loss of life or property resulting from any natural cause or cause of human origin, including but not limited to . . . fire." C.R.S. §24-33.5-703(3).

On June 19, 2013, at approximately 1355 hours, the Lime Gulch Fire was reported to State authorities near Foxton Road and the South Platte River Road on the Pike National Forest in Jefferson County. This wind-driven fire was quickly growing in size and intensity, prompting the mandatory evacuation of area homes. All available firefighting resources were committed to firefighting and structural protection.

On June 20, 2013, at approximately 0500 hours the Jefferson County Sheriff determined that the fire had extended from the Pike National Forest and would exceed the ability of the county and other local resources to contain and extinguish it and requested the response of the Division of Fire Prevention and Control. The Jefferson County Sheriff requested transfer of the fire to the State of Colorado under the Emergency Fire Fund (EFF) provisions.

At approximately 1200 hours, the Division of Fire Prevention and Control completed its assessment and determined that the Lime Gulch Fire met the criteria for EFF designation. However, EFF funds were exhausted in previous fires. Therefore, a disaster emergency was

requested and approved by the Governor at 1319 hours, retroactive to 0600 hours on June 20, 2013, as requested by the Division of Fire Prevention and Control.

In non-emergency circumstances, C.R.S. § 25-3.5-203(1)(b) requires a person providing emergency medical services in Colorado must possess a certification issued by the Colorado Department of Public Health and Environment.

During the continuance of any state of disaster, the Governor is authorized by C.R.S. § 24-33.5-704(7)(a) to suspend the provisions of any regulatory statute or the regulations of any state agency if strict compliance with the provisions of the statute or regulation would in any way "prevent, hinder, or delay necessary action in coping with the emergency."

II. Declaration and Directives

A. The Lime Gulch Fire constitutes a disaster emergency under C.R.S. § 24-33.5-703(3). My verbal order of June 20, 2013, at 1319 hours, declaring a disaster emergency effective at 0600 hours on June, 20, 2013, is hereby memorialized by this Executive Order and shall have the full force and effect of law as if it were contained within this Executive Order.

B. The State Emergency Operations Plan is hereby activated. All State departments and agencies shall take whatever actions may be required and requested by the Director of the Office of Emergency Management, including provision of appropriate staff and equipment as necessary.

C. Pursuant to C.R.S. § 24-33.5-706(4), the funds in the Disaster Emergency Fund are found to be insufficient to pay for fire suppression efforts related to the Lime Gulch Fire. Therefore, it is ordered that $550,000 be transferred into the Disaster Emergency Fund from the General Fund appropriation in Fiscal Year 2012-13 to the Controlled Maintenance Trust Fund. Therefore, it is ordered that $550,000 from the Disaster Emergency Fund is encumbered to pay for the fire suppression, response, and recovery effort related to the Lime Gulch Fire since its inception.

Included in the specified amount is $195,000 for recovery related to this disaster. These funds may be used to pay for disaster recovery resources as approved by the Director of the Office of Emergency Management to assist with state and local government costs incurred during and as a result of the current disaster emergency, including costs incurred by non-profit organizations on behalf of local government entities. The Director of the Office of Emergency Management is hereby authorized and directed to allocate the funding to the appropriate government agencies and execute awards, purchase orders or other mechanisms to effect the allocation of the funds. These funds shall remain available for this purpose for eighteen months from the date of this

Executive Order, and any unexpended funds shall remain in the Disaster Emergency Fund.

D. The Colorado Department of Public Safety is authorized and directed to coordinate application to the federal government for funds available for reimbursement and to coordinate application for any other funds available related to this disaster emergency. Due to the extent of this and other wildfires, and as provided in C.R.S. § 24-33.5-704(7)(a), the requirement for Colorado emergency medical services provider certification for personnel directly in support of wildfire suppression operations in the State of Colorado is suspended for providers that hold current emergency medical services provider licensure or certification in good standing from the National Registry of Emergency Medical Technicians or any state or territory in the United States until this executive order expires, unless extended as provided in Section III.

E. I authorize a 90-day extension of any accrued leave expiring on June 30, 2013, for any state employee working in any manner with any of the wildfire disaster emergencies since June 1, 2013.

F. The National Guard is activated and authorized to fight the Lime Gulch Fire and enforce the laws of the State of Colorado as provided in C.R.S. § 28-3-104.

III. Duration

This Executive Order shall expire thirty days from June 20, 2013, unless extended further by Executive Order, except that the funds described in paragraph II (C) above shall remain available for the described purposes for eighteen months from the date of this Executive Order.

GIVEN under my hand and the Executive Seal of the State of Colorado this twenty-seventh day of June, 2013.

John W. Hickenlooper
Governor

STATE OF COLORADO

OFFICE OF THE GOVERNOR

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John W. Hickenlooper
Governor

D 2013-019

EXECUTIVE ORDER

Amending the Declaration of Disaster Emergency
Due to the Black Forest Fire in El Paso County

Pursuant to the authority vested in the Governor of the State of Colorado and, in particular, pursuant to relevant portions of the Colorado Disaster Emergency Act, C.R.S. § 24-33.5-701, *et seq.*, I, John W. Hickenlooper, Governor of the State of Colorado, hereby issue this Executive Order amending Executive Order D 2013-010 declaring a disaster emergency due to the Black Forest Fire in El Paso County, Colorado.

I. Background and Purpose

The Governor is responsible for meeting the dangers to the state and people presented by disasters. The Colorado Disaster Emergency Act defines a disaster as "the occurrence or imminent threat of widespread or severe damages, injury or loss of life or property resulting from any natural cause or cause of human origin, including but not limited to . . . fire." C.R.S. §24-33.5-703(3).

On June 11, 2013, I verbally declared a disaster emergency for the Black Forest Fire. Executive Order D 2013-010 issued June 12, 2013, confirmed this declaration of disaster emergency. As of June 19, 2013, the Black Forest Fire resulted in two fatalities, the destruction of 502 homes, significant damage to eighteen other homes, and 14,280 acres burned.

On June 14, 2013, the Incident Manager and Colorado National Guard requested additional National Guard helicopters to relieve deployed Colorado National Guard helicopters and crews for maintenance and flight hour compliance. Because additional Colorado National Guard helicopters were not available, these resources needed to come from the other states through the use of the Emergency Management Assistance Compact (EMAC). As provided in § C.R.S. 24-60-2901, *et seq.*, I verbally approved the EMAC use request; this Executive Order amends D 2013-010 to document that verbal approval.

On June 17, 2013, I learned that on June 18, 2013, the Black Forest fire suppression activities will exceed the $8,000,000 provided in Executive Order D 2013-010. I verbally approved $2,000,000 additional funding on June 17, 2013. On June 19, 2013, I learned that on June 20,

2013, the Black Forest fire suppression activities will exceed the $10,000,000 provided in Executive Order D 2013-010 and the verbal approval given June 17, 2013. I verbally approved $3,000,000 additional funding on June 19, 2013. This Executive Order documents those verbal approvals and amends Executive Order D 2013-010 declaring a disaster emergency due to this fire.

II. Declaration and Directives

In addition to the declarations and directives contained in Executive Order D 2013-010, I declare and direct that paragraph II (C) of Executive Order D 2013-010 is hereby amended to read as follows and paragraphs II (F) and II (G) are hereby added as follows:

C. Pursuant to C.R.S. § 24-33.5-706(4), the funds in the Disaster Emergency Fund are hereby found insufficient to pay for fire suppression efforts related to the Black Forest Fire. Therefore, it is ordered that $6,200,000 be transferred into the Disaster Emergency Fund as follows:

- $2,100,000 from the General Fund appropriation in Fiscal Year 2012-13 to the Controlled Maintenance Trust Fund;
- $2,100,000 from the General Fund appropriation in Fiscal Year 2012-13 to the Department of Health Care Policy and Financing, Other Medical Services, Medicare Modernization State Contribution Payment;
- $37,640 from the General Fund appropriation in Fiscal Year 2012-13 to the Department of Corrections, Parole Board Personal Services;
- $451,090 from the General Fund appropriation in Fiscal Year 2012-13 to the Department of Corrections, Inmate Programs, Drug and Alcohol Treatment Subprogram Personal Services;
- $1,057,260 from the General Fund appropriation in Fiscal Year 2012-13 to the Department of Corrections, Institutions, Mental Health Subprogram Personal Services
- $99,259 from the General Fund appropriation in Fiscal Year 2012-13 to the Department of Corrections, Inmate Programs, Sex Offender Treatment Subprogram Personal Services;
- $221,457 from the General Fund appropriation in Fiscal Year 2012-13 to the Department of Corrections; Community Services, Community Supervision Subprogram, Youthful Offender System Aftercare Personal Services; and
- $133,294 from the General Fund appropriation in Fiscal Year 2012-13 to the Department of Corrections, Management, External Capacity Subprogram, Payments to House State Prisoners, Payments to Pre-Release Parole Revocation Facilities.

It is further ordered that $13,000,000 is encumbered to pay for the fire suppression, response, and recovery effort related to the Black Forest Fire since its inception.

Included in the specified amount is $195,000 for recovery related to this disaster. These funds may be used to pay for disaster recovery resources as approved by the Director of the Office of Emergency Management to assist with state and local government costs incurred during and as a result of the current disaster emergency, including costs incurred by non-profit organizations on behalf of local government entities. The Director of the Office of Emergency Management is hereby authorized and directed to allocate the funding to the appropriate government agencies and execute awards, purchase orders or other mechanisms to effect the allocation of the funds. These funds shall remain available for this purpose for eighteen months from the date of this Executive Order, and any unexpended funds shall remain in the Disaster Emergency Fund.

F. Pursuant to § C.R.S. 24-60-2901, *et seq.*, my verbal authorization of the use of the Emergency Management Assistance Compact (EMAC) for resources not available in Colorado is hereby memorialized by this Executive Order.

G. I authorize a 90-day extension of any accrued leave expiring on June 30, 2013, for any state employee working in any manner with any of the wildfire disaster emergencies since June 1, 2013.

III. Duration

This Executive Order shall expire thirty days from June 11, 2013, unless extended further by Executive Order, except that the funds described in paragraph II (C) above shall remain available for the described purposes for eighteen months from the date of this Executive Order.

GIVEN under my hand and the Executive Seal of the State of Colorado this tweny-seventh day of June, 2013.

John W. Hickenlooper
Governor

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John W. Hickenlooper
Governor

D 2013-020

EXECUTIVE ORDER

Amending the Declaration of Disaster Emergency Due to the West Fork Fire Complex in Mineral, Rio Grande, and Hinsdale Counties

Pursuant to the authority vested in the Governor of the State of Colorado and, in particular, pursuant relevant portions of C.R.S. § 28-3-104, relevant portions of the Colorado Disaster Emergency Act, C.R.S. § 24-33.5-701, *et seq.*, and C.R.S. § 24-60-2901, *et seq.*, I, John W. Hickenlooper, Governor of the State of Colorado, hereby issue this Executive Order amending Executive Order D 2013-017 declaring a disaster emergency due to the West Fork Fire Complex in Mineral, Rio Grande, and Hinsdale Counties, Colorado and making resources available to fight the fire and address the disaster emergency.

I. Background and Purpose

On July 1, 2013, the Colorado Division of Homeland Security and Emergency Management informed the Governor that activation of the Emergency Management Assistance Compact (EMAC) was necessary to replace a Colorado National Guard (CONG) helicopter providing hoist and medevac capability to the West Fork Fire Complex. The CONG helicopter and crew need to complete another mission starting on July 5, 2013. At 0919 hours, the Governor authorized the use of EMAC to provide a National Guard helicopter from another state. This amendment memorializes the authorization and use of EMAC.

II. Declaration and Directives

In addition to the declarations and directives contained in Executive Order D 2013-017, I declare and direct that paragraph II (F) of Executive Order D 2013-017 is hereby amended by adding the following sentence:

F. The use of the Emergency Management Assistance Compact for resources not available in Colorado is authorized as provided in C.R.S. § 24-60-2901, *et seq.*

III. Duration

Executive Order D 2013-017 remains in full force and effect as originally promulgated. This Executive Order shall remain in effect until amended or rescinded by executive order.

GIVEN under my hand and the Executive Seal of the State of Colorado this second day of July, 2013.

John W. Hickenlooper
Governor

7 - Glossary

GLOSSARY OF EMERGENCY / WILDFIRE TERMS

Aerial Fuels - All live and dead vegetation in the forest canopy or above surface fuels, including tree branches, twigs and cones, snags, moss, and high brush.

Aerial Ignition - Ignition of fuels by dropping incendiary devices or materials from aircraft.

Agency - A division of government with a specific function offering a particular kind of assistance. In ICS, agencies are defined either as jurisdictional (having statutory responsibility for incident management) or as assisting or cooperating (providing resources or other assistance).

Agency Representative - A person assigned by a primary, assisting, or cooperating Federal, State, local, or tribal government agency or private entity that has been delegated authority to make decisions affecting that agency's or organization's participation in incident management activities following appropriate consultation with the leadership of that agency.

Air Tanker - A fixed-wing aircraft equipped to drop fire retardants or suppressants.

Alternate Emergency Operations Center (AEOC) - An established location to evacuate to in the event that the primary EOC is not available due to natural or man made causes.

Amateur Radio Emergency Services (ARES) - Volunteer amateur radio operators who support state and local governments with amateur radio transmission support during times of emergencies.

American Red Cross (ARC) - A volunteer organization that works closely with government at all levels in planning for and providing assistance to disaster victims. The ARC operates under a Congressional charter. All of its disaster assistance is based on verified disaster-caused need, and is outright grant from donations from the American people.

Anchor Point - An advantageous location, usually a barrier to fire spread, from which to start building a fire line. An anchor point is used to reduce the chance of firefighters being flanked by fire.

Applicant - The state or local government submitting a project application or request for direct federal assistance under the Stafford Act, or on whose behalf the Governor's Authorized Representative takes such action.

Aramid - The generic name for a high-strength, flame-resistant synthetic fabric used in the shirts and jeans of firefighters. Nomex, a brand name for aramid fabric, is the term commonly used by firefighters.

Area Command (Unified Area Command) - An organization established (1) to oversee the management of multiple incidents that are each being handled by an ICS organization or (2) to oversee the management of large or multiple incidents to which several Incident Management Teams have been assigned. Area Command has the responsibility to set overall strategy and priorities, allocate critical resources according to priorities, ensure that incidents are properly managed, and ensure that objectives are met and strategies followed. Area Command becomes Unified Area Command when incidents are multi-jurisdictional. Area Command may be established at an emergency operations center facility or at some location other than an incident command post.

Aspect - Direction toward which a slope faces.

Assignments - Tasks given to resources to perform within given operational periods that are based on operational objectives defined in the IAP.

Assistant - Title for subordinates of principal Command Staff positions. The title indicates a level of technical capability, qualifications, and responsibility subordinate to the primary positions. Assistants may also be assigned to unit leaders.

Assisting Agency - An agency or organization providing personnel, services, or other resources to the agency with direct responsibility for incident management. See also Supporting Agency.

At-Risk Community - A group of homes or other improvements (such as utilities or transportation routes) within or adjacent to federal land in which conditions are conducive to a large-scale wildland fire and pose a significant threat to human life or property.

Available Resources - Resources assigned to an incident, checked in, and available for a mission assignment, normally located in a Staging Area.

Backfire - A fire set along the inner edge of a fireline to consume the fuel in the path of a wildfire and/or change the direction of force of the fire's convection column.

Backpack Pump - A portable sprayer with hand-pump, fed from a liquid-filled container fitted with straps, used mainly in fire and pest control. (See also Bladder Bag)

Behave - A system of interactive computer programs for modeling fuel and fire behavior that consists of two systems - BURN and FUEL.

Bladder Bag - A collapsible backpack portable sprayer made of neoprene or high-strength nylon fabric fitted with a pump. (See also Backpack Pump)

Blow-up - A sudden increase in fire intensity or rate of spread strong enough to prevent direct control or to upset control plans. Blow-ups are often accompanied by violent convection and may have other characteristics of a fire storm. (See Flare-up)

Board of County Commissioners (BOCC) - Governing body of public officials elected within a county.

Branch - The organizational level having functional or geographical responsibility for major aspects of incident operations. A branch is organizationally situated between the section and the division or group in the Operations Section, and between the section and units in the Logistics Section. Branches are identified by the use of Roman numerals or by functional area.

Brush Fire - A fire burning in vegetation that is predominantly shrubs, brush and scrub growth.

Brush - A collective term that refers to stands of vegetation dominated by shrubby, woody plants, or low growing trees, usually of a type undesirable for livestock or timber management.

Bucket Drops - The dropping of fire retardants or suppressants from specially designed buckets slung below a helicopter.

Buffer Zones - An area of reduced vegetation that separates wildlands from vulnerable residential or business developments. This barrier is similar to a greenbelt in that it is usually used for another purpose such as agriculture, recreation areas, parks, or golf courses.

Bump-up Method - A progressive method of building a fire line on a wildfire without changing relative positions in the line. Work is begun with a suitable space between workers. Whenever one worker overtakes another, all workers ahead move one space forward and resume work on the uncompleted part of the line. The last worker does not move ahead until completing his or her space.

Burn Out - Setting fire inside a control line to widen it or consume fuel between the edge of the fire and the control line.

Burning Ban - A declared ban on open air burning within a specified area, usually due to sustained high fire danger.

Burning Conditions - The state of the combined factors of the environment that affect fire behavior in a specified fuel type.

Burning Index - An estimate of the potential difficulty of fire containment as it relates to the flame length at the most rapidly spreading portion of a fire's perimeter.

Burning Period - That part of each 24-hour period when fires spread most rapidly, typically from 10-00 a.m. to sundown.

Candle or Candling - A single tree or a very small clump of trees which is burning from the bottom up.

Casualty - A person injured, and needing treatment, or killed because of technological or natural disaster.

Chain of Command - A series of command, control, executive, or management positions in hierarchical order of authority.

Chain - A unit of linear measurement equal to 66 feet.

Check-In - The process through which resources first report to an incident. Check-in locations include the incident command post, Resources Unit, incident base, camps, staging areas, or directly on the site.

Chief - The ICS title for individuals responsible for management of functional sections - Operations, Planning, Logistics, Finance/Administration, and Intelligence (if established as a separate section).

Civil Air Patrol (CAP) - An auxiliary of the U.S. Air Force that has volunteered to conduct various emergency services missions. These missions are mainly the use of light aircraft in Search and Rescue (SAR), Civil Defense (CD) and disaster relief operations.

Closure - Legal restriction, but not necessarily elimination of specified activities such as smoking, camping, or entry that might cause fires in a given area.

Cold Front - The leading edge of a relatively cold air mass that displaces warmer air. The heavier cold air may cause some of the warm air to be lifted. If the lifted air contains enough moisture, the result may be cloudiness, precipitation, and thunderstorms. If both air masses are dry, no clouds may form. Following the passage of a cold front in the Northern Hemisphere, westerly or northwesterly winds of 15 to 30 or more miles per hour often continue for 12 to 24 hours.

Cold Trailing - A method of controlling a partly dead fire edge by carefully inspecting and feeling with the hand for heat to detect any fire, digging out every live spot, and trenching any live edge.

Colorado Crime Information Center (CCIC) - The computer system with terminals in most law enforcement and communications agencies in Colorado, as well as the State EOC. It is used primarily for law enforcement functions, but a secondary use is as part of the warning and communications system for emergencies or disasters. It is connected to the National Crime Information Center (NCIC).

Colorado Information Analysis Center (CIAC) – Located within the Colorado Department of Public Safety. The mission of the Colorado Information Analysis Center is to provide an integrated, multi-disciplined, information sharing network to collect, analyze, and disseminate information to stakeholders in a timely manner in order to protect the citizens and the critical infrastructure of Colorado.

Colorado Search and Rescue Board (CSRB) - A voluntary, non?governmental organization that may coordinate assistance to local government during search and rescue missions.

Colorado Voluntary Organizations Active in Disaster (COVOAD) - A group of organizations providing voluntary assistance following an emergency or disaster.

Command - The act of directing, ordering, or controlling by virtue of explicit statutory, regulatory, or delegated authority.

Command Staff - In an incident management organization, the Command Staff consists of the Incident Command and the special staff positions of Public Information Officer, Safety Officer, Liaison Officer, and other positions as required, who report directly to the Incident Commander. They may have an assistant or assistants, as needed.

Common Operating Picture - A broad view of the overall situation as reflected by situation reports, aerial photography, and other information or intelligence. Communications Unit - An organizational unit in the Logistics Section responsible for providing communication services at an incident or an EOC. A Communications Unit may also be a facility (e.g., a trailer or mobile van) used to support an Incident Communications Center.

Complex - Two or more individual incidents located in the same general area which are assigned to a single incident commander or unified command.

Comprehensive Emergency Management (CEM) - An integrated approach to the management of emergency programs and activities for all four emergency phases (mitigation, preparedness, response and recovery), for all types of emergencies and disasters (natural, technological and attack), for all levels of government (local, state, and federal) and for the private sector.

Contain a fire - A fuel break around the fire has been completed. This break may include natural barriers or manually and/or mechanically constructed line.

Continuity of Government (COG) - All measures that may be taken to assure the continuity of essential functions of governments during or after an emergency or disaster.

Continuity of Operations Plan (COOP) - All measures that may be taken to assure the continuity of essential functions of governments during or after an emergency or disaster.

Control a fire - The complete extinguishment of a fire, including spot fires. Fireline has been strengthened so that flare-ups from within the perimeter of the fire will not break through this line.

Control Line - All built or natural fire barriers and treated fire edge used to control a fire.

Cooperating Agency - An agency supplying assistance other than direct operational or support functions or resources to the incident management effort.

Coyote Tactics - A progressive line construction duty involving self-sufficient crews that build fire line until the end of the operational period, remain at or near the point while off duty, and begin building fire line again the next operational period where they left off.

Creeping Fire - Fire burning with a low flame and spreading slowly.

Crew Boss - A person in supervisory charge of usually 16 to 21 firefighters and responsible for their performance, safety, and welfare.

Crown Fire (Crowning) - The movement of fire through the crowns of trees or shrubs more or less independently of the surface fire.

Curing - Drying and browning of herbaceous vegetation or slash.

Damage Assessment - The appraisal or determination of the actual effects resulting from technological or natural disaster.

Damage Survey Report (DSR) - A comprehensive engineering report prepared by a federal-state-local team that outlines the scope of work and estimated cost of repairs at each site of damage that has occurred as a result of disaster.

Dead Fuels - Fuels with no living tissue in which moisture content is governed almost entirely by atmospheric moisture (relative humidity and precipitation), dry-bulb temperature, and solar radiation.

Debris Burning - A fire spreading from any fire originally set for the purpose of clearing land or for rubbish, garbage, range, stubble, or meadow burning.

Defensible Space - An area either natural or manmade where material capable of causing a fire to spread has been treated, cleared, reduced, or changed to act as a barrier between an advancing wildland fire and the loss to life, property, or resources. In practice, "defensible space" is defined as an area a minimum of 30 feet around a structure that is cleared of flammable brush or vegetation.

Deployment - See Fire Shelter Deployment.

Deputy - A fully qualified individual who, in the absence of a superior, can be delegated the authority to manage a functional operation or perform a specific task. In some cases, a deputy can act as relief for a superior and, therefore, must be fully qualified in the position. Deputies can be assigned to the Incident Commander, General Staff, and Branch Directors.

Detection - The act or system of discovering and locating fires.

Direct Attack - Any treatment of burning fuel, such as by wetting, smothering, or chemically quenching the fire or by physically separating burning from unburned fuel.

Disaster - (State Definition) The occurrence or imminent threat of widespread or severe damage, injury, or loss of life or property, or significant adverse impact on the environment, resulting from any natural or technological hazards, or a terrorist act, including but not limited to fire, flood, earthquake, wind, storm, hazardous substance incident, water contamination requiring emergency action to avert danger or damage, epidemic, air contamination, blight, drought, infestation, explosion, civil disturbance, or hostile military or paramilitary action. For the purpose of state or federal disaster declarations, the term disaster generally falls into one of two categories relative to the level of severity and impact on local and state resources, they are - Major - likely to require immediate state assistance supplemented by limited federal resources, if necessary, to supplement intra-state efforts and resources; and Catastrophic - will require immediate and massive state and federal assistance in both the response and recovery aspects. Local government's adaptation of the definition of a disaster, denotes an event which threatens to or actually does inflict damage to people or property, and is, or is likely to be, beyond the capability of the services, personnel, equipment, and facilities of a local jurisdiction, thereby, requiring the augmentation of resources through state-directed assistance.

Dispatch - The ordered movement of a resource or resources to an assigned operational mission or an administrative move from one location to another.

Dispatch Center - A facility from which resources are directly assigned to an incident.

Dispatcher - A person employed who receives reports of discovery and status of fires, confirms their locations, takes action promptly to provide people and equipment likely to be needed for control in first attack, and sends them to the proper place.

Division - The partition of an incident into geographical areas of operation. Divisions are established when the number of resources exceeds the manageable span of control of the Operations Chief. A division is located within the ICS organization between the branch and resources in the Operations Section.

Dozer Line - Fire line constructed by the front blade of a dozer.

Dozer - Any tracked vehicle with a front-mounted blade used for exposing mineral soil.

Drip Torch - Hand-held device for igniting fires by dripping flaming liquid fuel on the materials to be burned; consists of a fuel fount, burner arm, and igniter. Fuel used is generally a mixture of diesel and gasoline.

Drop Zone - Target area for air tankers, helitankers, and cargo dropping.

Drought Index - A number representing net effect of evaporation, transpiration, and precipitation in producing cumulative moisture depletion in deep duff or upper soil layers.

Dry Lightning Storm - Thunderstorm in which negligible precipitation reaches the ground. Also called a dry storm.

Duff - The layer of decomposing organic materials lying below the litter layer of freshly fallen twigs, needles, and leaves and immediately above the mineral soil.

Emergency - (State Definition) *A suddenly occurring and often unforeseen situation* which is determined by the Governor to require state response or mitigation actions to immediately supplement local government in protecting lives and property, to provide for public health and safety, or to avert or lessen the threat of a disaster. Local government's adaptation of this definition connotates an event that threatens to or actually does inflict damage to people or property, exceeds the daily routine type of response, and still can be dealt with using local internal and mutual aid resources.

Emergency Alert System (EAS) - The replacement system for the Emergency Broadcast System (EBS). This system, based on the same structure as EBS, will allow local government representatives, to put out local warnings and alerts from and for their geographic areas. The EAS will also allow alerts and warnings to be broadcasted even if the participating radio station is unmanned after certain hours.

Emergency Operations Centers (EOCs) - The physical location at which the coordination of information and resources to support domestic incident management activities normally takes place. An EOC may be a temporary facility or may be located in a more central or permanently established facility, perhaps at a higher level of organization within a jurisdiction. EOCs may be organized by major functional disciplines (e.g., fire, law enforcement, and medical services), by jurisdiction (e.g., Federal, State, regional, county, city, tribal), or some combination thereof.

Emergency Operations Plan (EOP) - A brief, clear and concise document description of action to be taken, or instructions to all individual and local government services concerned, stating what will be done in the event of an emergency. The plan will state the method or scheme for taking coordinated action to meet the needs of the situation. It will state the action to be taken by whom, what, when and where based on predetermined assumptions, objectives and capabilities.

Emergency Public Information (EPI) - Information which is disseminated primarily, but not unconditionally, at the actual time of an emergency and in addition to providing information as such, of an emergency and in addition to providing information as such, frequently directs actions, instructs, and transmits direct orders.

Emergency Response Coordinator (ERC) - A senior staff member of a State Emergency Functional Lead Department who is responsible for coordination of emergency activities in support of the SEOC.

Emergency Response Provider - Includes Federal, State, local, and tribal emergency public safety, law enforcement, emergency response, emergency medical (including hospital emergency facilities), and related personnel, agencies, and authorities. See Section 2 (6), Homeland Security Act of 2002, Pub. L. 107-296, 116 Stat. 2135 (2002). Also known as Emergency Responder.

Emergency Support Functions (ESF) - Common types of emergency assistance that are likely to be requested from the state. These common types of assistance have been grouped functionally into 15 areas. State Departments have been assigned responsibilities for implementing these functions. Assignments are made based upon the department's statutory, programmatic or regulatory authorities and responsibilities.

Energy Release Component (ERC) - The computed total heat released per unit area (British thermal units per square foot) within the fire front at the head of a moving fire.

Engine Crew - Firefighters assigned to an engine. The Fireline Handbook defines the minimum crew makeup by engine type.

Engine - Any ground vehicle providing specified levels of pumping, water and hose capacity.

Entrapment - A situation where personnel are unexpectedly caught in a fire behavior-related, life-threatening position where planned escape routes or safety zones are absent, inadequate, or compromised. An entrapment may or may not include deployment of a fire shelter for its intended purpose. These situations may or may not result in injury. They include "near misses."

Environmental Assessment (EA) - EAs were authorized by the National Environmental Policy Act (NEPA) of 1969. They are concise, analytical documents prepared with public participation that determine if an Environmental Impact Statement (EIS) is needed for a particular project or action. If an EA determines an EIS is not needed, the EA becomes the document allowing agency compliance with NEPA requirements.

Environmental Impact Statement (EIS) - EISs were authorized by the National Environmental Policy Act (NEPA) of 1969. Prepared with public participation, they assist decision makers by providing information, analysis and an array of action alternatives, allowing managers to see the probable effects of decisions on the environment. Generally, EISs are written for large-scale actions or geographical areas.

Equilibrium Moisture Content - Moisture content that a fuel particle will attain if exposed for an infinite period in an environment of specified constant temperature and humidity. When a fuel particle reaches equilibrium moisture content, net exchange of moisture between it and the environment is zero.

Escape Route - A preplanned and understood route firefighters take to move to a safety zone or other low-risk area, such as an already burned area, previously constructed safety area, a meadow that won't burn, natural rocky area that is large enough to take refuge without being burned. When escape routes deviate from a defined physical path, they should be clearly marked (flagged).

Escaped Fire - A fire which has exceeded or is expected to exceed initial attack capabilities or prescription parameters.

Evacuation - Organized, phased, and supervised withdrawal, dispersal, or removal of civilians from dangerous or potentially dangerous areas, and their reception and care in safe areas.

Evacuees - All persons moved or moving from disaster areas to reception areas.

Event - A planned, non-emergency activity. ICS can be used as the management system for a wide range of events, e.g., parades, concerts, or sporting events.

Executive Order - a rule or order having the force of law, issued by an executive authority of a government.

Exercise - A practice/simulated response to a natural or technological disaster involving planning, preparation, and execution. It is carried out for the purpose of training and/or evaluation. Exercises can be described as - seminars, workshops, tabletops, drills, games, functional exercises, and full-scale exercises.

Extended Attack Incident - A wildland fire that has not been contained or controlled by initial attack forces and for which more firefighting resources are arriving, en route, or being ordered by the initial attack incident commander.

Extreme Fire Behavior - "Extreme" implies a level of fire behavior characteristics that ordinarily precludes methods of direct control action. One of more of the following is usually involved - high rate of spread, prolific crowning and/or spotting, presence of fire whirls, strong convection column. Predictability is difficult because such fires often exercise some degree of influence on their environment and behave erratically, sometimes dangerously.

Faller - A person who fells trees. Also called a sawyer or cutter.

Federal - Of or pertaining to the Federal Government of the United States of America.

Federal Emergency Management Agency (FEMA) - The federal agency responsible for the U.S. government's portion of the comprehensive emergency management program. It consists of a national office in Washington, D.C. and ten regional offices, one of which (Region VIII) is located in the Denver Federal Center in Lakewood, Colorado.

Federal Warning Point - A National Warning System **(NAWAS)** Warning Point located in a Federal installation.

Field Observer - Person responsible to the Situation Unit Leader for collecting and reporting information about an incident obtained from personal observations and interviews.

Fine (Light) Fuels - Fast-drying fuels, generally with a comparatively high surface area-to-volume ratio, which are less than 1/4-inch in diameter and have a timelag of one hour or less. These fuels readily ignite and are rapidly consumed by fire when dry.

Fingers of a Fire - The long narrow extensions of a fire projecting from the main body.

Fire Behavior Forecast - Prediction of probable fire behavior, usually prepared by a Fire Behavior Officer, in support of fire suppression or prescribed burning operations.

Fire Behavior Specialist - A person responsible to the Planning Section Chief for establishing a weather data collection system and for developing fire behavior predictions based on fire history, fuel, weather and topography.

Fire Behavior - The manner in which a fire reacts to the influences of fuel, weather and topography.

Fire Break - A natural or constructed barrier used to stop or check fires that may occur, or to provide a control line from which to work.

Fire Cache - A supply of fire tools and equipment assembled in planned quantities or standard units at a strategic point for exclusive use in fire suppression.

Fire Crew - An organized group of firefighters under the leadership of a crew leader or other designated official.

Fire Front - The part of a fire within which continuous flaming combustion is taking place. Unless otherwise specified the fire front is assumed to be the leading edge of the fire perimeter. In ground fires, the fire front may be mainly smoldering combustion.

Fire Intensity - A general term relating to the heat energy released by a fire.

Fire Line - A linear fire barrier that is scraped or dug to mineral soil.

Fire Load - The number and size of fires historically experienced on a specified unit over a specified period (usually one day) at a specified index of fire danger.

Fire Management Plan (FMP) - A strategic plan that defines a program to manage wildland and prescribed fires and documents the Fire Management Program in the approved land use plan. The plan is supplemented by operational plans such as preparedness plans, preplanned dispatch plans, prescribed fire plans, and prevention plans.

Fire Perimeter - The entire outer edge or boundary of a fire.

Fire Season - 1) Period(s) of the year during which wildland fires are likely to occur, spread, and affect resource values sufficient to warrant organized fire management activities. 2) A legally enacted time during which burning activities are regulated by state or local authority.

Fire Shelter Deployment - The removing of a fire shelter from its case and using it as protection against fire.

Fire Shelter - An aluminized tent offering protection by means of reflecting radiant heat and providing a volume of breathable air in a fire entrapment situation. Fire shelters should only be used in life-threatening situations, as a last resort.

Fire Storm - Violent convection caused by a large continuous area of intense fire. Often characterized by destructively violent surface indrafts, near and beyond the perimeter, and sometimes by tornado-like whirls.

Fire Triangle - Instructional aid in which the sides of a triangle are used to represent the three factors (oxygen, heat, fuel) necessary for combustion and flame production; removal of any of the three factors causes flame production to cease.

Fire Use Module (Prescribed Fire Module) - A team of skilled and mobile personnel dedicated primarily to prescribed fire management. These are national and interagency resources, available throughout the prescribed fire season, that can ignite, hold and monitor prescribed fires.

Fire Weather Watch - A term used by fire weather forecasters to notify using agencies, usually 24 to 72 hours ahead of the event, that current and developing meteorological conditions may evolve into dangerous fire weather.

Fire Weather - Weather conditions that influence fire ignition, behavior and suppression.

Fire Whirl - Spinning vortex column of ascending hot air and gases rising from a fire and carrying aloft smoke, debris, and flame. Fire whirls range in size from less than one foot to more than 500 feet in diameter. Large fire whirls have the intensity of a small tornado.

Firefighting Resources - All people and major items of equipment that can or potentially could be assigned to fires.

Flame Height - The average maximum vertical extension of flames at the leading edge of the fire front. Occasional flashes that rise above the general level of flames are not considered. This distance is less than the flame length if flames are tilted due to wind or slope.

Flame Length - The distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface); an indicator of fire intensity.

Flaming Front - The zone of a moving fire where the combustion is primarily flaming. Behind this flaming zone combustion is primarily glowing. Light fuels typically have a shallow flaming front, whereas heavy fuels have a deeper front. Also called fire front.

Flanks of a Fire - The parts of a fire's perimeter that are roughly parallel to the main direction of spread.

Flare-up - Any sudden acceleration of fire spread or intensification of a fire. Unlike a blow-up, a flare-up lasts a relatively short time and does not radically change control plans.

Flash Fuels - Fuels such as grass, leaves, draped pine needles, fern, tree moss and some kinds of slash, that ignite readily and are consumed rapidly when dry. Also called fine fuels.

Floodplain - The lowland and relatively flat areas adjoining inland and coastal waters including, at a minimum, that area subject to a one percent or greater chance of flooding in any given year.

Forb - A plant with a soft, rather than permanent woody stem, that is not a grass or grass-like plant.

Fuels - Combustible plant material, both living and dead, and combustible construction material that is capable of burning in a wildland fire situation.

Fuel Bed - An array of fuels usually constructed with specific loading, depth and particle size to meet experimental requirements; also, commonly used to describe the fuel composition in natural settings.

Fuel Loading - The amount of fuel present expressed quantitatively in terms of weight of fuel per unit area.

Fuel Model - Simulated fuel complex (or combination of vegetation types) for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified.

Fuel Moisture (Fuel Moisture Content) - The quantity of moisture in fuel expressed as a percentage of the weight when thoroughly dried at 212 degrees Fahrenheit.

Fuel Reduction - Manipulation, including combustion, or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control.

Fuel Type - An identifiable association of fuel elements of a distinctive plant species, form, size, arrangement, or other characteristics that will cause a predictable rate of fire spread or difficulty of control under specified weather conditions.

Fuel - Combustible material. Includes, vegetation, such as grass, leaves, ground litter, plants, shrubs and trees, that feed a fire. (See Surface Fuels)

Function - Function refers to the five major activities in ICS - Command, Operations, Planning, Logistics, and Finance/Administration. The term function is also used when describing the activity involved, e.g., the planning function. A sixth function, Intelligence, may be established, if required, to meet incident management needs.

Fusee - A colored flare designed as a railway warning device and widely used to ignite suppression and prescription fires.

General Staff - A group of incident management personnel organized according to function and reporting to the Incident Commander. The General Staff normally consists of the Operations Section Chief, Planning Section Chief, Logistics Section Chief, and Finance/Administration Section Chief.

Geographic Area - A political boundary designated by the wildland fire protection agencies, where these agencies work together in the coordination and effective utilization

Government Emergency Telephone System (GETS) - A federal government system that Colorado has access to that will allow landline telephone trunk access when systems are over loaded due to usage.

Governor's Authorized Representative (GAR) - (normally a senior member of the Office of Emergency Management staff) serves as the State's representative for the execution of all necessary documents for disaster assistance following a gubernatorial or Presidential declaration of an emergency or disaster.

Ground Fuel - All combustible materials below the surface litter, including duff, tree or shrub roots, punchy wood, peat, and sawdust, that normally support a glowing combustion without flame.

Group - Established to divide the incident management structure into functional areas of operation. Groups are composed of resources assembled to perform a special function not necessarily within a single geographic division. Groups, when activated, are located between branches and resources in the Operations Section. (See Division.)

Haines Index - An atmospheric index used to indicate the potential for wildfire growth by measuring the stability and dryness of the air over a fire.

Hand Line - A fireline built with hand tools.

Hazard - Something that is potentially dangerous or harmful, often the root cause of an unwanted outcome.

Hazard Reduction - Any treatment of a hazard that reduces the threat of ignition and fire intensity or rate of spread.

Hazardous Materials (HAZMAT) - Any element, compound, or combination thereof, which is flammable, corrosive, detonable, toxic, radioactive, an oxidizer, an etiologic agent, or highly reactive, and which, because of handling, storing processing, or packaging, may have detrimental effects upon operating and emergency personnel, the public, equipment and/or the environment.

Head of a Fire - The side of the fire having the fastest rate of spread.

Heavy Fuels - Fuels of large diameter such as snags, logs, large limb wood, that ignite and are consumed more slowly than flash fuels.

Helibase - The main location within the general incident area for parking, fueling, maintaining, and loading helicopters. The helibase is usually located at or near the incident base.

Helispot - A temporary landing spot for helicopters.

Helitack Crew - A group of firefighters trained in the technical and logistical use of helicopters for fire suppression.

Helitack - The use of helicopters to transport crews, equipment, and fire retardants or suppressants to the fire line during the initial stages of a fire.

Holding Actions - Planned actions required to achieve wildland prescribed fire management objectives. These actions have specific implementation timeframes for fire use actions but can have less sensitive implementation demands for suppression actions.

Holding Resources - Firefighting personnel and equipment assigned to do all required fire suppression work following fireline construction but generally not including extensive mop-up.

Hose Lay - Arrangement of connected lengths of fire hose and accessories on the ground, beginning at the first pumping unit and ending at the point of water delivery.

Hotshot Crew - A highly trained fire crew used mainly to build fireline by hand.

Hotspot - A particular active part of a fire.

Hotspotting - Reducing or stopping the spread of fire at points of particularly rapid rate of spread or special threat, generally the first step in prompt control, with emphasis on first priorities.

Incident - An occurrence or event, natural or human-caused, that requires an emergency response to protect life or property. Incidents can, for example, include major disasters, emergencies, terrorist attacks, terrorist threats, wild land and urban fires, floods, hazardous materials spills, nuclear accidents, aircraft accidents, earthquakes, hurricanes, tornadoes, tropical storms, war-related disasters, public health and medical emergencies, and other occurrences requiring an emergency response.

Incident Action Plan (IAP) - An oral or written plan containing general objectives reflecting the overall strategy for managing an incident. It may include the identification of operational resources and assignments. It may also include attachments that provide direction and important information for management of the incident during one or more operational periods.

Incident Command Post (ICP) - The field location at which the primary tactical-level, on-scene incident command functions are performed. The ICP may be collocated with the incident base or other incident facilities and is normally identified by a green rotating or flashing light.

Incident Command System (ICS) - A standardized on?scene emergency management concept specifically designed to allow its user(s) to adopt an integrated organizational structure equal to the complexity and demands of single or multiple incidents, without being hindered by jurisdictional boundaries.

Incident Commander (IC) - The individual responsible for all incident activities, including the development of strategies and tactics and the ordering and the release of resources. The IC has overall authority and responsibility for conducting incident operations and is responsible for the management of all incident operations at the incident site.

Incident Management Team (IMT) - The IC and appropriate Command and General Staff personnel assigned to an incident.

Incident Objectives - Statements of guidance and direction necessary for selecting appropriate strategy(s) and the tactical direction of resources. Incident objectives are based on realistic expectations of what can be accomplished when all allocated resources have been effectively deployed. Incident objectives must be achievable and measurable, yet flexible enough to allow strategic and tactical alternatives.

Incident - A human-caused or natural occurrence, such as wildland fire, that requires emergency service action to prevent or reduce the loss of life or damage to property or natural resources.

Individual Assistance (IA) - A division of a disaster response/recovery organization that directs or monitors assistance to families or individuals.

Infrared Detection - The use of heat sensing equipment, known as Infrared Scanners, for detection of heat sources that are not visually detectable by the normal surveillance methods of either ground or air patrols.

Initial Action - The actions taken by those responders first to arrive at an incident site.

Initial Attack - The actions taken by the first resources to arrive at a wildfire to protect lives and property, and prevent further extension of the fire.

Initial Response - Resources initially committed to an incident.

I**ntegrated Emergency Management System (IEMS)** - A system designed to coordinate responses to all of the major hazards that face a community or government; is based on the premise that there are common functions required in all emergency situations (e.g., warning, direction and control, etc.)

Intelligence Officer - The intelligence officer is responsible for managing internal information, intelligence, and operational security requirements supporting incident management activities. These may include information security and operational security activities, as well as the complex task of ensuring that sensitive information of all types (e.g., classified information, law enforcement sensitive information, proprietary information, or export-controlled information) is handled in a way that not only safeguards the information, but also ensures that it gets to those who need access to it to perform their missions effectively and safely.

Job Hazard Analysis - This analysis of a project is completed by staff to identify hazards to employees and the public. It identifies hazards, corrective actions and the required safety equipment to ensure public and employee safety.

Joint Information Center (JIC) - A facility established to coordinate all incident-related public information activities. It is the central point of contact for all news media at the scene of the incident. Public information officials from all participating agencies should collocate at the JIC.

Joint Information System (JIS) - Integrates incident information and public affairs into a cohesive organization designed to provide consistent, coordinated, timely information during crisis or incident operations. The mission of the JIS is to provide a structure and system for developing and delivering coordinated interagency messages; developing, recommending, and executing public information plans and strategies on behalf of the IC; advising the IC concerning public affairs issues that could affect a response effort; and controlling rumors and inaccurate information that could undermine public confidence in the emergency response effort.

Jump Spot - Selected landing area for smokejumpers.

Jump Suit - Approved protection suite work by smokejumpers.

Jurisdiction - A range or sphere of authority. Public agencies have jurisdiction at an incident related to their legal responsibilities and authority. Jurisdictional authority at an incident can be political or geographical (e.g., city, county, tribal, State, or Federal boundary lines) or functional (e.g., law enforcement, public health).

Keech Byram Drought Index (KBDI) - Commonly-used drought index adapted for fire management applications, with a numerical range from 0 (no moisture deficiency) to 800 (maximum drought).

Knock Down - To reduce the flame or heat on the more vigorously burning parts of a fire edge.

Ladder Fuels - Fuels which provide vertical continuity between strata, thereby allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease. They help initiate and assure the continuation of crowning.

Large Fire - 1) For statistical purposes, a fire burning more than a specified area of land e.g., 300 acres. 2) A fire burning with a size and intensity such that its behavior is determined by interaction between its own convection column and weather conditions above the surface.

Lead Plane - Aircraft with pilot used to make dry runs over the target area to check wing and smoke conditions and topography and to lead air tankers to targets and supervise their drops.

Liaison - A form of communication for establishing and maintaining mutual understanding and cooperation.

Liaison Officer - A member of the Command Staff responsible for coordinating with representatives from cooperating and assisting agencies.

Light (Fine) Fuels - Fast-drying fuels, generally with a comparatively high surface area-to-volume ratio, which are less than 1/4-inch in diameter and have a timelag of one hour or less. These fuels readily ignite and are rapidly consumed by fire when dry.

Lightning Activity Level (LAL) - A number, on a scale of 1 to 6, that reflects frequency and character of cloud-to-ground lightning. The scale is exponential, based on powers of 2 (i.e., LAL 3 indicates twice the lightning of LAL 2).

Line Scout - A firefighter who determines the location of a fire line.

Litter - Top layer of the forest, scrubland, or grassland floor, directly above the fermentation layer, composed of loose debris of dead sticks, branches, twigs, and recently fallen leaves or needles, little altered in structure by decomposition.

Live Fuels - Living plants, such as trees, grasses, and shrubs, in which the seasonal moisture content cycle is controlled largely by internal physiological mechanisms, rather than by external weather influences.

Local Emergency Operations Plan (LEOP) - The local (jurisdictional) level plan for actions to be taken by government and citizens when disaster threatens or strikes. It consists of assignment of responsibilities to agencies, coordinating instructions, staffing, essential facilities, and general operations common to most major emergencies.

Local Government - The elected officials of each political subdivision (counties and municipalities) have responsibility for reducing the vulnerability of people and property to the effects of emergencies and disasters. They should ensure that local governmental agencies are capable of efficient and responsive mobilization of resources in order to protect lives, minimize property loss, and expedite recovery efforts during an emergency or disaster. They should ensure that an Emergency Management Office serves the jurisdiction. The Local Emergency Operations Plan should be prepared based upon a valid hazards and risk analysis. (C.R.S. 24-32-2107)

Local Warning Point - The facility in a city, town or community which receives warnings over NAWAS and activates the public warning system in it's area of responsibility.

Logistics - Providing resources and other services to support incident management.

Logistics Section - The section responsible for providing facilities, services, and material support for the incident.

Major Disaster - As defined under the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5122), a major disaster is any natural catastrophe (including any hurricane, tornado, storm, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, or drought), or, regardless of cause, any fire, flood, or explosion, in any part of the United States, which in the determination of the President causes damage of sufficient severity and magnitude to warrant disaster assistance under this Act to supplement the efforts and available resources of States, tribes, local governments, and disaster relief organizations in alleviating the damage, loss, hardship, or suffering caused thereby.

Management by Objective - A management approach that involves a four-step process for achieving the incident goal. The Management by Objectives approach includes the following - establishing overarching objectives; developing and issuing assignments, plans, procedures, and protocols; establishing specific, measurable objectives for various incident management functional activities and directing efforts to fulfill them, in support of defined strategic objectives; and documenting results to measure performance and facilitate corrective action.

Memorandum of Agreement (MOA) - An agreement document between two or more agencies proscribing reciprocal assistance to be provided upon request (and if available from the supplying agency) and laying out the guidelines under which this assistance will operate.

Memorandum of Understanding (MOU) - see MOA

Micro-Remote Environmental Monitoring System (Micro-REMS) - Mobile weather monitoring station. A Micro-REMS usually accompanies an incident meteorologist and ATMU to an incident.

Mineral Soil - Soil layers below the predominantly organic horizons; soil with little combustible material.

Mitigate - To lessen in force or intensity.

Mitigation - The activities designed to reduce or eliminate risks to persons or property or to lessen the actual or potential effects or consequences of an incident. Mitigation measures may be implemented prior to, during, or after an incident. Mitigation measures are often informed by lessons learned from prior incidents. Mitigation involves ongoing actions to reduce exposure to, probability of, or potential loss from hazards. Measures may include zoning and building codes, floodplain buyouts, and analysis of hazard related data to determine where it is safe to build or locate temporary facilities. Mitigation can include efforts to educate governments, businesses, and the public on measures they can take to reduce loss and injury.

Mobilization - The process and procedures used by all organizations (Federal, State, local, and tribal) for activating, assembling, and transporting all resources that have been requested to respond to or support an incident.

Modular Airborne Firefighting System (MAFFS) - A manufactured unit consisting of five interconnecting tanks, a control pallet, and a nozzle pallet, with a capacity of 3,000 gallons, designed to be rapidly mounted inside an unmodified C-130 (Hercules) cargo aircraft for use in dropping retardant on wildland fires.

Mop-up - To make a fire safe or reduce residual smoke after the fire has been controlled by extinguishing or removing burning material along or near the control line, felling snags, or moving logs so they won't roll downhill.

Multi-Agency Coordination (MAC) - A generalized term which describes the functions and activities of representatives of involved agencies and/or jurisdictions who come together to make decisions regarding the prioritizing of incidents, and the sharing and use of critical resources. The MAC organization is not a part of the on-scene ICS and is not involved in developing incident strategy or tactics.

Multi-agency Coordination Entity - A multi-agency coordination entity functions within a broader multi-agency coordination system. It may establish the priorities among incidents and associated resource allocations, deconflict agency policies, and provide strategic guidance and direction to support incident management activities.

Multi-agency Coordination Systems - Multi-agency Coordination Systems provide the architecture to support coordination for incident prioritization, critical resource allocation, communications systems integration, and information coordination. The components of Multi-agency Coordination Systems include facilities, equipment, emergency operation centers (EOCs), specific multi-agency coordination entities, personnel, procedures, and communications. These systems assist agencies and organizations to fully integrate the subsystems of the NIMS.

Multi-jurisdictional Incident - An incident requiring action from multiple agencies that each have jurisdiction to manage certain aspects of an incident. In ICS, these incidents will be managed under Unified Command.

Mutual Aid Agreement - Written agreement between agencies and/or jurisdictions in which they agree to assist one another upon request, by furnishing personnel and equipment.

Mutual-Aid Agreement - Written agreement between agencies and/or jurisdictions that they will assist one another on request, by furnishing personnel, equipment, and/or expertise in a specified manner.

National - Of a nationwide character, including the Federal, State, local, and tribal aspects of governance and polity.

National Disaster Medical System - A cooperative, asset-sharing partnership between the U.S. Department of Health and Human Services, the U.S. Department of Veterans Affairs, the U.S. Department of Homeland Security, and the U.S. Department of Defense. NDMS provides resources for meeting the continuity of care and mental health services requirements of the Emergency Support Function 8 in the Federal Response Plan.

National Environmental Policy Act (NEPA) - NEPA is the basic national law for protection of the environment, passed by Congress in 1969. It sets policy and procedures for environmental protection, and authorizes Environmental Impact Statements and Environmental Assessments to be used as analytical tools to help federal managers make decisions.

National Fire Danger Rating System (NFDRS) - A uniform fire danger rating system that focuses on the environmental factors that control the moisture content of fuels.

National Incident Management System (NIMS) - A system mandated by HSPD-5 that provides a consistent nationwide approach for Federal, State, local, and tribal governments; the private-sector, and nongovernmental organizations to work effectively and efficiently together to prepare for, respond to, and recover from domestic incidents, regardless of cause, size, or complexity. To provide for interoperability and compatibility among Federal, State, local, and tribal capabilities, the NIMS includes a core set of concepts, principles, and terminology. HSPD-5 identifies these as the ICS; Multi-agency Coordination Systems; training; identification and management of resources (including systems for classifying types of resources); qualification and certification; and the collection, tracking, and reporting of incident information and incident resources.

National Response Plan - A plan mandated by HSPD-5 that integrates Federal domestic prevention, preparedness, response, and recovery plans into one all-discipline, all-hazards plan.

National Warning System (NAWAS) - A communication system from by the Federal Government to provide warning to the population of an attack or other national emergency. Reception is at local and state warning points.

National Weather Services (NWS) ? That federal government agencies charged with weather related reporting and projections.

National Wildfire Coordinating Group - A group formed under the direction of the Secretaries of Agriculture and the Interior and comprised of representatives of the U.S. Forest Service, Bureau of Land Management, Bureau of Indian Affairs, National Park Service, U.S. Fish and Wildlife Service and Association of State Foresters. The group's purpose is to facilitate coordination and effectiveness of wildland fire activities and provide a forum to discuss, recommend action, or resolve issues and problems of substantive nature. NWCG is the certifying body for all courses in the National Fire Curriculum.

Nomex - Trade name for a fire resistant synthetic material used in the manufacturing of flight suits and pants and shirts used by firefighters (see Aramid).

Nongovernmental Organization - An entity with an association that is based on interests of its members, individuals, or institutions and that is not created by a government, but may work cooperatively with government. Such organizations serve a public purpose, not a private benefit. Examples of NGOs include faith-based charity organizations and the American Red Cross.

Normal Fire Season - 1) A season when weather, fire danger, and number and distribution of fires are about average. 2) Period of the year that normally comprises the fire season.

Operational Period - The time scheduled for executing a given set of operation actions, as specified in the Incident Action Plan. Operational periods can be of various lengths, although usually not over 24 hours.

Operations Branch Director - Person under the direction of the operations section chief who is responsible for implementing that portion of the incident action plan appropriate to the branch.

Operations Section - The section responsible for all tactical incident operations. In ICS, it normally includes subordinate branches, divisions, and/or groups.

Overhead - People assigned to supervisory positions, including incident commanders, command staff, general staff, directors, supervisors, and unit leaders.

Pack Test - Used to determine the aerobic capacity of fire suppression and support personnel and assign physical fitness scores. The test consists of walking a specified distance, with or without a weighted pack, in a predetermined period of time, with altitude corrections.

Paracargo - Anything dropped, or intended for dropping, from an aircraft by parachute, by other retarding devices, or by free fall.

Peak Fire Season - That period of the fire season during which fires are expected to ignite most readily, to burn with greater than average intensity, and to create damages at an unacceptable level.

Personnel Accountability - The ability to account for the location and welfare of incident personnel. It is accomplished when supervisors ensure that ICS principles and processes are functional and that personnel are working within established incident management guidelines. Planning Meeting - A meeting held as needed prior to and throughout the duration of an incident to select specific strategies and tactics for incident control operations and for service and support planning. For larger incidents, the planning meeting is a major element in the development of the Incident Action Plan (IAP).

Personnel Protective Equipment (PPE) - All firefighting personnel must be equipped with proper equipment and clothing in order to mitigate the risk of injury from, or exposure to, hazardous conditions encountered while working. PPE includes, but is not limited to - 8-inch high-laced leather boots with lug soles, fire shelter, hard hat with chin strap, goggles, ear plugs, aramid shirts and trousers, leather gloves and individual first aid kits.

Planning Meeting - A meeting held as needed prior to and throughout the duration of an incident to select specific strategies and tactics for incident control operations and for service and support planning. For larger incidents, the planning meeting is a major element in the development of the Incident Action Plan (IAP).

Planning Section - Responsible for the collection, evaluation, and dissemination of operational information related to the incident, and for the preparation and documentation of the IAP. This section also maintains information on the current and forecasted situation and on the status of resources assigned to the incident.

Preparedness - The range of deliberate, critical tasks and activities necessary to build, sustain, and improve the operational capability to prevent, protect against, respond to, and recover from domestic incidents. Preparedness is a continuous process. Preparedness involves efforts at all levels of government and between government and private-sector and nongovernmental organizations to identify threats, determine vulnerabilities, and identify required resources. Within the NIMS, preparedness is operationally focused on establishing guidelines, protocols, and standards for planning, training and exercises, personnel qualification and certification, equipment certification, and publication management.

Preparedness Organizations - The groups that provide interagency coordination for domestic incident management activities in a non-emergency context. Preparedness organizations can include all agencies with a role in incident management, for prevention, preparedness, response, or recovery activities. They represent a wide variety of committees, planning groups, and other organizations that meet and coordinate to ensure the proper level of planning, training, equipping, and other preparedness requirements within a jurisdiction or area.

Prescribed Fire Plan (Burn Plan) - This document provides the prescribed fire burn boss information needed to implement an individual prescribed fire project.

Prescribed Fire - Any fire ignited by management actions under certain, predetermined conditions to meet specific objectives related to hazardous fuels or habitat improvement. A written, approved prescribed fire plan must exist, and NEPA requirements must be met, prior to ignition.

Prescription - Measurable criteria that define conditions under which a prescribed fire may be ignited, guide selection of appropriate management responses, and indicate other required actions. Prescription criteria may include safety, economic, public health, environmental, geographic, administrative, social, or legal considerations.

Prevention - Actions to avoid an incident or to intervene to stop an incident from occurring. Prevention involves actions to protect lives and property. It involves applying intelligence and other information to a range of activities that may include such countermeasures as deterrence operations; heightened inspections; improved surveillance and security operations; investigations to determine the full nature and source of the threat; public health and agricultural surveillance and testing processes; immunizations, isolation, or quarantine; and, as appropriate, specific law enforcement operations aimed at deterring, preempting, interdicting, or disrupting illegal activity and apprehending potential perpetrators and bringing them to justice.

Private Sector - Organizations and entities that are not part of any governmental structure. It includes for-profit and not-for-profit organizations, formal and informal structures, commerce and industry, and private voluntary organizations (PVO).

Project Fire - A fire of such size or complexity that a large organization and prolonged activity is required to suppress it.

Public Assistance - The federal financial assistance provided to state and local governments or to eligible private non-profit organizations for disaster-related requirements.

Public Information Officer (PIO) - A member of the Command Staff responsible for interfacing with the public and media or with other agencies with incident-related information requirements.

Publications Management - The publications management subsystem includes materials development, publication control, publication supply, and distribution. The development and distribution of NIMS materials is managed through this subsystem. Consistent documentation is critical to success, because it ensures that all responders are familiar with the documentation used in a particular incident regardless of the location or the responding agencies involved.

Pulaski - A combination chopping and trenching tool, which combines a single-bitted axe-blade with a narrow adze-like trenching blade fitted to a straight handle. Useful for grubbing or trenching in duff and matted roots. Well-balanced for chopping.

Qualification and Certification - This subsystem provides recommended qualification and certification standards for emergency responder and incident management personnel. It also allows the development of minimum standards for resources expected to have an interstate application. Standards typically include training, currency, experience, and physical and medical fitness.

Radiant Burn - A burn received from a radiant heat source.

Radiant Heat Flux - The amount of heat flowing through a given area in a given time, usually expressed as calories/square centimeter/second.

Radio Amateur Civil Emergency Services (RACES) ? Volunteer amateur radio operators who support state and local governments with amateur radio transmission support during times of emergencies.

Rappelling - Technique of landing specifically trained firefighters from hovering helicopters; involves sliding down ropes with the aid of friction-producing devices.

Rate of Spread - The relative activity of a fire in extending its horizontal dimensions. It is expressed as a rate of increase of the total perimeter of the fire, as rate of forward spread of the fire front, or as rate of increase in area, depending on the intended use of the information. Usually it is expressed in chains or acres per hour for a specific period in the fire's history.

Reburn - The burning of an area that has been previously burned but that contains flammable fuel that ignites when burning conditions are more favorable; an area that has reburned.

Reception Area - This refers to a location separate from staging areas, where resources report in for processing and out-processing. Reception Areas provide accountability, security, situational awareness briefings, safety awareness, distribution of IAPs, supplies and equipment, feeding, and bed down.

Recovery - The development, coordination, and execution of service- and site-restoration plans; the reconstitution of government operations and services; individual, private sector, non-governmental and public-assistance programs to provide housing and to promote restoration; long-term care and treatment of affected persons; additional measures for social, political, environmental, and economic restoration; evaluation of the incident to identify lessons learned; post-incident reporting; and development of initiatives to mitigate the effects of future incidents.

Red Card - Fire qualification card issued to fire rated persons showing their training needs and their qualifications to fill specified fire suppression and support positions in a large fire suppression or incident organization.

Red Flag Warning - Term used by fire weather forecasters to alert forecast users to an ongoing or imminent critical fire weather pattern.

Rehabilitation - The activities necessary to repair damage or disturbance caused by wildland fires or the fire suppression activity.

Relative Humidity (Rh) - The ratio of the amount of moisture in the air, to the maximum amount of moisture that air would contain if it were saturated. The ratio of the actual vapor pressure to the saturated vapor pressure.

Remote Automatic Weather Station (RAWS) - An apparatus that automatically acquires, processes, and stores local weather data for later transmission to the GOES Satellite, from which the data is re-transmitted to an earth-receiving station for use in the National Fire Danger Rating System.

Resource Management - Efficient incident management requires a system for identifying available resources at all jurisdictional levels to enable timely and unimpeded access to resources needed to prepare for, respond to, or recover from an incident. Resource management under the NIMS includes mutual-aid agreements; the use of special Federal, State, local, and tribal teams; and resource mobilization protocols.

Resource Management Plan (RMP) - A document prepared by field office staff with public participation and approved by field office managers that provides general guidance and direction for land management activities at a field office. The RMP identifies the need for fire in a particular area and for a specific benefit.
Resource Order - An order placed for firefighting or support resources.

Resources - Personnel and major items of equipment, supplies, and facilities available or potentially available for assignment to incident operations and for which status is maintained. Resources are described by kind and type and may be used in operational support or supervisory capacities at an incident or at an EOC.

Resources Unit - Functional unit within the Planning Section responsible for recording the status of resources committed to the incident. This unit also evaluates resources currently committed to the incident, the effects additional responding resources will have on the incident, and anticipated resource needs.

Resources - 1) Personnel, equipment, services and supplies available, or potentially available, for assignment to incidents. 2) The natural resources of an area, such as timber, crass, watershed values, recreation values, and wildlife habitat.

Response - Activities that address the short-term, direct effects of an incident. Response includes immediate actions to save lives, protect property, and meet basic human needs. Response also includes the execution of emergency operations plans and of mitigation activities designed to limit the loss of life, personal injury, property damage, and other unfavorable outcomes. As indicated by the situation, response activities include applying intelligence and other information to lessen the effects or consequences of an incident; increased security operations; continuing investigations into nature and source of the threat; ongoing public health and agricultural surveillance and testing processes; immunizations, isolation, or quarantine; and specific law.

Retardant - A substance or chemical agent which reduced the flammability of combustibles.

Run (of a fire) - The rapid advance of the head of a fire with a marked change in fire line intensity and rate of spread from that noted before and after the advance.

Running - A rapidly spreading surface fire with a well-defined head.

Safety Officer - A member of the Command Staff responsible for monitoring and assessing safety hazards or unsafe situations and for developing measures for ensuring personnel safety.

Safety Zone - An area cleared of flammable materials used for escape in the event the line is outflanked or in case a spot fire causes fuels outside the control line to render the line unsafe. In firing operations, crews progress so as to maintain a safety zone close at hand allowing the fuels inside the control line to be consumed before going ahead. Safety zones may also be constructed as integral parts of fuel breaks; they are greatly enlarged areas which can be used with relative safety by firefighters and their equipment in the event of a blowup in the vicinity.

Scratch Line - An unfinished preliminary fire line hastily established or built as an emergency measure to check the spread of fire.

Search and Rescue (SAR) - An organized mission to locate and remove a person(s) reported as missing.

Section - The organizational level having responsibility for a major functional area of incident management, e.g., Operations, Planning, Logistics, Finance/Administration, and Intelligence (if established). The section is organizationally situated between the branch and the Incident Command.

Severity Funding - Funds provided to increase wildland fire suppression response capability necessitated by abnormal weather patterns, extended drought, or other events causing abnormal increase in the fire potential and/or danger.

Single Resource - An individual, a piece of equipment and its personnel complement, or a crew or team of individuals with an identified work supervisor that can be used on an incident.

Size-up - To evaluate a fire to determine a course of action for fire suppression.

Slash - Debris left after logging, pruning, thinning or brush cutting; includes logs, chips, bark, branches, stumps and broken understory trees or brush.

Sling Load - Any cargo carried beneath a helicopter and attached by a lead line and swivel.

Slop-over - A fire edge that crosses a control line or natural barrier intended to contain the fire.

Smoke Management - Application of fire intensities and meteorological processes to minimize degradation of air quality during prescribed fires.

Smokejumper - A firefighter who travels to fires by aircraft and parachute.

Smoldering Fire - A fire burning without flame and barely spreading.

Snag - A standing dead tree or part of a dead tree from which at least the smaller branches have fallen.

Span of Control - The number of individuals a supervisor is responsible for, usually expressed as the ratio of supervisors to individuals. (Under the NIMS, an appropriate span of control is between 1 -3 and 1 -7.)

Spark Arrester - A device installed in a chimney, flue, or exhaust pipe to stop the emission of sparks and burning fragments.

Special Needs Populations - are groups whose needs are not fully addressed by traditional service providers or who feel they cannot comfortably or safely access and use the standard resources offered in disaster preparedness, relief and recovery. They include but are not limited to those who are physically or mentally disabled (blind, deaf, hard-of-hearing, cognitive disorders, mobility limitations), limited or non-English speaking, geographically or culturally isolated, medically or chemically dependent, homeless, frail/elderly, children, economically disadvantaged, and incarcerated.

Spot Fire - A fire ignited outside the perimeter of the main fire by flying sparks or embers.

Spot Weather Forecast - A special forecast issued to fit the time, topography, and weather of each specific fire. These forecasts are issued upon request of the user agency and are more detailed, timely, and specific than zone forecasts.

Spotter - In smokejumping, the person responsible for selecting drop targets and supervising all aspects of dropping smokejumpers.

Spotting - Behavior of a fire producing sparks or embers that are carried by the wind and start new fires beyond the zone of direct ignition by the main fire.

Staging Area - Location established where resources can be placed while awaiting a tactical assignment. The Operations Section manages Staging Areas.

Standard Operating Guidelines (SOG) - A set of instructions or guidelines covering steps or features of operations to promote effective actions.

Standard Operating Procedures (SOP) - A set of instructions having the force of a directive, covering those features of operations, which lend themselves to a definite or standardized procedure without loss of effectiveness.

State - When capitalized, refers to any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, and any possession of the United States. See Section 2 (14), Homeland Security Act of 2002, Pub. L. 107-296, 116 Stat. 2135 (2002).

State Coordinating Officer (SCO) - normally the Director for the Division of Emergency Management) serves as the Governor's principal assistant in the coordination and supervision all activities of state and local government in conducting emergency operations under a gubernatorial and/or Presidential emergency or disaster declaration. The State Coordinating Officer will act in cooperation with the Federal Coordinating Officer (FCO) during a Presidential disaster declaration.

State Division of Emergency Management (DEM) - The agency in the Division of Local Government, Department of Local Affairs, responsible for emergency management programs in the State of Colorado. It is located in Centennial, and is situated in the State Emergency Operations Center (EOC), which DEM organizes and operates during emergencies or disasters.

State Emergency Operations Center (SEOC) - The facility, located in the city of Centennial, from which state emergency/disaster operations are coordinated.

State Emergency Operations Plan (SEOP) - The state level plan for actions to be taken by government and citizens when disaster threatens or strikes. It consists of assignment of responsibilities to state agencies, coordinating instructions, staffing, essential facilities, and general operations common to most major emergencies.

State Warning Point - Same as Warning Point, with the additional responsibility of supervising and controlling that part of NAWAS which is within the state.

Strategic - Strategic elements of incident management are characterized by continuous long-term, high-level planning by organizations headed by elected or other senior officials. These elements involve the adoption of long-range goals and objectives, the setting of priorities; the establishment of budgets and other fiscal decisions, policy development, and the application of measures of performance or effectiveness.

Strategy - The general direction selected to accomplish incident objectives set by the IC.

Strategy - The science and art of command as applied to the overall planning and conduct of an incident.

Strike Team - A set number of resources of the same kind and type that have an established minimum number of personnel.

Strike Team Leader - Person responsible to a division/group supervisor for performing tactical assignments given to the strike team.

Strike Team - Specified combinations of the same kind and type of resources, with common communications, and a leader.

Structure Fire - Fire originating in and burning any part or all of any building, shelter, or other structure.

Supporting Technologies - Any technology that may be used to support the NIMS is included in this subsystem. These technologies include orthophoto mapping, remote automatic weather stations, infrared technology, and communications, among various others.

Suppressant - An agent, such as water or foam, used to extinguish the flaming and glowing phases of combustion when direction applied to burning fuels.

Suppression - All the work of extinguishing or containing a fire, beginning with its discovery.

Surface Fuels - Loose surface litter on the soil surface, normally consisting of fallen leaves or needles, twigs, bark, cones, and small branches that have not yet decayed enough to lose their identity; also grasses, forbs, low and medium shrubs, tree seedlings, heavier branchwood, downed logs, and stumps interspersed with or partially replacing the litter.

Swamper - (1) A worker who assists fallers and/or sawyers by clearing away brush, limbs and small trees. Carries fuel, oil and tools and watches for dangerous situations. (2) A worker on a dozer crew who pulls winch line, helps maintain equipment, etc., to speed suppression work on a fire.

Tactics - Deploying and directing resources on an incident to accomplish the objectives designated by strategy.

Task Force - Any combination of resources assembled to support a specific mission or operational need. All resource elements within a Task Force must have common communications and a designated leader.

Technical Assistance - Support provided to State, local, and tribal jurisdictions when they have the resources but lack the complete knowledge and skills needed to perform a required activity (such as mobile-home park design and hazardous material assessments).

Temporary Flight Restrictions (TFR) - A restriction requested by an agency and put into effect by the Federal Aviation Administration in the vicinity of an incident which restricts the operation of nonessential aircraft in the airspace around that incident.

Terra Torch - Device for throwing a stream of flaming liquid, used to facilitate rapid ignition during burn out operations on a wildland fire or during a prescribed fire operation.

Test Fire - A small fire ignited within the planned burn unit to determine the characteristic of the prescribed fire, such as fire behavior, detection performance and control measures.

Threat - An indication of possible violence, harm, or danger.

Timelag - Time needed under specified conditions for a fuel particle to lose about 63 percent of the difference between its initial moisture content and its equilibrium moisture content. If conditions remain unchanged, a fuel will reach 95 percent of its equilibrium moisture content after four timelag periods.

Tools - Those instruments and capabilities that allow for the professional performance of tasks, such as information systems, agreements, doctrine, capabilities, and legislative authorities.

Torching - The ignition and flare-up of a tree or small group of trees, usually from bottom to top.

Tribal - Any Indian tribe, band, nation, or other organized group or community, including any Alaskan Native Village as defined in or established pursuant to the Alaskan Native Claims Settlement Act (85 stat. 688) [43 U.S.C.A. and 1601 et seq.], that is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians.

Two-way Radio - Radio equipment with transmitters in mobile units on the same frequency as the base station, permitting conversation in two directions using the same frequency in turn.

Type - A classification of resources in the ICS that refers to capability. Type 1 is generally considered to be more capable than Types 2, 3, or 4, respectively, because of size; power; capacity; or, in the case of incident management teams, experience and qualifications.

Uncontrolled Fire - Any fire which threatens to destroy life, property, or natural resources.

Underburn - A fire that consumes surface fuels but not trees or shrubs. (See Surface Fuels)

Unified Area Command - A Unified Area Command is established when incidents under an Area Command are multi-jurisdictional. (See Area Command.)

Unified Command - An application of ICS used when there is more than one agency with incident jurisdiction or when incidents cross-political jurisdictions. Agencies work together through the designated members of the UC, often the senior person from agencies and/or disciplines participating in the UC, to establish a common set of objectives and strategies and a single IAP.

Unit - The organizational element having functional responsibility for a specific incident planning, logistics, or finance/administration activity.

Unity of Command - The concept by which each person within an organization reports to one and only one designated person. The purpose of unity of command is to ensure unity of effort under one responsible commander for every objective.

Vectors - Directions of fire spread as related to rate of spread calculations (in degrees from upslope).

Volunteer - A person who does a job or performs a service for which s/he receives no salary.

Volunteer Fire Department (VFD) - A fire department of which some or all members are unpaid.

Water Tender - A ground vehicle capable of transporting specified quantities of water.

Weather Information and Management System (WIMS) - An interactive computer system designed to accommodate the weather information needs of all federal and state natural resource management agencies. Provides timely access to weather forecasts, current and historical weather data, the National Fire Danger Rating System (NFDRS), and the National Interagency Fire Management Integrated Database (NIFMID).

Wet Line - A line of water, or water and chemical retardant, sprayed along the ground, that serves as a temporary control line from which to ignite or stop a low-intensity fire.

Wildland Fire Implementation Plan (WFIP) - A progressively developed assessment and operational management plan that documents the analysis and selection of strategies and describes the appropriate management response for a wildland fire being managed for resource benefits.

Wildland Fire Situation Analysis (WFSA) - A decision-making process that evaluates alternative suppression strategies against selected environmental, social, political, and economic criteria. Provides a record of decisions.

Wildland Fire Use - The management of naturally ignited wildland fires to accomplish specific prestated resource management objectives in predefined geographic areas outlined in Fire Management Plans.

Wildland Fire - Any nonstructure fire, other than prescribed fire, that occurs in the wildland.

Wildland Urban Interface (WUI) - The line, area or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

Wind Vectors - Wind directions used to calculate fire behavior.

ZULU Time - mean solar time at the zero meridian of Greenwich, England, used as the basis for standard time throughout the world. Mountain Standard Time is usually Zulu minus 7 hours and during Daylight Savings Time – Zulu minus 6 hours.

OTHER ACRONYMS

AAR	After Action Report
ACP	Access Control Point
ADAD	Alcohol and Drug Abuse Division
AFB	Air Force Base
ANG	Air National Guard
APHIS	Animal and Plant Health Inspection Service
ARC	American Red Cross
ARES	Amateur Radio Emergency Services
ARNG	Army National Guard
CADRE	Community Agency Disaster Relief Effort
CAO	Chief Administrative Officer
CAT	Crisis Action Team
CBI	Colorado Bureau of Investigation (CDPS)
CCP	Casualty Collection Point
CDA	Colorado Department of Agriculture
CDC	Centers for Disease Control and Prevention
CDHS	Colorado Department of Human Service
CDNR	Colorado Department of Natural Resources
CDOT	Colorado Department of Transportation
CDPHE	Colorado Department of Public Health and Environment
CDPS	Colorado Department of Public Safety
CEOC	County Emergency Operations Center
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CGC	Colorado Geologic Survey
CHMC	Community Mental Health Center
CIAC	Colorado Information Analysis Center (OPSFS/CDPS)
CIO	Chief Information Officer
CMC	Crisis Management Center (CDPHE) renamed EOC
CMO	Chief Medical Officer
COHAN	Colorado Health Alert Network
CONPLAN	Concept of Operations Plan
CP	Command Post
CPHMVS	Colorado Public Health and Medical Volunteer System
CSEPP	Chemical Stockpile Emergency Preparedness Program
CSERMP	Colorado State Emergency Resource Mobilization Plan
CSP	Colorado State Patrol (CDPS)
CSU-VDL	Colorado State University – Veterinary Diagnostic Laboratory
CVCN	Colorado Volunteer Center Network
DCE	Defense Coordinating Element
DCO	Defense Coordinating Officer
DEM	Division of Emergency Management (DOLA)
DERA	Designated Emergency Response Authority
DFS	Division of Fire Safety
DMAT	Disaster Medical Assistance Team
DMH	Division of Mental Health (CDHS)
DMORT	Disaster Mortuary Operational Response Team
DMVA	Colorado Department of Military and Veterans Affairs
DOD	Department of Defense
DOE	Department of Energy
DOJ	Department of Justice
DOLA	Colorado Department of Local Affairs
DOMS	Director of Military Support
DOS	Department of State
DOT	Department of Transportation
DOW	Division of Wildlife (DNR)
DTR	Digital Truck Radio
DTRA	Defense Threat Reduction Agency

EAS	Emergency Alert System replaces EBS
EBS	Emergency Broadcast System replaced by EAS
ECG	Emergency Coordination Group (CDPHE)
EMA	Emergency Management Agency
EMAC	Emergency Management Assistance Compact
EMS	Emergency Medical Services
EMT	Emergency Medical Technician
EOC	Emergency Operations Center
EOD	Explosive Ordnance Disposal
EOP	Emergency Operations Plan
EPLO	Emergency Preparedness Liaison Officer
ERT-A	Emergency Response Team – Advance Element
ERT-N	Emergency Response Team – National Element
ESF	Emergency Support Function
FCO	Federal Coordinating officer
FEMA	Federal Emergency Management Agency
FMO	Fire Marshall's Office
FOIA	Freedom of Information Act
FOSC	Federal On-Scene Coordinator
FSIS	Food Safety and Inspection Service
GAR	Governor's Authorized Representative
GEEERC	Governor's Expert Emergency Epidemic Response Committee
HAN	Health Alert Network
HEICS	Hospital Incident Command System
HSOC	Homeland Security Operations Center (DHS) replaced by NOC
IAIP	Information Analysis and Infrastructure Protection (DHS)
IC	Incident Commander
ICC	Incident Command Center
ICS	Incident Command System
IM	Incident Management
JFO	Joint Field Office (FEMA)
JIC	Joint Information Center
JIS	Joint Information System
JOC	Joint Operations Center
JPIC	Joint Public Information Center
JTF	Joint Task Force
LEOC	Local Emergency Operations Center
LTRC	Long-Term Recovery Committee
MACC	Multi-Agency Coordination Center
MMRS	Metropolitan Medical Response System
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MSCA	Military Support to Civil Authorities
MSDS	Material Safety Data Sheets
MSO	Managed Services Organizations
NDMS	National Disaster Medical System
NIMS	National Incident Management System
NIOSH	National Institute of Occupational Safety and Health
NOC	National Operations Center (DHS) replaces HSOC
NRCC	National Response Coordination Center (FEMA)
NRP	National Response Plan
OEDIT	Office of Economic Development and International Trade (Gov Office)
OEMC	Office of Energy Management and Conservation (Governor's Office)
OPSFS	Office of Preparedness, Security, and Fire Safety (CDPS)
OTI	Office of Treatment Improvement
PA	Public Assistance
PAO	Public Affairs Officer
PIO	Public Information Officer

RACES	Radio Amateur Civil Emergency Services
ROSS	Resource Ordering and Status System
RRCC	Regional Response Coordination Center (FEMA) (replaces ROC)
SCO	State Coordinating Officer
SEOC	State Emergency Operations Center
SEOP	State Emergency Operations Plan
SFO	Senior Federal Official
SITREP	Situation Report
SOP	Standard Operating Procedures
UCS	Unified Command System
US&R	Urban Search and Rescue
VX	O-Ethyl Methyl Phophonothiolate (a V-agent)
WUI	Wildland Urban Interface