Lamar, Colorado, Blowing Dust Climatology March 10, 2010

Introduction – Executive Summary

PM10 concentrations for both the Lamar Power Plant and Municipal Building sites for January of 2004 through February of 2009 have been analyzed and compared with meteorological data for the period. The analyses included an evaluation of climate and land use characteristics; cluster analysis of PM10 concentrations, 30-day total precipitation, and daily maximum 5-second wind gust speeds; NOAA HYSPLIT back trajectories for high-wind, blowing dust events; and an assessment of satellite imagery. *Cluster analysis shows that without wind gusts above 40 mph and dry soils caused by 30-day precipitation totals of 0.6 inches or less, the exceedances of the PM10 standard measured during the period would not have occurred*. The conditions for blowing dust are consistent with earlier analyses completed by the Colorado Department of Public Health and Environment (1998) which indicate that significant dust storms only occur when soils are sufficiently dry and hourly average wind speeds are at or above 30 miles per hour or wind gust speeds are at or above 40 miles per hour. The high-wind events occur on less than 15% of the days in the period. The PM10 exceedances occur on less than 1% of the days in the record. *This document provides a detailed weight of evidence analysis for dust transport into and within Colorado and demonstrates that "but for" the exceptional high winds over dry soils these exceedances would not have occurred*.

Trajectory analyses and land use patterns point to three likely source areas that may contribute to blowing dust during blowing-dust events. The first is the Lamar PM10 Non-attainment Area (NAA) and Prowers County. *Blowing dust sources within the NAA and Prowers County have been reasonably controlled for particulate matter, as demonstrated by the PM10 State Implementation Plan (SIP) and Maintenance Plan for the area.* In addition, the Power Plant monitor, which is responsible for most of the exceedances, is inappropriately sited and does not represent ambient air exposure. The second likely source area is lands in eastern Colorado outside of Prowers County and the NAA. Small grain (wheat-fallow-sorghum) farmlands are a likely source for dust in late fall through spring. The Natural Resources Conservation Service (NRCS) has provided reasonable controls for these sources during the period of record and has alternative programs for erosion control as lands under contract with the Conservation Reserve Program (CRP) are released from contracts (in the five-year period beginning in late 2009.) The third source area includes lands in Arizona and New Mexico. Natural sources in these states may include deserts, barren lands, and playas; and anthropogenic sources may include agricultural lands. Control of these sources is beyond the purview of the State of Colorado. Existing and planned programs operated by the NRCS and the states may already reasonably control agricultural sources within these states.

Regional Precipitation

Lamar, Colorado, is located in a part of the country that is largely arid to semi-arid. Arid to semi-arid soils make much of the region susceptible to blowing dust. Figures 1 through 3 show the annual average precipitation for Colorado, Arizona, and New

Mexico, respectively. Lamar is located in the Arkansas River Valley of southeastern Colorado where the annual precipitation is typically 10 to 20 inches. Large areas of Arizona, which can be upwind of Lamar during blowing dust events, receive between 5 and 15 inches of precipitation each year. Much of New Mexico, which is also frequently upwind of Lamar during blowing dust events, also receives only 5 to 15 inches per year. Figure 4 shows the 1971-2000 monthly normal precipitation amounts for Lamar, Colorado, from the National Climatic Data Center. The annual average for this time period is 15.82 inches. The wettest months are May through August. The driest months are October, November, December, January, February, and March. These months receive an average of only 0.64 inches per month. The annual monthly average precipitation is 1.32 inches.

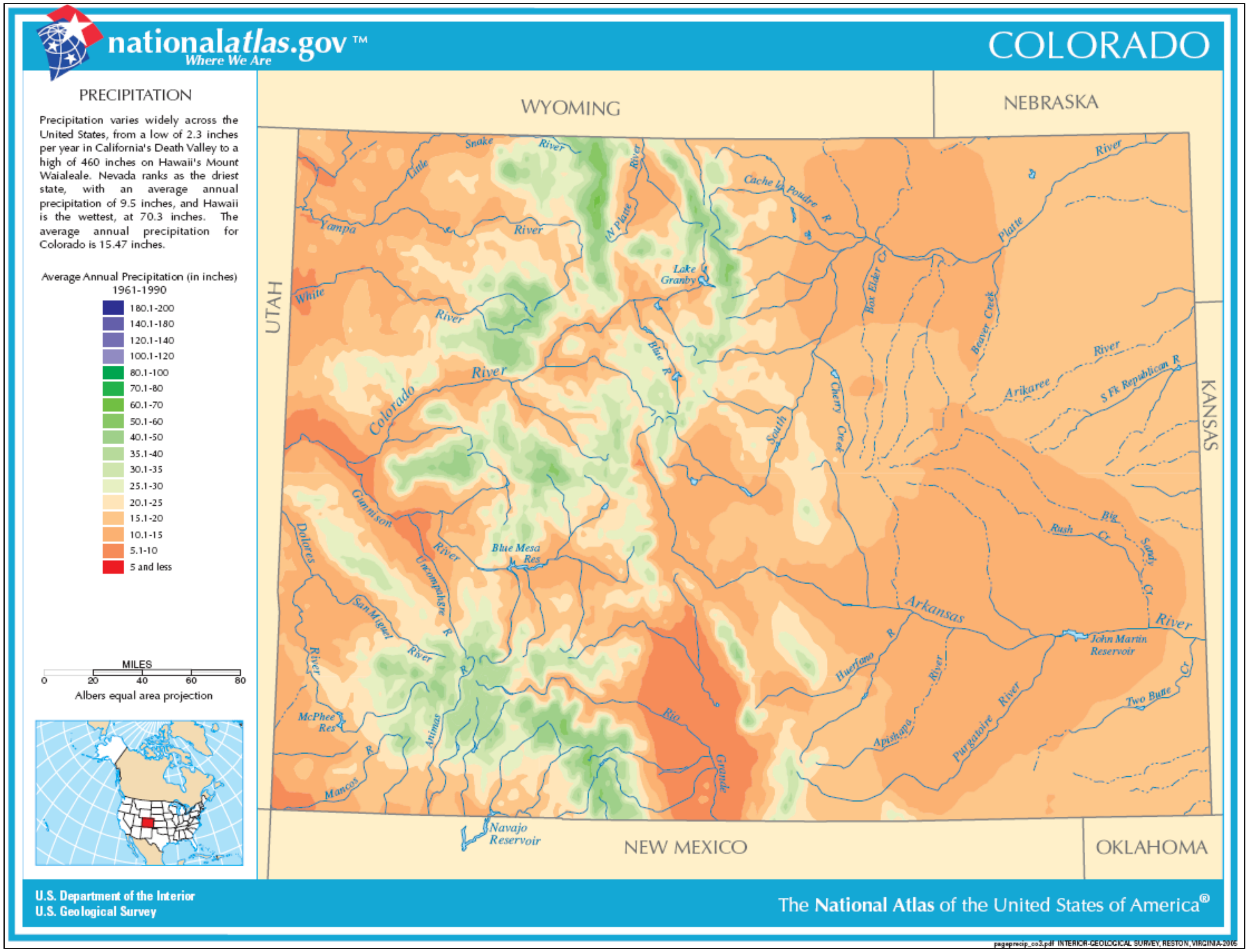


Figure 1. Average annual precipitation in Colorado based on 1961-1990 normals.

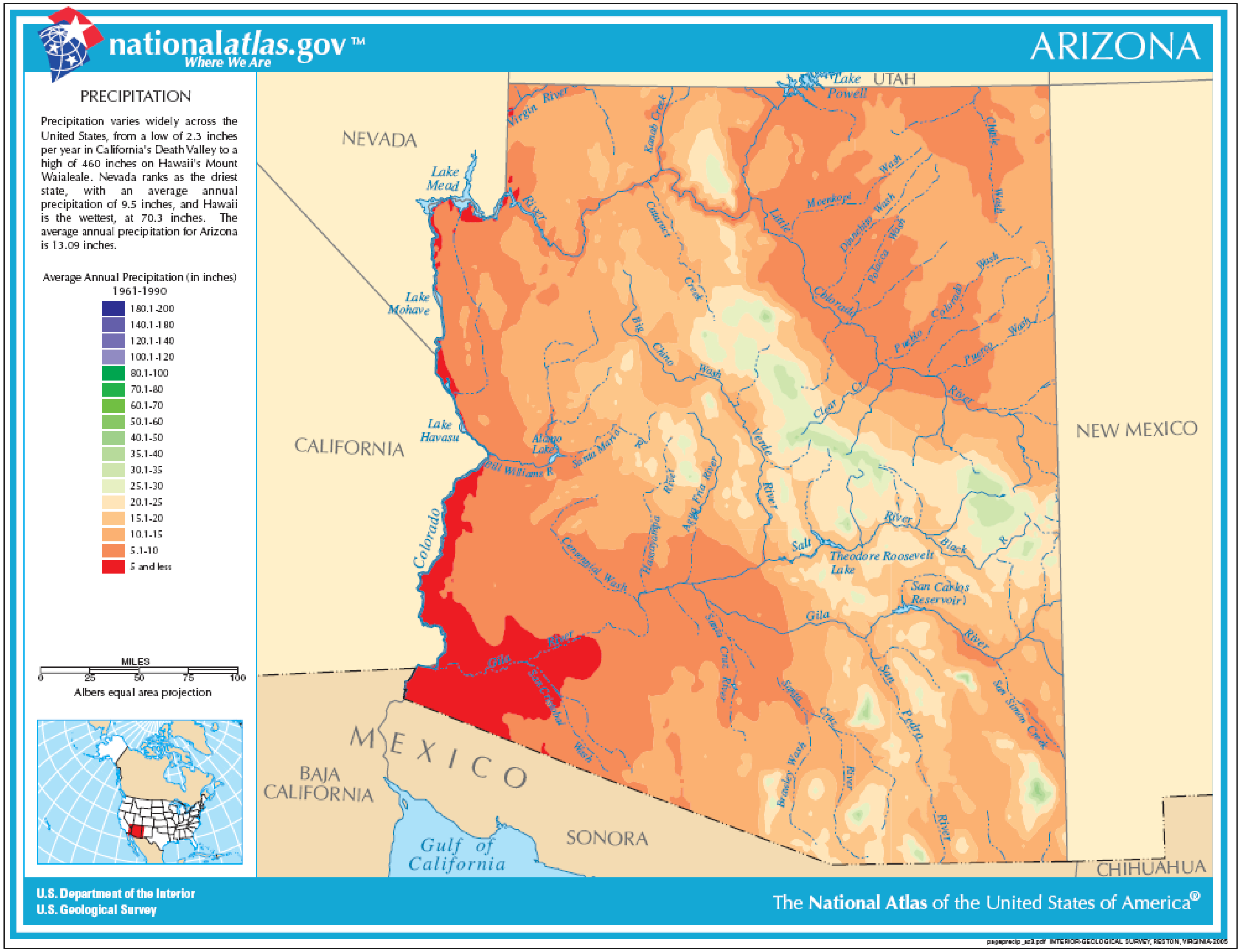


Figure 2. Average annual precipitation in Arizona based on 1961-1990 normals.

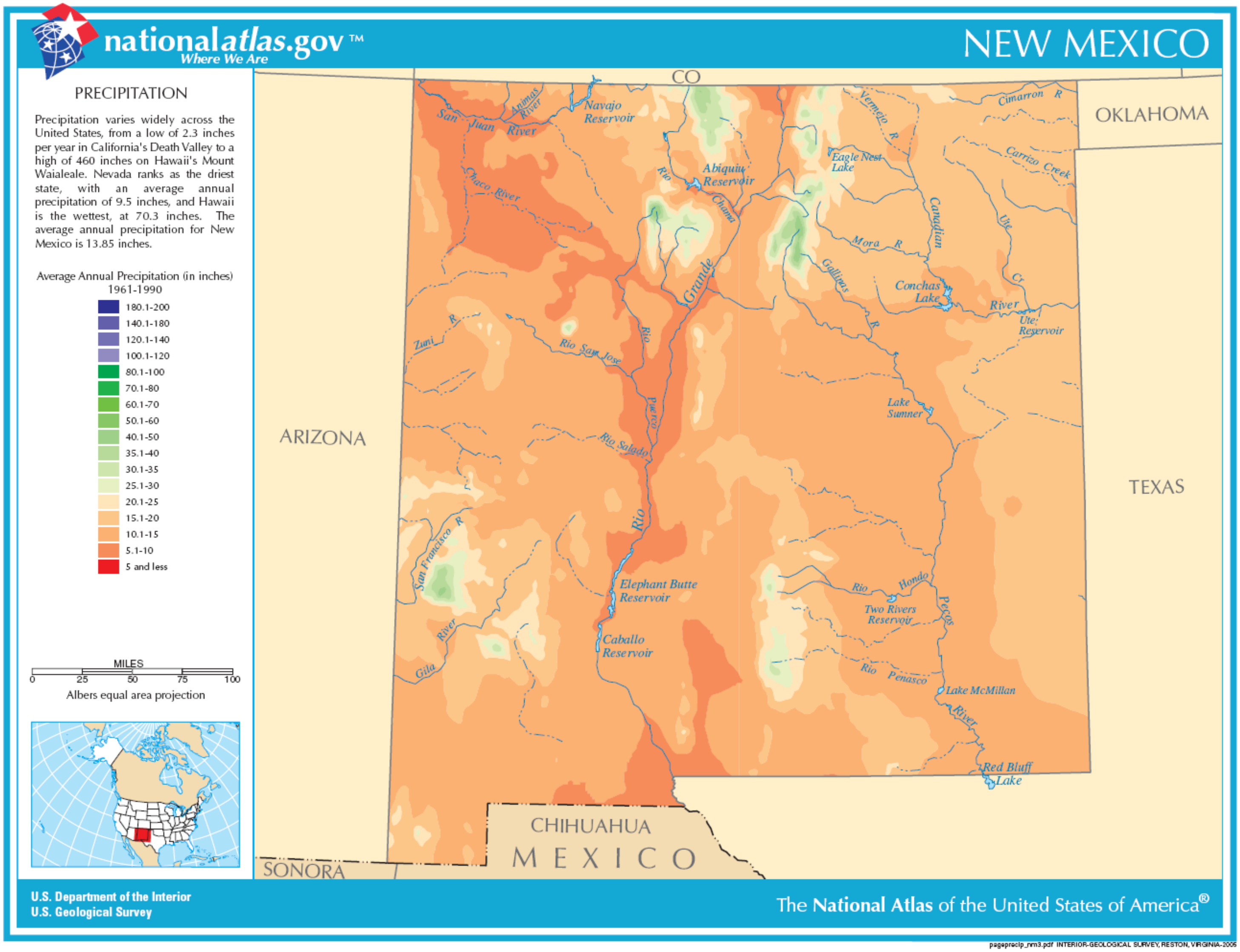


Figure 3. Average annual precipitation in New Mexico based on 1961-1990 normals.

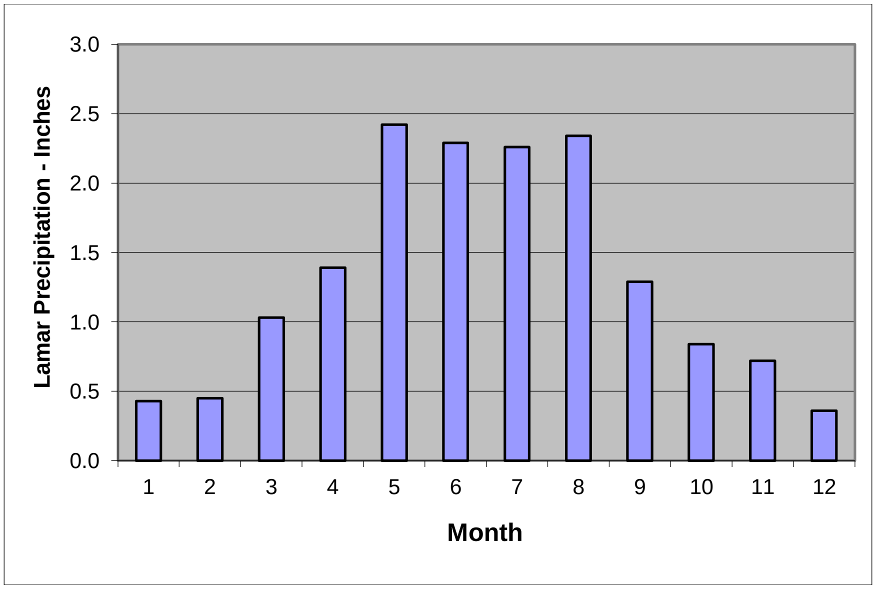


Figure 4. 1971-2000 monthly normal precipitation in Lamar, Colorado.

Cluster Analysis

K-means cluster analysis has been applied to Lamar Power and Municipal Building PM10 concentrations, Lamar 30-day total precipitation for each PM10 monitoring day, and Lamar daily maximum wind gust speeds for each monitoring day (a readily available wind variable with good predictive power.) K-means cluster analysis is a statistical method for identifying clusters or groupings of values for many variables. For environmental variables, these clusters often represent distinct processes, conditions, or events. In this case, cluster analysis differentiates PM10 concentrations associated with strong winds, low soil moistures, and blowing dust by providing mean values for these 4 variables for 5 distinct categories of PM10 events. The period of record considered was from January 2004 through February 2009. The Lamar Airport weather station was used to represent Lamar conditions. Initial screening of a variety of multi-day precipitation averages demonstrated that the 30-day total precipitation values appear to be a better metric for blowing dust conditions than shorter-term totals.

The results of the cluster analysis are presented in Table 1 below. Cluster 1 represents high soil moisture conditions, moderate gust speeds, and low PM10 concentrations. Cluster 2 represents low to moderate soil moisture, low PM10, and moderate gust speeds. Cluster 3 represents low to moderate soil moisture, high gusts, and low to moderate PM10. Cluster 4 represents low soil moisture, low gusts, and low PM10. Finally, Cluster 5 represents high PM10, high gusts, and low soil moisture. Cluster numbers, Lamar Power PM10 concentrations, and Lamar daily maximum gust speeds are plotted in Figure 5. Similar results for the Lamar Municipal Building site are presented in Figure 6. The data in Figures 5 and 6 clearly show that the highest PM10 concentrations tend to occur in Cluster 5 with gusts above 40 mph. Seven exceedances in this period occurred on days with peak gusts above 45 mph.

Figures 7 and 8 show the Lamar Power and Municipal Building PM10 concentrations versus Lamar 30-day precipitation totals, respectively, by cluster. The blowing dust group, Cluster 5, is generally associated with 30-day precipitation totals of less than 1.00 inches at Lamar. Concentrations of 150 ug/m3 or higher occurred when the 30-day precipitation was 0.6 inches or lower. Strong winds and low soil moisture content can lead to blowing dust in Colorado and adjoining states. If it were not for high winds and low soil moisture content, these exceedances would not have occurred.

Table 1. K-means cluster analysis means for Lamar PM10 and meteorological variables.

Cluster Variables	**Cluster 1 Means**	**Cluster 2 Means**	**Cluster 3 Means**	**Cluster 4 Means**	**Cluster 5 Means**
Lamar 5-second Gust in mph	27.4	34.7	38.9	19.5	52.6
Lamar Power PM10 in ug/m3	22.6	22.6	53.2	19.6	154.9
Lamar Municipal PM10 in ug/m3	20.6	18.0	38.5	16.4	111.9
Lamar 30-day Precipitation in Inches	3.68	0.75	0.85	0.64	0.43
Count	295	552	183	799	15

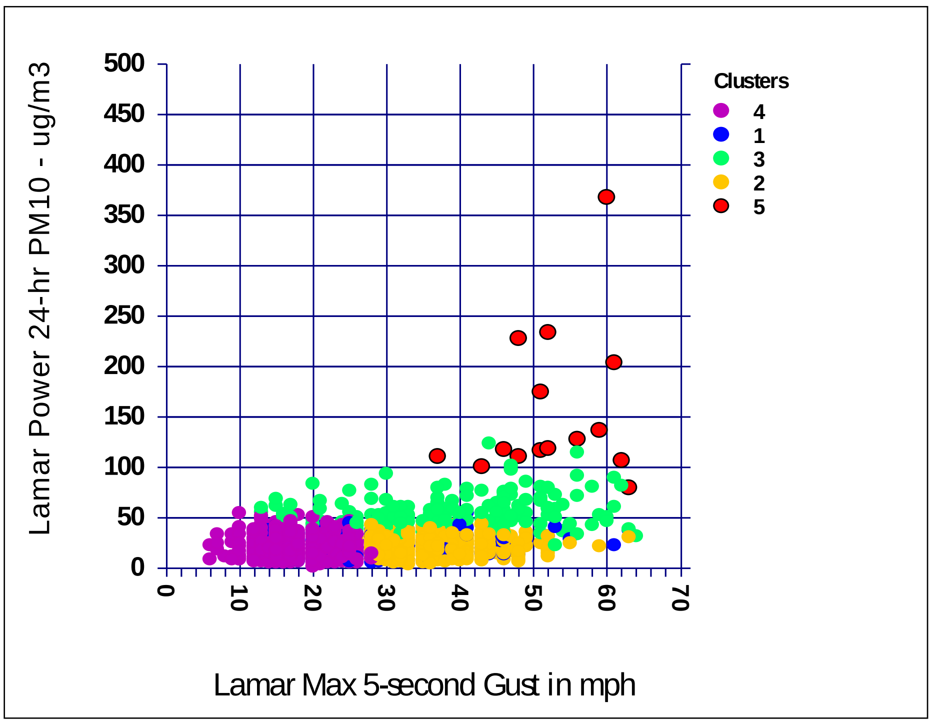


Figure 5. Lamar Power 24-hour PM10 concentrations versus Lamar gust speed by cluster.

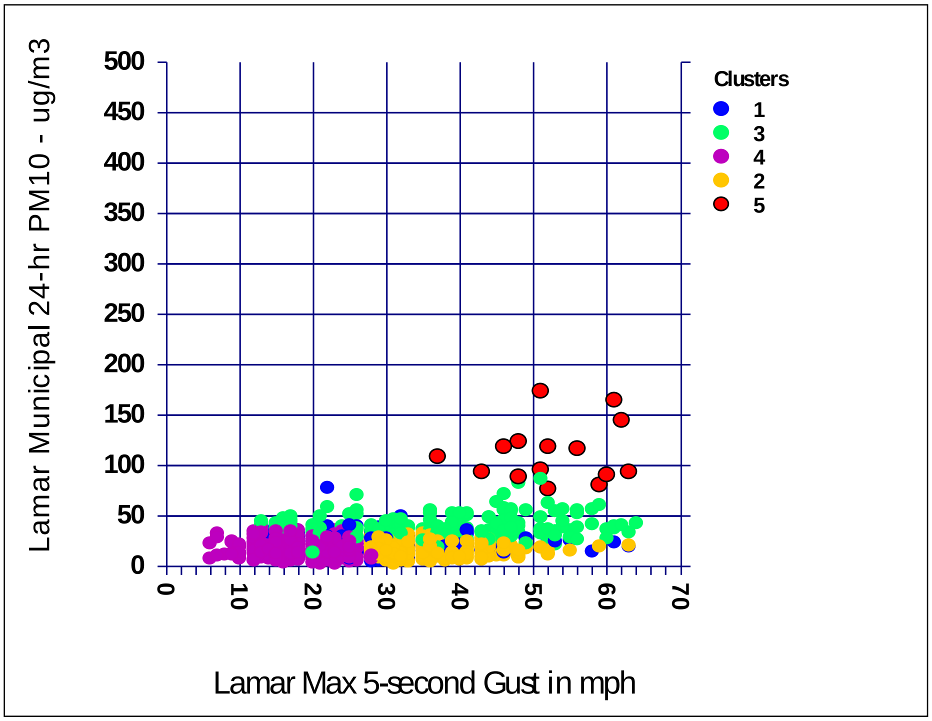


Figure 6. Lamar Municipal Building 24-hour PM10 concentrations versus Lamar gust speed by cluster.

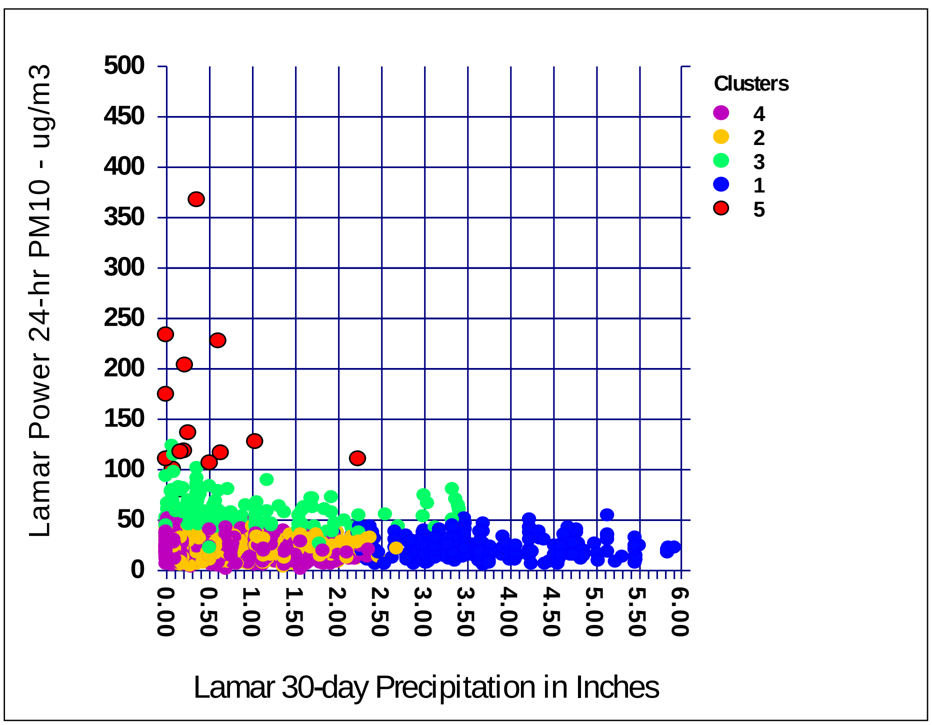


Figure 7. Lamar Power 24-hour PM10 concentrations versus Lamar 30-day total precipitation by cluster.

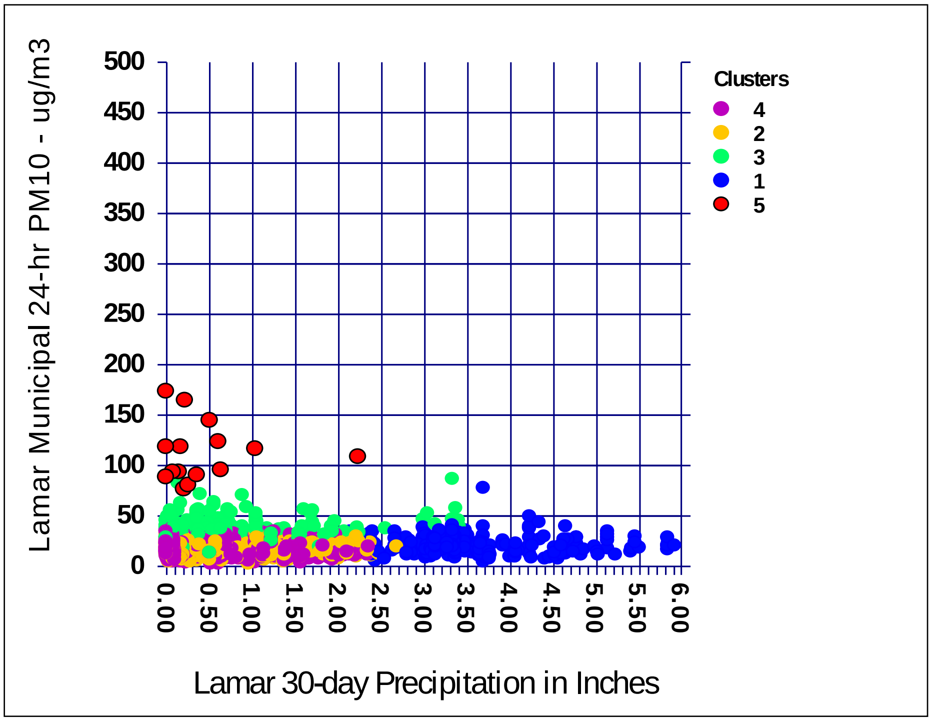


Figure 8. Lamar Municipal Building 24-hour PM10 concentrations versus Lamar 30-day total precipitation by cluster.

High Wind and PM10 Exceedance Climatology for Lamar

Figure 9 presents monthly percentiles for Lamar wind gust speeds for January 2004 through March 2009. Wind gusts generally considered to be high enough for significant blowing dusts (40 mph or higher) are within the upper 15 percent during most months of the year and in the upper 20 percent during April May and June. Figure 10 shows an annual average histogram for Lamar wind gusts. Gusts of 40 mph or higher occur 12 percent of the time. Gusts of 41 mph or higher occur 10% of the time, and the 95 percentile gust is 47 mph. Consequently, these high wind events can be viewed as exceptional rather than normal. Cluster analysis also shows that the blowing dust events represent less than 1% of the 1844 PM10 sample days considered (sample days must have had measurements at both sites to be considered in the cluster analysis.)

Gusts above 40 can occur any month of the year, but are most likely in March, April, May, June and July. Figure 4 shows that at Lamar May, June, and July are the wettest months and March and April are among the drier months of the year. It is in drier years, therefore, that blowing dust may be most prevalent during the late spring and early summer months. January and February are typically very dry, and might be expected to have a significant proportion of blowing dust events. Figure 11 and 12 show that the main blowing dust season at Lamar can be considered to run from January through May, based on data from January 2004 through February of 2009.

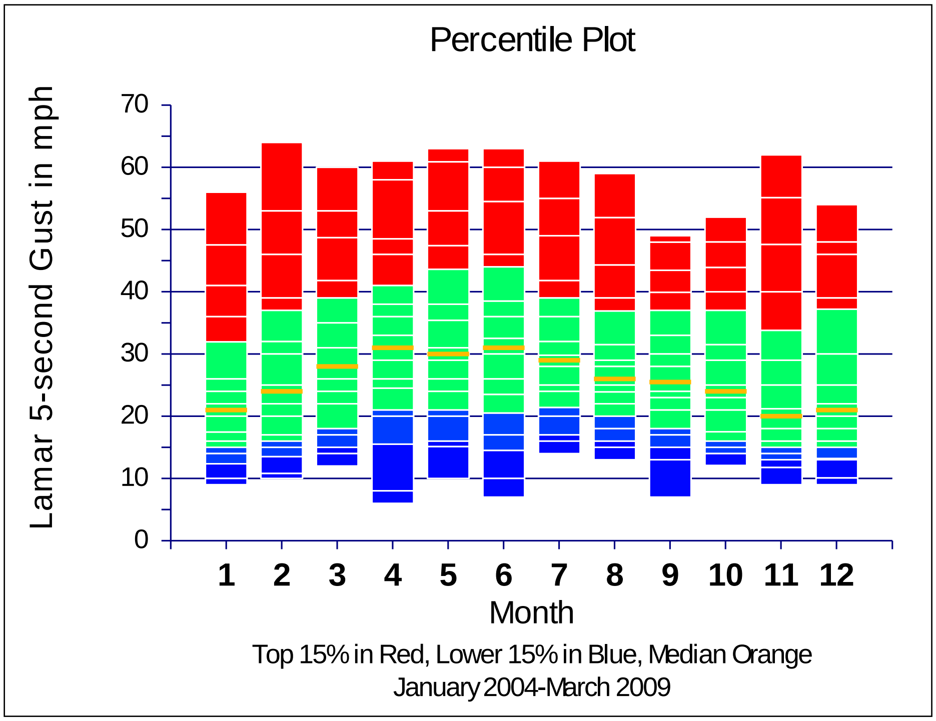


Figure 9. Percentile plot of Lamar daily maximum 5-second gust speed in miles per hour showing that gusts of 40 mph or greater generally occur within the top 15 percentile speeds for each month of the year.

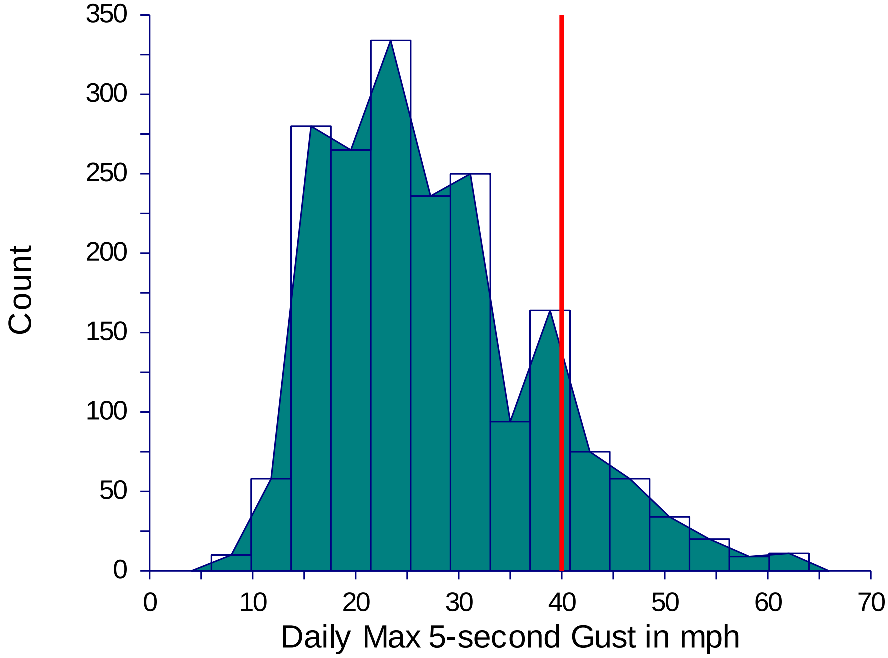


Figure 10. Histogram of daily maximum 5-second wind gusts at Lamar based on January 2004 – March 2009. The red line at gusts of 40 mph represents the 88 percentile value.

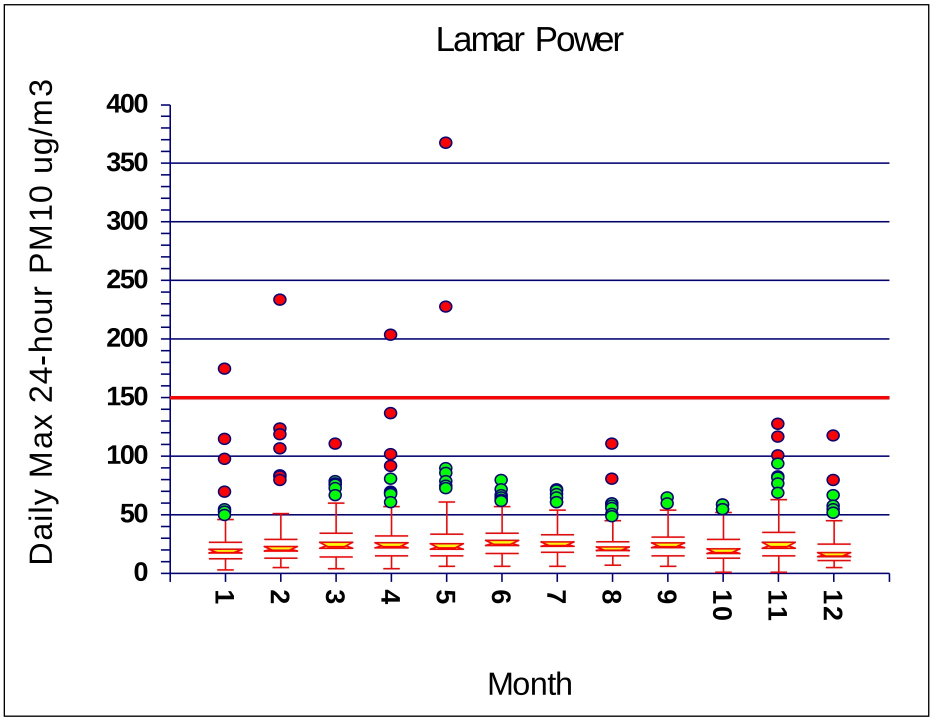


Figure 11. Box plot of daily maximum Lamar Power 24-hour PM10 concentrations in ug/m3 by month for January 2004 through February 2009.

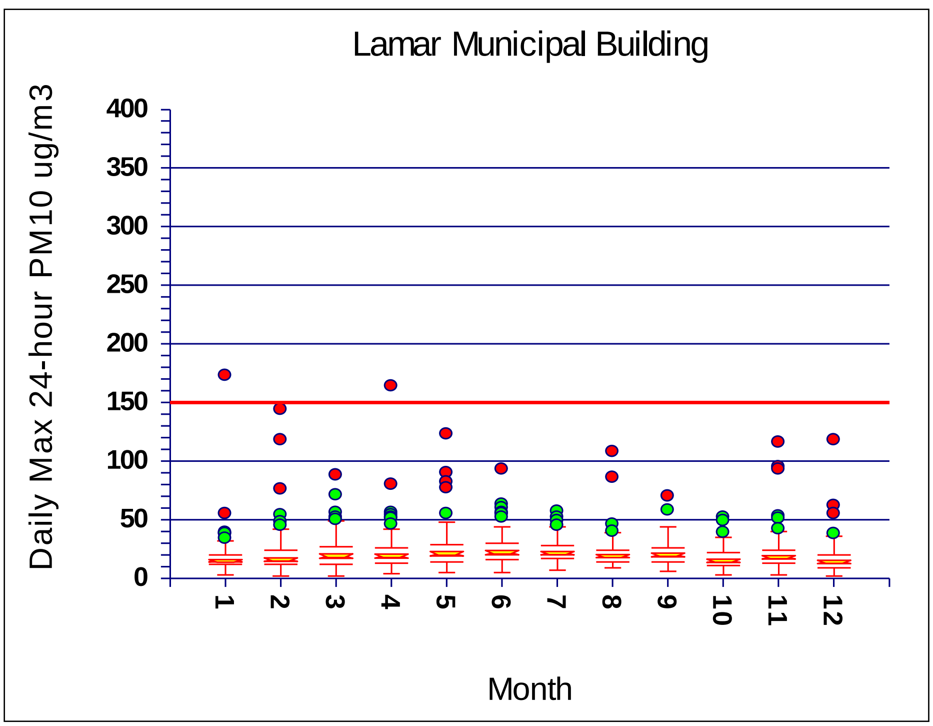


Figure 12. Box plot of daily maximum Lamar Municipal Building 24-hour PM10 concentrations in ug/m3 by month for January 2004 through February 2009.

Back Trajectory Analyses and Source Regions

NOAA HYSPLIT 36-hour back trajectories were calculated for Lamar for the eight 24-hour periods from 2004 through early 2009 with strong regional winds, dry soils, and either the Power Plant or Municipal Building PM10 concentrations in excess of 125 ug/m3. Each of these events was classified as a Cluster 5 blowing dust event in the cluster analysis previously discussed. Trajectories were modeled every 4 hours for each day. The 6 back trajectories for each day were calculated for an arrival height of 500 meters using EDAS40 data and model vertical velocities (see: http://www.arl.noaa.gov/HYSPLIT.php). The eight days used in the analysis and the monitor concentrations measured on these days are presented in Table 2.

The specific back trajectories for the periods with haze and/or elevated gusts at Lamar on these high-concentration days are shown in Figure 13. Transport for the highest concentrations generally falls into one of two categories. In one category, transport originates from the north-northwest through north and covers parts of northeastern and eastern Colorado. In the second, transport is from the west-southwest, southwest, or south and originates in southern Colorado, New Mexico, or Arizona.

Table 2. Lamar Power Plant and Municipal Building monitor days with concentrations for at least one site in excess of 125 ug/m3 and blowing dust conditions (from 2004 through early 2009).

Year	Month	Day	Lamar Power 24-hour PM10 concentration in ug/m3	Lamar Municipal 24-hour PM10 concentration in ug/m3
2008	5	2	367	90
2009	2	6	233	118
2008	5	22	227	123
2005	4	5	203	164
2009	1	19	174	173
2006	4	15	136	80
2006	11	14	127	116
2009	2	17	106	144

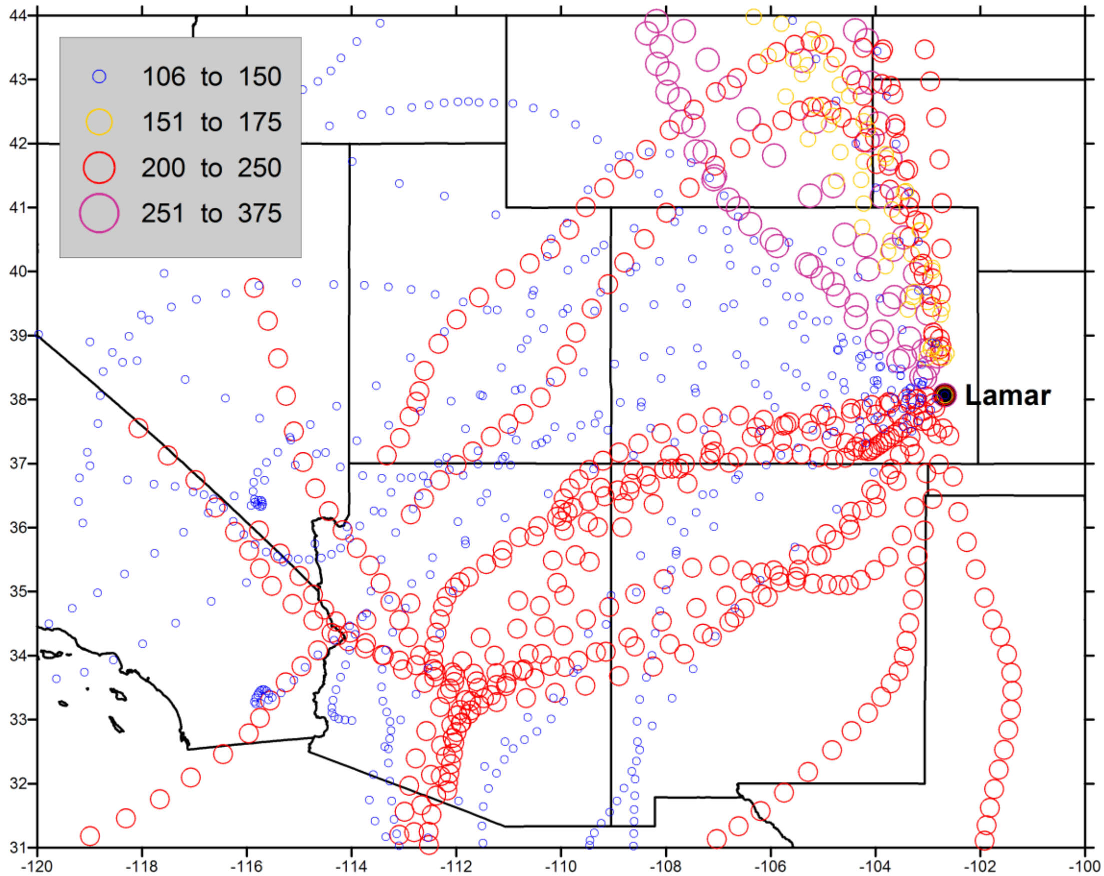


Figure 13. NOAA HYSPLIT 36-hour back trajectories for Lamar for the periods with haze and/or elevated gusts at Lamar on the eight Cluster 5 high-concentration days shown in Table 2. Trajectory points are sized and color-coded to reflect 24-hour PM10 concentrations at the Power Plant in ug/m3.

An analysis of the annual frequency of dust storms (Orgill and Sehmel, 1976) in the western half of the U.S. suggests that large areas of eastern Colorado, western Kansas, Texas, New Mexico and Arizona are source regions for blowing dust (see Figure 14). The back trajectories in Figure 13 cross these source areas and suggest that dust from upwind states can contribute to PM10 concentrations at Lamar during regional high-wind events.

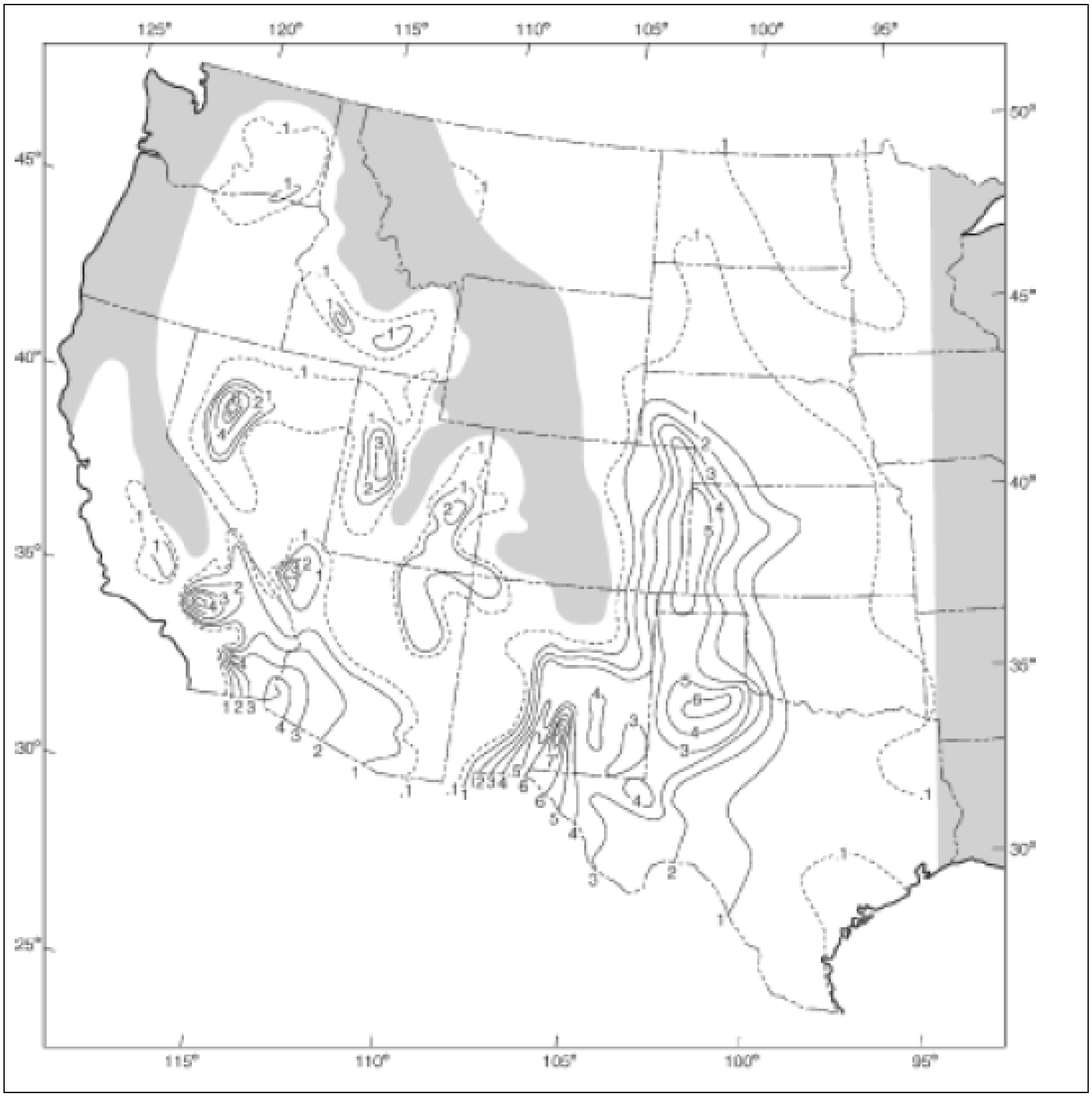


Figure 14. Number of dust storms per year from: Orgill, M.M., Sehmel, G.A., 1976. Frequency and diurnal variation of dust storms in the contiguous USA. *Atmospheric Environment 10*, 813–825.

Dust Transport Example 1

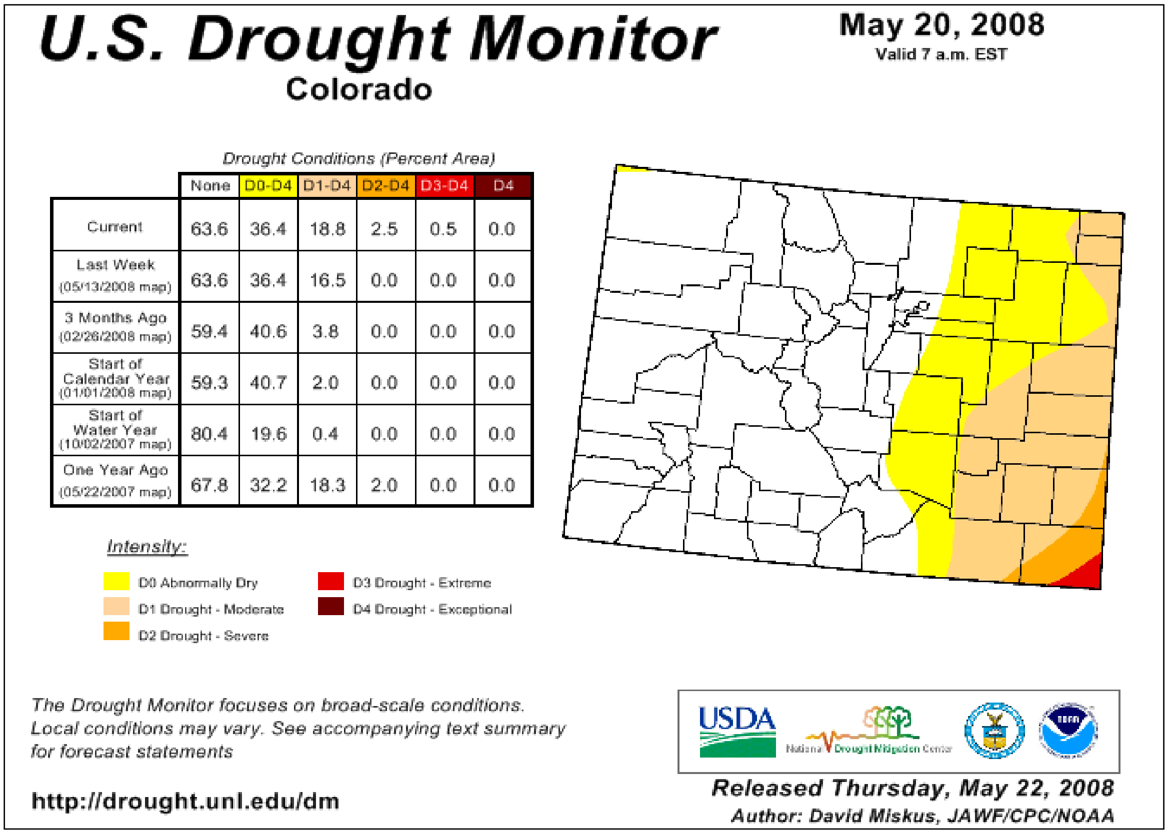
A blowing dust exceedance at Lamar on May 22, 2008, provides an example of a regional high-wind, blowing-dust event with transport from New Mexico into southeastern Colorado.

On Thursday May 22, 2008, Lamar Colorado recorded an exceedance of the twenty-four-hour PM10 standard with a concentration of 227 ug/m3 at the Lamar Power Plant. A twenty-four-hour PM10 concentration of 123 ug/m3 was measured at the Lamar Municipal Building on May 22. An intense surface low-pressure system was centered over Southeast Colorado with a strong upper level cut-off low over the Great Basin. The central pressure of the low-pressure system ranged from 985 to 987 mb while over southeast Colorado. The central pressure of the storm is significant since storms of about 1000 mb or lower were identified as a typical precondition for blowing dust in eastern Colorado when soils are dry (see reference for the *Natural Events Action Plan for High Wind Events – Lamar, Colorado* at the end of this attachment).

Sustained winds and gusts in eastern and southeastern Colorado exceeded blowing dust criteria. Many sites showed wind speeds in excess of 30 miles per hour (mph) and gusts in excess of 40 mph. Winds at Lamar were above the blowing dust thresholds for several hours on May 22, and gusts were as high as 58 mph.

Figure 15 shows that abnormally dry to moderate drought conditions prevailed in eastern and southeastern Colorado on May 6, 2008. Figure 16 shows that there was a significant soil moisture deficit in southeastern Colorado in April of 2008; and this deficit spread southward into Texas, southwestern Kansas, Oklahoma, and New Mexico.

This same storm system caused significant blowing dust in New Mexico and points south on May 21. A NOAA Operational Significant Event Imagery (OSEI) satellite product in Figure 17 shows blowing dust plumes identified by NOAA scientists in the southwestern U.S. and northern Mexico. Figures 18 and 19 provide additional satellite evidence for large-scale blowing dust in New Mexico on May 21. NOAA 24-hour HYSPLIT back trajectories for a several-hour period at Lamar on May 22 (the windiest period in southeast Colorado - each hour from 11 AM MST to 6 PM MST) in Figure 20 show that the air mass over Lamar on May 22 had its origins in New Mexico and Texas on May 21. Figures 21 and 22 show the relationships between these back trajectories and PM10 exceedances and blowing dust on the previous day. (Available satellite imagery for Colorado does not show any obvious blowing dust on either May 21 or May 22, 2008.) Twenty-four hour PM10 concentrations in southern New Mexico ranged from near 200 ug/m3 to just over 1000 ug/m3 on May 21. Back trajectories clearly suggest that some of the PM10 in the atmosphere over Lamar on May 22 had been transported from the dust storm stricken areas of New Mexico on May 21.



	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	63.6	36.4	18.8	2.5	0.5	0.0
Last Week (05/13/2008 map)	63.6	36.4	16.5	0.0	0.0	0.0
3 Months Ago (02/26/2008 map)	59.4	40.6	3.8	0.0	0.0	0.0
Start of Calendar Year (01/01/2008 map)	59.3	40.7	2.0	0.0	0.0	0.0
Start of Water Year (10/02/2007 map)	80.4	19.6	0.4	0.0	0.0	0.0
One Year Ago (05/22/2007 map)	67.8	32.2	18.3	2.0	0.0	0.0

Figure 15. Drought status for the Colorado on May 20, 2008 (source: the USDA, NOAA, and the National Drought Mitigation Center at: http://drought.unl.edu/dm/archive.html).

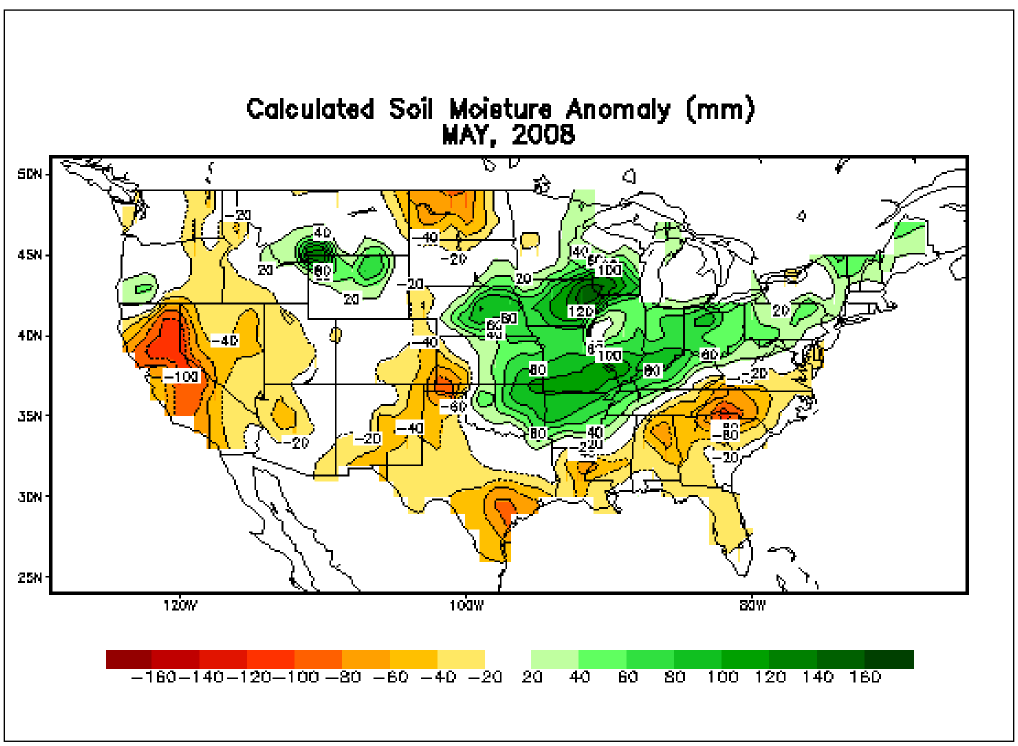


Figure 16. Calculated Soil Moisture Anomaly (mm) May 2008 (http://www.ncdc.noaa.gov/img/climate/research/2008/may/cpc-soil-moist-anom-200806.gif).

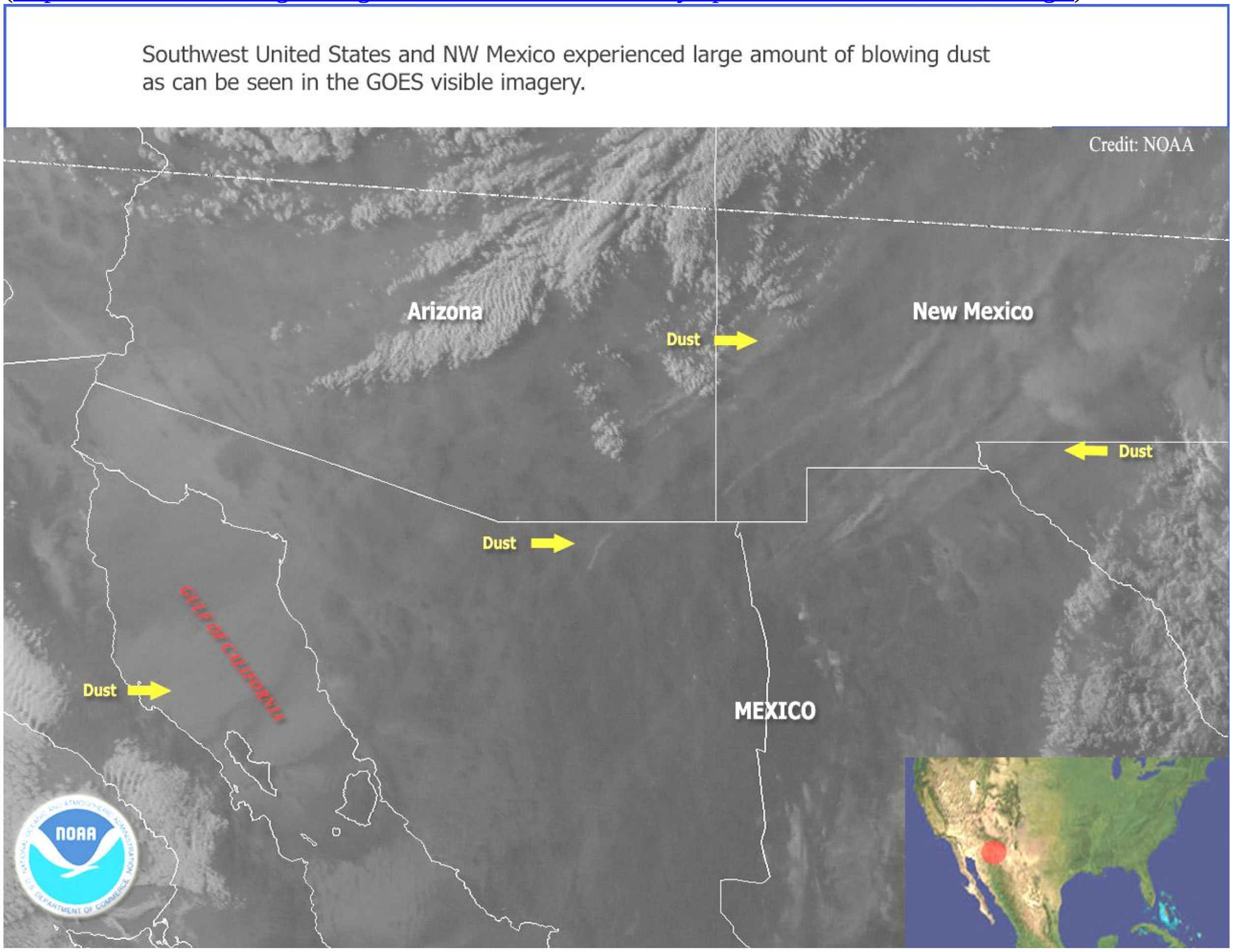


Figure 17. Plumes of blowing dust are visible across southern Arizona, New Mexico, northern New Mexico, and the Gulf of California in this NASA MODIS satellite image for 6:45 PM MDT on May 21, 2008. (source: http://www.osei.noaa.gov/Events/Dust/US_Southwest/2008/DSTusmx142_G12.jpg)

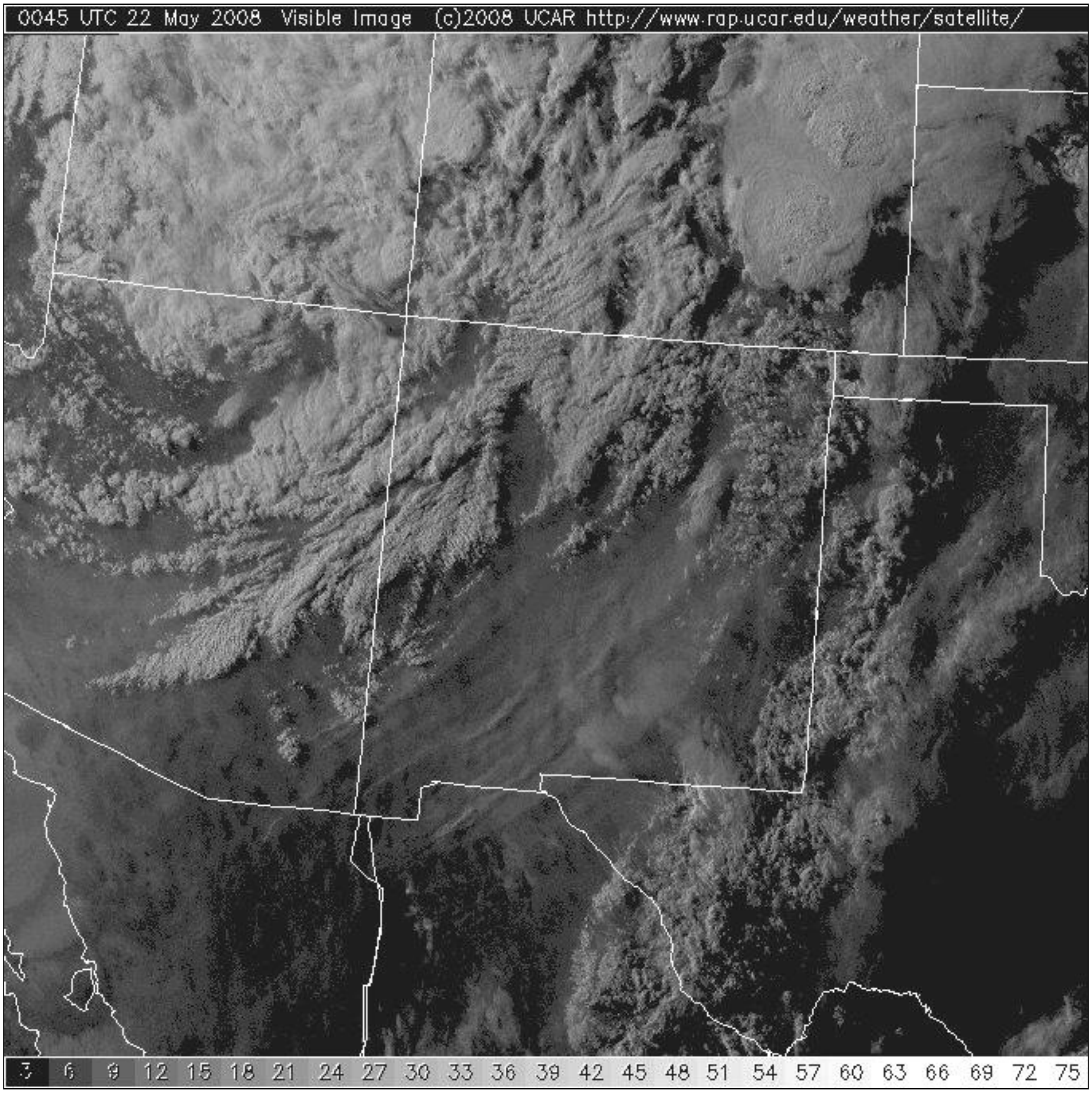


Figure 18. Visible satellite image of the southwestern U.S. for 6:45 PM MDT on May 21, 2008, showing pronounced southwest to northeast trending plumes of blowing dust in New Mexico.

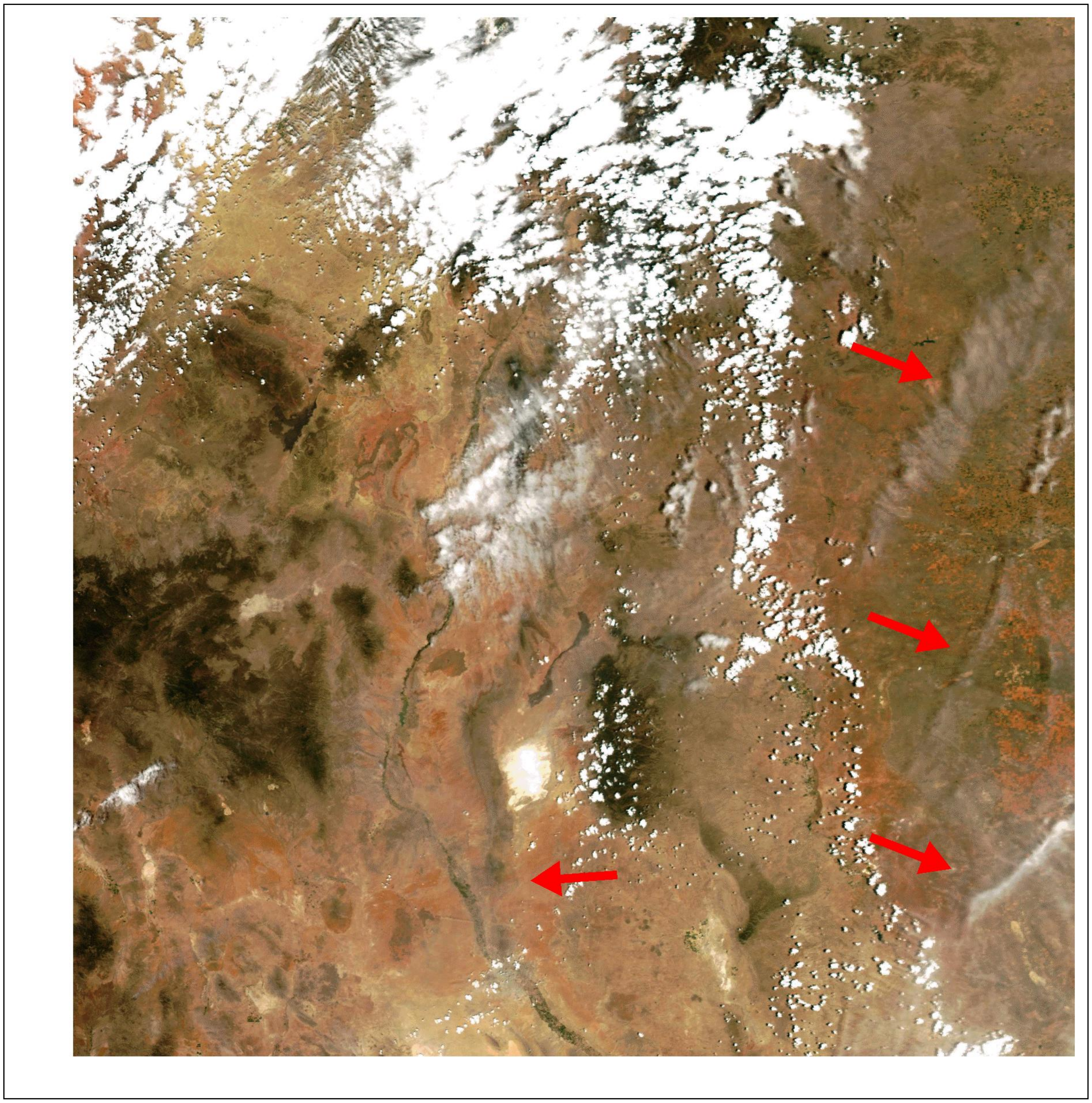


Figure 19. Visible satellite image of New Mexico at 1:40 PM MST, May 21, 2008. Plumes and areas of blowing dust are marked with an arrow (http://activefiremaps.fs.fed.us/imagery.php?op=fire&passID=51054&month=5&year=2008).

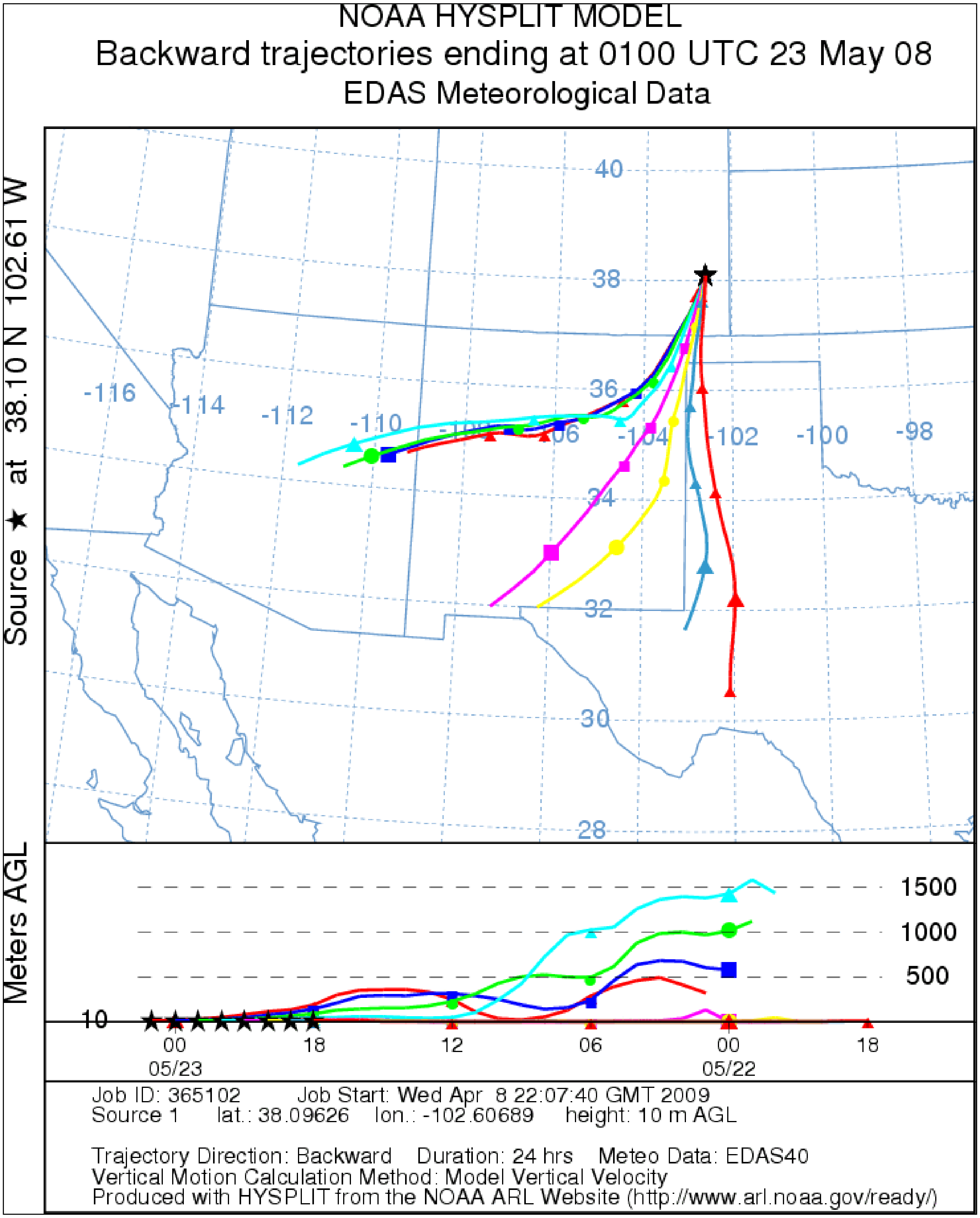


Figure 20. NOAA HYSPLIT 24-hour back trajectories for Lamar Colorado for each hour from 11 AM MST to 6 PM MST on May 22, 2008.

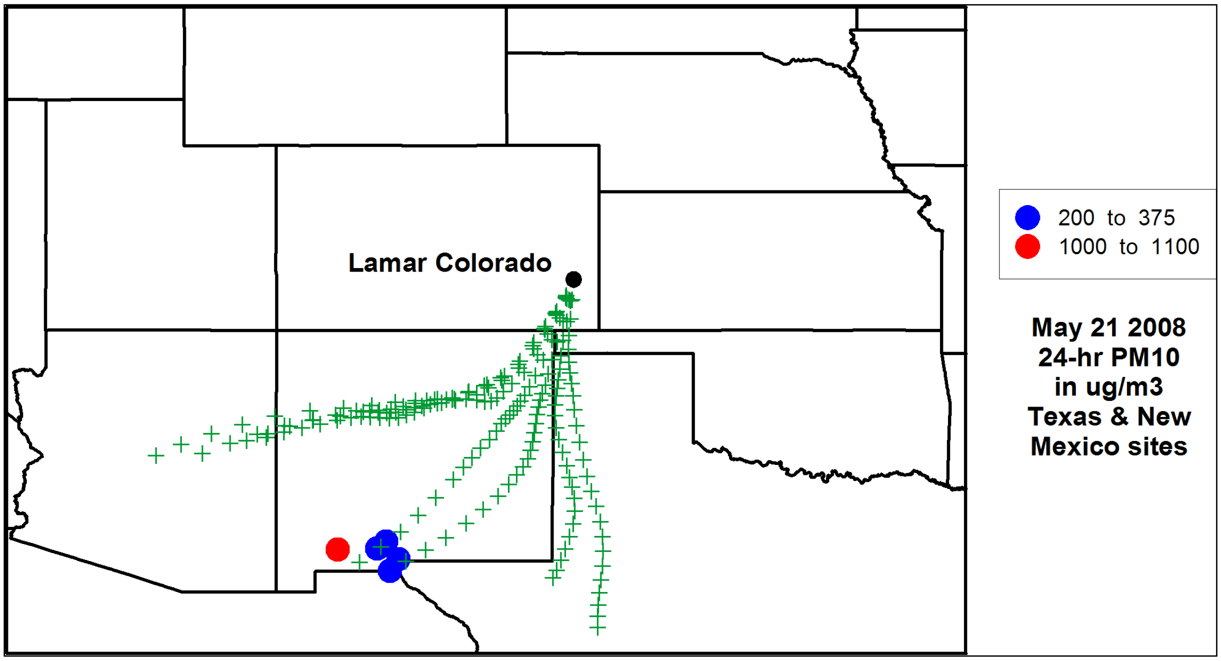


Figure 21. NOAA HYSPLIT 24-hour back trajectories for Lamar Colorado from Figure 20 and May 21 PM10 exceedance concentrations in southern New Mexico and Texas.

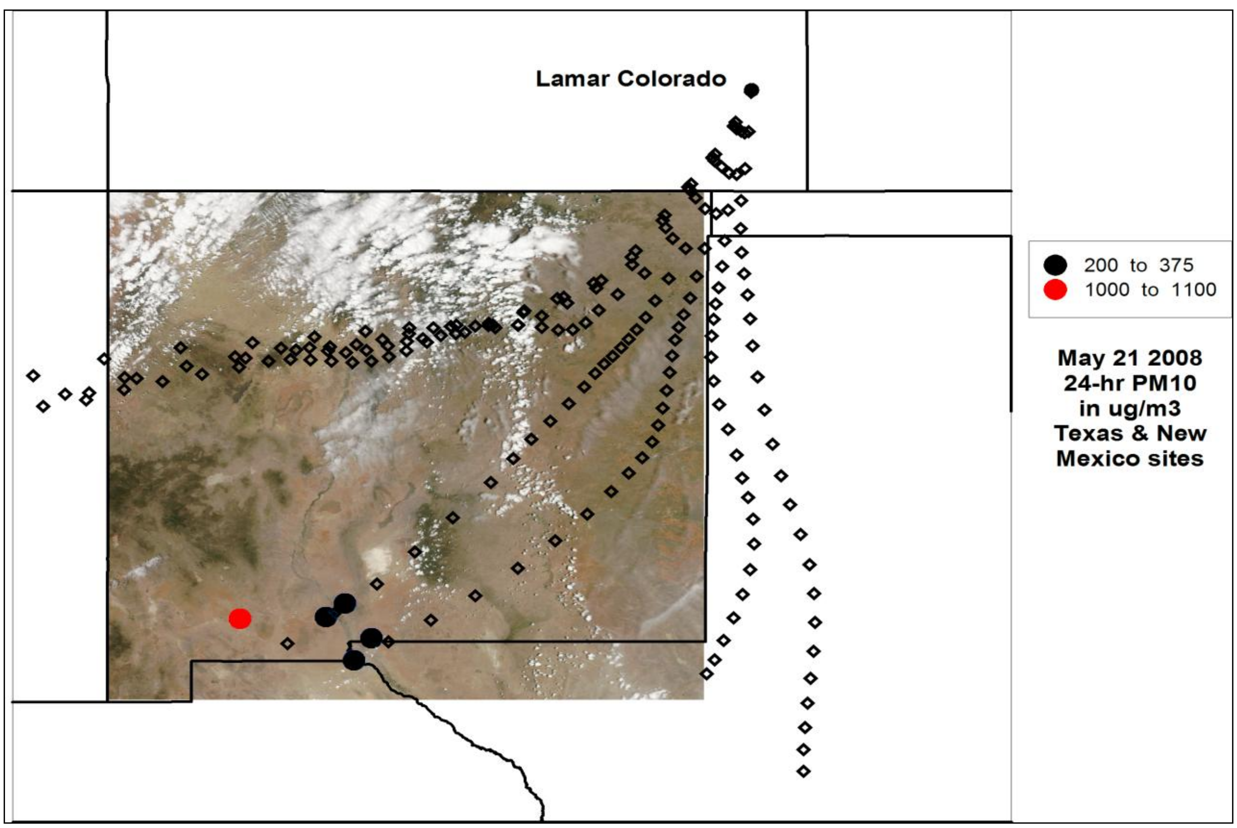


Figure 22. NOAA HYSPLIT 24-hour back trajectories for Lamar Colorado from Figure 20, May 21 PM10 exceedance concentrations in southern New Mexico and Texas, and May 21 visible satellite image from Figure 19.

Dust Transport Example 2

A blowing dust exceedance at Lamar on January 19, 2009, provides an example of a regional high-wind, blowing-dust event with transport from eastern and northeastern Colorado and southwestern Nebraska into southeastern Colorado. On Monday January 19, 2009, Lamar, Colorado, recorded exceedances of the twenty-four-hour PM10 standard with a concentration of 174 ug/m3 at the Lamar Power Plant monitor and 173 ug/m3 at the Lamar Municipal Building monitor. These exceedances were the consequence of strong northerly winds in combination with dry conditions, which caused significant blowing dust across the plains of eastern Colorado, western Kansas, and western Nebraska. The winds were partly the result of a strong pressure gradient between a 1048 millibar high pressure system over the western U.S. and a complex series of low pressure systems over the eastern U.S.

These surface features were associated with a high amplitude upper level trough centered over the Ohio Valley and an upper level ridge centered over northern Idaho. Figure 23 shows the 700 millibar analysis for 12Z January 19 (5 AM MST January 19). The 700-millibar level is at approximately 10,000 feet above sea level. There was a wind speed maximum of 60 to 70 knots at this level that stretched from the Texas Panhandle to western South Dakota including eastern Colorado and western Nebraska. Once the morning inversion had dissipated the momentum associated with the 700-millibar wind speed maximum mixed down to the surface intensifying the winds induced by the surface pressure gradient. In Figure 24 the 700 millibar analysis for 00Z January 20, 2009, (5 PM MST January 19) continues to show 40 to 50 knot winds over eastern Colorado and western Nebraska.

The combination of the mixing and the tight surface pressure gradient caused surface winds of 30 to 40 mph with gusts of 35 to 60 mph. Winds of this strength will cause blowing dust if soils are dry. Wind speeds of 30 mph or greater and gusts of 40 mph or higher have been shown to cause blowing dust in eastern Colorado (see reference for the *Natural Events Action Plan for High Wind Events – Lamar, Colorado* at the end of this attachment). The conditions necessary for strong gusty winds were in place over the area of concern for the daytime hours of January 19, 2009.

Figures 25 and 26 show surface maps for eastern Colorado and western Kansas for some of the hours with the strongest vertical mixing of the atmosphere. They show wind speeds across the region of 20 to 40 mph and wind gusts of 25 to 51 mph. Once again, wind speeds and gust speeds exceeded thresholds that have been shown to cause blowing dust in eastern Colorado (see reference for the *Natural Events Action Plan for High Wind Events – Lamar, Colorado* at the end of this attachment).

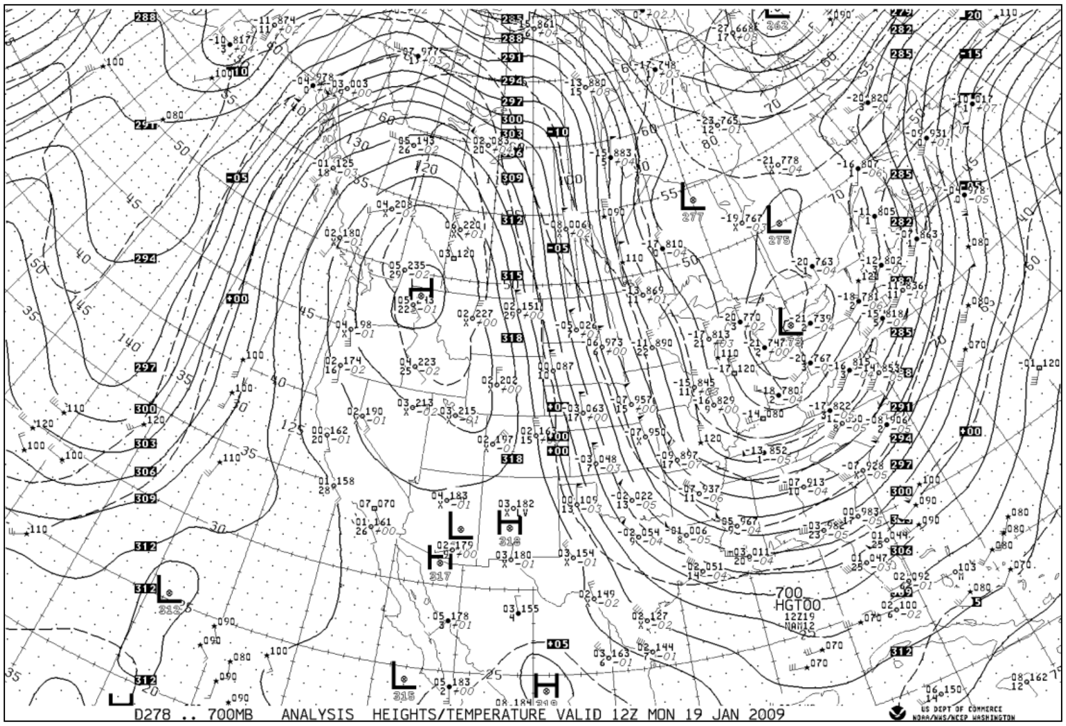


Figure 23. 700 millibar analysis for 12Z January 19, 2009, or *5 AM MST January 19, 2009*, (from Colorado State University's archive of National Weather Service fax maps: http://archive.atmos.colostate.edu/).

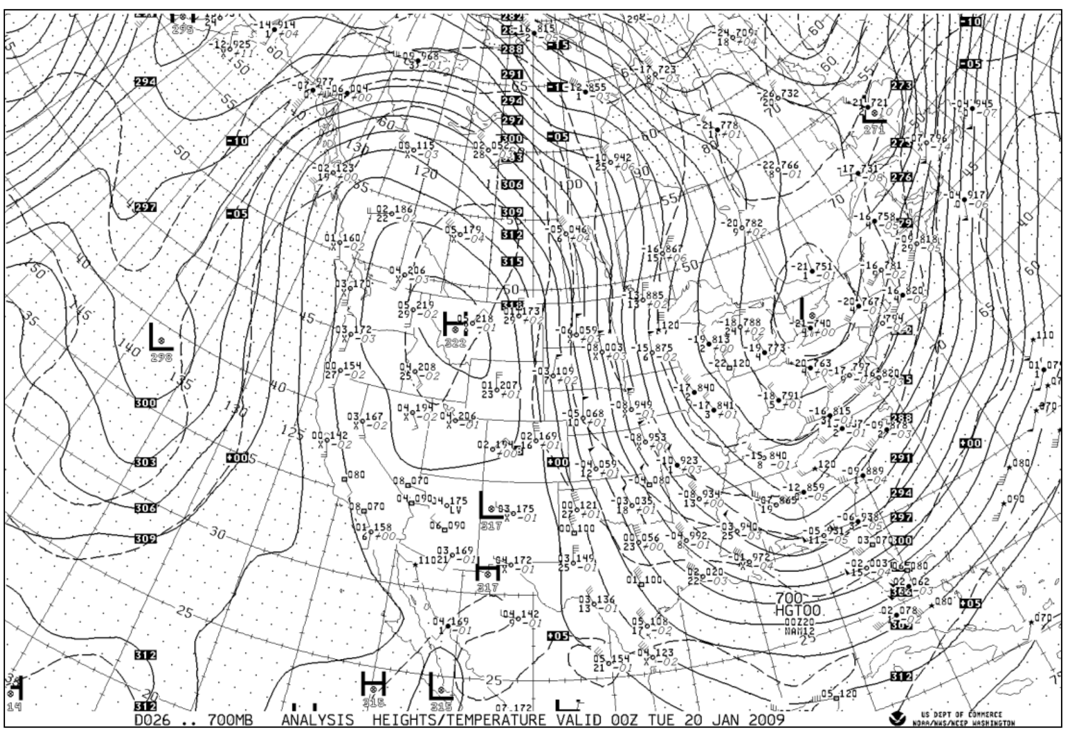


Figure 24. 700 millibar analysis for 00Z January 20, 2009, or *5 PM MST January 19, 2009*, (from Colorado State University's archive of National Weather Service fax maps: http://archive.atmos.colostate.edu/).

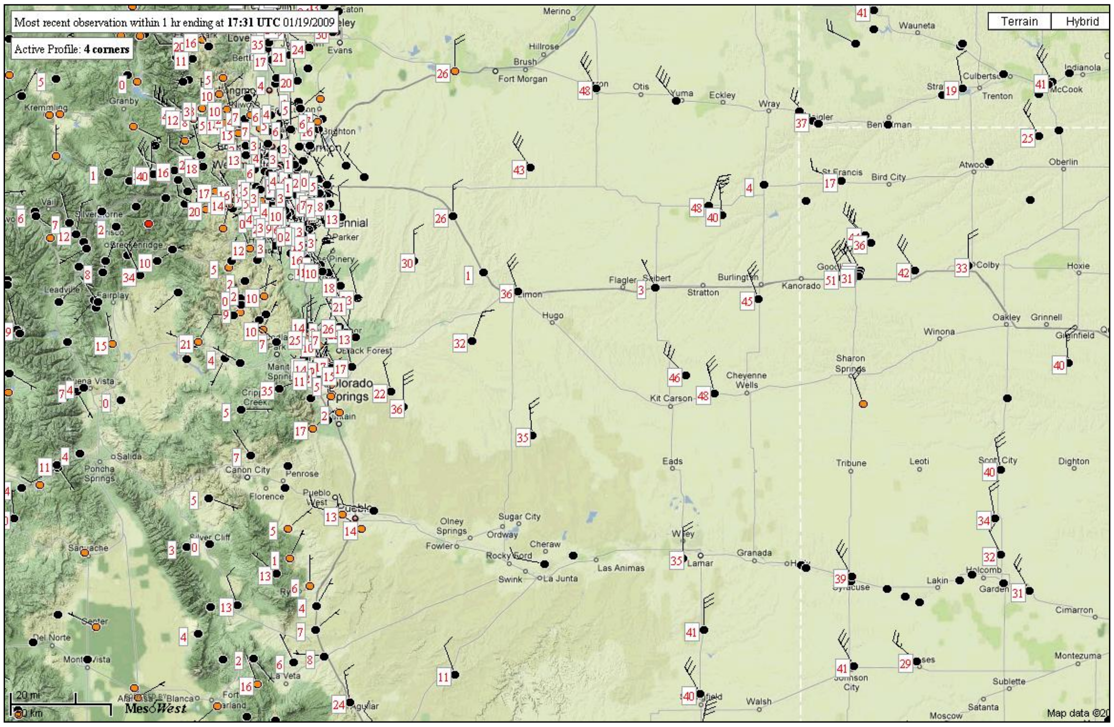


Figure 25. Wind directions and gust speeds in mph in eastern Colorado and western Kansas 17:31 UTC January 19, 2009 (10:31 AM MST on January 19, 2009). (http://mesowest.utah.edu/index.html)

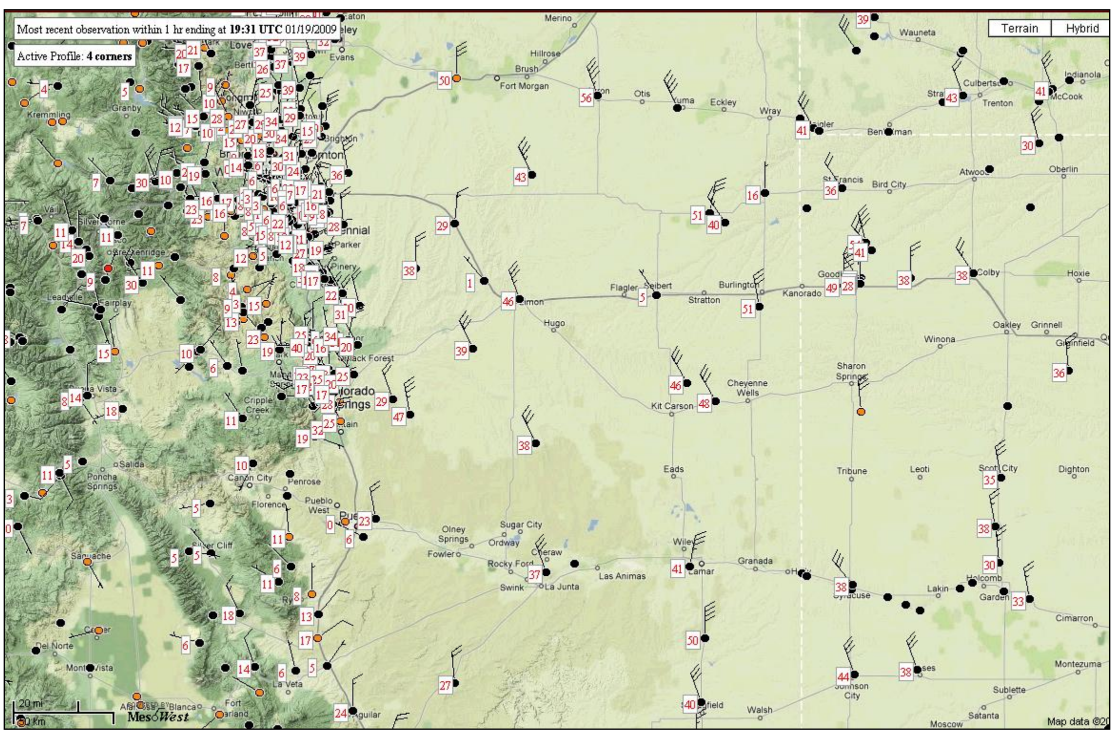


Figure 26. Wind directions and gust speeds in mph in eastern Colorado and western Kansas 19:31 UTC January 19, 2009 (12:31 PM MST on January 19, 2009). (http://mesowest.utah.edu/index.html)

Figure 27 shows the percent of normal precipitation for Colorado during January 2009. Most of eastern Colorado had less than 50 percent of normal precipitation. This lack of precipitation was not limited to January. The region had been abnormally dry since November of 2008 as shown in Figure 28. Figure 28 indicates that most of eastern Colorado had below normal precipitation, and the area around Lamar had less than 50 percent of normal precipitation from November 2008 through January 2009. Figure 29 shows that most of eastern Colorado had less than one inch of total precipitation in the three months of November 2008 through January 2009. Figure 30, shows that Prowers County, Colorado (the county Lamar is in), was classified as having moderate drought conditions on January 20 and most of eastern Colorado had abnormally dry conditions.

Tables 3 through 6 show the National Weather Service observations for the eastern Colorado sites of Akron, Burlington, Limon, and Lamar. Winds of 30 mph or greater, wind gusts of 40 mph or greater, reduced visibility, and the weather type of "haze" are highlighted in yellow. Note that Burlington is the only town not located in an area classified as having Moderate Drought or Abnormally Dry conditions. Burlington only had three hours of reduced visibility. This is the fewest hours of reduced visibility of the four stations. Lamar had the greatest number with nine hours of reduced visibility. Lamar reported four hours with haze and six hours with reduced visibility after the winds had died down to values below the thresholds needed to cause blowing dust. *The only explanation for the haze and reduced visibility after the winds had subsided would be dust that was transported into the Lamar area from areas far upwind.*

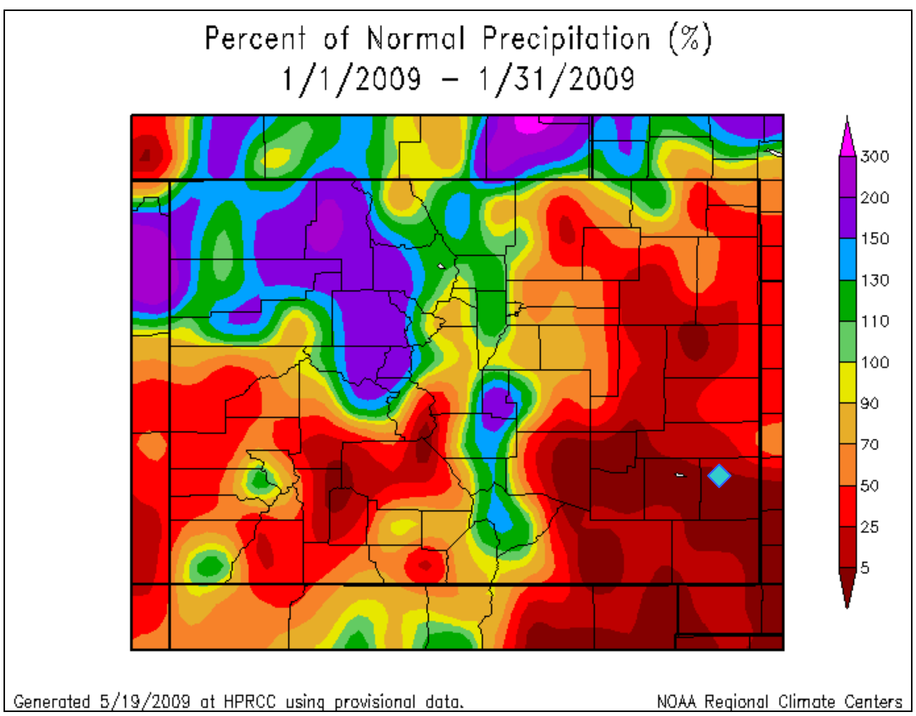


Figure 27. Percent of Normal Precipitation for January 2009, source High Plains Regional Climate Center (http://www.hprcc.unl.edu/maps/current/index.php?action=update_userdate&daterange=Jan&year=09). Blue diamond shows the approximate location of Lamar.

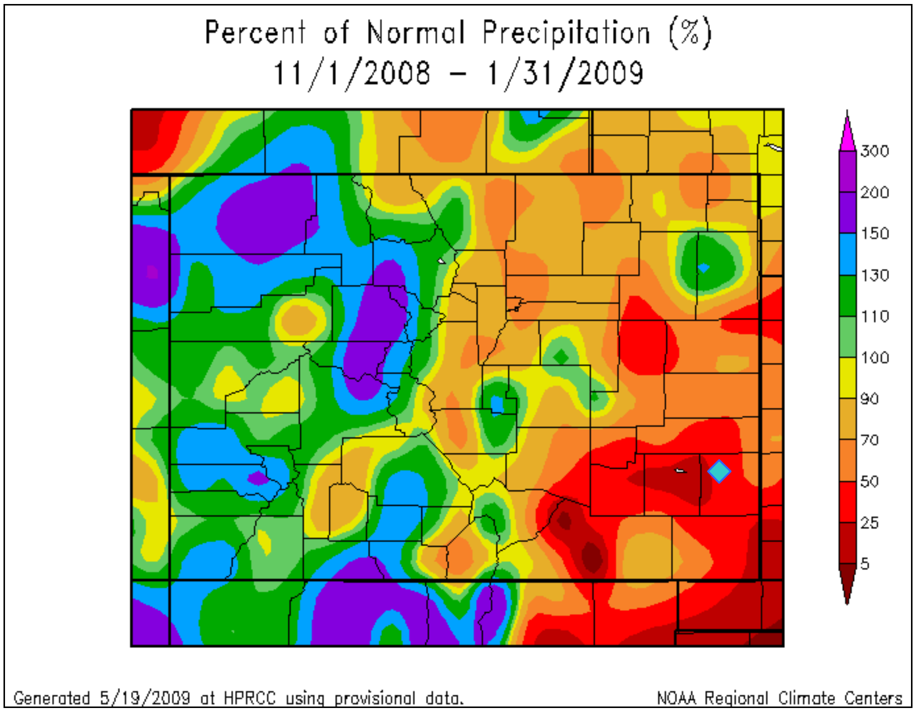


Figure 28. Percent of Normal Precipitation for 11/1/2008 – 1/31/2009, source High Plains Regional Climate Center (http://www.hprcc.unl.edu/maps/current/index.php?action=update_product&product=PNorm). Blue diamond shows the approximate location of Lamar.

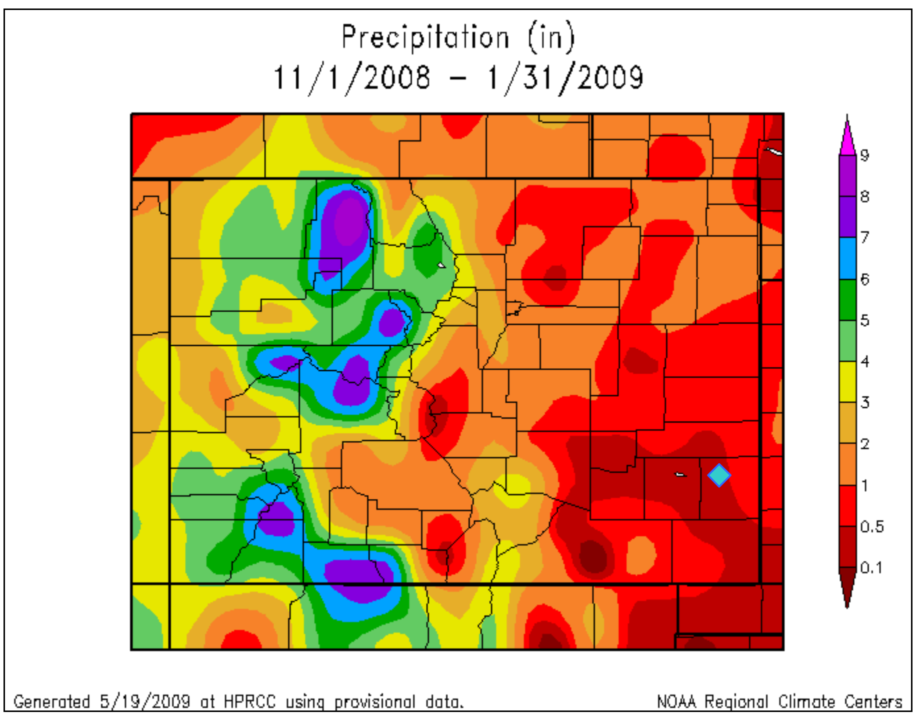


Figure 29. Precipitation in inches for 11/1/2008 – 1/31/2009, source High Plains Regional Climate Center (http://www.hprcc.unl.edu/maps/current/index.php?action=update_product&product=PNorm). Blue diamond shows the approximate location of Lamar.

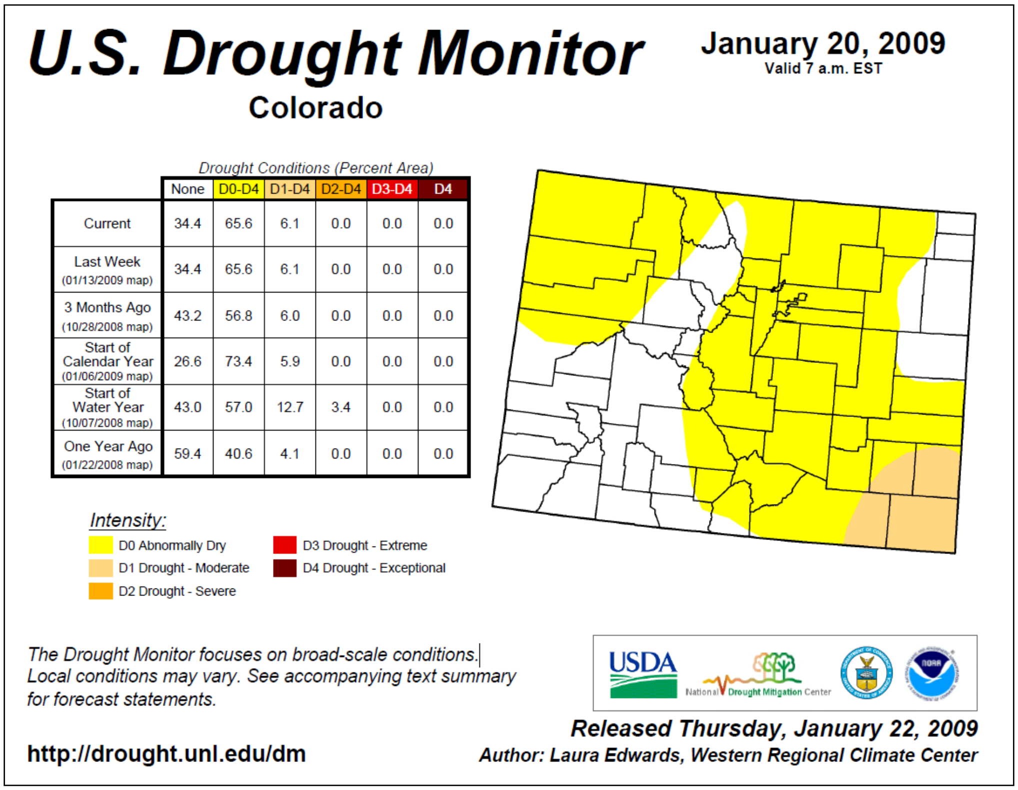


Figure 30. Drought status for the Colorado on January 20, 2009 (source: the USDA, NOAA, and the National Drought Mitigation Center at: http://drought.unl.edu/dm/archive.html).

Table 3. Wind and weather observations for Akron, Colorado, reported by the University of Utah MesoWest site (http://mesowest.utah.edu/index.html) for January 19, 2009. Speeds at or above the blowing dust thresholds and haze and reduced visibility (caused by dust) have been highlighted in yellow.

Time in MST January 19	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
23:53	33.1	38	15		300	clear	10
22:53	33.1	41	12		310	clear	10
21:53	33.1	45	12		320	clear	10
20:53	30.9	49	10		340	clear	10
19:53	37	40	13		340	clear	10
18:53	44.1	31	21		340	clear	10
17:53	46.9	29	25	35	340	clear	10
16:53	50	25	23	31	350	clear	10
16:30	51.8	24	28	36	340	partly cloudy	10
15:53	54	20	32	44	340	mostly cloudy	7
15:24	55.4	18	37	47	340	haze	6
14:53	55.9	18	33	43	350	haze	4
14:05	57.2	14	36	47	350	haze	3
13:53	57	13	38	48	350	haze	2.5
13:29	57.2	12	30	44	340	haze	3
13:18	57.2	11	38	53	340	haze	2.5
12:53	57.9	11	35	49	330	haze	3
12:41	57.2	11	41	52	340	haze	3
12:23	57.2	10	43	56	340	haze	2
12:15	57.2	10	48	56	330	haze	3
11:53	57.9	10	41	54	340	haze	2.5
11:38	57.2	10	38	53	340	haze	4
10:53	57	10	37	48	330	clear	10
9:53	54	13	37	48	330	clear	10
8:53	50	18	29	39	320	clear	10
7:53	44.1	24	21	30	300	clear	10
6:53	42.1	27	17	25	300	clear	10
5:53	42.1	29	20		310	clear	10
4:53	39.9	31	14	22	290	clear	10
3:53	43	27	20	26	290	clear	10
2:53	43	29	21	28	300	clear	10
1:53	43	30	21		300	clear	10
0:53	45	28	24	32	300	clear	10

Table 4. Wind and weather observations for Burlington, Colorado, reported by the University of Utah MesoWest site (http://mesowest.utah.edu/index.html) for January 19, 2009. Speeds at or above the blowing dust thresholds and haze and reduced visibility (caused by dust) have been highlighted in yellow.

Time in MST January 19	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
23:53	30	58	12		330	clear	10
22:53	33.1	53	12		330	clear	10
21:53	34	49	10		330	clear	10
20:53	37	44	15		350	clear	10
19:53	39	39	12		360	clear	10
18:53	42.1	33	16		360	clear	10
17:53	45	28	17		10	clear	10
16:53	50	21	20	26	10	clear	10
15:53	55.9	16	23	32	360	clear	10
14:53	59	15	32	46	350	clear	10
13:53	61	14	36	49	350	clear	7
12:53	61	10	36	51	350	haze	6
11:53	60.1	10	31	51	350	clear	9
10:53	57.9	11	33	47	350	clear	10
9:53	55.9	13	30	45	340	clear	10
8:53	52	17	28	37	340	clear	10
7:53	48.9	19	30	41	330	clear	10
6:53	46.9	24	25	33	330	clear	10
5:53	46.9	24	21	32	330	clear	10
4:53	48	25	30	39	330	clear	10
3:53	46.9	26	26	37	330	clear	10
2:53	46.9	27	29	41	330	clear	10
1:53	48	26	30	43	320	clear	10
0:53	48	27	30	43	330	clear	10

Table 5. Wind and weather observations for Limon, Colorado, reported by the University of Utah MesoWest site (http://mesowest.utah.edu/index.html) for January 19, 2009. Speeds at or above the blowing dust thresholds and haze and reduced visibility (caused by dust) have been highlighted in yellow.

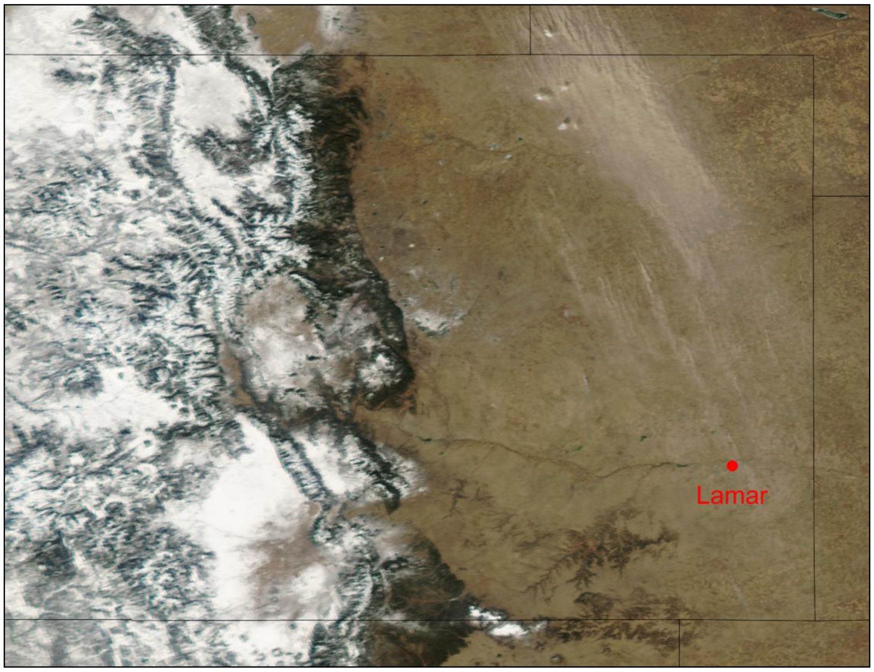
Time in MST January 19	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
23:55	36	32	14		340	clear	10
22:55	39.9	26	23	32	340	clear	10
21:55	39.9	26	20		330	clear	10
20:55	41	24	18		330	clear	10
19:55	44.1	20	24	36	340	clear	10
18:55	45	22	23	33	340	clear	10
17:55	45	24	13	24	350	clear	10
16:55	50	20	23	33	350	clear	10
15:55	55	17	30	48	350	clear	8
14:55	57	13	33	48	340	clear	7
14:30	57.2	11	35	52	340	haze	5
14:23	57.2	11	38	52	340	haze	2.5
13:55	57.9	11	44	54	340	haze	4
13:44	57.2	10	43	56	340	haze	5
13:33	57.2	10	39	49	340	haze	4
13:19	57.2	10	37	56	340	haze	2.5
13:06	59	9	41	56	340	haze	3
12:55	59	10	43	55	340	clear	10
11:55	57.9	9	37	46	340	clear	10
10:55	57	10	33	48	340	clear	10
9:55	53.1	14	29	36	340	clear	10
8:55	46	21	28	33	330	clear	10
7:55	37	35	12		340	clear	10
6:55	33.1	41	12		290	clear	10
5:55	33.1	43	13		290	clear	10
4:55	37.9	34	16		330	clear	10
3:55	41	30	21		340	clear	10
2:55	42.1	27	22	28	340	clear	10
1:55	44.1	25	21	31	340	clear	10
0:55	45	26	26	33	340	clear	10

Table 6. Wind and weather observations for Lamar, Colorado, reported by the University of Utah MesoWest site (http://mesowest.utah.edu/index.html) for January 19, 2009. Speeds at or above the blowing dust thresholds and haze and reduced visibility (caused by dust) have been highlighted in yellow.

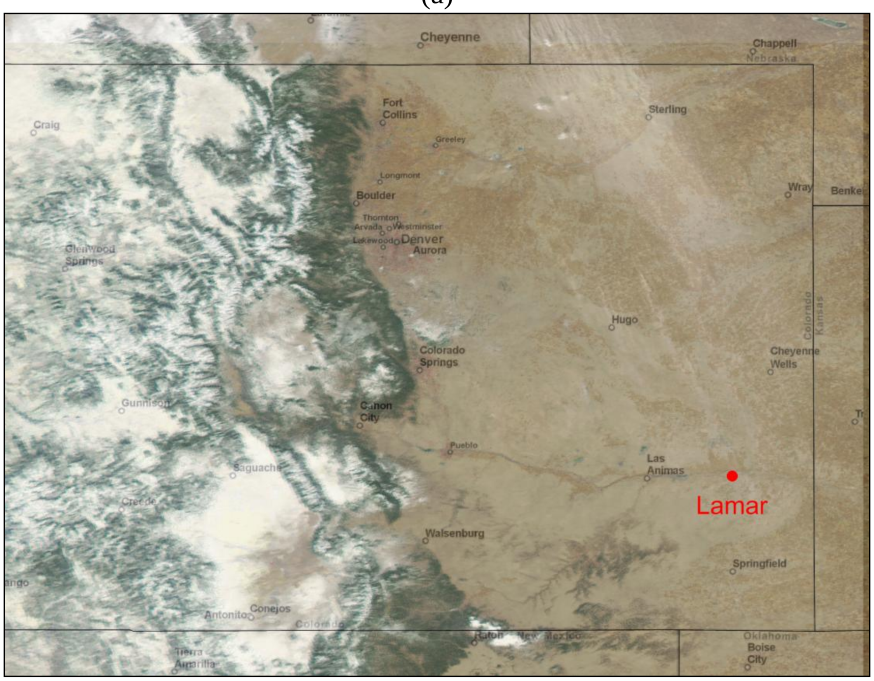
Time in MST January 19	Temperature Degrees F	Relative Humidity in %	Wind Speed in mph	Wind Gust in mph	Wind Direction in Degrees	Weather	Visibility in miles
23:53	30	48	7		340	clear	10
22:53	33.1	43	7		350	clear	10
21:53	37	37	7		20	clear	10
20:53	41	33	9		20	clear	9
19:53	43	30	10		10	clear	8
18:53	48.9	23	10		10	haze	6
18:41	48.2	23	8		10	haze	6
17:53	55	18	15		20	haze	5
16:53	57.9	14	13	22	30	haze	4
16:40	60.8	12	16	28	20	haze	4
15:53	62.1	13	26	37	20	haze	4
14:53	64.9	9	30	38	10	clear	7
13:53	66.9	7	35	45	20	haze	6
12:53	66.9	6	32	40	20	clear	10
11:53	66.9	6	36	41	10	clear	9
10:53	64	9	23	31	350	clear	10
9:53	57.9	12	22	35	360	clear	10
8:53	54	16	22	29	330	clear	10
7:53	43	27	14		320	clear	10
6:53	37	35	9		290	clear	10
5:53	37.9	34	10		320	clear	10
4:53	39.9	31	10		320	clear	10
3:53	39.9	31	13		300	clear	10
2:53	41	31	14		300	clear	10
1:53	42.1	30	13		300	clear	10
0:53	42.1	29	13		310	mostly clear	10

Figure 31 presents two versions of the NASA MODIS true color satellite picture of Colorado at 19:27Z January 19, 2009 (12:27 MST January 19, 2009) (from the USFS site at http://activefiremaps.fs.fed.us/imagery.php?op=fire&fireID=co-000).

A large area of blowing dust in north-to-south lines can be seen over northeastern Colorado with smaller areas across the rest of eastern Colorado. This picture was taken near the beginning of the blowing dust episode. The blowing dust would become more wide spread over the next couple of hours. Figure 32 contains back trajectory plots for Lamar during the peak period of winds and reduced visibilities. These back trajectories are from the NOAA HYSPLIT model using high-resolution NAM12 meteorological input data (http://ready.arl.noaa.gov/HYSPLIT.php). The back trajectory paths in Colorado, Wyoming, and Nebraska are completely consistent with the observed dust plumes in the MODIS imagery.



(a)



(b)

Figure 31. (a) MODIS satellite picture of Colorado at 19:27Z January 19, 2009 (12:27 MST January 19, 2009) and (b) the same image with town and city labels. (http://activefiremaps.fs.fed.us/resources/2009019/co-000/crefl2_A2009019192756-2009019193607_250m_co-000_143.jpg).

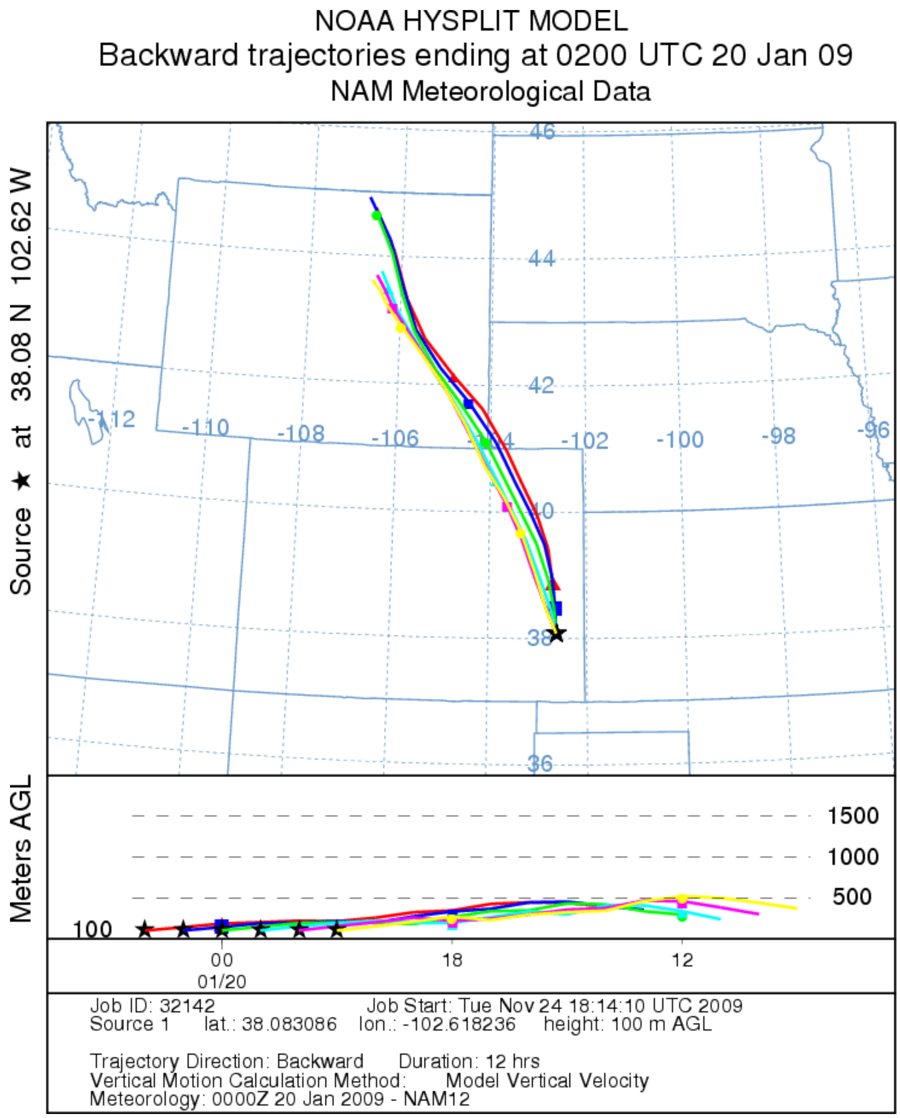


Figure 32. NOAA HYSPLIT 12-hour back trajectory plots for each hour during the windiest period on January 19, 2009. The HYSPLIT model run was based on data from the high-resolution 12-kilometer grid spacing NAM numerical weather model.

Landform Signs of Blowing Dust

Surface geologic features in some areas of eastern Colorado reflect the effects of wind-blown dust caused by passing, intense low pressure systems and their associated cold fronts (see Figure 33). Eolian or wind-blown soil deposits can be seen in this aerial image of the area immediately to the west and south of Kit Carson, Colorado, which is about 50 miles north of Lamar. These north-northwest to south-southeast trending lines are caused by strong northerly to north-northwesterly winds. The Air Pollution Control Division does not know whether these features were created in the centuries immediately after the last Ice Age, the Dust Bowl years, during recent events, or in some combination of these; but the structures point to wind patterns that have been a consistent part of the climate of eastern Colorado for thousands of years. This part of Colorado has been subject to dust storms since the end of the last Ice Age.

Figure 33. Eolian or wind-blown soil structures in the area immediately to the west and south of Kit Carson, Colorado, which is about 50 miles north of Lamar.

Source Areas and Emissions Controls

What are the likely sources for blowing dust measured during exceedance events at these two PM10 monitoring sites in Lamar? Three categories are considered here. The first category includes local sources within the Lamar PM10 Non-attainment area (NAA), which is shown along with land use categories in Figures 34 through 36. The land use categories within the NAA include low and high-density residential, grasslands, and the commercial, industrial, and transportation category.

The Lamar Redesignation Request and Maintenance Plan (Colorado Department of Public Health and Environment, 2001) and the Revised Natural Events Action Plan (Colorado Department of Public Health and Environment et al., 2003) indicate that many BACM measures have been applied to reduce fugitive dust. Roads within the NAA are largely paved. According to the EPA (Federal Register: October 25, 2005 (Volume 70, Number 205, Rules and Regulations, Page 61563-61567), there were four monitoring stations in the Lamar area in 2004:

"…two of which have been monitoring PM_{10} since the mid-1970s and the other two started monitoring this year for a special study that was at the request of the Prowers Local Health Department to monitor potential impacts from nearby feed lots. The two special purpose monitors (SPM) operated for 6 months (March to September, 2004) on an every 6th day schedule. Both monitors recorded lower values than the permanent PM_{10} monitors that run on an every day schedule. The highest 24-hour value recorded was 69 ug/m3 at the Red Barn station, well below the 24-hour 150 g/m3 PM_{10} standard."

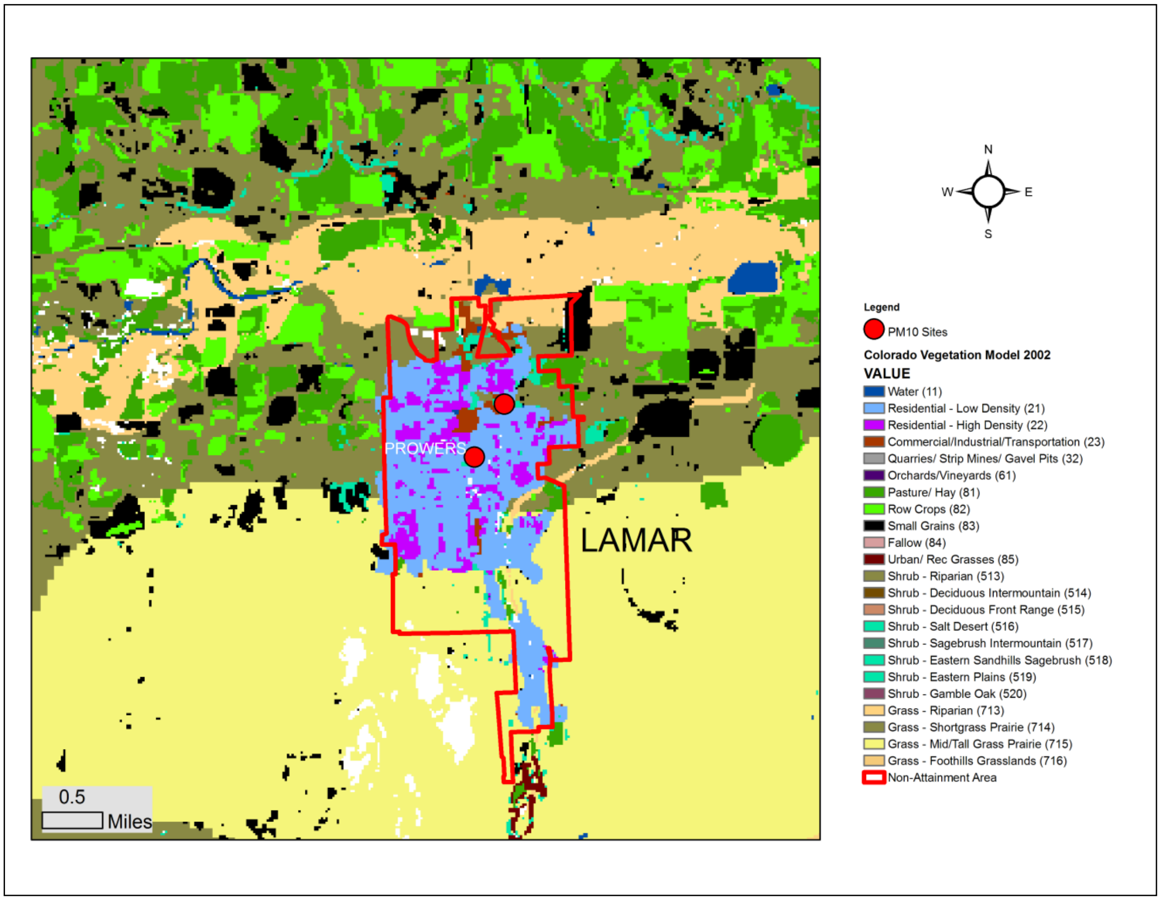


Figure 34. The Lamar PM10 Non-attainment Area (outlined in red) and vegetative cover and land use categories.

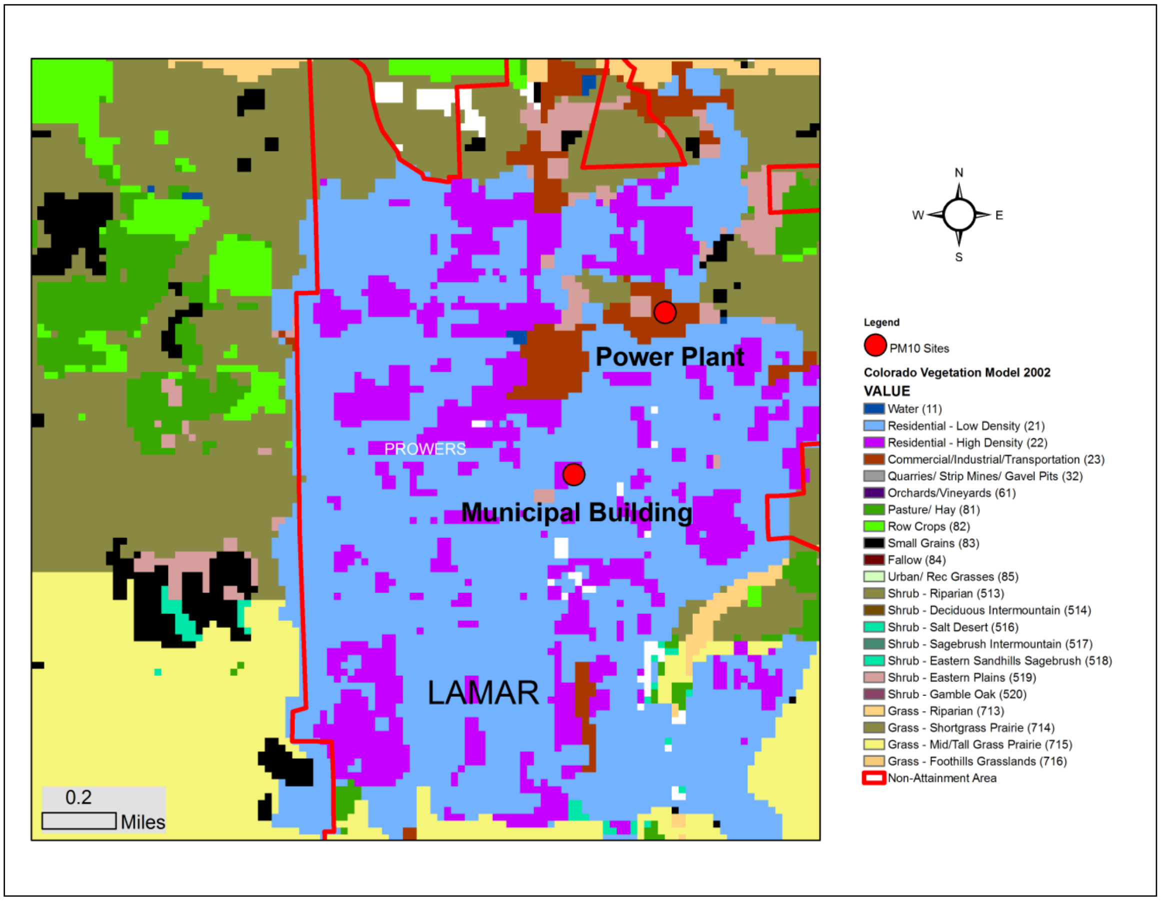


Figure 35. The Lamar PM10 Non-attainment Area (outlined in red), locations of the Lamar PM10 monitors, and vegetative cover and land use categories.

Figure 36. Aerial view of the Lamar PM10 monitoring sites.

There are no extensive areas of significant fugitive dust sources within the NAA (see Colorado Department of Public Health and Environment, 2001, for emission inventories). Reasonable control measures have been implemented by the Lamar PM10 SIP for both the NAA and Prowers County. Sources for wind blown dust within the NAA area are likely dwarfed by natural and agricultural sources outside of the NAA.

It is possible, however, that dust sources within the Power Plant property fenceline affect concentrations at the Power Plant monitor. Figures 35 and 36 show that this monitor is within the Power Plant facility and potentially subject to fugitive emissions from this industrial facility, including those from unpaved and exposed soils and gravels. Because this monitor is on top of a building within plant property and not in a public area, it can be exposed to higher concentrations of facility emissions and does not represent ambient air public exposure offsite. Figure 37 shows the relationship between Lamar Power Plant and Lamar Municipal Building PM10 concentrations for January 2004 through February 2009. Concentrations at the Power Plant are, on average, 23% higher than those at the Municipal Building. The 95 percentile values for the Power Plant and Municipal Buildings are 53 ug/m3 and 39 ug/m3, respectively.

The second category of blowing dust sources considered here are natural and agricultural sources in eastern Colorado. Dryland farming is the dominant farming type in southeastern Colorado and occurs on areas with highly erodible soils. The wheat-sorghum-fallow system is common in much of eastern and southeastern Colorado. The wheat-sorghum-fallow system is generally a planting of wheat, followed by a planting of sorghum and then a period with the land left fallow to allow the soil to recover. According to the Colorado State Extension publication 0.5160 (http://www.ext.colostate.edu/pubs/crops/00516.html), "soils under no-till production systems store more water than soils on conventional stubble mulch systems and allow conversion to more intense crop rotations." Sorghum is a plant suited for dry arid climates with a very extensive root system that holds soil in place as well as helping soil stay moist. Lands in these crop systems are shown in several of the land use maps presented below as small grain croplands (in black). Croplands in this system are typically left fallow for as much as 14 months to allow natural soil water content a chance to recover between crops. If sufficient no-till or low tillage practices are not followed, these lands can be significant sources for blowing dust during the fall, winter, and spring of the year, and they may also be significant sources of dust even with reasonable agricultural controls applied.

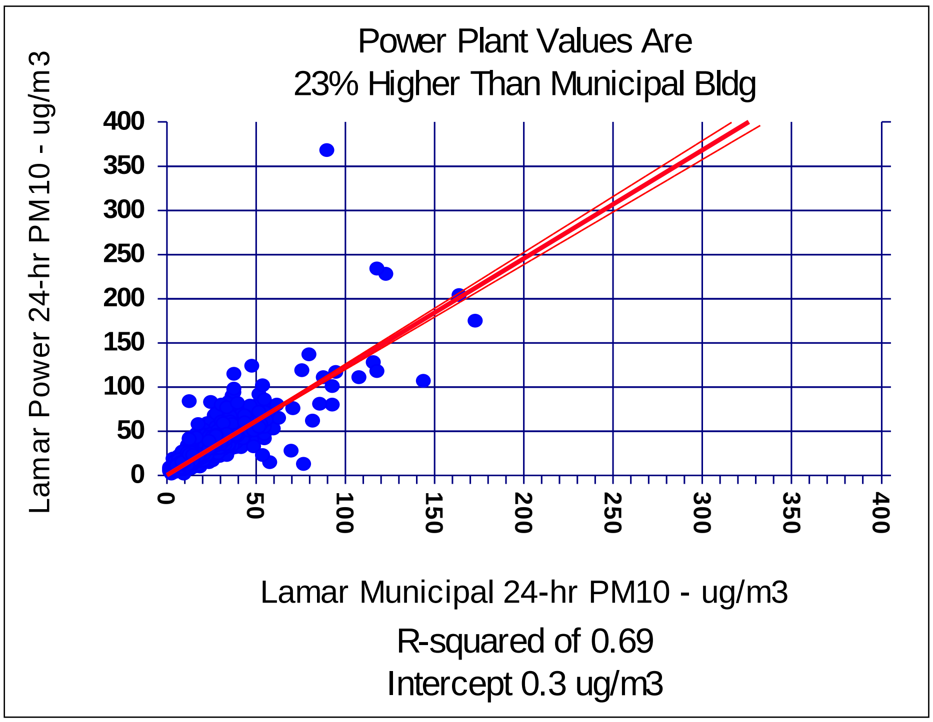


Figure 37. Linear regression between Lamar Power Plant and Municipal Building PM10 concentrations for January 2004 through February of 2009. (The slope is 1.23.)

On April 18, 2004, a major dust storm occurred in eastern Colorado and Western Kansas (see the satellite image in Figure 38). This system did not lead to extreme blowing dust in Lamar. The Lamar Power Plant and Municipal Building concentrations on April 18, 2004, were 80 ug/m3 and 56 ug/m3, respectively. This storm, however, demonstrates the role of small grain fallow rotation farming on blowing dust in eastern Colorado. Figure 39 shows the land use categories in the counties near Lamar, and Figure 40 shows the satellite image superimposed on the land use map. It's clear from this last image that the area of intensive small grain and fallow cropland in Lincoln and Kiowa Counties is a source for large plumes of blowing dust moving to the northeast during this phase of the storm. Although somewhat limited within the immediate Lamar area, these small grain and fallow cropland areas are common in all of the counties in the region.

The Natural Resources Conservation Service (NRCS) is the federal agency responsible for promoting soil conservation practices on agricultural lands. The NRCS administers the Conservation Reserve Program (CRP). CRP has entered into contracts with farmers in the High Plains states to keep marginal agricultural lands, which are vulnerable to erosion, in grassland and natural vegetative cover.

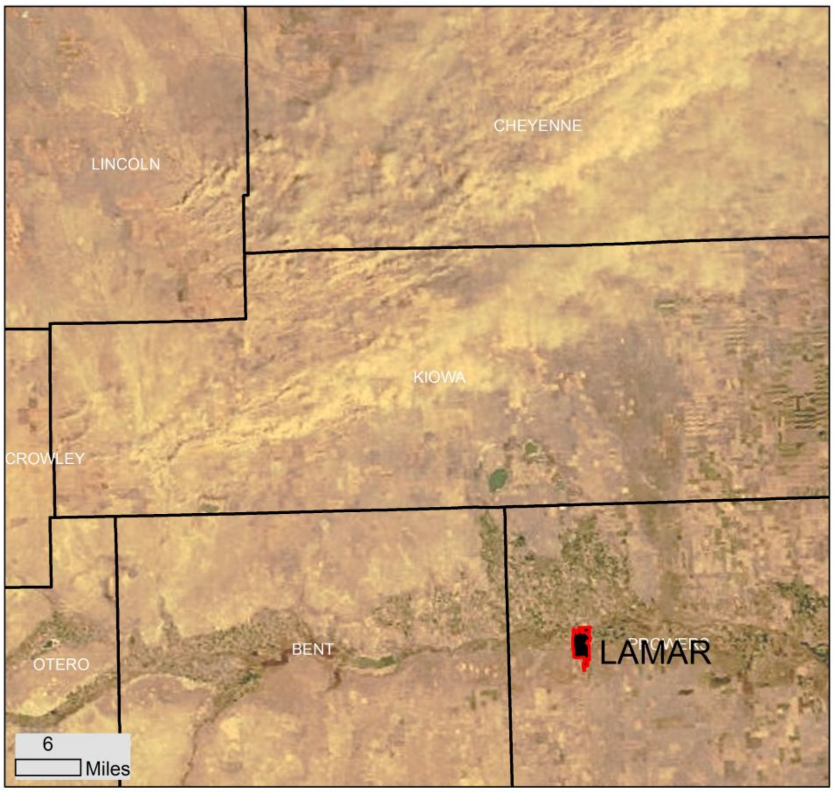


Figure 38. Satellite image of a dust storm north of Lamar on April 18, 2004. (Source: http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=13048)

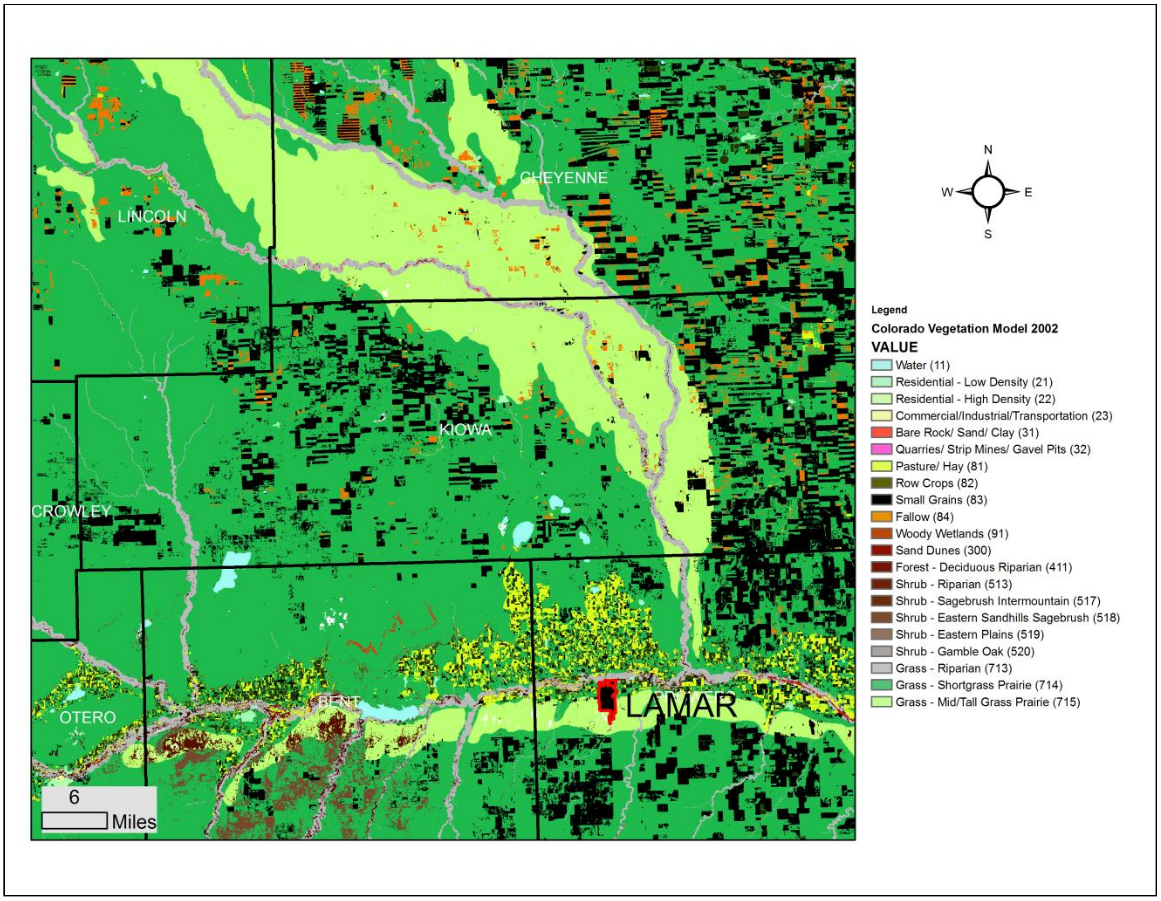


Figure 39. Vegetative cover and land use categories in the vicinity of Lamar, Colorado.

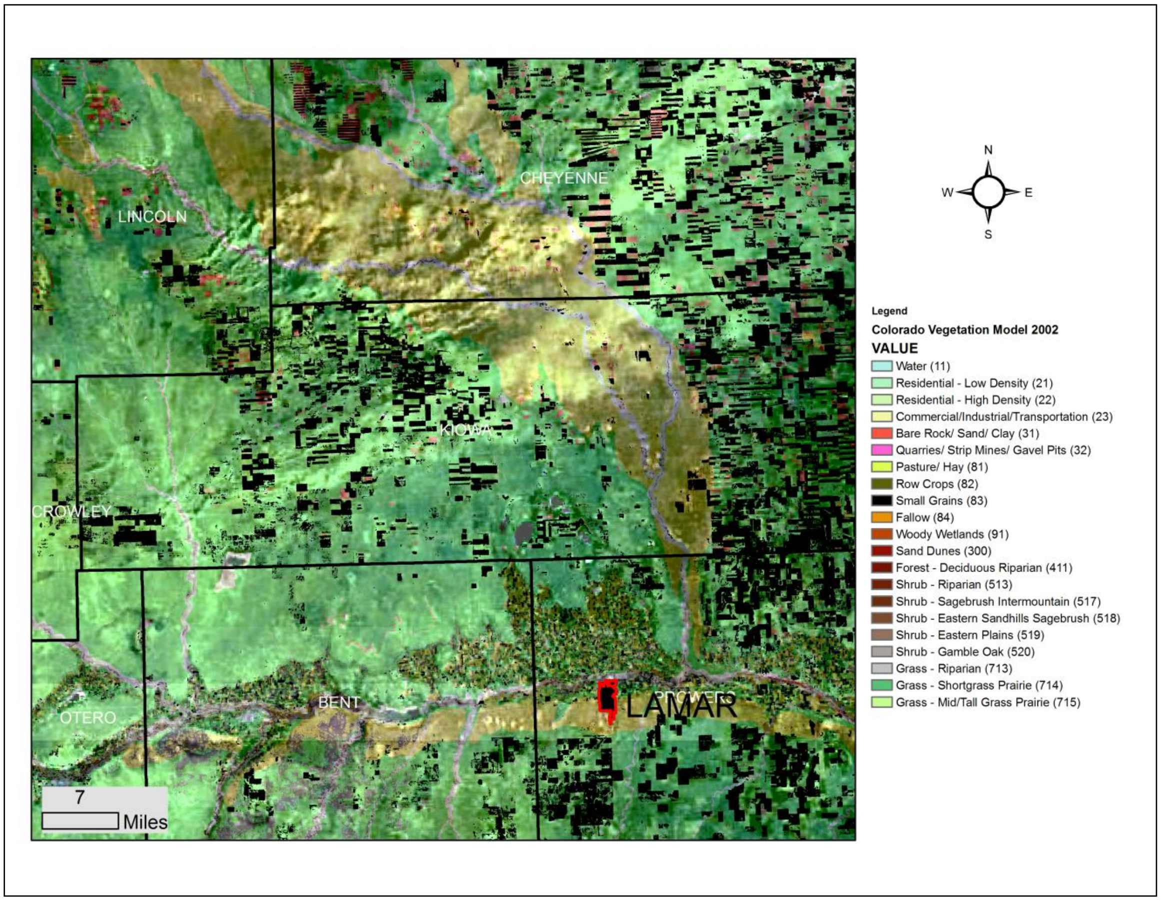


Figure 40. Vegetative cover and land use categories in the vicinity of Lamar, Colorado, superimposed with the satellite image from Figure 38 for April 18, 2004.

This NRCS program and others are cited in the Revised Lamar Natural Events Action Plan (Colorado Department of Public Health and Environment et al., 2003). More specifically, the plan indicates that:

"recognizing the problems associated with erodible land and other environmental-sensitive cropland, the U.S. Department of Agriculture (USDA) included conservation provisions in the Farm Bill. This legislation created the Conservation Reserve Program (CRP) to address these concerns through conservation practices aimed at reducing soil erosion and improving water quality and wildlife habitat."

"The CRP encourages farmers to enter into contracts with USDA to place erodible cropland and other environmentally-sensitive land into long-term conservation practices for 10-15 years. In exchange, landowners receive annual rental payments for the land and cost-share assistance for establishing those practices."

"The CRP has been highly successful in Prowers County by placing approximately 146,000 acres of Prowers County cropland, or 28% of total cropland, under contract. Most of this land has been planted with a perennial grass cover to protect the soil and retain its moisture. Strong support of the program by Prowers County farmers continues as 38% of the counties HEL cropland has been offered for conservation practices."

"While the following initiatives are not meant to be enforceable, many efforts are underway that further reduce blowing dust and its impacts. These include:

- The CRP has moved to include all available area lands into area contracts. These contracts are good through 2007. Success of the CRP initiatives is measured through ongoing monitoring of the contracts to ensure ample grass coverage to minimize blowing dust.

- CRP sends out information several times per year through radio and the area newspaper to further reach farmers interested in topsoil protection.

- In response to the significant Colorado drought the CRP is working with multiple parties in extensive annual planning efforts to limit blowing dust and its impacts. These planning efforts change year to year depending on the severity of the drought."

These programs were in effect during the period addressed in the analysis in this attachment (2004-2009). The NRCS in Colorado has also worked through the CRP and other programs to bring erosion control practices to croplands throughout eastern Colorado. Beginning in September of 2009, however, 743,238 acres of the 2,412,238 acres of Colorado land under the CRP were to become eligible to come out of the CRP in the subsequent five-year period. Much of this land is in eastern and southeastern Colorado. Land released from the CRP has the potential to increase the amount of lands contributing to blowing dust in eastern Colorado. The NRCS, however, has identified a variety of alternatives and options to promote soil conservation on the lands that will be released from CRP contracts (http://www.co.nrcs.usda.gov/programs/CRP/crp.html).

These include conservation easements, enrollment in the Continuous CRP (a subset of CRP), transition to grazing land, and managing land for wildlife. Returning the land to cropland is also an option, and the NRCS is encouraging conservation tillage for these lands. The Colorado office of the NRCS has a form letter that will be sent to those whose contracts will be expiring. It includes the following:

> "Over the next five years, approximately two million acres of land contracted under the Conservation Reserve Program (CRP) will expire in Colorado. A significant portion of <<***COUNTY NAME***>> County land enrolled in CRP either expired last September, or will be expiring within the next few years."
>
> "The current crop prices are causing many landowners to consider farming their CRP land by returning it to crop production. However, there are some valuable information and alternatives that must be considered prior to making this major decision…"

> "While some fields may return to cropland, many acres of CRP are environmentally sensitive and not suited to annual crop production. By making the decision to return CRP land to cropland you will impact the local economy, landscape, and environment. It is important for you to consider several factors before deciding what to do when your CRP contract expires: soil productivity and limitations, past yields, commodity prices, production, conversion or renovation costs, and other required investments."
>
> "There are several options available to landowners who have expiring CRP contracts. These options include: re-enrolling eligible acres into Continuous CRP, returning land to a cropland rotation, utilizing and enhancing forage as pasture or hayland, or managing the expired CRP for wildlife."
> "It is important for you to develop an NRCS approved conservation plan, particularly when considering converting expired CRP acres to cropland. It requires proper planning and good management. NRCS conservation plans provide an inventory and complete assessment of a landowner's resources, as well as recommendations for improving those resources, which if implemented can positively impact your bottom line."

According to the NRCS (see brochure at: http://www.co.nrcs.usda.gov/programs/CRP/CCRP_1.pdf):

> "The Continuous CRP program (CCRP), a subset of the Conservation Reserve Program, offers year round enrollment and increased incentives to keep these small sensitive areas in permanent cover.
>
> **Practice Incentive Payment (PIP) -** This is an additional incentive of 40% of eligible practice establishment costs.
>
> **Signing Incentive Payment (SIP)** - This is a one time incentive payment for signing the Continuous CRP contract.
>
> **Rental Incentive Payment—**This is an additional incentive payment equal to the shown percentage of the CRP rental rate. All of the above incentives are in addition to the regular CRP rental payment. For more information on CCRP, contact your local USDA Service Center."

Details on the incentive payments for various categories of land use conservation practices can be found in the brochure link above. Additional information on NRCS post-CRP programs is presented in Figures 41 through 44 below.

Conclusions and Summary

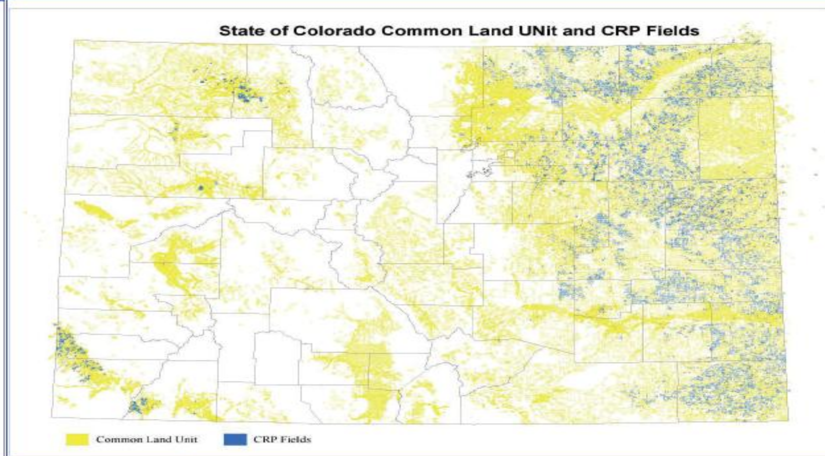
PM10 concentrations for both the Lamar Power Plant and Municipal Building sites for January of 2004 through February of 2009 have been analyzed and compared with meteorological data for the period. The analyses included an evaluation of climate and land use characteristics; cluster analysis of PM10 concentrations, 30-day total precipitation, and daily maximum 5-second gust speeds; NOAA HYSPLIT back trajectories for high-wind, blowing dust events; and an assessment of satellite imagery. *Cluster analysis shows that without wind gusts above 40 mph and dry soils caused by 30-day precipitation totals of 0.6 inches or less, the exceedances of the PM10 standard measured during the period would not have occurred*. The high-wind events occur on less than 15% of the days in the period. The PM10 exceedances occur on less than 1% of the days in the record. *This document provides a detailed weight of evidence analysis for dust transport into and within Colorado and demonstrates that but for the exceptional high winds over dry soils these exceedances would not have occurred*.

Trajectory analyses and land use patterns point to three likely source areas that may contribute to blowing dust during blowing dust events. The first is the Lamar PM10 Non-attainment Area (NAA) and Prowers County. *Blowing dust sources within the NAA and Prowers County have been reasonably controlled, as demonstrated by the PM10 State Implementation Plan (SIP) and Maintenance Plan for the area.* In addition, the Power Plant monitor, which is responsible for most of the exceedances, is inappropriately sited and does not represent ambient exposure. The second likely source area is lands in eastern Colorado outside of Prowers County and the NAA.

Natural Resources Conservation Service

Post-CRP Options in Colorado

Currently, there are 2,412,238 Conservation Reserve Program (CRP) acres in Colorado. On September 30, 2009, 743,238 acres are eligible to come out of CRP.



Conversion to Grazing Land Requirements and Options

-Develop a conservation plan that outlines grazing management and development needs.

-Install identified conservation measures for proper grazing distribution.
>If using Environmental Quality Incentives Program funds to install identified practices producer MUST WAIT UNTIL CRP CONTRACT EXPIRES.
>May be able to locate and use other funds to begin some work prior to contract expiration.

-Conservation Easements.
>Grassland Reserve Program (grazing land only).
>Farm and Ranchland Protection Program (crop and grass lands).

Conversion to Cropland Requirements and Options

-Develop a conservation plan to maintain compliance and program eligibility.
>Identified measure must be installed within the first year.
>Must address Threatened and Endangered Species and Species of Concern.
-Current policy allows some work to begin up to 6-months prior to expiration of contract.

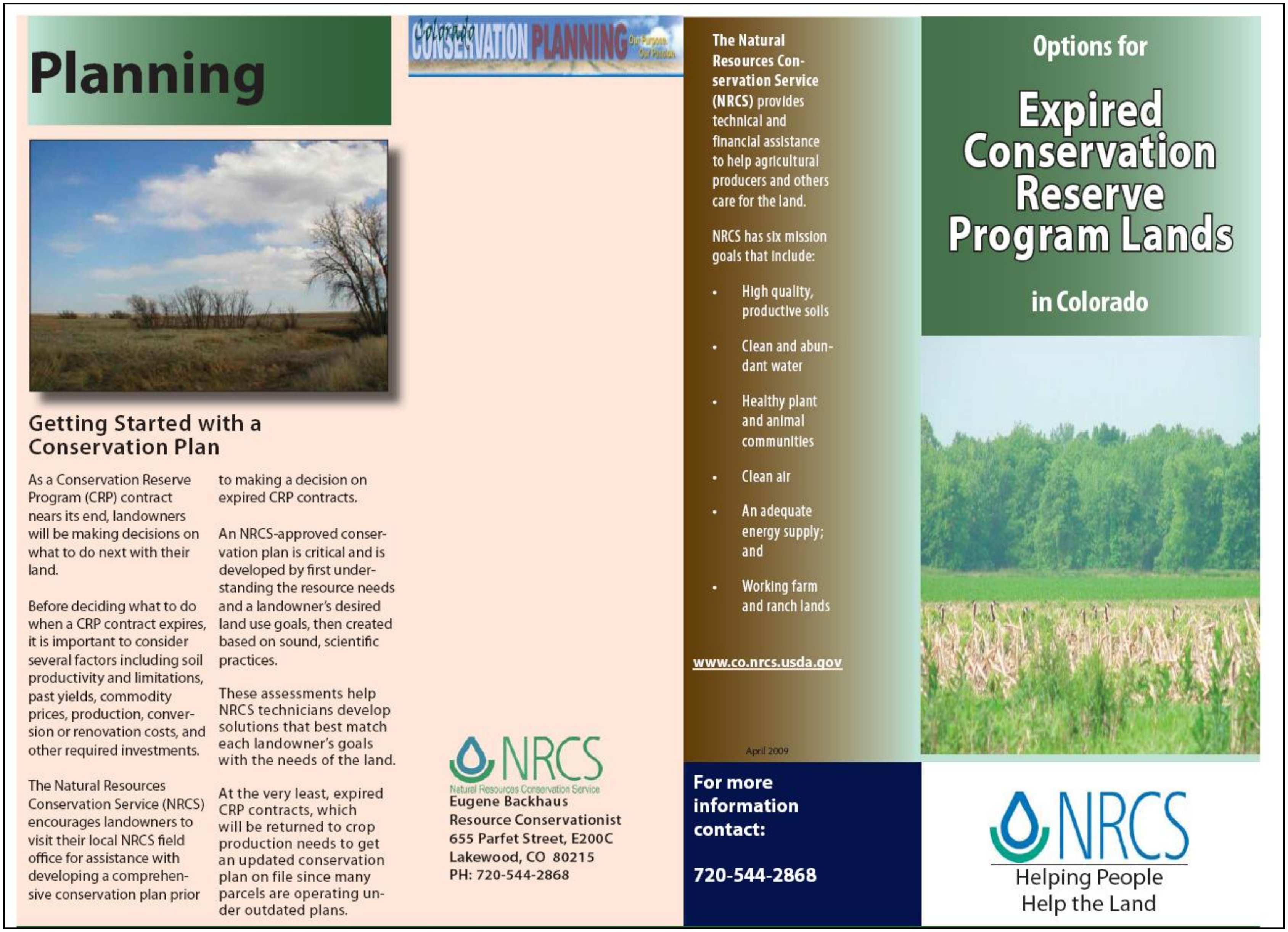
-Will be a minimum of 12-months before income begins.

-Will again be subject to market and weather changes, both negative and positive.

For further information, contact your local conservation district, Natural Resources Conservation Service, or Farm Service Agency office.

NRCS is an Equal Opportunity Provider and Employer

Figure 41. Colorado NRCS overview of Post-CRP options in Colorado.



Planning

Getting Started with a Conservation Plan

As a Conservation Reserve Program (CRP) contract nears its end, landowners will be making decisions on what to do next with their land.

Before deciding what to do when a CRP contract expires, it is important to consider several factors including soil productivity and limitations, past yields, commodity prices, production, conversion or renovation costs, and other required investments.

The Natural Resources Conservation Service (NRCS) encourages landowners to visit their local NRCS field office for assistance with developing a comprehensive conservation plan prior to making a decision on expired CRP contracts.

An NRCS-approved conservation plan is critical and is developed by first understanding the resource needs and a landowner's desired land use goals, then created based on sound, scientific practices.

These assessments help NRCS technicians develop solutions that best match each landowner's goals with the needs of the land.

At the very least, expired CRP contracts, which will be returned to crop production needs to get an updated conservation plan on file since many parcels are operating under outdated plans.

Colorado CONSERVATION PLANNING

NRCS
Natural Resources Conservation Service

Eugene Backhaus
Resource Conservationist
655 Parfet Street, E200C
Lakewood, CO 80215
PH: 720-544-2868

The Natural Resources Conservation Service (NRCS) provides technical and financial assistance to help agricultural producers and others care for the land.

NRCS has six mission goals that include:

- High quality, productive soils
- Clean and abundant water
- Healthy plant and animal communities
- Clean air
- An adequate energy supply; and
- Working farm and ranch lands

www.co.nrcs.usda.gov

April 2009

For more information contact:

720-544-2868

Options for

Expired Conservation Reserve Program Lands

in Colorado

NRCS
Helping People
Help the Land

Figure 42. NRCS brochure on Post-CRP options, page 1.

Overview

The Conservation Reserve Program (CRP) protects millions of acres of American topsoil from erosion and is designed to safeguard the Nation's natural resources.

Acreage enrolled in the CRP is planted to resource-conserving vegetative covers, making the program a major contributor to increased wildlife populations in many parts of the country.

Over two million acres of Colorado's grass-lands are currently listed within the CRP with contracts expiring through 2013.

Due to changes in the 2008 Farm Bill, agricul-tural producers having these grasslands may find little opportunity to re-enroll their land in the CRP.

According to the Colorado Deparment of Agriculture, if a large portion of expiring CRP acres go back into cropland, Colorado will lose many of its important conservation benefits accrued over the lifetime of the contracts that established these grasslands including reduced soil erosion and improved wildlife habitat.

However, if some of the expiring CRP lands are kept in grass and managed for other uses, many of the conservation benefits realized during the CRP contracts could be maintained or enhanced.

Options

Options for Expiring Conservation Reserve Program Lands

Conversion to Grazing Land

REQUIREMENTS AND OPTIONS

- Develop a conservation plan that outlines grazing management and development needs
- Install identified conservation measures for proper grazing distribution
- If using Environmental Quality Incentives Program funds to install identified practices, producer **MUST WAIT UNTIL CRP CONTRACT EXPIRES**
- May be able to locate and use other funds to begin some work prior to contract expiration
- Conservation Easements
- Grassland Reserve Program (grazing land only)
- Farm and Ranchland Protection Program (crop and grass lands)

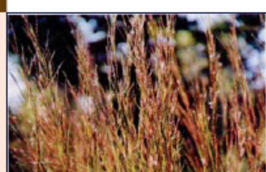
Conversion to Cropland

REQUIREMENTS AND OPTIONS

- Develop a conservation plan to maintain compliance and program eligibility
- Identified measure must be installed within the first year
- Must address Threatened and Endandered Species and Species of Concern
- Current policy allows some work to begin up to five months prior to expiration of contract
- Will be at least until July 2010 before income begins
- Will again be subject to market and weather changes, both negative and positive.

Enrollment in Continuous CRP

- **SAFE** - The new State acres for wildlife Enhancement (SAFE) program focuses on high priority wildlife habitat areas, and aims to retain desirable cover to halt the decline of numerous at-risk species.
- **CREP** - the Conservation Reserve Enhance-ment Program helps protect environmentally sensitive land, decrease erosion, and restore wildlife habitat.
- **High priority conservation practices** - an opportunity to re-enroll a portion of expired land into Continuous CRP and focuses on environmentally sensitive land.



Conservation Reserve Program - encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filterstrips, or riparian buffers.

NRCS Programs that Can Help:

- Environmental Quality Incentives Program (EQIP)
- Continuous Conservation Reserve Program (CCRP)
- Grassland Reserve Program (GRP)
- Farm and Ranchland Protection Program (FRPP)

Figure 43. NRCS brochure on Post-CRP options, page 2.

United States Department of Agriculture
Natural Resources Conservation Service

Expiring CRP Options—Transition to Grazingland

USDA Natural Resources Conservation Service — Colorado March 2009

Between the years 2009 and 2013, approximately 2 million acres of CRP contracts will expire in Colorado. This mass contract expiration has the potential to impact soil erosion, wildlife habitat, water quality, farm incomes and rural economies. However, the USDA Natural Resources Conservation Service provides technical assistance and financial incentives to producers and landowners as they chose to transition these lands to other uses.

Incentives for Grazing Management

Through its Environmental Quality Incentives Program, the NRCS offers technical and financial assistance for producers with expiring CRP who want to transition that land management into a grazing management system. The NRCS can provide financial assistance for installing necessary infrastructure such as fences, livestock pipeline and tanks. The NRCS also provides management incentive payments for grazing management, weed control and wildlife habitat management.

Potential Payments for CRP transition to Grazingland

Practice	Example Incentive Payment (Tentative costs calculated for Northeast Colorado)
382-Fence	$0.85/Foot
516-Pipeline	$1.35/foot
614-Watering Facililty	$0.60—$1.35/gallon
528-Grazing Management	$10/acre
595-Pest Management	$10/acre
645-Upland Wildlife Habitat Management	$10—$15/acre

NRCS Technical Assistance

NRCS Field Office staff, Range Conservationists and Wildlife Biologists are available to offer technical advice on implementing or expanding a grazing system onto CRP ground.

For More Information

To learn more about these incentives, or for other options for expiring CRP, contact your local NRCS Field Office. Log on to www.nrcs.usda.gov to find your nearest office.

Figure 44. NRCS information on expiring CRP options – transition to grazing land.

Small grain (wheat-fallow-sorghum) farmlands in eastern Colorado are a likely source for dust in late fall through spring. The Natural Resources Conservation Service (NRCS) has provided reasonable controls for these sources during the period of record and has alternative programs for erosion control as lands under contract with the Conservation Reserve Program (CRP) are released from contracts (in the five-year period beginning in late 2009.) The third source area includes lands in Arizona and New Mexico. Natural sources in these states may include barren lands and playas, and anthropogenic sources may include agricultural lands. Control of these sources is beyond the purview of the State of Colorado. Agricultural sources within these states may already be reasonably controlled by existing and planned programs operated by the NRCS and the states.

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