

Part IV. Plant Assessment Form

For use with “Criteria for Categorizing Invasive Non-Native Plants that Threaten Colorado’s Wildlands and Agriculture”
By the Colorado Noxious Weed Advisory Committee

Electronic version: December 4, 2008

Table 1. Species and Evaluator Information

Species name (Latin binomial):	Melilotus officinalis (L.) Lam.
Synonyms:	Melilotus officinalis (L.) Lam Norgold MEUOF., Melilotus alba Medikus, orth.var., Melilotus albus Medik, Melilotus albus Medik.var annus Coe, Melilotus arvensis Wallr., Melilotus leucanthus W.D.J. Koch ex DC., Melilotus lutea Gueldenst, Melilotus officinalis (L.) Lam.var. micranthus O.E. Schulz.
Common names:	Yellow sweetcolver, White sweetclover, Bokhara-clover, Honey-clover, White melilot, White sweet-clover, Meliloto blanco, Ribbed millet, Field millet, Cornilla real, Official melilot.
Evaluation date (mm/dd/yy):	4/23/10
Evaluator #1 Name/Title:	Ryan Edwards/Graduate Research Assistant
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Address:	enter text here

Section below for list committee use—please leave blank

List committee members:	enter text here
Committee review date:	enter text here
List date:	enter text here
Re-evaluation date(s):	enter text here

General comments on this assessment:

Yellow sweetclover was introduced to the state in 1890. Today, Yellow sweetclover can be found in 36 counties across the state, and is considered naturalized by some. Due to its beneficial species attributes (e.g. nitrogen fixation, increased soil water absorption, increased soil aeration, soil stabilization and increase forage potential) Yellow sweetclover is endorsed by the USDA/NRCS to be planted by growers in rangeland settings, reclamation and restoration seed mixtures. Livestock and wildlife actively feed upon Yellow sweetclover, however the plants do contain coumarin, which can lead to Sweetclover bleeding disease.

Yellow sweetclover is a member of the Fabaceae family, and actively fixes nitrogen. It is an erect, annual forb with a large taproot that forms secondary bacterial nodules. Plants produce multiple stems that are tipped with numerous yellow flowers, and have pea-like leaves.

This is a controversial species, however it does not appear to be a continuous problem in any particular location in Colorado (i.e. its ephemeral). Our recommendation would be to put this species on a watch list and identify infested locations that can be monitored overtime to provide the necessary data to make an unbiased decision.

Table 2. Criteria, Section, and Overall Scores

1.1	Impact on abiotic ecosystem processes	B	Other Pub. Mat'l	<p>Impact</p> <p><i>Enter four characters from Q1.1-1.4 below:</i></p> <p>BBBU</p> <p><i>Using matrix, determine score and enter below:</i></p> <p>B</p>	<p>Wildlands Plant Score</p> <p><i>Using matrix, determine Overall Score and Alert Status from the first, second, and third section scores and enter below:</i></p> <p>Moderate</p> <p>No Alert</p>
1.2	Impact on plant community	B	Other Pub. Mat'l		
1.3	Impact on higher trophic levels	B	Other Pub. Mat'l		
1.4	Impact on genetic integrity	U	No Information		
2.1	Role of anthropogenic and natural disturbance	B (2 pts)	Other Pub. Mat'l	<p>Invasiveness</p> <p><i>Enter the sum total of all points for Q2.1-2.7 below:</i></p> <p>19</p> <p><i>Use matrix to determine score and enter below:</i></p> <p>A</p>	
2.2	Local rate of spread with no management	A (3 pts)	Other Pub. Mat'l		
2.3	Recent trend in total area infested within state	A (3 pts)	Other Pub. Mat'l		
2.4	Innate reproductive potential Wksht A	A (3 pts)	Other Pub. Mat'l		
2.5	Potential for human-caused dispersal	A (3 pts)	Observational		
2.6	Potential for natural long-distance dispersal	B (2 pts)	Other Pub. Mat'l		
2.7	Other regions invaded	A (3 pts)	Observational		
3.1	Ecological amplitude/Range	A	Other Pub. Mat'l	<p>Distribution</p> <p><i>Using matrix, determine score and enter below:</i></p> <p>B</p>	
3.2	Distribution/Peak frequency Wrksht B	C	Observational		

4.1	Poisonous to livestock	C (1pts)	Other Pub. Mat'l
4.2	Detrimental to economic crops	D (0 pts)	Rev'd, Sci. Pub'n
4.3	Detrimental to management of agricultural system, rangeland and pasture	C (1 pt)	Other Pub. Mat'l
4.4	Human impacts Wrksht C	C (1 pt)	Observational

Agricultural / Human Impact

Enter the sum total of all points for Q4.1-4.4 below:

3

Use matrix to determine score and enter below:

C

Agricultural Plant Score

Using matrix, determine Overall Score and Alert Status from the second, third and fourth section scores and enter below:

Moderate

No Alert

Table 3. Documentation

Question 1.1 Impact on abiotic ecosystem processes	B Other Pub. Mat'l back
Identify ecosystem processes impacted: Yellow sweetclover can fix nitrogen levels in the soil, and increases aeration and water absorption due to a large taproot (3).	
Rationale: Increasing soil nitrogen has been shown to increase weed pressure. However, a report in the literature linked Yellow sweetclover production in a fallow system, to a 75-97% decrease in weed densities the following year (6).	
Sources of information: (3) USDA/NRCS plant guide: Yellow sweetclover & White sweetclover. available at http://plant-materials.nrcs.usda.gov/pubs/idpmcpg8268.pdf (6) Blackshaw, R.E., Moyer, J. R., Doram, R.C., and Boswell, A.L. 2001. Yellow sweetclover, green manure, and its residues effectively suppress weeds during fallow. <i>Weed Science</i> . 49:406-413.	
Question 1.2 Impact on plant community composition, structure, and interactions	B Other Pub. Mat'l back
Identify type of impact or alteration: Yellow sweetclover may may invade disturbed areas, and compete with native species for limited resources (4).	
Rationale: While early succession may occur, Yellow sweetclover is easily replaced as succession continues. Large infestations of Yellow sweetclover can raise nitrogen levels in the surroundings soils, allowing an avenue for further weed infestations, however there has been no published situations where this has occurred.	
Sources of information: (4) USFS weed of the week: Yellow sweetclover. available at http://www.invasive.org/weedcd/pdfs/wow/yellow_sweetclover.pdf	
Question 1.3 Impact on higher trophic levels	B Other Pub. Mat'l back
Identify type of impact or alteration: Yellow sweetclover contains coumarin, which can cause Sweetclover bleeding disease (3). However, livestock and wildlife do actively feed upon Yellow sweetclover, however it does have a bitter taste and takes time for cattle to become accustomed to the taste (3).	
Rationale: Coumarin breaks down into di-coumarin when the plants become damaged. Di-coumarin is a anticoagulant, which can cause hemorrhaging in livestock or wildlife. Yellow sweetclover can also cause bloating in livestock and wildlife, however this appears to be minor.	
Sources of information: (3) USDA/NRCS plant guide: Yellow sweetclover & White sweetclover. available at http://plant-materials.nrcs.usda.gov/pubs/idpmcpg8268.pdf	
Question 1.4 Impact on genetic integrity	U No Information back
Identify impacts: There are conflicting reports in the literature as to the crossability of Yellow sweetclover and	

White sweetclover (<i>M. alba</i>). Further research is needed to assess their genetics of these supposed hybrids.	
Rationale: Conflicting reports in the literature indicate that under laboratory conditions, Yellow and White sweetclover have been crossed, and genetically the white trait appears to be selected against. However, none of these experiments have been carried out in the field, and it is unclear if the two plants could hybridize.	
Sources of information: enter text here	
Question 2.1 Role of anthropogenic and natural disturbance in establishment	B Other Pub. Mat'l back
Describe role of disturbance: Yellow sweetclover responds rapidly to disturbance, and quickly establishes large populations (3).	
Rationale: Yellow sweetclovers ability to establish on disturbed sites, reproduce quickly from seed, fix nitrogen, increase soil moisture and aeration, provided soil stabilization, and provide a edible food source for livestock are all reasons that Yellow sweetclover is promoted as a reclamation species (3). Populations of Yellow sweetclover are also used in rangeland seed mixtures, phytoremediation projects, soil stabilization projects and restoration type settings for the above desired characteristics.	
Sources of information: (3) USDA/NRCS plant guide: Yellow sweetclover & White sweetclover. available at http://plant-materials.nrcs.usda.gov/pubs/idpmcpg8268.pdf	
Question 2.2 Local rate of spread with no management	A Other Pub. Mat'l back
Describe rate of spread: Yellow sweetclover populations can quickly establish on sites that have been disturbed (4).	
Rationale: With no management, Yellow sweetclover populations can quickly establish on any site that has some form of a disturbance, and populations can persist and reproduce throughout early succession. While the species beneficial attributes (e.g. nitrogen fixation, increased soil moisture, soil stabilization, etc) are beneficial in situations where Yellow sweet clover is planted, situations where Yellow sweet clover introduction was not planned follow similar patterns of establishment and 'weediness' characteristics.	
Sources of information: (4) USFS weed of the week: Yellow sweetclover. available at http://www.invasive.org/weedcd/pdfs/wow/yellow_sweetclover.pdf	
Question 2.3 Recent trend in total area infested within state	A Other Pub. Mat'l back
Describe trend: According to the USDA PLANTS database, Yellow sweet clover can be found in 36 counties in Colorado (1). The earliest specimen in the CSU herbarium comes from Larimer county in 1890 (2)	
Rationale: Yellow sweetclover is a naturalized weed in our state, and there are no active management plans available to handle the infestations. Ranchers, hay farmers, and land managers view the plant as a beneficial	

species, due to its nitrogen fixing capabilities and its increased forage and cover for livestock and wildlife.	
Sources of information: (1) USDA PLANTS database: Yellow sweet clover. available at http://plants.usda.gov/java/profile?symbol=MEOF (2) CSU herbarium: Yellow sweetclover. available at http://wsprod.colostate.edu/cwis440/herbarium/plantinfo.asp?PlantID=1724	
Question 2.4 Innate reproductive potential	A Other Pub. Mat'l back
Describe key reproductive characteristics: Conflicting reports in the literature indicate the level of seed production lies anywhere from 5,000 to 100,000 seeds/plant (5).	
Rationale: More research is needed on the topic to further pin down the approximate seed production per plant. However, it has been observed in the field that each plant of Yellow sweetclover does produce many seeds, and even though the exact number is still debated, it is a given that populations will produce large seed crops every year.	
Sources of information: (5) Gucker, Corey L. 2009. <i>Melilotus alba</i> , <i>M. officinalis</i> . In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2010, April 23].	
Question 2.5 Potential for human-caused dispersal	A Observational back
Identify dispersal mechanisms: Yellow sweetclover is promoted for planting in reclamation, restoration, and rangeland settings due to its beneficial species attributes (3). Dispersal, therefore, is classified as intentional.	
Rationale: Human planting of Yellow sweetclover for increased grazing or reclamation aspects appears to be a potential avenue for its dispersal around the state. Once plants have been introduced to an area, the seeds will naturally become self perpetuating groups, and it is only a matter of time until the plants exhibit 'weediness'.	
Sources of information: (3) USDA/NRCS plant guide: Yellow sweetclover & White sweetclover. available at http://plant-materials.nrcs.usda.gov/pubs/idpmcpg8268.pdf	
Question 2.6 Potential for natural long-distance dispersal	B Other Pub. Mat'l back
Identify dispersal mechanisms: Yellow sweetclover seeds are not actively dispersed naturally, due to the lack of appendages on the seeds (5). Seeds typically drop to the soil surface. However, dispersal by animals is common as the plants are feed upon, and the animals defecate out viable seed over large areas of terrain (5). Water also appears to be a natural disperser of Yellow sweet clover.	
Rationale: As animals come into feed upon Yellow sweetclover, the seeds benefit from the acids found in the digestive tracts. It has been shown that sulfuric acid scarification can increase germination by 40%.	

Sources of information: (5) Gucker, Corey L. 2009. Melilotus alba, M. officinalis. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2010, April 23].	
Question 2.7 Other regions invaded	A Observational back
Identify other regions: According to the USDA PLANTS database, Yellow Sweetclover is found in every state and every province in Canada except Nunavut (1).	
Rationale: Yellow sweetclover has become naturalized in many states, and is present in many different habitats across the country.	
Sources of information: (1) USDA PLANTS database: Yellow sweet clover. available at http://plants.usda.gov/java/profile?symbol=MEOF	
Question 3.1 Ecological amplitude/Range	A Other Pub. Mat'l back
Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: According to the USDA PLANTS database, Yellow sweetclover can be found in 36 counties in Colorado (1). The earliest specimen in the CSU herbarium comes from Larimer county in 1890 (2)	
Rationale: Yellow sweetclover is a naturalized weed in our state, and there are no active management plans available to handle the infestations. Ranchers, hay farmers, and land managers view the plant as a beneficial species due to its nitrogen fixing capabilities and its increased forage and cover for livestock and wildlife.	
Sources of information: (1) USDA PLANTS database: Yellow sweet clover. available at http://plants.usda.gov/java/profile?symbol=MEOF (2) CSU herbarium: Yellow sweetclover. available at http://wsprod.colostate.edu/cwis440/herbarium/plantinfo.asp?PlantID=1724	
Question 3.2 Distribution/Peak frequency	C Observational back
Describe distribution: Yellow sweetclover is found across the state, and is particularly present in urban areas, hay meadows, and scrublands.	
Rationale: Infestations of Yellow sweetclover arise following patterns of plantings. As ranchers and farmers continue to plant Yellow sweetclover, the distribution of the plant will likely increase across the state.	
Sources of information: enter text here	

Question 4.1 Poisonous to Livestock	C Other Pub. Mat'l back
Describe impacts in terms of high probability of death, long-term health impacts, or short-term health impacts: Yellow sweetclover contains coumarin, which can cause Sweetclover bleeding disease (3). However, livestock and wildlife do actively feed upon yellow sweetclover, however it does have a bitter taste and takes time for cattle to become accustomed to the taste (3).	
Rationale: Coumarin breaks down into di-coumarin when the plants become damaged. Di-coumarin is an anticoagulant, which can cause hemeraging in livestock or wildlife. Yellow sweetclover can also cause bloating in livestock and wildlife.	
Sources of information: (3) USDA/NRCS plant guide: Yellow sweetclover & White sweetclover. available at http://plant-materials.nrcs.usda.gov/pubs/idpmcpg8268.pdf	
Question 4.2 Detrimental to Economic Crops	D Rev'd, Sci. Pub'n back
Describe impacts to all aspects of cropping systems (see guidelines): Yellow sweetclover can be grown in monoculture stands for green manure. Yellow sweetclover, when grown in a fallow system as a green manure, reduced weed pressure by 75-97% (6). In hay crops, the presence of Yellow sweet clover can decrease the overall quality of hay and may influence harvesting times (3).	
Rationale: Yellow sweetclover can be grown as an economic crop, and is actively planted into seeding mixtures for reclamation, rangeland, phytoremediation, or it can be used as a green manure. Negative effects of Yellow sweetclover are rare, and do not indicate the severity of the influence on the harvest of hay.	
Sources of information: (3) USDA/NRCS plant guide: Yellow sweetclover & White sweetclover. available at http://plant-materials.nrcs.usda.gov/pubs/idpmcpg8268.pdf (6) Blackshaw, R.E., Moyer, J. R., Doran, R.C., and Boswell, A.L. 2001. Yellow sweetclover, green manure, and its residues effectively suppress weeds during fallow. Weed Science. 49:406-413.	
Question 4.3 Detrimental to Mgmt of Agricultural System, Rangeland and Pasture	C Other Pub. Mat'l back
Describe impacts to water diversion systems, increased water use, reduced forage for livestock: Yellow sweetclover is incorporated into restoration, reclamation and rangeland seed mixtures (3).	
Rationale: Due to its beneficial species attributes, Yellow sweetclover is actively incorporated into seeding mixtures to increase soil nitrogen, water and aeration in the soil. As succession continues, Yellow sweet clover is further replaced by other species, limiting its overall effects.	
Sources of information: (3) USDA/NRCS plant guide: Yellow sweetclover & White sweetclover. available at http://plant-materials.nrcs.usda.gov/pubs/idpmcpg8268.pdf	

Question 4.4 Human Health Impacts	C Observational back
Describe key human impacts such as; irritants, property values, recreational values, and industry impacts: Yellow sweetclover contains coumarin, which can cause Sweetclover bleeding disease (3).	
Rationale: The effects of the bleeding disease appear to be minor, as the plants are actively grazed upon by animals. Effects on humans have not been recorded in the literature, however the effects should be the same as with livestock.	
Sources of information: (3) USDA/NRCS plant guide: Yellow sweetclover & White sweetclover. available at http://plant-materials.nrcs.usda.gov/pubs/idpmcpg8268.pdf	

Worksheet A

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Reaches reproductive maturity in 2 years or less	Yes: 1 pt
Dense infestations produce >1,000 viable seed per square meter	Yes: 2 pts
Populations of this species produce seeds every year.	Yes: 1 pt
Seed production sustained over 3 or more months within a population annually	No: 0 pt
Seeds remain viable in soil for three or more years	Yes: 2 pts
Viable seed produced with <i>both</i> self-pollination and cross-pollination	No: 0 pt
Has quickly spreading vegetative structures (rhizomes, roots, etc.) that may root at nodes	No: 0 pt
Fragments easily and fragments can become established elsewhere	No: 0 pts
Resprouts readily when cut, grazed, or burned	No: 0 pt
	6 pts Total Unknowns
	A (6+ pts)
Note any related traits: Yellow sweetclover plants can produce upwards of 5,000 seeds/plant, and it is reported in the literature that the seeds are viable in the soil for up to 30 years (4).	

Worksheet B - Colorado Ecological Types and Land Use

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Major Ecological and Land Use Types	Minor Ecological and Land Use Types	Code*
Freshwater and Aquatic Systems	lakes, ponds, reservoirs	Unknown
	rivers, streams, canals	Unknown
Riparian and wetlands	Riparian forest	D. present
	Riparian shrublands	D. present
	Wet meadows	Unknown
Grasslands	Shortgrass prairie	D. present
	Tallgrass prairie	D. present
	Sandsage prairie	D. present
	Montane meadows	D. present
Irrigated Agriculture	Hay meadows	C. 5-20%
	Irrigated crops (alfalfa, corn, sugar beets)	Unknown
Dryland Agriculture	Dryland crops (wheat, corn, millet, dryland grass hay, sunflowers, mustard for biodiesel)	D. present
Developed Lands	Urban, exurban, industrial	C. 5-20%
Arid Shrublands	Sagebrush shrublands	D. present
	Foothills shrublands	C. 5-20%
	Gambel oak shrublands	Unknown
Woodlands	Pinyon - juniper	Unknown
	Ponderosa pine	Unknown
	Limber pine	Unknown
Forest	Lodgepole pine	Unknown
	Spruce-fir	Unknown
Alpine	Boulder and rock fields	Unknown
	Dwarf shrublands	Unknown
	Tundra	Unknown
Barrens (lower elevation)	Dunes	Unknown
	Rock outcrops	Unknown
	Canyonlands	Unknown

* A. means >50% of type occurrences are invaded; B means >20% to 50%; C. means >5% to 20%; D. means present but ≤5%; U. means unknown (unable to estimate percentage of occurrences invaded).

Worksheet C – Human Impacts

Human health impacts; irritants (sap), spines, poisonous, and/or smoke impacts	Yes: 1 pt
Property values are decreased due to increased risk of fire	No: 0 pts
Decreased property value due to moderate to heavy infestations	No: 0 pts
Decreased land value for recreational use; boating, fishing, camping, etc.	No: 0 pts
Impact of listing detrimental to industry; agriculture, horticulture, nursery, and/or seed	No: 0 pt
	1 pt Total Unknowns
	C (1-2)
Note any related traits: Yellow sweetclover contains coumarin, which can cause Sweetclover bleeding disease (3).	