Plant Assessment Form

For use with the "Criteria for Categorizing Invasive Non-Native Plants that Threaten Wildlands" by the California Exotic Pest Plant Council and the Southwest Vegetation Management Association (Warner et al. 2003)

Printable version, February 28, 2003
(Modified for use in Arizona, 07/02/04)

Table 1. Species and Evaluator Information

Species name (Latin binomial)**:**	*Bromus tectorum* L. (USDA 2005)
Synonyms:	*Anisantha tectorum* (L.) Nevski, *Bromus tectorum* L. var. *glabratus* Spenner, *Bromus tectorum* L. var. *hirsutus* Regel, *Bromus tectorum* L. var. *nudus* Klett & Richter (USDA 2005)
Common names:	Cheatgrass, downy brome
Evaluation date (mm/dd/yy)**:**	02/08/03
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Committee review date:	02/17/04
List date:	02/17/04
Re-evaluation date(s):	

Table 2. Scores, Designations, and Documentation Levels

	Question	Score	Documentation Level	Section Scores	Overall Score & Designations
1.1	Impact on abiotic ecosystem processes	**A**	Reviewed scientific publication	**"Impact"** **Section 1 Score:** **A**	**"Plant Score"** **Overall Score:** **High** **Alert Status:** **None**
1.2	Impact on plant community	**A**	Reviewed scientific publication		
1.3	Impact on higher trophic levels	**A**	Reviewed scientific publication		
1.4	Impact on genetic integrity	**D**	Reviewed scientific publication		
2.1	Role of anthropogenic and natural disturbance	**A**	Other published material	**"Invasiveness"** *For questions at left, an A gets 3 points, a B gets 2, a C gets 1, and a D or U gets=0. Sum total of all points for Q2.1-2.7:* **18 pts** **Section 2 Score:** **A**	
2.2	Local rate of spread with no management	**A**	Other published material		
2.3	Recent trend in total area infested within state	**B**	Observational		
2.4	Innate reproductive potential	**A**	Other published material		
2.5	Potential for human-caused dispersal	**A**	Other published material		
2.6	Potential for natural long-distance dispersal	**A**	Other published material		
2.7	Other regions invaded	**C**	Other published material		 Something you should know.
3.1	Ecological amplitude	**A**	Other published material	**"Distribution"** **Section 3 Score:** **A**	
3.2	Distribution	**A**	Other published material		

Table 3. Documentation

Question 1.1 Impact on abiotic ecosystem processes *Score:* **A** *Doc'n Level:* **Rev. sci. pub.**
Identify ecosystem processes impacted: Cheatgrass 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 to 100 years to every 3 to 5 years.
Rationale: Early fine fuel of cheatgrass 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: See West (1979), Whisenant (1990), Mosley et al. (1999; for review and other citations), and Young (2000).

Question 1.2 Impact on plant community composition, structure, and interactions *Score:* **A** *Doc'n Level:* **Rev. sci. pub.**
Identify type of impact or alteration: Cheatgrass disrupts ecosystems that are not adapted to increased rates of fire frequency. It is also known to displace native vegetation by outcompeting them for soil moisture.
Rationale: Cheatgrass is well adapted to fire and often dominates plant communities after fire (Melgoza et al. 1990). Changes in fire frequency can completely alter vegetation and lead to monotypic stands of cheatgrass. The change induced by cheatgrass in the fire cycle frequency is probably the species' greatest competitive advantage. Although fire is a natural part of the sagebrush grassland ecosystem, those fires usually occurred at intervals between 60 to 100 years. Cheatgrass infested areas burn at a much greater frequency, every 3 to 5 years. At this frequency, native shrubs and perennial grasses cannot recover and after a few wildfire cycles a cheatgrass monoculture develops. This monoculture further increases the frequency of fires and increases the dominance by cheatgrass in the area. Put simply, fire begets cheatgrass and cheatgrass begets fire. Vast numbers of cheatgrass seedlings usually germinate after the first fall rain in infested areas. The root system continues to develop throughout most of the winter and the plant has an extensive root system by spring. This allows it to extract higher levels of soil moisture and nutrients. Cheatgrass reproduces only from seeds and rapidly exploits the available water and nutrients in early spring. In sensitive ecological regions such as Northern Arizona, cheatgrass competes with native plants and can change the soil chemistry of an area, thereby reducing the populations of native plants. One study demonstrated cheatgrass' ability to reduce soil moisture to the permanent wilting point to the depth of 28 in (70 cm), reducing competition from other species.
Sources of information: See West (1979), Melgoza et al. (1990), Whisenant (1990), Skipper (1996), Devine (1998), Mosley et al. (1999; for review and other citations), Young (2000), and Carpenter and Murray (Undated); see also the Northern Arizona Integrated Weed Management Reference CD\Resources: *Bromus tectorum* infosheet.

Question 1.3 Impact on higher trophic levels *Score:* **A** *Doc'n Level:* **Rev. sci. pub.**
Identify type of impact or alteration: Cheatgrass has had a negative effect on wildlife, particularly due to change in fire frequency which alters habitat structure. The implications of loss of shrubland refugia may be severe for ground squirrels and their predators. Does have a positive impact of forage for wildland in spring. Dried awns can damage the mouths of native wildlife species. Reduces biodiversity in ecosystems by replacing native vegetation.
Rationale: Slow-moving fauna such as desert tortoises are sometimes killed in the rapidly moving fires. Although cheatgrass provides good quality forage when used by livestock in the early spring, it can have negative effects when consumed in late spring and summer. Mature seeds contain long, stiff awns that often puncture the mouth and throat tissue of livestock, reducing feed intake and subsequent

weight gain. Effects on native game species are largely unknown, but expected to be similar to livestock. The process in which a pristine shrub-steppe ecosystem deteriorates into one dominated by cheatgrass takes several years and has several distinct cycles. First, some sort of disturbance, typically heavy grazing, allows cheatgrass and other annuals to invade and proliferate. The dry beds of cheatgrass in the summer increase the occurrence of frequent fires. Initially, this creates an environment dominated by annual grasses, matchweed (*Gutierrezia sarothrae*), and rabbitbrush (*Chrysothamnus* spp.). 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. This complete replacement of native flora, esp shrubs that are an important component of community structure, alters the structure of animal communities. Animal species that have co-evolved with a vegetation community for forage, cover and shelter, cannot adapt quickly enough to the rapid changes in the plant community. Sagebrush provides a principal source of browse on winter ranges for both wild and domestic ungulates, it is undoubtedly central to the habitat requirements of a host of other wildlife species. A study by Van Horne et al (1997), found that the replacement of native shrub species by exotic annual forbs and grasses appears to be a unidirectional and permanent change in the study area in Idaho. Their findings suggest that further loss of shrubland in the Birds of Prey Area could greatly reduce ground squirrel densities that occur during such "ecological crunches," enhancing the risk of localized or area-wide extinction of populations. Moreover, given the apparent dependence of ground squirrels on native bunchgrasses for food and water, it is likely that replacement of these grasses by cheatgrass, with its much shorter succulent phase, would have a strong negative impact on ground squirrel populations, especially where there are few alternative forages, such as on grassland sites.
Sources of information: See West (1979), Currie et al. (1987), Van Horne et al (1997), Mosley et al. (1999; for review and other citations), Young (2000), Carpenter and Murray (Undated), and Meyer (Undated); score also based on inference.

Question 1.4 Impact on genetic integrity *Score:* **D** *Doc'n Level:* **Rev. sci. pub.**
Identify impacts: Hybridization with other species rarely occurs under natural conditions.
Rationale: Unlikely to hydridize with native *Bromus* species. No evidence that this has occurred.
Sources of information: See Upadhaya et al. (1986) and Rice and Mack (1991b).

Question 2.1 Role of anthropogenic and natural disturbance in establishment *Score:* **A** *Doc'n Level:* **Other pub.**
Describe role of disturbance: Cultivation and subsequent land abandonment, excessive livestock grazing and repeated fires can all interact to proliferate cheatgrass. 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. Study plots from the Ecological Restoration Institute from Powell Plateau on the North Rim of Grand Canyon National Park show an occurrence of cheatgrass at a frequency of 1 to 14%, which demonstrates the plant's ability to invade undisturbed sites.
Sources of information: See Douglas et al. (1990), Rice and Mack (1991a), and Mosley et al. (1999; for review and other citations); also considered Ecological Restoration Institute, unpublished data.

Question 2.2 Local rate of spread with no management *Score:* **A** *Doc'n Level:* **Other pub.**
Describe rate of spread: Can double in area in less than 10 years.
Rationale: Because cheatgrass 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.

Observations from the North Rim areas (Powell Plateau and the Walhalla Plateau) demonstrate cheatgrass infestations have the ability to double within 10 years.	
Sources of information: See Mosley et al. (1999); also considered personal observations by K. Watters (Research Technician, Grand Canyon National Park, Flagstaff, Arizona, 2002 to 2003).	

Question 2.3 Recent trend in total area infested within state	*Score:* **B** *Doc'n Level:* **Obs.**
Describe trend: Increasing, but less rapidly.	
Rationale: According to many local botanists, cheatgrass has not occupied its total potential range in Arizona. In ponderosa pine and pinyon juniper habitat, the invasion has gone from existing in small pockets to expanding.	
Sources of information: Observational information from B. Phillips (Zone Botanist, U.S. Department of Agriculture, Forest Service, Coconino, Kaibab and Prescott National Forests).	

Question 2.4 Innate reproductive potential	*Score:* **A** *Doc'n Level:* **Other pub.**
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: See Young and Evans (1985), Upadhaya et al. (1986), Mosley et al. (1999), Young (2000), and Zouhar (2003).	

Question 2.5 Potential for human-caused dispersal	*Score:* **A** *Doc'n Level:* **Other pub**.
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. According to botanists with the USFS, there is an element of cheatgrass seed in certified weed-free seed used for reseeding areas that have been burned as it is impossible to separate. Both fire suppression and prescribed fire activities can aid in the dispersal of cheatgrass.	
Rationale: There are numerous opportunities for dispersal to new areas. Fire suppression equipment and firefighters track the seeds to new areas where plants can readily establish. Whereas prescribed fire seeks to restore natural processes in Ponderosa pine ecosystems, species diversity is not immediately altered by fire. However, within the first 3 years of a prescribed fire program, high-fire intensity patches are also the most susceptible to invasion by non-native plant species. The lower elevation ponderosa pine forests are potentially most susceptible to new invasions. Particularly troublesome is the apparently recent expansion of non-native cheatgrass in these forests in Kings Canyon National Park. As is the case with species diversity in general, the expansion of cheatgrass is strongly correlated with localized patch-level fire intensity.	
Sources of information: See Mosley et al. (1999), Keeley (2000), and Young (2000); also considered personal communication with B. Phillips (Zone Botanist, U.S. Department of Agriculture, Forest Service, Coconino, Kaibab and Prescott National Forests).	

Question 2.6 Potential for natural long-distance dispersal	*Score:* **A** *Doc'n Level:* **Other pub.**
Identify dispersal mechanisms: Cheatgrass is spread by wind, water, attachment to animal fur and hooves, or by small rodents and ants.	

Rationale: Long distance dispersal of cheatgrass by natural mechanisms is frequent. Cheatgrass is subject to animal dispersal as well-established base populations are common and barbed seeds easily cling to fur and hooves and are transported to new areas to form new populations. The eroded nature of annual grassland sites dominated by cheatgrass may promote water flow and therefore dispersal through this mechanism.	
Sources of information: See and Young (2000) and Zouhar (2003); also considered: An Assessment of Exotic Plant Species of Rocky Mountain National Park. *Bromus tectorum* L. (available online at: http://www.npwrc.usgs.gov/resource/othrdata/explant/bromtect.htm; accessed January 8, 2004.	

Question 2.7 Other regions invaded	*Score:* **C** *Doc'n Level:* **Other pub**.
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. In Utah, cheatgrass is invasive in sagebrush (*Artemisia* spp.) steppe and bunchgrass regions Great Basin desert scrub. Cheatgrass invades elsewhere in habitat types that have already been invaded in the state.	
Rationale: Native to southern Europe, northern Africa, and southwestern Asia. One of the most widely invasive species around the world. In Utah 297,000 acres is considered cheatgrass monoculture (>60%), and cheatgrass is considered a major understory component (10 to 59%) in 1,082,880 acres. According to S. Cassidy (personal communication, 2003) and L. Walker (personal communication, 2003), both of whom have worked extensively with cheatgrass on the Arizona Strip, cheatgrass covers every square foot of the Great Basin desert scrub and grassland ecological types.	
Sources of information: See Upadhaya (1986), Mosley at al. (1999), and Young (2000). Also considered personal communications with S. Cassidy (Natural Resources Conservation Service, 2003) and L. Walker (Weed Specialist, Bureau of Land Management, Arizona Strip, St. George, Utah, 2003)	

Question 3.1 Ecological amplitude	*Score:* **A** *Doc'n Level:* **Other pub.**
Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: Downy brome was first found in the United States near Denver, Colorado, in the late 1800s (Whitson et al. 1991). It is most abundant in the Great Basin and Columbia Basin of the western United States.	
Rationale: Most common in sagebrush/bunchgrass communities, although its distribution extends to higher-elevation juniper, pinyon-juniper, and pine woodlands.	
Sources of information: See Mosley at al. (1999) and Young (2000).	

Question 3.2 Distribution	*Score:* **A** *Doc'n Level:* **Other pub.**
Describe distribution: Widespread throughout Arizona. Dominant annual grass on sagebrush rangelands on the Colorado Plateau and in rapidly colonizing Pinyon Juniper and Ponderosa pine woodlands in National Forest lands.	
Rationale: Most common introduced annual grass in the United States. Today, cheatgrass is the dominant species on more than 100 million acres of the Intermountain west. Although cheatgrass can be found in both disturbed and undisturbed shrub-steppe and intermountain grasslands, the largest infestations are usually found in disturbed shrub-steppe areas, overgrazed rangeland, abandoned fields, eroded areas, road verges, and waste places.	
Sources of information: See Whisenant (1990), Mosley at al. (1999), Young (2000), and Carpenter and Murray (Undated); distribution scores also based on Working Group observations.	

Worksheet A. Reproductive Characteristics

Complete this worksheet to answer Question 2.4.

Reaches reproductive maturity in 2 years or less	**[Yes]**	**No**	**1 pt.**
Dense infestations produce >1,000 viable seed per square meter	**[Yes]**	**No**	**2 pt.**
Populations of this species produce seeds every year.	**[Yes]**	**No**	**1 pt.**
Seed production sustained for 3 or more months within a population annually	**[Yes]**	**No**	**1 pt.**
Seeds remain viable in soil for three or more years	**[Yes]**	**No**	**2 pt.**
Viable seed produced with *both* self-pollination and cross-pollination	**[Yes]**	**No**	**1 pt.**
Has quickly spreading vegetative structures (rhizomes, roots, etc.) that may root at nodes	**Yes**	**[No]**	**1 pt.**
Fragments easily and fragments can become established elsewhere	**Yes**	**[No]**	**2 pt.**
Resprouts readily when cut, grazed, or burned	**[Yes]**	**No**	**1 pt.**
	Total pts: 9	**Total unknowns: 0**	
	Score : A		

Note any related traits:

Worksheet B. Arizona Ecological Types
(*sensu* Brown 1994 and Brown et al. 1998)

Major Ecological Types	Minor Ecological Types	Code*
Dunes	dunes	
Scrublands	Great Basin montane scrub	**A**
	southwestern interior chaparral scrub	
Desertlands	Great Basin desertscrub	**A**
	Mohave desertscrub	
	Chihuahuan desertscrub	
	Sonoran desertscrub	
Grasslands	alpine and subalpine grassland	
	plains and Great Basin shrub-grassland	**A**
	semi-desert grassland	**D**
Freshwater Systems	lakes, ponds, reservoirs	
	rivers, streams	
Non-Riparian Wetlands	Sonoran wetlands	
	southwestern interior wetlands	
	montane wetlands	
	playas	
Riparian	Sonoran riparian	
	southwestern interior riparian	
	montane riparian	**D**
Woodlands	Great Basin conifer woodland	**D**
	Madrean evergreen woodland	
Forests	Rocky Mountain and Great Basin subalpine conifer forest	
	montane conifer forest	**D**
Tundra (alpine)	tundra (alpine)	

*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).

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