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)**:**	*Cirsium arvense* (L.) Scop. (USDA 2005)
Synonyms:	*Carduus arvensis* (L.) Robson, *Cirsium arvense* (L.) Scop. var. *argenteum* (Vest) Fiori, *Cirsium arvense* (L.) Scop. var. *horridum* Wimmer & Grab., *Cirsium arvense* (L.) Scop. var. *integrifolium* Wimmer & Grab., *Cirsium arvense* (L.) Scop. var. *mite* Wimmer & Grab., *Cirsium arvense* (L.) Scop. var. *vestitum* Wimmer & Grab., *Cirsium incanum* (Gmel.) Fisch., *Cirsium setosum* (Willd.) Bess. ex Bieb., *Serratula arvensis* L. (USDA 2005)
Common names:	Canada thistle, field thistle, creeping thistle, California thistle
Evaluation date (mm/dd/yy)**:**	06/20/04
Evaluator #1 Name/Title:	William J. Litzinger, Environmental Studies Faculty
Affiliation:	Prescott College
Phone numbers:	(928) 778−2090 extension 2233
Email address:	wlitzinger@prescott.edu
Address:	220 Grove Avenue, Prescott, Arizoba 86301
Evaluator #2 Name/Title:	Dana Backer/Conservation Ecologist
Affiliation:	The Nature Conservancy
Phone numbers:	(520) 622−3861
Email address:	dbacker@tnc.org
Address:	1510 East Ft. Lowell Rd., Tucson, Arizona 85719
List committee members:	W. Albrecht, W. Austin, D. Backer, J. Hall, L. Moser, F. Northam, B. Phillips, J. Schalau, K. Watters
Committee review date:	08/06/04
List date:	08/06/04
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	**B**	Other published material	**"Impact"** **Section 1 Score:** **B**	**"Plant Score"** **Overall Score:** **Medium** **Alert Status:** **None**
1.2	Impact on plant community	**A**	Other published material		
1.3	Impact on higher trophic levels	**B**	Other published material		
1.4	Impact on genetic integrity	**U**	Observational		
2.1	Role of anthropogenic and natural disturbance	**B**	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:* **14 pts** **Section 2 Score:** **B**	
2.2	Local rate of spread with no management	**A**	Other published material		
2.3	Recent trend in total area infested within state	**U**	No information		
2.4	Innate reproductive potential	**A**	Other published material		
2.5	Potential for human-caused dispersal	**B**	Other published material		
2.6	Potential for natural long-distance dispersal	**C**	Other published material		
2.7	Other regions invaded	**A**	Other published material		RED FLAG **YES** Something you should know.
3.1	Ecological amplitude	**A**	Observational	**"Distribution"** **Section 3 Score:** **B**	
3.2	Distribution	**D**	Observational		

Red Flag Annotation

Cirsium arvense has been observed in a variety of ecosystems/plant communities across Arizona and in even more ecological types in other states, but it currently has few occurrences within any specific ecological type in Arizona. Above elevations of 1,525 meters (5,000 feet), *C. arvense* has a high potential to invade many ecological types. It may not have had, however, enough time or opportunity to exploit

these types. Because this plant is extremely difficult to control, land managers currently without infestations may want to consider this plant as a priority for early detection and monitor accordingly.

Table 3. Documentation

Question 1.1 Impact on abiotic ecosystem processes *Score:* **B** *Doc'n Level:* **Other pub.**
Identify ecosystem processes impacted: Canada thistle significantly depletes soil nutrients and moisture.
Rationale: Canada thistle has dense horizontal roots and deep vertical roots that deeply penetrate the soil. Vertical roots can grow up to 22.5 feet below the surface and horizontally, roots ordinarily can grow as far as 20 feet in one season (Rogers 1928). Most patches spread at the rate of 1–2 meters/year (Amor and Harris 1975). The extensiveness of the root system makes it highly effective at uptaking soil moisture, minerals, and soil nutrients (Moore 1975). Although *Cirsium arvense* is primarily an economic concern to agricultural land in Canada. In crop situations (Canada) it uses light, moisture and nutrients needed by the crop thus reducing crop yield (Moore 1975). Where *C. arvense* forms dense stands in natural areas, similar impacts—the microclimate of the soil and air temperature will be cooler due to less light penetration—are expected. It is not clear what indirect or direct impacts can result from this effect.
Sources of information: See cited literature citations. The article by Moore (1975), cited often, is a review article; therefore, "Other published material" was used as the level of documentation.

Question 1.2 Impact on plant community composition, structure, and interactions *Score:* **A** *Doc'n Level:* **Other pub.**
Identify type of impact or alteration: Canada thistle alters community structure and composition, decreases species diversity, and directly competes with and displaces native vegetation.
Rationale: A single seedling can form a large patch of stems through the vegetative propagation of the root system. The spread of the clone may continue indefinitely, groups of stems becoming independent as the root system breaks up. Canada thistle usually occurs as a clump of stems and a large area may become infested by a single introduction but no seed will be produced [need both sexes] (Moore 1975). Several authors have identified this plant as "pervasive." In an isolated undisturbed study area east of Fort Collins in Colorado, species diversity decreased with an increase in relative frequency of Canada thistle; this characteristic remained consistent throughout the growing season (Stachion and Zimdahl 1980). When litter from Canada thistle was incorporated into non-infested Canada thistle soil, the growth of some species (non-natives-green foxtail, *Amaranthus retroflexus* and *Hordeum jubatum*) were reduced but cucumbers were not (greenhouse experiment). Effects were correlated with the addition of litter (Stachion and Zimdahl 1980). Similar results occurred for the addition of Canada thistle root and foliage residues independent of soil or additional nutrients. This previous study and studies by Bendall (1975) demonstrated the toxicity of Canada thistle roots and foliage. Working Group members noted its ability to act as a natural herbicide. *Cirsium arvense* is primarily an economic concern to agricultural land in Canada. In crop situations it uses light, moisture and nutrients needed by the crop thus reducing crop yield (Moore 1975). This situation is artificially maintained and may not hold true for natural settings. From Nuzzo (1997): Canada thistle aggressively invades natural communities primarily by vegetative expansion and secondarily by seedling establishment. It competes by depleting soil moisture for the germination of native species, vegetatively expands by horizontal roots to form dense, closed stands, and appears to be mildly allelopathic (Stachion and Zimdahl 1980). Seedlings require high light and low competition to survive (Bakker 1960, Hodgson 1968, Moore 1975). Thus, it is often an edge of forest or early successional species.
Sources of information: See cited literature.

Question 1.3 Impact on higher trophic levels *Score:* **B** *Doc'n Level:* **Other pub.**
Identify type of impact or alteration: Canada thistle reduces forage for native grazers and livestock (Hodgson 1968 in Stachion and Zimdahl 1980). It is unpalatable and the flower has spines. Competes for foraging pollinators and is a host for predatory introduced and native insects.
Rationale: Although young thistle shoots are sometimes eaten by grazing animals (in Europe, Detmers 1927 in Moore 1975), spines on mature shoots can irritate grazing animals and cause skin inflammations and possibly infections (Rogers 1928, Moore 1975). From Nuzzo (1997): Flowers of *C. arvense* are exclusively insect-pollinated (Lalonde and Roitberg 1994). More insect species visit *Cirsium arvense* than other *Cirsium* or *Carduus* species due to the "accessibility of its copious nectar" (Ellis and Ellis-Adam 1992). Although *Cirsium arvense* may help maintain diversity of pollinating insects in this way (Ellis and Ellis-Adam 1992), it negatively impacts native plant communities and may thus have a negative impact on overall insect diversity as well. The flowering time of Canada thistle corresponds with the flowering times of native thistles and many other native plants (W. Litzinger, personal observations, 2004) thus competing for foraging pollinators.
Sources of information: See cited literature. Also considered the unpublished field observations of W. Litzinger (Environmental Studies Faculty, Prescott College, Prescott, Arizona, 2004).

Question 1.4 Impact on genetic integrity *Score:* **U** *Doc'n Level:* **Obs.**
Identify impacts: Because of its phenology and potential distribution Canada thistle could possibly hybridize with native species, but this has not been documented.
Rationale: Canada thistle can potentially occur in the same habitats and flower at the same time as native species, such as *Cirsium arizonicum*, and *Cirsium parryi* (Litzinger, personal observations, 2004). From Moore (1975): Approximately nine hybrids between *C. arvense* and Old World species of C*irsium* have been reported in Europe (Hegi 1929) but only one of the latter species (*C. palustre*) has been introduced in North America and it is rare [and does not occur in Arizona]. Randall Scott (personal communication, 2004) has looked for *Cirsium* hybrids in northern Arizona and has not encountered any that appear to involve *C. arvense*. It is from a very different lineage within *Cirsium* from the native species of the Southwest and Scott suspects that given the period of time that it was separated from these species (and the resulting genetic differentiation they all have undergone) that it would be able to hybridize with them.
Sources of information: See cited literature. Also considered the unpublished field observations of W. Litzinger (Environmental Studies Faculty, Prescott College, Prescott, Arizona, 2004) and personal communication with R. Scott (Professor, Northern Arizona University, Falgstaff, Arizona, 2004).

Question 2.1 Role of anthropogenic and natural disturbance in establishment *Score:* **B** *Doc'n Level:* **Other pub.**
Describe role of disturbance: Canada thistle needs disturbance for introduction and establishment.
Rationale: Canada thistle has difficulty establishing itself from seed in undisturbed areas whereas it has a high seedling establishment rate on bare soil (Amor and Harris 1974 in Nuzzo 1997). Plowing and other soil disturbances (soil relocation associated with construction, road building, etc.) can spread vegetative structures which can propagate and establish elsewhere. If an area is undisturbed but next to a disturbed area, *C. arvense* can spread into the undisturbed area via asexual reproduction (Working Group comments).
Sources of information: See cited literature. Also considered Working Group member observations.

Question 2.2 Local rate of spread with no management *Score:* **A** *Doc'n Level:* **Other pub.**
Describe rate of spread: Canada thistle spreads rapidly by the vegetative growth of its horizontal root system.
Rationale: Vegetative spread through horizontal growth of the root system can extend 4 to 5 m radially in one season (Bakker 1960); 6 meters (according to Hayden [1934] and Rogers [1928] in Moore 1975). Individual clones can reach up to 35 m in diameter in one growing season (Donald 1994).
Sources of information: See cited literature.

Question 2.3 Recent trend in total area infested within state *Score*: **U** *Doc'n Level:* **No info.**
Describe trend: Appears to be stable in Arizona, but remains undocumented.
Rationale: From Nuzzo (1997): From the 17th century to the present Canada thistle spread widely in North America. It was declared a noxious weed by the state of Vermont in 1795 (Hansen 1918). By 1918 it was a noxious weed in the 25 northern states and by 1991 in 35 states and 6 Canadian provinces. It is now in all U.S. states (Moore 1975).
Sources of information: See cited literature. The Working Group members thought that there is not enough evidence or personal knowledge of this plant in Arizona to respond to this question.

Question 2.4 Innate reproductive potential *Score:* **A** *Doc'n Level:* **Other pub.**
Describe key reproductive characteristics: Canada thistle has a high innate reproductive potential both by seed and from vegetative structures.
Rationale: Canada thistle produces abundant seed from both female and hermaphroditic male flowers. Highly successful vegetative propagation by creeping horizontal roots which extend year after year, giving rise to numerous aerial shoots and thus establishing independent plants (Moore 1975). From Nuzzo (1997): Annual seed production of single plants averages 1500 seeds and can be up to 5300 seeds per plant (Moore 1975). Seed viability and seedling establishment rates are high. Although *C. arvense* are obligate outcrossers, up to 26% of "male" plants are self-fertile hermaphrodites capable of producing seeds (Kay 1985). Germination and dormancy vary with ecotypes. Some ecotypes have lower germination rates and/or long dormancy periods (Hodgson 1964). Seed longevity appears to be a direct relation to the depth of the planting. Seed buried in the soil can remain viable for up to 21 years in the U.S. and percent germination after x number of years is a function of storage depth (Toole and Brown 1946). Viability is dependent on environmental conditions and depth of buried seed (Moore 1975). Canada thistle readily propagates from root fragments. Root fragments as small as 0.5 cm up to six weeks old can regenerate.
Sources of information: See cited literature.

Question 2.5 Potential for human-caused dispersal *Score:* **B** *Doc'n Level:* **Other pub.**
Identify dispersal mechanisms: Canada thistle seed is spread by: a contaminant in agricultural seed and hay; in livestock manure; fire suppression activities; and on farm and fire machinery (Nuzzo 1997). Vegetative propagules are spread by plowing and other soil disturbances, typically road construction.
Rationale: Increased road building, off road vehicle use, and disturbances such as from heavy equipment used to fight wild land fires, including activities such as constructing fire containment lines, can contribute to the spread of Canada thistle. Working Group members thought that hay for agricultural purposes had high human-caused dispersal potential but the other means were occasional.
Sources of information: See Nuzzo (1997). Also considered Working Group member discussion.

Question 2.6 Potential for natural long-distance dispersal *Score:* **C** *Doc'n Level:* **Other pub.**
Identify dispersal mechanisms: Canada thistle disperses long-distance by wind blown seeds (infrequent); water; and animals. Viable seed can pass through the digestive tract of grazing animals.
Rationale: From Nuzzo (1997): Most often the pappus breaks off easily from the seed, leaving the seeds in the flower head with most of the seeds landing near the parent plant. Some long distance dispersal occurs as evidenced by the 0.2% of seeds found with a pappus still attached 1 km from the parent plant (Bakker 1960). Seed viability is very low (0.5%) after passage through bovine digestive tracts (Lhotska and Holub 1989). Seeds may also be transported by water (Hope 1927).
Sources of information: See cited literature.

Question 2.7 Other regions invaded *Score:* **A** *Doc'n Level:* **Other pub.**
Identify other regions: Other ecological type invaded elsewhere but not in Arizona are montane wetland (assumed equivalent to sedge meadows; see below). And in New Mexico, pinyon-juniper (Great Basin conifer woodland) and southwestern interior riparian (assumed equivalent to *Populus-Fraxinus* habitats of California; see below).
Rationale: From Zouchar (2001): Southwest: In New Mexico, Canada thistle was found in pinyon-juniper (*Pinus-Juniperus* spp.) woodland, on an abandoned uranium spoil, with broom snakeweed (*Gutierrezia sarothrae*), Indian ricegrass (*Achnatherum hymenoides*), winterfat (*Krascheninnikovia lanata*), hairy goldenaster (*Heterotheca villosa*), scarlet globemallow (*Sphaeralcea coccinea*), black grama (*Bouteloua eriopoda*), and tall dropseed (*Sporobolus asper*) (Fisher and Fancher 1990). At Mesa Verde National Park in Colorado, Canada thistle is found in Colorado pinyon (*Pinus edulis*)-juniper (*Juniperus* spp.) habitats where it is most common in riparian corridors with species such as boxelder (*Acer negundo*), Utah serviceberry (*Amelanchier utahensis*), fendlerbush (*Fendlera rupicola*), Gambel oak (*Quercus gambelii*), Wood's rose (*Rosa woodsii*), mountain snowberry (*Symphoricarpos oreophilus*), true mountain-mahogany (*Cercocarpus montanus*), chokecherry (*Prunus virginiana*), and antelope bitterbrush (*Purshia tridentata*) (Floyd-Hanna and Hanna 1999). In the coastal redwood (*Sequoia sempervirens*) zone in California, Canada thistle may be found in cottonwood (*Populus* spp.)-ash (*Fraxinus* spp.) habitats (Waring and Major 1964) (assumed equivalent to southwestern interior riparian). From Nuzzo (1997): Canada thistle is native to southeastern Europe and the eastern Mediterranean, possibly northern Europe, western Asia and northern Africa. From the 17th century to the present Canada thistle as spread widely in North America. It was declared a noxious weed by the state of Vermont in 1795 (Hansen 1918). By 1918 it was a noxious weed in the 25 northern states and by 1991 in 35 states and 6 Canadian provinces. It is now in all U.S. states and has near global distribution between 37 and 58−59 degrees north latitude and at latitudes greater than 37 degrees south, exclusive of Antarctica (Moore 1975). *Cirsium arvense* is invasive in prairies and other grasslands in the midwest and Great Plains and in riparian areas in the intermountain west. It is particularly troublesome in the northwest and north-central states, and in southern Canada (Moore 1975). *Cirsium arvense* occurs in nearly every upland herbaceous community within its range, and is a particular threat in prairie communities and riparian habitats. In the Great Plains Canadian thistle invades wet and wet-mesic grasslands as well as prairie potholes in the Dakotas. It also invades riparian areas and along irrigation ditches from the western plains across the northern half of the intermountain west to the Sierra Nevada and Cascade ranges. In the upper Midwest (Wisconsin and Illinois) *Cirsium arvense* is found in degraded sedge meadows, growing on tussocks elevated above the normal high water line. In Canada, *Cirsium arvense* is frequent in prairie marsh (Thompson and Shay 1989) and sedge meadow (Hogenbirk and Wein 1991). Throughout its range it is common on roadsides, in old fields, croplands, and pastures, in deep, well-aerated, mesic soils. In eastern North America, it occasionally occurs in relatively dry habitats, including sand dunes and sandy fields, as well as on the

edges of wet habitat, including stream banks, lakeshores, cleared swamps, muskegs and ditches (Moore 1975).

In Canada it is occasionally found in dry habitats-sand dunes and open sandy areas, although it prefers moister areas. It is found in grassy openings in woods and on forest margins both deciduous and conifer, edges of wet habitat, including stream banks, lakeshores, cleared swamps, muskegs and ditches (Moore 1975).

Sources of information: See cited literature.

Question 3.1 Ecological amplitude *Score:* **A** *Doc'n Level:* **Obs.**

Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: Invades three major ecological types. See Worksheet B.

From Nuzzo (1997): The species range is determined by rainfall, temperature, and day length (in Canada; Moore 1975). Based on optimal growth preferences (occurs at 77° F day and 59° F night, in mesic soil with high nitrogen (15–30 ppm) (Haderlie et al. 1987). In Montana the plant grows best where rainfall averages 50–75 cm/year (Hodgson 1968).

Thus, in Arizona, Canada thistle may be limited by high summer temperatures, short-day length, and low rainfall and may not invade other ecological types in Arizona in the short-term.

From Nuzzo (1997): *Cirsium arvense* grows on all but waterlogged, poorly aerated soils, including clay, clay loam, silt loam, sandy loam, sandy clay, sand dunes, gravel, limestone, and chalk, but not peat (Rogers 1928, Bakker 1960, Hodgson 1968, Moore 1975). It grows best on mesic soils: in a transplant experiment, Hogenbirk and Wein (1991) determined that *Cirsium arvense* cover increased 5- to 13-fold when sods were moved from a wetland to a mesic location.

Canada thistle was collected in Arizona near Flagstaff in 1920 and near Prescott in 1936 (Kearney and Peebles 1960). Litzinger (personal observations, 2004) collected Canada thistle in June, 2003 along a dry wash in an interior chaparral community near Prescott, Arizona.

Favorable conditions are unshaded, moist, aerated clay loam (Bakker 1960).

Rationale: The ecological types that Canada thistle invades in Arizona have not been formally documented beyond what can be inferred from herbaria records. The following information comes from Working Group member personal observations and herbaria records.

Areas of infestation: in Switzer Canyon—in an urban area (SFPWMA 2000); in the Prescott area it has not become locally common or locally widespread (W. Litzinger, personal observation, 2004)—potentially could invade montane forests and grasslands in the area; and Canyon Creek of Tonto National Forest (northeast Gila County) (F. Northam, personal communication, 2003.

Cirsium arvense is present in Yavapai (Prescott) and Coconino (Flagstaff) Counties (Kearney and Peebles 1960, SEINet 2004).

Sources of information: See cited literature. Also considered personal observations by W. Litzinger (Environmental Studies Faculty, Prescott College, Prescott, Arizona, 2004), personal communication with F. Northam (Noxious Weed Coordinator, Arizona Department of Agriculture, 2003), and information from SEINet (Southwest Environmental Information Network), Arizona herbaria specimen database (available online at: http://seinet.asu.edu/collections; accessed June 22, 2004).

Question 3.2 Distribution	*Score:* **D** *Doc'n Level:* **Obs.**
Describe distribution: The frequency at which Canada thistle invades the ecological types listed in Worksheet B is low (<5%).	
Rationale: The distribution within the state is not well documented. Although the actual distribution is considered low, the future potential is high.	
Sources of information: The estimated distribution of Canada thistle as indicated in Worksheet B are based on field observations (see question 3.1) and Working Group member consensus.	

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: 10 Total unknowns: 0		
	Score : A		

Note any related traits: Could fragment but does not do so easily (Working Group consensus).

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	**D**
Desertlands	Great Basin desertscrub	
	Mohave desertscrub	
	Chihuahuan desertscrub	
	Sonoran desertscrub	
Grasslands	alpine and subalpine grassland	
	plains and Great Basin shrub-grassland	
	semi-desert grassland	
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	
	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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