# 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)**:** | Arundo donax L. |
| **Synonyms:** | Arundo glauca Bubani, Arundo latifolia Salisb., Arundo sativa Lam., Cynodon donax (L.) Raspail, Donax arundinaceus P. Beauv., Scolochloa arundinacea (P. Beauv.) Mert. & Koch, Scolochloa donax (L.) Guadin |
| **Common names:** | Giant reed, bamboo reed, donax reed, elephant grass, reed cane, reed grass, Spanish reed, wild cane |
| **Evaluation date** (mm/dd/yy)**:** | 01/25/10 |
| **Evaluator #1 Name/Title:** | Brad Lindenmayer/Research Assistant |
| **Affiliation:** | Colorado State University |
| **Phone numbers:** | (970) 302-3918 |
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| **Evaluator #2 Name/Title:** | Scott Nissen/Professor |
| **Affiliation:** | Colorado State University |
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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:**

**Table 2. Criteria, Section, and Overall Scores**

| | | | | | | |
|---|---|---|---|---|---|---|
| 1.1 | Impact on abiotic ecosystem processes | A | Other Pub. Mat'l | **Impact**<br>*Enter four characters from Q1.1-1.4 below:*<br>**AAAD**<br>*Using matrix, determine score and enter below:*<br>**A** | | |
| 1.2 | Impact on plant community | A | Other Pub. Mat'l | | | |
| 1.3 | Impact on higher trophic levels | A | Other Pub. Mat'l | | | |
| 1.4 | Impact on genetic integrity | D | Rev'd, Sci. Pub'n | | | |
| | | | | | | |
| 2.1 | Role of anthropogenic and natural disturbance | B (2 pts) | Other Pub. Mat'l | **Invasiveness**<br>*Enter the sum total of all points for Q2.1-2.7 below:*<br>**12**<br>*Use matrix to determine score and enter below:*<br>**B** | | |
| 2.2 | Local rate of spread with no management | B (2 pts) | Rev'd, Sci. Pub'n | | | **Wildlands Plant Score**<br>*Using matrix, determine Overall Score and Alert Status from the first, second, and third section scores and enter below:*<br>**High**<br>**Red Alert** |
| 2.3 | Recent trend in total area infested within state | U (0 pts) | Other Pub. Mat'l | | | |
| 2.4 | Innate reproductive potential Wksht A | B (2 pts) | Other Pub. Mat'l | | | |
| 2.5 | Potential for human-caused dispersal | B (2 pts) | Other Pub. Mat'l | | | |
| 2.6 | Potential for natural long-distance dispersal | B (2 pts) | Other Pub. Mat'l | | | |
| 2.7 | Other regions invaded | B (2 pts) | Rev'd, Sci. Pub'n | | | |
| | | | | | | |
| 3.1 | Ecological amplitude/Range | U | Rev'd, Sci. Pub'n | **Distribution**<br>*Using matrix, determine score and enter below:*<br>**U** | | |
| 3.2 | Distribution/Peak frequency Wrksht B | U | Other Pub. Mat'l | | | |

| | | | |
|---|---|---|---|
| 4.1 | Poisonous to livestock | C (1pts) | Rev'd, Sci. Pub'n |
| 4.2 | Detrimental to economic crops | B (2 pts) | Other Pub. Mat'l |
| 4.3 | Detrimental to management of agricultural system, rangeland and pasture | A (3 pts) | Other Pub. Mat'l |
| 4.4 | Human impacts Wrksht C | A (3 pts) | Other Pub. Mat'l |

## 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 Other Pub. Mat'l back |
|---|
| Identify ecosystem processes impacted: Increased flooding and siltation of riparian areas as well as alteration of fire regime and depletion of water tables in arid climates. Can also alter water conditions in riparian zones |
| Rationale: Dense networks of giant reed rhizomes and stems can alter flow regimes in riparian corridors causing flooding as well as the collection of sediment (1). Additionally, giant reed is readily flammable throughout most of the year and is adapted to a periodic fire regime increasing the risk of high intensity and more frequent fires in riparian corridors (2,3). Giant reed consumes more water through transpiration than native plants, as much as 2,000 L/meter annually of standing biomass, and has the potential to decrease ground water availability (4). Giant reed reduces natural canopy structure and increases water temperature resulting in decreased oxygen levels (5). Reduced canopy can also increase algal photsynthetic activity, which in turn can increase water pH (6). |
| Sources of information: (1) DiTomaso, J.M. and E.A. Healy. 2003. Aquatic and Riparian Weeds of the West. pp. 254-262. University of California Division of Agriculture and Natural Resources.<br>(2) Zohary, M and A.J. Willis. 1992. The vegetation of Egypt. Chapman and Hall, London.<br>(3) Scott, G. 1994. Fire threat from Arundo donax. In: Jackson, N.E., P. Frandsen, S. Douthit (eds.) November (1993) Arundo donax workshop proceedings. pp 17-18. Ontario, Canada.<br>(4) Iverson, M.E. 1994. The impact of Arundo donax on water resources. In: Jackson, N.E., P. Frandsen, S. Douthit (eds.) November (1993) Arundo donax workshop proceedings. pp 19-25. Ontario, Canada.<br>(5) Dunne, T. and L.B. Leopold. 1978. Water in environmental planning. W.H. Freeman and Company, New York<br>(6) Chadwick and Associates. 1992. Santa Ana River use attainability analysis. Volume 2: Aquatic biology, habitat and toxicity analysis. Santa Ana Watershed Project Authority, Riverside, CA |
| **Question 1.2** Impact on plant community composition, structure, and interactions A Other Pub. Mat'l back |
| Identify type of impact or alteration: Displacemes native riparian plants and is an alternative host for agronomically important viruses. |
| Rationale: Due to its perennial growth habit and creeping rhizomes, giant reed quikly forms dense monocultures which displace native species such as willows and cottonwoods (2). Giant reed also is an alternative host for beet western yellows virus, sugarcane mosiac virus, and maize dwarf mosiac virus (1). |
| Sources of information: (1) DiTomaso, J.M. and E.A. Healy. 2003. Aquatic and Riparian Weeds of the West. pp. 254-262. University of California Division of Agriculture and Natural Resources.<br>(2) Bell, G.P. 1997. Ecology and management of Arundo donax, and approaches to riparian habitat restoration in southern California. In: Brock, J.H., M. Wade, P. Pysek, D. Green (eds.) Plant Invasion: Studies from North America and Europe. pp 103-113. Leiden, The Netherlands, Backhuys. |
| **Question 1.3** Impact on higher trophic levels A Other Pub. Mat'l back |
| Identify type of impact or alteration: Reduces riparian wildlife habitat along steam banks and can alter aquatic environment. |

Rationale: Invasion and colonization of giant reed displaces important native willow and cottonwood habitat for such species as the federally endangered bird, the least Bell's viero (Viero bellii pusillus) and the federally threatened bird, the willow flycatcher (Empidonax traillii eximus) (1,2,3,4,5). It has also been shown that giant reed provides no suitable food or habitat for native wildlife species (2). Giant reed reduces natural canopy structure and increases water temperature resulting in decreased oxygen levels reducing habitat suitability for fish(6). Reduced canopy can also increase algal photsynthetic activity, which in turn can increase water pH again reducing habitat suitability for fish (7).

Sources of information: (1) DiTomaso, J.M. and E.A. Healy. 2003. Aquatic and Riparian Weeds of the West. pp. 254-262. University of California Division of Agriculture and Natural Resources.

(2) Bell, G.P. 1997. Ecology and management of Arundo donax, and approaches to riparian habitat restoration in southern California. In: Brock, J.H., M. Wade, P. Pysek, D. Green (eds) Plant Invasion: Studies from North America and Europe. pp 103-113. Leiden, The Netherlands, Backhuys.

(3) Hendricks, B. and J. Reiger. 1989. Description of nesting habitat for the Least Bell's Viero. USDA Forest Service Gen. Tech. Rep. PSW-110

(4) Franzerb, K. 1989. Ecology and conservation of the lest Bell's viero. U.S. Fish and Wildlife Service, Biological Report 89(1) pp 17.

(5) Zembal, R. 1990. Riparian habitat and breeding birds of along the Santa Margarita and Santa Ana Rivers of southern California. In: Schoenherr, A.A. (ed.), Endangered plant communities of southern California. pp 98-114. Southern California Botanists, Special Publ. No. 3. Fullerton, CA.

(6) Dunne, T. and L.B. Leopold. 1978. Water in environmental planning. W.H. Freeman and Company, New York

(7) Chadwick and Associates. 1992. Santa Ana River use attainability analysis. Volume 2: Aquatic biology, habitat and toxicity analysis. Santa Ana Watershed Project Authority, Riverside, CA

**Question 1.4** Impact on genetic integrity D Rev'd, Sci. Pub'n back

Identify impacts: No impact on genetic integrity

Rationale: Since giant reed does not have any related species established in Colorado and reproduces strictly from rhizome and stem fragments there is no chance for hybridization (1,2). Giant reed does not produce any viable seed (1,2). A recent genetic analysis also revealed low genetic variability, suggesting a species that exhibits primarily asexual reproduction (3).

Sources of information: (1) DiTomaso, J.M. and E.A. Healy. 2003. Aquatic and Riparian Weeds of the West. pp. 254-262. University of California Division of Agriculture and Natural Resources.

(2) Bell, G.P. 1997. Ecology and management of Arundo donax, and approaches to riparian habitat restoration in southern California. In: Brock, J.H., M. Wade, P. Pysek, D. Green (eds.) Plant Invasion: Studies from North America and Europe. pp 103-113. Leiden, The Netherlands, Backhuys.

(3) Khudamrongsawat, J., R. Tayyar, J.S. Holt. 2004. Genetic diversity of giant reed (Arundo donax) in the Santa Ana River, California. Weed Science, 52:395-405.

| **Question 2.1** Role of anthropogenic and natural disturbance in establishment B Other Pub. Mat'l back |
|---|
| Describe role of disturbance: Fire and flood disturbance play an important role in the invasiveness of giant reed. |
| Rationale: Giant reed is adapted to fire disturbance and will send up new shoots from rhizomes quickly after fires, out-competing native plants forming pure giant reed stands (1). Flooding also distributes rhizome fragments causing new establishments of giant reed downsteam (1, 2). |
| Sources of information: (1) DiTomaso, J.M. and E.A. Healy. 2003. Aquatic and Riparian Weeds of the West. pp. 254-262. University of California Division of Agriculture and Natural Resources.<br>(2) Bell, G.P. 1997. Ecology and management of Arundo donax, and approaches to riparian habitat restoration in southern California. In: Brock, J.H., M. Wade, P. Pysek, D. Green (eds) Plant Invasion: Studies from North America and Europe. pp 103-113. Leiden, The Netherlands, Backhuys. |
| **Question 2.2** Local rate of spread with no management B Rev'd, Sci. Pub'n back |
| Describe rate of spread: Local rate of spread can increase at a less than rapid rate without management |
| Rationale: Giant reed establishes from rhizome fragments spread primarily by flooding and can take advantage of fire disturbance. It has been shown that giant reed shoots can grow 6.25 cm/day during the first 40 days of growth from established rhizomes and 2.67 cm/day over 150 days which far surpass natives like willow (1). Giant reed is also capable of reaching mature heights of 2.5 to 4.0 meters within its first growing season (1). However, giant reed rhizome fragments do not tolerate cold tempertures (2) and a recent study has shown reduced rooting from rhizomes at tempertures below 17.5 degrees Celsius (3) which makes it hard to overwinter in most parts of Colorado. |
| Sources of information: (1) Rieger, J.P. and D.A. Kreager. 1989. Giant reed (Arundo donax): A climax community of the riparian zone. USDA Forest Service Gen. Tech. Rep. PSW-110.<br>(2) DiTomaso, J.M. and E.A. Healy. 2003. Aquatic and Riparian Weeds of the West. pp. 254-262. University of California Division of Agriculture and Natural Resources.<br>(3) White, A.H.M.B., T. Mizutani, E.R. Motamed, M.L. Merryfield, D.E. Miller, D.E. Alexander. 2005. Temperature and Endogenous Factors Cause Seasonal Patterns in Rooting by Stem Fragments of the Invasive Giant Reed, Arundo donax (Poaceae). Int. J. Plant Sci. 166(3): 507-517. |
| **Question 2.3** Recent trend in total area infested within state U Other Pub. Mat'l back |
| Describe trend: Giant reed has yet to be documented in the state of Colorado. |
| Rationale: Since giant reed has yet to be found in the state of Colorado, its trend in area infested is unknown (1) |
| Sources of information: (1) http://plants.usda.gov/ |
| **Question 2.4** Innate reproductive potential B Other Pub. Mat'l back |
| Describe key reproductive characteristics: Giant reed reproduces vegetatively. |

Rationale: Giant reed reproduces exclusively from rhizome and shoot fragments which are dispersed primarily by flooding. Giant reed does not produce any viable seed, but its vegetative propagules are viable within the first year of growth (1,2).

Sources of information: (1) DiTomaso, J.M. and E.A. Healy. 2003. Aquatic and Riparian Weeds of the West. pp. 254-262. University of California Division of Agriculture and Natural Resources.

(2) Bell, G.P. 1997. Ecology and management of Arundo donax, and approaches to riparian habitat restoration in southern California. In: Brock, J.H., M. Wade, P. Pysek, D. Green (eds) Plant Invasion: Studies from North America and Europe. pp 103-113. Leiden, The Netherlands, Backhuys.

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

Identify dispersal mechanisms: Giant reed has been dispersed through ornamental/agricultural sales and has the potential to be spread along irrigation canals.

Rationale: Giant reed was introduced first in California in the 1820s for erosion control and for light construction material(1). Subsequent introductions and plantings have been made for use as reeds in musical intruments, as an ornamental(2), and as a source of cellulose for bio-fuel (3). Rhizome and stem fragments are dispersed by flooding and could have the potential for dispersal along irrigation canals (2).

Sources of information: (1) Hoshovsky, M. 1987. Arundo donax. Element Stewardship Abstract. The Nature Conservancy, San Francisco, CA. pp 10.

(2) Bell, G.P. 1997. Ecology and management of Arundo donax, and approaches to riparian habitat restoration in southern California. In: Brock, J.H., M. Wade, P. Pysek, D. Green (eds.) Plant Invasion: Studies from North America and Europe. pp 103-113. Leiden, The Netherlands, Backhuys.

(3) Barney, J.N. and J.M. DiTomaso. 2008. Nonnative species and bioenergy: are we cultivating the nextinvader? BioScience 58: 64-70.

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

Identify dispersal mechanisms: Rhizome fragments have the potential to be dispersed long distances by flooding.

Rationale: Flooding in riparian ecosystems can break up and disperse giant reed rhizome and stem fragments, transporting them great distances downstream (1).

Sources of information: (1) Bell, G.P. 1997. Ecology and management of Arundo donax, and approaches to riparian habitat restoration in southern California. In: Brock, J.H., M. Wade, P. Pysek, D. Green (eds.) Plant Invasion: Studies from North America and Europe. pp 103-113. Leiden, The Netherlands, Backhuys.

**Question 2.7** Other regions invaded B Rev'd, Sci. Pub'n back

Identify other regions: Giant reed has invaded riparian ecosystems and warm coastal freshwaters in CA, AZ, NM, NV, TX, OK, KS, MO, AR, LA, AL, TN, KY, IL, MS, GA, FL, SC, NC, VA, WV, MD and even Northern Mexico.

Rationale: Giant reed thrives in riparian ecosystems and coastal freshwaters in warm climates (1, 2, 3) but probably hasn't invaded Colorado due to low surviability over the cold winters found in much of the state (4).

Sources of information: (1) DiTomaso, J.M. and E.A. Healy. 2003. Aquatic and Riparian Weeds of the West. pp. 254-262. University of California Division of Agriculture and Natural Resources.

(2) Bell, G.P. 1997. Ecology and management of Arundo donax, and approaches to riparian habitat restoration in southern California. In: Brock, J.H., M. Wade, P. Pysek, D. Green (eds) Plant Invasion: Studies from North America and Europe. pp 103-113. Leiden, The Netherlands, Backhuys.

(3) http://plants.usda.gov/

(4) White, A.H.M.B., T. Mizutani, E.R. Motamed, M.L. Merryfield, D.E. Miller, D.E. Alexander. 2005. Temperature and Endogenous Factors Cause Seasonal Patterns in Rooting by Stem Fragments of the Invasive Giant Reed, Arundo donax (Poaceae). Int. J. Plant Sci. 166(3): 507-517.

**Question 3.1** Ecological amplitude/Range U Rev'd, Sci. Pub'n back

Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: Giant reed has not yet been documented in the state of Colorado

Rationale: There are no documented reports of giant reed in Colorado (1), but Colorado has several of the ecosystems that it thrives in. It is likely that cold winter tempertures may prevent its establishment to the state (2).

Sources of information: (1) http://plants.usda.gov/

(2) White, A.H.M.B., T. Mizutani, E.R. Motamed, M.L. Merryfield, D.E. Miller, D.E. Alexander. 2005. Temperature and Endogenous Factors Cause Seasonal Patterns in Rooting by Stem Fragments of the Invasive Giant Reed, Arundo donax (Poaceae). Int. J. Plant Sci. 166(3): 507-517.

**Question 3.2** Distribution/Peak frequency U Other Pub. Mat'l back

Describe distribution: Giant reed has not yet been reported in the state of Colorado

Rationale: There are no documented reports of giant reed in Colorado (1), but Colorado has several of the ecosystems that it thrives in.

Sources of information: (1) http://plants.usda.gov/

**Question 4.1** Poisonous to Livestock C Rev'd, Sci. Pub'n back

Describe impacts in terms of high probability of death, long-term health impacts, or short-term health impacts: Heath effects to livestock might occur long-term, but death is not likely unless large amounts are ingested

Rationale: Giant reed leaves and stems contain several chemicals including: silica, tri-terpenes, sterols, cardiac glyocosides, curare-mimicking indoles, hydroxamic acid, and other alkaloids (1, 2, 3, 4). Most grazers avoid giant reed due to unpalatability of alakoid compounds or can tolerate them.

Sources of information: (1) Jackson, G.C. and J.R. Nunez. 1964. Identification of silica present in the giant reed (Arundo donax L.) J. Agric. Univ. (Puerto Rico) 48:60-62.

(2) Chandhuri, R.K. and S. Ghosal. 1970. Triterpenes and sterols from the leaves of Arundo donax. Phytochemistry 9: 1895-1896.

(3) Ghosal, S., R.K. Chandhuri, S.K. Cutta, S.K. Bhattachuapa. 1972. Occurance of curarimimetic indoles in the flowers of Arundo donax. Planta Med. 21: 22-28.

(4) Zuniga, G.E., V.H. Argandona, H.M. Niemeyer, L.J. Corcuera. 1983. Hydroxamic acid content in wild and cultivated Gramineae. Phytochemistry 22: 2665-2668.

**Question 4.2** Detrimental to Economic Crops B Other Pub. Mat'l back

Describe impacts to all aspects of cropping systems (see guidelines): Host of several diseases that may have moderate impact

Rationale: Giant reed is an alternative host for beet western yellows virus, sugarcane mosiac virus, and maize dwarf mosiac virus (1). Several important crop species are susceptible to beet western yellows virus including: sugarbeet, cucumbers, lettuce, spinach, soybean, chili pepper, and sunflower (2). Sorghum and corn are susceptible to sugarcane mosaic virus (3). Maize dwarf mosaic virus also affects corn and sorghum (4).

Sources of information: (1) DiTomaso, J.M. and E.A. Healy. 2003. Aquatic and Riparian Weeds of the West. pp. 254-262. University of California Division of Agriculture and Natural Resources.

(2)http://www.agls.uidaho.edu/ebi/vdie/descr089.htm

(3) http://phene.cpmc.columbia.edu/ICTVdB/00.057.0.01.062.htm

(4) http://phene.cpmc.columbia.edu/ICTVdB/00.057.0.01.039.htm

**Question 4.3** Detrimental to Mgmt of Agricultural System, Rangeland and Pasture A Other Pub. Mat'l back

Describe impacts to water diversion systems, increased water use, reduced forage for livestock: The agricultural impact of giant reed would be severe on irrigation canals.

Rationale: If giant reed were to be introduced earthen irrigation canals would have a high potential to be severely impacted. Current cultural practices of burning would promote giant reed colonization and seasonal flows in the canals would simulate flooding and distribute rhizome fragments throughout the canal system (1). In addition, ginat reed would have the potential to remove large amounts of water from the irrigation canals, 2000 L/meter of standing biomass annually, reducing the amount of water delivered to crop producers (2).

Sources of information: (1) DiTomaso, J.M. and E.A. Healy. 2003. Aquatic and Riparian Weeds of the West. pp. 254-262. University of California Division of Agriculture and Natural Resources.

(2) Iverson, M.E. 1994. The impact of Arundo donax on water resources. In: Jackson, N.E., P. Frandsen, S. Douthit (eds.) November (1993) Arundo donax workshop proceedings. pp 19-25. Ontario, Canada.

**Question 4.4** Human Health Impacts A Other Pub. Mat'l back

Describe key human impacts such as; irritants, property values, recreational values, and industry impacts: High

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|---|
| impacts to humans result from decreased property values due to increased fire risk and heavy infestations, as well as decreased land values for recreation. |
| Rationale: Giant reed is quite prone to fire and formation of dense monocultures (1) and increased fire risk and heavy infestations of weeds have been shown to decrease property values. These same factors affect the value of land for recreation such as boating, fishing, camping. Some studies has even shown that giant reed stands along rivers can alter the water temperature and pH reducing fish populations (2, 3). |
| Sources of information: (1) DiTomaso, J.M. and E.A. Healy. 2003. Aquatic and Riparian Weeds of the West. pp. 254-262. University of California Division of Agriculture and Natural Resources.<br>(2) Dunne, T. and L.B. Leopold. 1978. Water in environmental planning. W.H. Freeman and Company, New York<br>(3) Chadwick and Associates. 1992. Santa Ana River use attainability analysis. Volume 2: Aquatic biology, habitat and toxicity analysis. Santa Ana Watershed Project Authority, Riverside, CA |

## Worksheet A

back

| | |
|---|---|
| Reaches reproductive maturity in 2 years or less | **Yes: 1 pt** |
| Dense infestations produce >1,000 viable seed per square meter | **No: 0 pts** |
| Populations of this species produce seeds every year. | **No: 0 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 | **No: 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 | **Yes: 1 pt** |
| Fragments easily and fragments can become established elsewhere | **Yes: 2 pts** |
| Resprouts readily when cut, grazed, or burned | **Yes: 1 pt** |
| **5 pts** | **Total Unknowns** |
| **B (4-5 pts)** | |

**Note any related traits:** enter text here

## Worksheet B - Colorado Ecological Types and Land Use

back

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

## Worksheet C – Human Impacts

| | |
|---|---|
| Human health impacts; irritants (sap), spines, poisonous, and/or smoke impacts | **No: 0 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. | **Yes: 1 pt** |
| Impact of listing detrimental to industry; agriculture, horticulture, nursery, and/or seed | **No: 0 pt** |
| **4 pts** | **Total Unknowns** |
| **A (4+ pts)** | |

**Note any related traits:** enter text here