Part IV. Plant Assessment Form

For use with "Criteria for Categorizing Invasive Non-Native Plants that Threaten Wildlands" by the California Exotic Pest Plant Council and the Southwest Vegetation Management Association

Table 1. Species and Evaluator Information

Species name (Latin binomial)**:**	*Bromus tectorum*
Synonyms:	Cheatgrass
Common names:	Downy brome
Evaluation date (mm/dd/yy)**:**	2/8/03
Evaluator #1 Name/Title:	Joe DiTomaso
Affiliation:	UC Davis
Phone numbers:	530-754-8715
Email address:	DiTomaso@vegmail.ucdavis.edu
Address:	Weed Science Program, Robbins Hall, Univ. California, Davis CA 95616
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 review committee use—please leave blank

Review committee members:	Carla Bossard, John Randall, Peter Warner, Doug Johnson, John Hall, Dana Backer, Cindy Roye, Matt Brooks
Committee review date:	2/10/03
List date:	enter text here
Re-evaluation date(s):	enter text here

Table 2. Criteria, Section, and Overall Scores

1.1	Impact on abiotic ecosystem processes	**A**	**Rev'd, Sci. Pub'n**
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	**D**	**Doc'n level**

"Impact"

Enter four characters from Q1.1-1.4 below:

AABD

Use matrix determine the score; enter below:

A

2.1	Role of anthropogenic and natural disturbance	**A 3**	**Other Pub. Mat'l**
2.2	Local rate of spread with no management	**A 3**	**Rev'd, Sci. Pub'n**
2.3	Recent trend in total area infested within state	**C 1**	**Observational**
2.4	Innate reproductive potential	**A 3**	**Rev'd, Sci. Pub'n**
2.5	Potential for human-caused dispersal	**B 2**	**Other Pub. Mat'l**
2.6	Potential for natural long-distance dispersal	**C 1**	**Other Pub. Mat'l**
2.7	Other regions invaded	**C 1**	**Other Pub. Mat'l**

"Invasiveness"

For questions at left, recall that an A gets 3 points, a B gets 2, a C gets 1, and a D or U gets=0. Enter the sum total of all points for Q2.1-2.7 below:

14

Use matrix to determine score and enter below:

B

"Plant Score"

Using matrix, determine the Overall Score and Alert Status from the three section scores and enter them below:

High

No Alert

3.1	Ecological amplitude	**A**	**Other Pub. Mat'l**
3.2	Distribution	**A**	**Other Pub. Mat'l**

"Distribution"

Use matrix determine the score; enter below:

A

Worksheet A. Complete this worksheet to answer Question 2.4.

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 *both* self-pollination and cross-pollination	**Yes: 1 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**
7 pts	**Total Unknowns 0**
A (6+ pts)	

Table 3. Documentation

Question 1.1 Impact on abiotic ecosystem processes
Identify ecosystem processes impacted: Changes the frequency, extent, and timing of wildfires. In many areas that have been invaded by cheatgrass the natural fire cycle has shortened from every 60-100 years to every 3-5 years.
Rationale: Early fine fuel of downy brome forms a continuum between shrubs and bunchgrasses allowing fires to carry farther. The shorter fire frequency has eliminated many shrubs in these communities. As fires become even more frequent, the area will be dominated by annual grasses alone, with the loss of surface soil, nutrients, and near permanent deterioration of the site.
Sources of information: Young, J. 2000. *Bromus tectorum*. In, Invasive Plants of California's Wildlands. Eds., C. Bossard, J. Randall, M. Hoshovsky. UC Press, Berkeley; Whisenant, S.G. 1990. Changing fire frequencies on Idaho's Snake River Plains. USDA For. Ser. Gen Tech. Rep INT-276, 4-10; West, N.E. 1979. Basic synecological relationships of sagebrush-dominated lands in the Great Basin and the Colorado Plateau. Pp. 33-41 *In* Anon. The Sagebrush Ecosystem: A Symposium, Utah State University, College of Natural Resources, Logan, Utah; Whisenant, S.G. 1989. Changing fire frequencies on Idaho's Snake River Plains: Ecological and management implications. Proceedings-Symposium on Cheatgrass Invasion, Shrub Die-off, and Other Aspects of Shrub Biology and Management. General Technical Report INT-276 Forest Service Intermountain Research Station, November 1990; Many others papers, see Mosley, J.C., S.C. Bunting and M.E. Manoukian. 1999. Cheatgrass. In, Biology and Management of Noxious Rangeland Weeds. Eds. R.L. Sheley and J.K. Petroff. Oregon State Univ. Press, Corvallis for review and other citations.
Question 1.2 Impact on plant community composition, structure, and interactions
Identify type of impact or alteration: Can displace native vegetation by outcompeting them for soil moisture.
Rationale: Downy brome is well adapted to fire and often dominates plant communities after fire (Melgoza et al. 1990). Changes in fire frequency can complete alter vegetation and lead to monotypic stands of downy brome.
Sources of information: Melgoza, G., R.S. Nowak, and R.J. Tausch. 1990. Soil water exploitation after fire: Competition between *Bromus tectorum* (cheatgrass) and two native species. Oecologia 83:7-13; Young, J. 2000. *Bromus tectorum*. In, Invasive Plants of California's Wildlands. Eds., C. Bossard, J. Randall, M. Hoshovsky. UC Press, Berkeley; Many others papers, see Mosley, J.C., S.C. Bunting and M.E. Manoukian. 1999. Cheatgrass. In, Biology and Management of Noxious Rangeland Weeds. Eds. R.L. Sheley and J.K. Petroff. Oregon State Univ. Press, Corvallis for review and other citations.
Question 1.3 Impact on higher trophic levels
Identify type of impact or alteration: Has had a negative effect on wildlife, particularly due to change in fire frequency. Does have a positive impact of forage for wildland in spring.
Rationale: Slow-moving fauna such as desert tortoises are sometimes killed in the rapidly moving fires. The effects on native game species are largely unknown, but expected to be similar to livestock.
Sources of information: Young, J. 2000. *Bromus tectorum*. In, Invasive Plants of California's Wildlands. Eds., C. Bossard, J. Randall, M. Hoshovsky. UC Press, Berkeley
Question 1.4 Impact on genetic integrity
Identify impacts: Hybridization with other species rarely occurs under natural conditions.
Rationale: Unlikely to hydridize with other native *Bromus* species. No evidence that this has occurred.
Sources of information: Upadhaya, M.K., R. Turkington, and D. McIlvride. 1986. The biology of Canadian weeds. 75. *Bromus tectorum* L. Canadian Journal of Plant Science 66:689-709; Rice, K.J., and R.N. Mack. 1991. Ecological genetics of *Bromus tectorum*: intraspecific variation in phenotypic plasticity. Oecologia 88:84-90.
Question 2.1 Role of anthropogenic and natural disturbance in establishment
Describe role of disturbance: Cultivation and subsequent land abandonment, excessive livestock grazing and repeated fires can all interact to proliferate downy brome. However, it can also thrive in areas that have never been cultivated or grazed by domestic livestock.
Rationale: Movement into grasslands and scrublands appear to be initially in disturbed areas, but it is then capable of moving into undisturbed sites. In undisturbed sites, cheatgrass will most commonly spread along soil cracks and work its way outward into the natural community.
Sources of information: See Mosley, J.C., S.C. Bunting and M.E. Manoukian. 1999. Cheatgrass. In, Biology and Management of Noxious Rangeland Weeds. Eds. R.L. Sheley and J.K. Petroff. Oregon State Univ. Press, Corvallis for review and other citations; Douglas, B.J., A.G. Thomas and D. A. Derksen. 1990. Downy brome (*Bromus tectorum*) invasion into southwestern Saskatchewan. Canadian J. Plant Sci. 70:1143-1151; Rice, K.J., and R.N. Mack. 1991. Ecological genetics of *Bromus tectorum*: A hierarchical analysis of phenotypic variation. Oecologia 88:77-83.
Question 2.2 Local rate of spread with no management
Describe rate of spread: Can double in less than 10 years.

Rationale: Because downy brome now occupies 100 million acres in the US and was only introduced a bit over 100 years ago, it is clear that it is capable of doubling its infestation level within 10 years.
Sources of information: Mosley, J.C., S.C. Bunting and M.E. Manoukian. 1999. Cheatgrass. In, Biology and Management of Noxious Rangeland Weeds. Eds. R.L. Sheley and J.K. Petroff. Oregon State Univ. Press, Corvallis.
Question 2.3 Recent trend in total area infested within state
Describe trend: Probably is remaining stable throughout the west, including California.
Rationale: Because it has occupied the full extent of its range, it is likely to be stable at this time.
Sources of information: Observational information.
Question 2.4 Innate reproductive potential
Describe key reproductive characteristics: High seed production every year. Seeds can survive for about 3 years in the soil, but most seed survives only one year.
Rationale: Reproductive strategy similar to most other invasive winter annual grasses. The density of cheatgrass plants in degraded grassland communities is about 10,000 to 13,000 plants/m^2. At this population level 10,000 to 15,000 viable but dormant seeds/m^2 are present in the litter and surface soil. Even with the elimination of the current year's seed production, the seed bank is capable of renewing cheatgrass populations for two or possibly three years without noticeable reductions in plant density. Cheatgrass is a highly self-pollinating species.
Sources of information: Young, J. 2000. *Bromus tectorum*. In, Invasive Plants of California's Wildlands. Eds., C. Bossard, J. Randall, M. Hoshovsky. UC Press, Berkeley; Mosley, J.C., S.C. Bunting and M.E. Manoukian. 1999. Cheatgrass. In, Biology and Management of Noxious Rangeland Weeds. Eds. R.L. Sheley and J.K. Petroff. Oregon State Univ. Press, Corvallis; Young, J.A. and R.A. Evans. 1985. Demography of *Bromus tectorum* in *Artemisia* communities. *In*: J. White (ed.). The Population Structure of Vegetation. Dr. W. Junk Publishers, Dordrecht, Netherlands; Upadhaya, M.K., R. Turkington, and D. McIlvride. 1986. The biology of Canadian weeds. 75. *Bromus tectorum* L. Canadian Journal of Plant Science 66:689-709.
Question 2.5 Potential for human-caused dispersal
Identify dispersal mechanisms: Spread by attachment to human clothing or by clinging to hair and fur of livestock. Contaminated grain seed probably was the early method of dispersal. Seeds can also be dispersed as a contaminant in hay and straw or by mud clinging to machinery.
Rationale: Not as important in downy brome at it is in other longer awned annual grasses.
Sources of information: Young, J. 2000. *Bromus tectorum*. In, Invasive Plants of California's Wildlands. Eds., C. Bossard, J. Randall, M. Hoshovsky. UC Press, Berkeley; Mosley, J.C., S.C. Bunting and M.E. Manoukian. 1999. Cheatgrass. In, Biology and Management of Noxious Rangeland Weeds. Eds. R.L. Sheley and J.K. Petroff. Oregon State Univ. Press, Corvallis
Question 2.6 Potential for natural long-distance dispersal
Identify dispersal mechanisms: Spread by wind, attachment to animal fur, or by small rodents. Animals can also transport seed in their feces and hooves.
Rationale: Movement by natural means probably not very long distance.
Sources of information: Young, J. 2000. *Bromus tectorum*. In, Invasive Plants of California's Wildlands. Eds., C. Bossard, J. Randall, M. Hoshovsky. UC Press, Berkeley
Question 2.7 Other regions invaded
Identify other regions: Has invaded other areas of Europe, southern Russia, west central Asia, most of North America, Japan, South Africa, Australia, New Zealand, Iceland, and Greenland.
Rationale: Native to southern Europe, northern Africa, and southwestern Asia. One of the most widely invasive species around the world.
Sources of information: Young, J. 2000. *Bromus tectorum*. In, Invasive Plants of California's Wildlands. Eds., C. Bossard, J. Randall, M. Hoshovsky. UC Press, Berkeley; Mosley, J.C., S.C. Bunting and M.E. Manoukian. 1999. Cheatgrass. In, Biology and Management of Noxious Rangeland Weeds. Eds. R.L. Sheley and J.K. Petroff. Oregon State Univ. Press, Corvallis; Upadhaya, M.K., R. Turkington, and D. McIlvride. 1986. The biology of Canadian weeds. 75. *Bromus tectorum* L. Canadian Journal of Plant Science 66:689-709.
Question 3.1 Ecological amplitude
Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: First introduced to the US in 1861 into the east coast and first found in California around Yosemite in 1900.
Rationale: Most common in sagebrush/bunchgrass communities, although its distribution extends to higher-elevation juniper, pinyon-juniper, and pine woodlands.
Sources of information: Young, J. 2000. *Bromus tectorum*. In, Invasive Plants of California's Wildlands. Eds., C. Bossard, J. Randall, M. Hoshovsky. UC Press, Berkeley; Mosley, J.C., S.C. Bunting and M.E. Manoukian. 1999. Cheatgrass. In, Biology and Management of Noxious Rangeland Weeds. Eds. R.L. Sheley and J.K. Petroff. Oregon State Univ. Press, Corvallis

Question 3.2 Distribution
Describe distribution: Widespread throughout California. Dominant annual grass on sagebrush rangelands on the Modoc Plateau and along the eastern Sierra Nevada to Owens Valley. Also in the coniferous forest zone. Widespread throughout the Great Basin. Less common in valley grasslands.
Rationale: Most common introduced annual grass in the United States. Today, *Bromus tectorum* is the dominant species on more than 100 million acres of the Intermountain west. Although *Bromus tectorum* can be found in both disturbed and undisturbed shrub-steppe and intermountain grasslands (e.g., where dominant grasses are *Agropyron spicatum* = *Pesudorogneria spicata* and *Festuca idahoensis*), the largest infestations are usually found in disturbed shrub-steppe areas, overgrazed rangeland, abandoned fields, eroded areas, sand dunes, road verges, and waste places.
Sources of information: Young, J. 2000. *Bromus tectorum*. In, Invasive Plants of California's Wildlands. Eds., C. Bossard, J. Randall, M. Hoshovsky. UC Press, Berkeley; Mosley, J.C., S.C. Bunting and M.E. Manoukian. 1999. Cheatgrass. In, Biology and Management of Noxious Rangeland Weeds. Eds. R.L. Sheley and J.K. Petroff. Oregon State Univ. Press, Corvallis; Whisenant, S.G. 1989. Changing fire frequencies on Idaho's Snake River Plains: Ecological and management implications. Proceedings-Symposium on Cheatgrass Invasion, Shrub Die-off, and Other Aspects of Shrub Biology and Management. General Technical Report INT-276 Forest Service Intermountain Research Station, November 1990; Carpenter, A.T. and T.A. Murray. 2002. *Bromus tectorum*. The Nature Conservancy. Element Stewardship Abstract http://tncweeds.ucdavis.edu/esadocs/documnts/bromtec.html

Complete the worksheet that corresponds to your state using the letter codes and instructions in Section 3.

Worksheet C - California Ecological Types

(*sensu* Holland 1986)

Major Ecological Types	Minor Ecological Types	Code
Marine Systems	marine systems	**score**
Freshwater and Estuarine Aquatic Systems	lakes, ponds, reservoirs	**score**
	rivers, streams, canals	**score**
	estuaries	**score**
Dunes	coastal	**score**
	desert	**score**
	interior	**score**
Scrub and Chaparral	coastal bluff scrub	**score**
	coastal scrub	**D. presen**
	Sonoran desert scrub	**score**
	Mojavean desert scrub (incl. Joshua tree woodland)	**score**
	Great Basin scrub	**A. >50%**
	chenopod scrub	**score**
	montane dwarf scrub	**score**
	Upper Sonoran subshrub scrub	**score**
Grasslands, Vernal Pools, Meadows, and other Herb Communities	coastal prairie	**D. presen**
	valley and foothill grassland	**C. 5-20%**
	Great Basin grassland	**A. >50%**
	vernal pool	**score**
	meadow and seep	**score**
	alkali playa	**score**
	pebble plain	**score**
Bog and Marsh	bog and fen	**score**
	marsh and swamp	**score**
Riparian and Bottomland	riparian forest	**score**
	riparian woodland	**score**
	riparian scrub (incl.desert washes)	**score**
Woodland	cismontane woodland	**score**
	piñon and juniper woodland	**B. 20-50%**
	Sonoran thorn woodland	**score**
Forest	broadleaved upland forest	**score**
	North Coast coniferous forest	**score**
	closed cone coniferous forest	**score**
	lower montane coniferous forest	**C. 5-20%**
	upper montane coniferous forest	**score**
	subalpine coniferous forest	**score**
Alpine Habitats	alpine boulder and rock field	**score**
	alpine dwarf scrub	**score**

* 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).