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)**:**	Brassica tournefortii Gouan
Synonyms:	none
Common names:	African mustard, Sahara mustard, Wild turnip, Asian mustard, Morrocan mustard
Evaluation date (mm/dd/yy)**:**	2/25/10
Evaluator #1 Name/Title:	Ryan Edwards
Affiliation:	Colorado State University
Phone numbers:	720-208-1569
Email address:	Redwards155@hotmail.com
Address:	300 w. pitkin ave, 1179: weed research, Ft. Collins, CO 80525
Evaluator #2 Name/Title:	enter text here
Affiliation:	enter text here
Phone numbers:	enter text here
Email address:	enter text here
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:
African Mustard (Brassica tournefortii Gouan) is an invasive, annual herb which has infested desert areas of New Mexico, Arizona, Texas, Nevada, and California. African mustard has been known to be a prolific seed producer (>9000 seeds/plant), and can exhibit a 'tumble-weed' like quality when it dries. African mustard forms dense patches where it establishes, and can also increase fuel fire fuel loads.

African mustard is member of the mustard family and exhibits similar growth patterns. It will first germinate into a basal rosette, with lobed leaves and rounded tips. African mustard quickly produces multiple erect stems that branch from its base, and have rough, stringy hairs on them. Stems can grow upwards of forty inches and exhibit a brush like quality. African mustard produces small, yellow flowers with four oblong petals arranged in an X formation. Plants are a winter annual, and have a quick life cycle (most will have fruited and died before April or May).

Table 2. Criteria, Section, and Overall Scores

1.1	Impact on abiotic ecosystem processes	A	Rev'd, Sci. Pub'n		**Impact** *Enter four characters from Q1.1-1.4 below:* **AABB** *Using matrix, determine score and enter below:* **A**		
1.2	Impact on plant community	A	Rev'd, Sci. Pub'n				
1.3	Impact on higher trophic levels	B	Rev'd, Sci. Pub'n				
1.4	Impact on genetic integrity	B	Rev'd, Sci. Pub'n				
2.1	Role of anthropogenic and natural disturbance	A (3 pts)	Other Pub. Mat'l		**Invasiveness** *Enter the sum total of all points for Q2.1-2.7 below:* **16** *Use matrix to determine score and enter below:* **B**		**Wildlands Plant Score** *Using matrix, determine Overall Score and Alert Status from the first, second, and third section scores and enter below:* **High** **Red Alert**
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	U (0 pts)	No Information				
2.4	Innate reproductive potential Wksht A	A (3 pts)	Rev'd, Sci. Pub'n				
2.5	Potential for human-caused dispersal	B (2 pts)	Other Pub. Mat'l				
2.6	Potential for natural long-distance dispersal	A (3 pts)	Other Pub. Mat'l				
2.7	Other regions invaded	B (2 pts)	Rev'd, Sci. Pub'n				
3.1	Ecological amplitude/Range	U	No Information		**Distribution** *Using matrix, determine score and enter below:* **U**		
3.2	Distribution/Peak frequency Wrksht B	U	No Information				

4.1	Poisonous to livestock	**D (0 pts)**	**Rev'd, Sci. Pub'n**
4.2	Detrimental to economic crops	**A (3 pts)**	**Rev'd, Sci. Pub'n**
4.3	Detrimental to management of agricultural system, rangeland and pasture	**A (3 pts)**	**Rev'd, Sci. Pub'n**
4.4	Human impacts Wrksht C	**A (3 pts)**	**Doc'n level**

Agricultural / Human Impact

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

9

Use matrix to determine score and enter below:

A

Agricultural Plant Score

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

Moderate

Red Alert

Table 3. Documentation

Question 1.1 Impact on abiotic ecosystem processes	A Rev'd, Sci. Pub'n back
Identify ecosystem processes impacted: It has been observed that African mustard can drastically reduce soil moisture, and limit surrounding plants from establishing due to its very early germination (1, 2). African mustard has also been observed to increase fuel loads for fires (1, 2).	
Rationale: African mustard is generally associated with desert environments, where water resources are already scarce and the threat of fire is relatively high. Dense infestations in California have been known to "light the desert on fire", due to the dense patches that African mustard can form.	
Sources of information: (1) Graham, J., Johnson, W.S., and Powell, E. 2003. Identifying and Managing Sahara Mustard. University of Nevada Cooperative Extension publication FS-05-02. (2) Trader, M.R., Brooks, M.L., and Draper, J.V. 2006. Seed Production by the non-native Brassica tournefortii (Sahara mustard) along desert roadsides. Madrono 53(4): 312-320.	
Question 1.2 Impact on plant community composition, structure, and interactions	A Rev'd, Sci. Pub'n back
Identify type of impact or alteration: African mustard germinates early in the growing season, and can out-compete surrounding plants for available moisture, nutrients and light (2). Once established, African mustard can form dense clumps of vegetation, preventing other plants from establishing.	
Rationale: In the Mojave and Sonoran deserts, winter rains typically cause ephemeral plants to germinate in the early fall with the growth season limited to the winter and spring. African Mustard can flower as early as December, set seed by January and complete its life cycle by early April (2). This rapid growth pattern can decrease limited soil moisture for surrounding plants, and induce shading on small seedlings.	
Sources of information: (2) Trader, M.R., Brooks, M.L., and Draper, J.V. 2006. Seed Production by the non-native Brassica tournefortii (Sahara mustard) along desert roadsides. Madrono 53(4): 312-320.	
Question 1.3 Impact on higher trophic levels	B Rev'd, Sci. Pub'n back
Identify type of impact or alteration: Grazing animals can graze upon African mustard with no reports of any negative effects (2).	
Rationale: Impacts could be considered indirect; in desert environments, displacement of limited grazing plants can have a high effect, simply due to the low population numbers found in the environments.	
Sources of information: (2) Trader, M.R., Brooks, M.L., and Draper, J.V. 2006. Seed Production by the non-native Brassica tournefortii (Sahara mustard) along desert roadsides. Madrono 53(4): 312-320.	

Question 1.4 Impact on genetic integrity	B Rev'd, Sci. Pub'n back
Identify impacts: Crosses have been performed between African mustard and other mustards (i.e. Brassica rapa) (3).	
Rationale: These crosses were performed under laboratory conditions. However, the potential for natural crosses between African mustard and other mustards must be taken into consideration.	
Sources of information: (3) Choudhary, B.R., and Joshi, P. 2001. Crossability of Brassica tornefortii and B. rapa, and morphology and cytology of their F1 hybrids. Theoretical applied genetics 102: 1123-1128.	
Question 2.1 Role of anthropogenic and natural disturbance in establishment	A Other Pub. Mat'l back
Describe role of disturbance: African mustard does not need disturbance to establish (1).	
Rationale: Potential invasions and establishments of African mustard have been shown to occur without any known incidents of disturbance. This adaptation could allow African mustard populations to easily invade desert environments, simply due to the already present stress levels on the native plants found there.	
Sources of information: (1) Graham, J., Johnson, W.S., and Powell, E. 2003. Identifying and Managing Sahara Mustard. University of Nevada Cooperative Extension publication FS-05-02.	
Question 2.2 Local rate of spread with no management	A Other Pub. Mat'l back
Describe rate of spread: Infestations of African mustard can spread rapidly due to its very flexible ease at dispersal (1).	
Rationale: Without management, African mustard can easily move across the landscape due to the three methods of dispersal it has (i.e. 'tumbleweed'-like, mucilaginous seed coat, animal dispersal).	
Sources of information: (1) Graham, J., Johnson, W.S., and Powell, E. 2003. Identifying and Managing Sahara Mustard. University of Nevada Cooperative Extension publication FS-05-02.	
Question 2.3 Recent trend in total area infested within state	U No Information back
Describe trend: There are no known occurrences of African mustard entering and becoming established in Colorado.	
Rationale: According to the USDA PLANTS database, African mustard has been found in New Mexico, Texas, Arizona, Nevada, and California (5).	

Sources of information:

(5) USDA PLANTS database: Brassica tournefortii Gouan/Asian mustard. Available at http://plants.usda.gov/java/nameSearch?keywordquery=asian+mustard&mode=comname.

Question 2.4 Innate reproductive potential A Rev'd, Sci. Pub'n back

Describe key reproductive characteristics: African mustard plants can produce between 750-9000 seeds (4).

Rationale: The magnitude at which African mustard plants produce seeds is in part a defense mechanism against predation. The more seeds that can be produced, the safer the popualtion isfrom depeltion by predators and disease (2).

Sources of information:

(2) Trader, M.R., Brooks, M.L., and Draper, J.V. 2006. Seed Production by the non-native Brassica tournefortii (Sahara mustard) along desert roadsides. Madrono 53(4): 312-320.

(4) New Mexico State University cooperative extension fact sheet. Brassica tournefortii: commonly known as Sahara mustard. Available at http://www.weeds.edu/factsheet.php?weed_id=183

Question 2.5 Potential for human-caused dispersal B Other Pub. Mat'l back

Identify dispersal mechanisms: African mustard posses a mucilaginous seed coat when it comes in contact with water. This seed coat is relatively sticky, and can adhere to many surfaces (i.e. fur, clothing, machinery) (1).

Rationale: The need for water to activate this mucilaginous seed coat, presents a hurdle for African mustard dispersal, due to the environments that it is found in (i.e. desert). However, the fact still remains that with the right conducive conditions, African mustard can easily be spread by anthropogenic means.

Sources of information:

(1) Graham, J., Johnson, W.S., and Powell, E. 2003. Identifying and Managing Sahara Mustard. University of Nevada Cooperative Extension publication FS-05-02.

Question 2.6 Potential for natural long-distance dispersal A Other Pub. Mat'l back

Identify dispersal mechanisms: African mustard can spread through three methods; 1) The plant has been show to breakoff at the soil surface and act as a tumbleweeds, spreading seeds as it moves, 2) Seeds have been show to create a muculagenious gel along the seed coat when seeds come in contact with water, allowing the seeds to stick to multiple surfaces (i.e. fur, clothing, machinery) and 3) seeds have been known to be cached by rodents upwards of 100 meters from the parent plant (1).

Rationale: The flexability in dispersal that African mustard presents could potentially create vast stretches of area that can become infested.

Sources of information:

(1) Graham, J., Johnson, W.S., and Powell, E. 2003. Identifying and Managing Sahara Mustard. University of Nevada Cooperative Extension publication FS-05-02.
Question 2.7 Other regions invaded B Rev'd, Sci. Pub'n back
Identify other regions: African mustard has been shown to invade habitats that are relatively dry (i.e. deserts, dry scrublands, dry brush lands) and it has been shown to invade dry land wheat fields in Australia (1,6).
Rationale: The potential for African mustard to invade dry land wheat crops poses a serious problem, especially here in Colorado. Dry environments appear to be highly susceptible to African mustard.
Sources of information: (1) Graham, J., Johnson, W.S., and Powell, E. 2003. Identifying and Managing Sahara Mustard. University of Nevada Cooperative Extension publication FS-05-02. (6) Chauhan B.S., Gill, G., and Preston C. 2006. African mustard (Brassica tournefortii) germination in southern Australia. Weed Science 54:891-897.
Question 3.1 Ecological amplitude/Range U No Information back
Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: There is no information in the literature describing African mustard invading Colorado at this present time.
Rationale: According to the USDA PLANTS database, African mustard has been found in New Mexico, Texas, Arizona, Nevada, and California (5). There have been no reports of any African mustard found in the state.
Sources of information: (5) USDA PLANTS database: Brassica tournefortii Gouan/Asian mustard. Available at http://plants.usda.gov/java/nameSearch?keywordquery=asian+mustard&mode=comname.
Question 3.2 Distribution/Peak frequency U No Information back
Describe distribution: There is no information in the literature describing African mustard invading Colorado at this present time.
Rationale: See question 3.1.
Sources of information: enter text here
Question 4.1 Poisonous to Livestock D Rev'd, Sci. Pub'n back
Describe impacts in terms of high probability of death, long-term health impacts, or short-term health impacts: There are no reports in the literature of toxic compounds found in African mustard.

Rationale: The literature has no instances in which livestock have been poisoned by African mustard. It appears that African mustard is regularly grazed upon (2).
Sources of information: (2) Trader, M.R., Brooks, M.L., and Draper, J.V. 2006. Seed Production by the non-native Brassica tournefortii (Sahara mustard) along desert roadsides. Madrono 53(4): 312-320.
Question 4.2 Detrimental to Economic Crops A Rev'd, Sci. Pub'n back
Describe impacts to all aspects of cropping systems (see guidelines): African mustard has been shown to cause significant yield losses in crops (6). Densities of 1 African mustard plant/m^2, caused a 0.35 yield loss in wheat. (6). There are also reports of African mustard being resistant to the herbicide chlorsulfuron.
Rationale: Infestations of African mustard into dry land agriculture could drastically reduce yields for Colorado farmers. Couple these infestations with the ease of dispersal, over large areas, and this could be a significant pest if it were to establish.
Sources of information: (6) Chauhan B.S., Gill, G., and Preston C. 2006. African mustard (Brassica tournefortii) germination in southern Australia. Weed Science 54:891-897.
Question 4.3 Detrimental to Mgmt of Agricultural System, Rangeland and Pasture A Rev'd, Sci. Pub'n back
Describe impacts to water diversion systems, increased water use, reduced forage for livestock: As stated prior, it has been observed that African mustard can drastically reduce soil moisture, and limit surrounding plants from establishing due to its very early germination (1, 2). African mustard has also been observed to increase fuel loads for fires (1, 2).
Rationale: Once a significant population of African mustard establishes on a site, it can quickly reduce the soil moisture and impeded the germination of surrounding plants. For pastures and rangelands, this could decrease the overall levels of grazing, and introduce a possible fire risk when fuel loads become too high.
Sources of information: (1) Graham, J., Johnson, W.S., and Powell, E. 2003. Identifying and Managing Sahara Mustard. University of Nevada Cooperative Extension publication FS-05-02. (2) Trader, M.R., Brooks, M.L., and Draper, J.V. 2006. Seed Production by the non-native Brassica tournefortii (Sahara mustard) along desert roadsides. Madrono 53(4): 312-320.
Question 4.4 Human Health Impacts A Rev'd, Sci. Pub'n back
Describe key human impacts such as; irritants, property values, recreational values, and industry impacts: African mustard has also been observed to increase fuel loads for fires (1, 2).
Rationale: Possible irritants that African mustard could impose on humans would be smoke from fires sparked by the large fuel loads that African mustard can create. Infestations could also decrease property values due to

large infestations crowding out native species, reduced soil moisture, and reduced recreation from large patches of African mustard.
Sources of information: (1) Graham, J., Johnson, W.S., and Powell, E. 2003. Identifying and Managing Sahara Mustard. University of Nevada Cooperative Extension publication FS-05-02. (2) Trader, M.R., Brooks, M.L., and Draper, J.V. 2006. Seed Production by the non-native Brassica tournefortii (Sahara mustard) along desert roadsides. Madrono 53(4): 312-320.

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	**Unknown: 0 pts**
Seeds remain viable in soil for three or more years	**Unknown: 0 pts**
Viable seed produced with *both* 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	**Yes: 2 pts**
Resprouts readily when cut, grazed, or burned	**Yes: 1 pt**
	7 pts 2 unknowns
	A (6+ pts)

Note any related traits: Plants can produce upwards of 9000 seeds, can fragment easily and act as a tumble weed, spreading seeds across the landscape.

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	**Unknown**
	Riparian shrublands	**Unknown**
	Wet meadows	**Unknown**
Grasslands	Shortgrass prairie	**Unknown**
	Tallgrass prairie	**Unknown**
	Sandsage prairie	**Unknown**
	Montane meadows	**Unknown**
Irrigated Agriculture	Hay meadows	**Unknown**
	Irrigated crops (alfalfa, corn, sugar beets)	**Unknown**
Dryland Agriculture	Dryland crops (wheat, corn, millet, dryland grass hay, sunflowers, mustard for biodiesel)	**Unknown**
Developed Lands	Urban, exurban, industrial	**Unknown**
Arid Shrublands	Sagebrush shrublands	**Unknown**
	Foothills shrublands	**Unknown**
	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	**Yes: 1 pt**
Decreased property value due to moderate to heavy infestations	**Yes: 2 pts**
Decreased land value for recreational use; boating, fishing, camping, etc.	**Unkown: 0 pts**
Impact of listing detrimental to industry; agriculture, horticulture, nursery, and/or seed	**Yes: 2 pt**
	6 pts 1 unknown
	A (4+ pts)

Note any related traits: African mustard has been known to increase fire fuel loads, increasing the chances for smoke irritation. African mustard also forms dense patches, which can decrease soil moisture and possibly decrease property values.