

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):	<i>Hordeum murinum</i> L. (USDA 2005)
Synonyms:	<i>Hordeum murinum</i> L.: <i>Hordeum leporinum</i> Link; <i>Hordeum murinum</i> spp. <i>glaucum</i> : <i>Critesion glaucum</i> (Steud.) A. Löve, <i>Critesion murinum</i> (L.) A. Löve ssp. <i>glaucum</i> (Steud.) W.A. Weber, <i>Hordeum glaucum</i> Steud., <i>Hordeum stebbinsii</i> Covas; <i>Hordeum murinum</i> spp. <i>leporinum</i> : <i>Critesion murinum</i> (L.) A. Löve ssp. <i>leporinum</i> (Link) A. Löve, <i>Hordeum leporinum</i> Link; <i>Hordeum murinum</i> ssp. <i>murinum</i> : <i>Critesion murinum</i> (L.) A. Löve (USDA 2005).
Common names:	<i>Hordeum murinum</i> L.: Mouse barley; <i>Hordeum murinum</i> spp. <i>glaucum</i> : Smooth barley; <i>Hordeum murinum</i> spp. <i>leporinum</i> : Leporinum barley, hare barley, wild barley, barely grass; <i>Hordeum murinum</i> ssp. <i>murinum</i> : Wall barley.
Evaluation date (mm/dd/yy):	05/21/04
Evaluator #1 Name/Title:	Dennis J. Casper/Biological Technician
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List committee members:	05/21/04: D. Backer, D. Casper, D. Foster, P. Guertin, J. Hall, C. Laws, F. Northam 09/24/04: D. Backer, J. Brock, D. Casper, J. Cotton, R. de la Torre, J. Hall, K. Klementowski, H. Messing, B. Munda, F. Northam, J. Ward
Committee review date:	5/21/04 and 09/24/04
List date:	09/24/04
Re-evaluation date(s):	

Taxonomic Comment: See the Red Flag Annotation section.

Table 2. Scores, Designations, and Documentation Levels

Question		Score	Documentation Level	Section Scores	Overall Score & Designations
1.1	Impact on abiotic ecosystem processes	B	Observational	“Impact” Section 1 Score: B	“Plant Score” Overall Score: Medium Alert Status: None
1.2	Impact on plant community	B	Reviewed scientific publication		
1.3	Impact on higher trophic levels	C	Other published material		
1.4	Impact on genetic integrity	U	Observational		
				“Invasiveness” <i>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:</i> 15 pts Section 2 Score: B	 Something you should know.
2.1	Role of anthropogenic and natural disturbance	B	Reviewed scientific publication		
2.2	Local rate of spread with no management	B	Other published material		
2.3	Recent trend in total area infested within state	C	Observational		
2.4	Innate reproductive potential	A	Reviewed scientific publication		
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		
				“Distribution” Section 3 Score: A	
3.1	Ecological amplitude	A	Observational		
3.2	Distribution	A	Observational		

Red Flag Annotation

Some authorities recognize *Hordeum glaucum*, *H. leporinum*, and *H. murinum* as separate species; however, based on the use of the U.S. Department of Agriculture Plants Database [USDA 2005] as the authority for reconciling taxonomic questions, *H. murinum* is recognized herein as the valid species taxon and *H. m. glaucum*, *H. m. leporinum*, and *H. m. murinum* are recognized as subspecies.

Table 3. Documentation

<p>Question 1.1 Impact on abiotic ecosystem processes</p>	<p>Score: B Doc'n Level: Obs.</p>
<p>Identify ecosystem processes impacted: Dense stands may increase fire frequency and intensity though this species is not promoted by fire; it competes successfully for light, water, and nutrients due to its ability to start growth early in the season.</p>	
<p>Rationale: Direct information on wildland fires fueled by <i>Hordeum murinum</i> are lacking, however it is well established that high density stands of exotic winter ephemeral grasses have supported damaging fires in the Sonoran desert (Esque and Schwalbe 2001). In California <i>H. m. leporinum</i> was found to be the annual grass most sensitive to burning. When grassland contained up to 90% of <i>H. m. leporinum</i>, this percentage was reduced to less than 5% after burning. The early maturation of <i>H. m. leporinum</i> enables it to complete its life cycle ahead of later-maturing associated annual and perennial species (Dean 1990). Early germination and establishment also provides these plants an advantage in capturing needed resources (light, water, and nutrients) (Guertin and Halvorson 2003). Note: Little research has been conducted on <i>H. m. leporinum</i> in natural areas (Dean 1990).</p>	
<p>Sources of information: See cited literature. Score based on inference drawn from the literature.</p>	
<p>Question 1.2 Impact on plant community composition, structure, and interactions</p>	<p>Score: B Doc'n</p>
<p>Level: Rev. sci. pub.</p>	
<p>Identify type of impact or alteration: Can become dominant over native plants, particularly where livestock is grazed and where soil nitrogen is high.</p>	
<p>Rationale: Some native annuals may have density-dependent germination (Inouye 1980 in Burgess et al. 1991) whereby the presence of established plants on a site prevents others from germinating. <i>Hordeum murinum</i> does not suppress germination at high densities. After good rains, mass germination in these species produces dense stands that suppress other ephemerals (Burgess et al. 1991). <i>Hordeum m. leporinum</i> is a successful invader species, particularly where land has been disturbed (i.e. continuous grazing) and where soil nutrient levels are high and nitrogen rich. Under climatic conditions similar to the Mediterranean (warm, dry summers and cool, moist winters that are relatively frost free), the species can become dominant over native plants (Dean 1990). This species does particularly well in areas with high nitrogen leaf litter such as mesquite bosques in Sonoran riparian and Sonoran desertscrub (i.e., Hassayampa River Preserve and Catalina State Park). It is in these areas where impact on plant community dynamics could be significant, particularly when climatic conditions are favorable (D. Casper, personal observation, 2004).</p>	
<p>Sources of information: See cited literature. Also considered personal observations by D. Casper (Biological Technician, National Park Service, Organ Pipe Cactus National Monument, Ajo, Arizona, 2004). Score based in part on inference drawn from the literature and observations by D. Casper.</p>	
<p>Question 1.3 Impact on higher trophic levels</p>	<p>Score: C Doc'n Level: Other pub.</p>
<p>Identify type of impact or alteration: Seed awn could harm wildlife, the forage produced is of high quality before seed heads develop.</p>	
<p>Rationale: Because the seed awn is often so damaging to stock animals, it is possible that the species could be harmful to wildlife (Dean 1990). <i>Hordeum murinum</i> is generally a localized species in favored environments that grow a host of other native and non-native species; therefore, its impact on higher trophic levels is probably small. More research is needed on the impact of <i>H. murinum</i> on higher trophic levels. It was suggested during Working Group member discussions that the presence of dense stands of <i>H. murinum</i> could affect foraging patterns of animals because of the presence of the mechanical deterrent of seed awns in dense stands.</p>	
<p>Sources of information: See cited literature. Also considered Working Group member discussions on May 21, 2004).</p>	

Question 1.4 Impact on genetic integrity	<i>Score: U Doc'n Level: Obs.</i>
Identify impacts: Unknown; not likely significant because barely grass usually has closed flowers.	
Rationale: Native congeners occur in Arizona (Kearney and Peebles 1960). No studies were found that address whether <i>Hordeum murinum</i> (and all of its subspecies) can hybridize with native barleys. The flowers can be wind pollinated, but mostly are cleistogamous and are self-fertilized (Giles and Lefkovitch 1986, Weiller et al. 1995 in Guertin and Halvorson 2003).	
Sources of information: See cited literature. Score based on inference drawn from the literature.	

Question 2.1 Role of anthropogenic and natural disturbance in establishment	<i>Score: B Doc'n Level: Rev. sci. pub.</i>
Describe role of disturbance: This species thrives in ruderal habitats associated with grazing and human habitation, it can establish in the absence of disturbance.	
Rationale: <i>Hordeum murinum</i> typically grows in disturbed, ruderal sites or cultivated fields (Burgess et al. 1991). In Arizona <i>H. m. leporinum</i> is common on disturbed soil of roadsides, irrigation ditches, vacant lots, and lawns (Dean 1990). This species is widespread throughout Arizona and is locally present in relatively undisturbed natural areas. It's important to note that cattle grazing has occurred or continues to occur in many natural areas throughout the state and creates suitable site for <i>Hordeum murinum</i> establishment (D. Casper, unpublished data, 2004).	
Sources of information: See cited literature. Also considered unpublished information of D. Casper (<i>Hordeum</i> Occurrence in Local Floras of Arizona. Worksheet produced for AZ-WIPWG meeting [see table following Worksheet B]. Research conducted online May 7, 2004 at: http://seinet.asu.edu/bioExplorer/ChecklistChoices.jsp).	

Question 2.2 Local rate of spread with no management	<i>Score: B Doc'n Level: Other pub.</i>
Describe rate of spread: The rate of spread will vary with climatic conditions, in years with the appropriate weather regimes the rate of spread can be locally high	
Rationale: <i>Hordeum murinum</i> can rapidly colonize areas when environmental conditions are good (i.e. no hard freeze and good moisture) because of its early germination, early rapid growth rate, high seed production, and efficient dispersal mechanisms (Biddiscombe et al. 1954, Smith 1972 in Dean 1990). No research was located on the local rate of spread within Arizona.	
Sources of information: See cited literature. Score based on inference drawn from the literature.	

Question 2.3 Recent trend in total area infested within state	<i>Score: C Doc'n Level: Obs.</i>
Describe trend: Not known with certainty, but inferred to be fairly stable considering how long it has been within the state.	
Rationale: It is thought to have been introduced to North and South America, and to Australia, by the early nineteenth century (Smith 1972, Cocks et al. 1976 in Dean 1990). <i>Hordeum murinum</i> has a nearly complete germination of its seeds. Because of this life-history strategy, little evidence exists for large seed banks to develop for this species (Popay and Sanders 1974 in Guertin and Halvorson 2003).	
Sources of information: See cited literature. Score based on inference drawn from the literature.	

Question 2.4 Innate reproductive potential	<i>Score: A Doc'n Level: Rev. sci. pub.</i>
Describe key reproductive characteristics: See Worksheet A.	
Rationale: Life-history strategy: an annual, C3 graminoid. Reproduces by seed (Guertin and Halvorson 2003). Growth to seed maturation is rapid, and ripe seed production is copious. Halloran and Pennell (1981) found 19 to 29 seeds produced per head. In a study conducted on pasture in Australia, Smith (1968) found an average seed set of 1166 seeds per 64 inches square (>28,000 seeds m ²) under three different grazing regimes and natural rainfall conditions. The flowers can be wind pollinated, but mostly are cleistogamous and are self-fertilized (Giles and Lefkovitch 1986, Weiller et al. 1995 in Guertin and	

<p>Halvorson 2003). <i>Hordeum m. leporinum</i> flowers from March to April in the lower elevations in Arizona, and until October in the higher elevations (Parker 1972 in Guertin and Halvorson 2003). In any one location <i>Hordeum murinum</i> produces seed for a relatively short period of time 1 to 2 months (D. Casper, personal observation, 2004). A viable, 200 year-old seed (<i>H. m. leporinum</i>) was found in adobe brick in southwest North America (Mexico) (Mabberley 1997, Spira and Wagner 1983). Generally, after a short dormancy, almost 100% germination occurs, with a few seed remaining dormant (Guertin and Halvorson 2003). Little evidence exists for large seed banks to develop for this species (Popay and Sanders 1974 in Guertin and Halvorson 2003). Heavy grazing...increased tillering and heads produced (Smith 1968 in Dean 1990).</p>
<p>Sources of information: See cited literature citations. Also considered personal observations by D. Casper (Biological Technician, National Park Service, Organ Pipe Cactus National Monument, Ajo, Arizona, 2004).</p>

<p>Question 2.5 Potential for human-caused dispersal Score: A Doc'n Level: Other Pub.</p>
<p>Identify dispersal mechanisms: Seed is transported in the fur of domesticated grazing animals</p>
<p>Rationale: These seeds easily disperse when long awn attaches to stock (Dean 1990). In Arizona <i>H. m. leporinum</i> is common on disturbed soil of roadsides, irrigation ditches, vacant lots, and lawns (Dean 1990). Livestock probably account for much of the dispersal of this species. Disturbed conditions associated with agriculture provide areas for <i>H. murinum</i> to thrive and spread along roadway corridors is common. <i>Hordeum murinum</i> is often a contaminant in the early cut of alfalfa, so it could be transported in hay (F. Northam, personal communication, 2004).</p>
<p>Sources of information: See cited literature. Also considered personal communication with F. Northam (Weed Biologist [former Arizona Department of Agriculture, Noxious Weed Coordinator], Tempe, Arizona, 2004).</p>

<p>Question 2.6 Potential for natural long-distance dispersal Score: A Doc'n Level: Other Pub.</p>
<p>Identify dispersal mechanisms: Wind; birds; long-awned seed can be transported in the fur of animals; also seed is highly viable.</p>
<p>Rationale: Seed is distributed by wind, birds, or when the awns of the seeds attach to the wool or fur of animals (Ridley 1930 in Guertin and Halvorson 2003). <i>Hordeum m. leporinum</i> showed 92% mean fertility of seed heads (Halloran and Pennel 1981).</p>
<p>Sources of information: See cited literature.</p>

<p>Question 2.7 Other regions invaded Score: C Doc'n Level: Other Pub.</p>
<p>Identify other regions: <i>Hordeum murinum</i> has invaded elsewhere but only in ecological types that it has already invaded in Arizona</p>
<p>Rationale: Extremely widespread genus; from western Asia; introduced to North and South America, Africa, and to Australia.</p>
<p>Sources of information: See Guertin and Halvorson (2003) and Dean (1990).</p>

<p>Question 3.1 Ecological amplitude Score: A Doc'n Level: Obs.</p>
<p>Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: <i>Hordeum murinum</i> invades seven major ecological types in Arizona (See Worksheet B). <i>Hordeum m. leporinum</i> is found from 275 to 2750 m in Arizona (Dean 1990). Earliest record found was 1902 for <i>H. m. glaucum</i> (SEINet 2004).</p>
<p>In Arizona this species has invaded all major ecological types with the exception of alpine and dunes (See Worksheet B and subsequent table). In North America, <i>Hordeum murinum</i> can be found from Maine and British Columbia to northern Mexico; it is absent in most Midwestern states (Dean 1990, USDA 2005).</p>

<p>Rationale: <i>Hordeum murinum</i> is thought to have been introduced to North and South America, and to Australia, by the early nineteenth century (Smith 1972, Cocks et al. 1976 in Dean 1990). As early as 1901, McClatchie (1901) warned that <i>H. m. glaucum</i> would become a “problem invasive” in the Salt River floodplain if no measures were taken to halt its spread (cited in Stromberg and Chew 2002).</p>
<p>Sources of information: See cited literature. Also considered information from SEINet (Southwest Environmental Information Network), Arizona herbaria specimen database (available online at: http://seinet.asu.edu/collections; accessed September 2004), unpublished information of D. Casper (<i>Hordeum</i> Occurrence in Local Floras of Arizona. Worksheet produced for AZ-WIPWG meeting [see table following Worksheet B]. Research conducted online May 7, 2004 at: http://seinet.asu.edu/bioExplorer/ChecklistChoices.jsp), and Working Group member observations.</p>

<p>Question 3.2 Distribution Score: A Doc'n Level: Obs.</p>
<p>Describe distribution: <i>Hordeum murinum</i> is present in Arizona in every county except Navajo, Apache, and Greenlee (Guertin and Halvorson 2003).</p>
<p>Rationale: <i>Hordeum m. leporinum</i> is indigenous to the Mediterranean region where it typically occurs in disturbed areas. In North America it is found from Maine and British Columbia to northern Mexico; it is absent from most Midwestern states (Dean 1990). <i>Hordeum murinum</i> is rated A for Sonoran Riparian. It is a common understory plant in mesquite bosques of Arizona’s Hassayampa River (observations by H. Richter cited in Dean 1990).</p>
<p>Sources of information: See cited literature. Also considered information from SEINet (Southwest Environmental Information Network), Arizona herbaria specimen database (available online at: http://seinet.asu.edu/collections; accessed September 2004) and Working Group member observations.</p>

Worksheet A. Reproductive Characteristics

Complete this worksheet to answer Question 2.4.

Reaches reproductive maturity in 2 years or less	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	1 pt.
Dense infestations produce >1,000 viable seed per square meter	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	2 pt.
Populations of this species produce seeds every year.	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	1 pt.
Seed production sustained for 3 or more months within a population annually	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	1 pt.
Seeds remain viable in soil for three or more years	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	2 pt.
Viable seed produced with <i>both</i> self-pollination and cross-pollination	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	1 pt.
Has quickly spreading vegetative structures (rhizomes, roots, etc.) that may root at nodes	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	1 pt.
Fragments easily and fragments can become established elsewhere	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No	2 pt.
Resprouts readily when cut, grazed, or burned	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	1 pt.
		Total pts: 8 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	
	southwestern interior chaparral scrub	C
Desertlands	Great Basin desertscrub	C
	Mohave desertscrub	C
	Chihuahuan desertscrub	D
	Sonoran desertscrub	C
Grasslands	alpine and subalpine grassland	
	plains and Great Basin shrub-grassland	U
	semi-desert grassland	C
Freshwater Systems	lakes, ponds, reservoirs	
	rivers, streams	
Non-Riparian Wetlands	Sonoran wetlands	C
	southwestern interior wetlands	
	montane wetlands	
	playas	
Riparian	Sonoran riparian	A
	southwestern interior riparian	B
	montane riparian	D
Woodlands	Great Basin conifer woodland	D
	Madrean evergreen woodland	D
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).

<i>Hordeum murinum</i> (and included subspecies): Occurrence in Local Floras in Arizona			
Location	Occurrence**	Major Ecol. Type	Minor Ecol. Type
Buckeye Hills Recreation Area	P	Desertlands	Sonoran desertscrub
Canyon De Chelly N.M.	P	Desertlands	Great Basin desertscrub
Castle Dome Mountains	A	Desertlands	Sonoran desertscrub
Chiricahua National Monument	A	Forests/Woodlands	montane conifer forest/ Madrean evergreen woodland
Hassayampa River Preserve	P	Riparian	Sonoran Riparian
Lake Pleasant Regional Park	P	Desertlands/ Freshwater Systems	Sonoran desertscrub/ lakes ponds, reservoirs
McDowell Mountains Regional Park	P	Desertlands	Sonoran desertscrub
Organ Pipe Cactus N.M.	P	Desertlands	Sonoran desertscrub
Buenos Aires N.W.R.	P	Grasslands	semi-desert grassland
Sierra Ancha	P	Woodlands/ Scrublands/Forests	Great Basin conifer woodland & Madrean evergreen woodland/ southwestern interior chaparral/ montane conifer forest
San Pedro Riparian Conservation Area	P	Desertlands/ Riparian	Chihuahuan desertscrub/ Sonoran riparian
West Fork Oak Creek Canyon	P	Riparian/ Woodlands/Forests	southwestern interior riparian/ Great Basin conifer woodland & Madrean evergreen woodland/ montane conifer forest
Pinal Mountains	A	Woodlands/ Scrublands/Forests	Great Basin conifer woodland & Madrean evergreen woodland/ southwestern interior chaparral/ montane conifer forest
San Tan Semi-Regional Park	P	Desertlands	Sonoran Riparian
Seven Springs	P	Desertlands/ Scrublands/ Grasslands/ Riparian	Sonoran desertscrub/ southwestern interior chaparral/ semi-desert grassland/ Sonoran Riparian
Sierra Estrella Regional Park	P	Desertlands	Sonoran desertscrub
South Mountain	P	Desertlands	Sonoran desertscrub
Superstition Mountains Wilderness	P	Desertlands/ Scrublands/ Grasslands	Sonoran desertscrub/ southwestern interior chaparral/ semi-desert grassland
White Tank Mountains Regional Park	P	Desertlands	Sonoran desertscrub

*Based on information at <http://seinet.asu.edu/> and knowledge of the ecological types.

**A = absent; P = present.

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Hordeum [*m.*] *glaucum*: at <http://muse.bio.cornell.edu/delta/pooid/www/descr204.htm>;

Hordeum [*m.*] *leporinum*: at <http://muse.bio.cornell.edu/delta/pooid/www/descr206.htm>;

Hordeum [*m.*] *murinum*: at <http://muse.bio.cornell.edu/delta/pooid/www/descr208.htm>.