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)**:**	*Tamarix aphylla* (L.) Karst. (USDA 2005)
Synonyms:	*Tamarix articulata* Vahl (USDA 2005)
Common names:	Athel tamarisk
Evaluation date (mm/dd/yy)**:**	09/24/04
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Committee review date:	09/24/04
List date:	09/24/04
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**	Observational	**"Impact"** **Section 1 Score:** **B**	**"Plant Score"** **Overall Score:** **Low** **Alert Status:** **None**
1.2	Impact on plant community	**B**	Other published material		
1.3	Impact on higher trophic levels	**U**	No Information		
1.4	Impact on genetic integrity	**D**	Other published material		
2.1	Role of anthropogenic and natural disturbance	**C**	Observational	**"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:* **6 pts** **Section 2 Score:** **C**	
2.2	Local rate of spread with no management	**C**	Observational		
2.3	Recent trend in total area infested within state	**C**	Observational		
2.4	Innate reproductive potential	**C**	Other published material		
2.5	Potential for human-caused dispersal	**C**	Observational		
2.6	Potential for natural long-distance dispersal	**C**	Observational		
2.7	Other regions invaded	**U**	Other published material		RED FLAG **YES** Something you should know.
3.1	Ecological amplitude	**D**	Other published material	**"Distribution"** **Section 3 Score:** **D**	
3.2	Distribution	**D**	Observational		

Red Flag Annotation

Tamarix aphylla currently has a limited distribution within Arizona wildlands even though many thousands of populations are present in agricultural and urban areas of southwestern Arizona. The species was introduced to provide windbreaks for homesteads. Until recently seeds were thought to be sterile and the only means of spread into wildlands was via vegetative reproduction. It is now known that *T. aphylla* can hybridize with other *Tamarix* spp. One documented occurrence of this is along the Gila River in

western Maricopa County. It is unclear at this point what the morphology, physiology, reproduction by seed, and invasiveness of the hybrids will be, as well as the attributes of any subsequent backcross progeny.

Table 3. Documentation

Question 1.1 Impact on abiotic ecosystem processes *Score:* **B** *Doc'n Level:* **Obs.**
Identify ecosystem processes impacted: Dense canopies of mature plants intercept sunlight and provide wind barriers. Root growth by this species has a detrimental effect on availability of soil moisture and nutrients. Litter production by athel tamarisk is similar to what has been reported for other *Tamarix* spp.
Rationale: Athel tamarisk forms dense canopied evergreen trees 30 to 50 feet tall by 25 to 50 feet wide (Brenzel 2001). Mature plants which have established along desert stream corridors form an extremely shaded area in a radius of 3 to 7 meters around root crown and in most cases no other vegetation grows in this shaded area (F. Northam, personal communication, 2004). Due to copious litter production, it is assumed salt also becomes concentrated in the litters as with other *Tamarix* spp. (Carpenter 1998). Root growth makes this species a poor choice for planting near cultivated gardens. Thus, horticultural advisors recognize how detrimental athel tamarisk is to adjacent plants (Brenzel 2001). Guertin and Halvorson (2003) reviewed reports and books containing descriptions of biological traits common to the genus *Tamarix*; extensive root growth which makes these species more efficient at acquiring moisture and nutrients than native plants was identified as one trait allowing tamarisk woodlands to dominate southwestern desert waterways. It is assumed athel tamarisk roots have the same competitive advantage.
Sources of information: See cited literature. Also considered personal communication with F. Northam (Weed Biologist, Tempe, Arizona, 2004; field observations made while serving as the Arizona Department of Agriculture, Noxious Weed Coordinator, 2000 to 2003). Score based on inference drawn from the literature.

Question 1.2 Impact on plant community composition, structure, and interaction *Score:* **B** *Doc'n Level:* **Other pub.**
Identify type of impact or alteration: Athel tamarisk's aggressive growth and its adaptability to disturbed floodplain sites bestow competitive advantages that result in replacement of natural communities. Tamarisk species accumulate salts in their foliage and litter.
Rationale: Patches of athel tamarisk in flood plains of Santa Cruz, Gila River and Salt Rivers have no herbaceous species or native shrubs growing within the areas covered by canopies of this species (F. Northam, personal communication, 2004). Soil beneath mature athel tamarisk trees are covered with a layer of litter, and it is assumed that this salt and litter production by athel tamarisk is similar to what has been reported for other *Tamarix* spp (Carpenter 1998). In other words, unnatural salt accumulation occurs in and under the litter which inhibits establishment of native species. Horticultural assessments agree with this conclusion (Duffield and Jones 1998).
Sources of information: See cited literature. Also considered personal communication with F. Northam (Weed Biologist, Tempe, Arizona, 2004; field observations made while serving as the Arizona Department of Agriculture, Noxious Weed Coordinator, 2000 to 2003).

Question 1.3 Impact on higher trophic levels *Score:* **U** *Doc'n Level:* **No info.**
Identify type of impact or alteration: None indentified.
Rationale: Impact unknown.
Sources of information: None.

Question 1.4 Impact on genetic integrity *Score:* **D** *Doc'n Level:* **Other pub.**
Identify impacts: No known hybridization.
Rationale: No native plants in the same genus are known to exist in Arizona (Kearney and Peebles 1960).
Sources of information: See cited literature.

Question 2.1 Role of anthropogenic & natural disturbance in establishment *Score:* **C** *Doc'n Level:* **Obs.**
Describe role of disturbance: A combination of human intervention and a specific natural disturbance (intensive flood event) is necessary for establishment.
Rationale: Most athel tamarisk seed produced in Arizona is sterile (Guertin and Halvorson 2003). Vegetative dispersal of live limbs and root fragments in natural conditions depends on some force capable of breaking, transporting and burying fragments from live trees. Violent flash floods in desert water courses are the likely energy source for moving this species in natural conditions, and probably explains why escaped populations in southern and southwestern Arizona are found on desert floodplains downstream from urban or farm lands (F. Northam, personal communication, 2004). Thus, observed distributions in riparian areas/stream corridors, plus the lack of viable seed, are assumed to account for the limited occurrences in non-cultivated desert floodplains in southern and southwestern Arizona Recent field studies have demonstrated three cases of viable seed production and hybridization with other *Tamrix* spp. in Arizona, California and Nevada (Gaskin and Shafroth 2005). Because this constitutes a significant change from historical concepts concerning this species reproduction in Arizona, establishment of athel tamarisk may be shifting toward less dependence on disturbance. This aspect of *T. aphylla* biology needs to be closely monitored in Arizona riparian areas during the next few years.
Sources of information: See cited literature. Also considered personal communication with F. Northam (Weed Biologist, Tempe, Arizona, 2004; field observations made while serving as the Arizona Department of Agriculture, Noxious Weed Coordinator, 2000 to 2003).

Question 2.2 Local rate of spread with no management *Score:* **C** *Doc'n Level:* **Obs.**
Describe rate of spread: Stable.
Rationale: Observations of athel tamarisk populations around old farm and ranch homesteads indicate this species has been present for many decades in the agricultural areas of central, south-central and southwestern Arizona. However, this species' dispersal into wildland stream corridors is limited to small populations scattered across several hundred acres (F. Northam, personal communication, 2004). Makarick (1999) also reported limited opportunity to spread in Colorado River riparian areas in the Grand Canyon.
Sources of information: See cited literature. Also considered personal communication with F. Northam (Weed Biologist, Tempe, Arizona, 2004; field observations made while serving as the Arizona Department of Agriculture, Noxious Weed Coordinator, 2000 to 2003).

Question 2.3 Recent trend in total area infested within state *Score:* **C** *Doc'n Level:* **Obs.**
Describe trend: No published reports were found indicating this species has increased its range in Arizona during the past 30 years.
Rationale: Discussions in the rationale sections of questions 2.1 and 2.2 indicate that there is limited probability for athel tamarisk to increase its range in Arizona. Climate zone adaptability cited for athel tamarisk in Brenzel (2001) indicates this species will not tolerate winters above 5000 feet in Arizona. Because mature stands of this species have been present in Arizona several decades with no

documentation of movement beyond current range, it is concluded that athel tamarisk is far less intrusive than deciduous *Tamarix* spp. (Carpenter 1998).
Sources of information: See cited literature. Score based on inference drawn from the literature.

Question 2.4 Innate reproductive potential *Score:* **C** *Doc'n Level:* **Other pub.**
Describe key reproductive characteristics: Viable seed production is rare. Vegetative reproduction is limited by natural environmental factors and human intervention.
Rationale: Historical population trends indicate innate reproductive potential has been low in Arizona (Guertin and Halvorson 2003; F. Northam, personal communication, 2004). Recent research by Gaskin and Shafroth (2005) has identified a site on the Gila River in Maricopa County where *T. aphylla-Tamarix* spp. hybrids were growing. This suggests a potential for seed production and dispersal that have not been previously reported for this species.
Sources of information: See cited literature. Also considered personal communication with F. Northam (Weed Biologist, Tempe, Arizona, 2004; field observations made while serving as the Arizona Department of Agriculture, Noxious Weed Coordinator, 2000 to 2003). See also the discussion in the rationale section of question 2.1.

Question 2.5 Potential for human-caused dispersal *Score:* **C** *Doc'n Level:* **Obs.**
Identify dispersal mechanisms: Human-planted populations.
Rationale: Thousands of athel tamarisk populations are present in agricultural and urban areas of southwest Arizona. These plants (located around farm homesteads, in parks, along field borders, etc) were planted and many are still maintained by human efforts (F. Northam, personal communication, 2004). However, recent field studies of *Tamarix* spp. hybridization in the southwestern U.S. indicates *T. aphylla* dispersal may be shifting to natural seed dissemination (Gaskin and Shafroth 2005).
Sources of information: See cited literature. Also considered personal communication with F. Northam (Weed Biologist, Tempe, Arizona, 2004; field observations made while serving as the Arizona Department of Agriculture, Noxious Weed Coordinator, 2000 to 2003).

Question 2.6 Potential for natural long-distance dispersal *Score:* **C** *Doc'n Level:* **Obs.**
Identify dispersal mechanisms: Intense flooding in desert water courses.
Rationale: See discussion in rational section of question 2.1. Flood events capable of breaking fragments from athel tamarisk trees are rare in Arizona's climatic zones where this species was introduced and now thrives (F. Northam, personal communication, 2004).
Sources of information: See Guertin and Halvorson (2003) and Gaskin and Shafroth (2005). Also considered personal communication with F. Northam (Weed Biologist, Tempe, Arizona, 2004; field observations made while serving as the Arizona Department of Agriculture, Noxious Weed Coordinator, 2000 to 2003).

Question 2.7 Other regions invaded *Score:* **U** *Doc'n Level:* **Other pub.**
Identify other regions: Athel tamarisk is originally from Africa and the middle East (Welsh et al. 1987) and now occurs in Utah, California, New Mexico, Nevada, and Texas (USDA 2005). Ecosystems invaded in western United States include Ponderosa pine, sagebrush, desertshrub, chaparral-mountain shrub, pinyon-juniper, and desert grasslands (Tesky 1992).
Rationale: Even though athel tamrisk is reported in other states, information is not available to determine whether this species has escaped from ornamental, landscaped, or agricultural situations into ecosystems equivalent to non-infested Arizona wildlands.
Sources of information See cited literature.

Question 3.1 Ecological amplitude	*Score:* **D** *Doc'n Level:* **Other pub.**
Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: Athel tamarisk was introduced into Arizona at the beginning of the 20th century by J.J. Thornber, University of Arizona, and was used for windbreaks and homestead ornamentals (Benson and Darrow 1981). According to Tesky (1992), athel tamarisk has established outside cultivation on salt flats, springs, and other saline habitats, especially along streams and rivers. In Arizona it has been found along the saline portions of the lower Colorado and Gila Rivers and in the Salton Sea Basin in California. This species is a facultative phreatophyte that is drought tolerant and adapted to saline and alkaline soils in regions with less than 16 inches annual rainfall. Observations in Sonoran desert riparian areas indicate athel tamarisk can establish and thrive in regions with less than 10 inches rainfall when floods provide adequate moisture for vegetative reproduction (F. Northam, personal communication, 2004).	
Rationale: Observations of established athel tamarisk in land which has not had native vegetation cleared for agricultural, urban, right-of-way, industrial, recreation or horticultural uses has been limited to watercourses in the Sonoran or Mohave deserts.	
Sources of information. See cited literature. Also considered personal communication with F. Northam (Weed Biologist, Tempe, Arizona, 2004; field observations made while serving as the Arizona Department of Agriculture, Noxious Weed Coordinator, 2000 to 2003).	

Question 3.2 Distribution	*Score:* **D** *Doc'n Level:* **Obs.**
Describe distribution: Observations of established athel tamarisk in land which has not had native vegetation cleared for agricultural, urban, right-of-way, industrial, recreational or horticultural uses has been limited to floodplains and banks of watercourses in the Sonoran or Mohave deserts.	
Rationale: Observations of athel tamarisk populations around old farm and ranch homesteads indicate this species has been present for many decades in the agricultural areas of central, south-central and southwestern Arizona. However, this species' dispersal into wildland stream corridors is limited to small populations scattered across several hundred acres of Sonoran and Mohave Desert region (F. Northam, personal communication, 2004). Violent flash floods in desert water courses are the likely energy source for moving this species in natural conditions, and probably explains why escaped populations in southern and southwestern Arizona are found on desert floodplains downstream from urban or farm lands. Thus, present distributions in non-cultivated desert floodplains and riparian areas/stream corridors are assumed to depend on flood dynamics and deep soil moisture sources that maintain vegetative growth of dislodged limbs or roots (F. Northam, personal communication, 2004). **Note:** Recent documentation of athel tamarisk hybridization and seed production may change the historical concept of this plant being dispersed only by vegetative means (Gaskin and Shafroth 2005).	
Sources of information: See cited literature. Also considered personal communication with F. Northam (Weed Biologist, Tempe, Arizona, 2004; field observations made while serving as the Arizona Department of Agriculture, Noxious Weed Coordinator, 2000 to 2003).	

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: 3 Total unknowns: 0

Score : C

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	
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	**D**
	southwestern interior riparian	
	montane riparian	
Woodlands	Great Basin conifer woodland	
	Madrean evergreen woodland	
Forests	Rocky Mountain and Great Basin subalpine conifer forest	
	montane conifer forest	
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).

Literature Cited

Benson, L., and R.A. Darrow. 1981. Trees and Shrubs of the Southwestern Deserts. 3rd edition. The University of Arizona Press, Tucson.

Brenzel, K.N. (ed.). 2001. Sunset Western Garden Book. Sunset Publishing Company, Menlo Park, California.

Brown, D.E. (ed.). 1994. Biotic Communities: Southwestern United States and Northwestern Mexico. University of Utah Press, Salt Lake City. 342 p. [Plus companion 60-inch by 48-inch map, Biotic Communities of the Southwest].

Brown, D., F. Reichenbacher, and S. Franson, S. 1998. A Classification of North American Biotic Communities. University of Utah Press, Salt Lake City. 141 p.

Carpenter, A.T. 1998. *Tamarix ramosissima* Ledebour, *Tamarix pentandra* Pallas, *Tamarix chinensis* Loureiro, and *Tamarix parviflora* De Candolle. Element Stewardship Abstract. The Nature Conservancy. Available online at: http://tncweeds.ucdavis.edu/esadocs/documnts/tamaram.html; accessed September 23, 2004.

Duffield, M.R., and W.D. Jones. 1998. Plants for Dry Climates. How to Select, Grow and Enjoy. Fisher Books, Tucson, Arizona. 192 p.

Gaskin, J.F., and P.B. Shafroth. 2005. Hybridization of *Tamarix ramosissima* and *T. chinensis* (saltcedars) with *T. aphyalla* (athel) (family Tamaricaceae) in the southwestern USA determined from DNA sequence data. Madrono 52:1–10.

Guertin, P., and W.L. Halvorson. 2003. Status of Fifty Introduced Plants in Southern Arizona Parks. U.S. Geological Survey, Sonoran Desert Research Station, School of Renewable Natural Resources, University of Arizona, Tucson. Available online at: http://sdrsnet.srnr.arizona.edu/index.php?page=datamenue&lib=2&sublib=13; accessed September 23, 2004.

Kearney, T.H., and R.H. Peebles (and collaborators). 1960. Arizona Flora. 2nd edition with supplement by J.T. Howell and E. McClintock and collaborators. University of California Press, Berkeley. 1085 p.

Makarick, L.J. 1999. Draft Exotic Plants for Grand Canyon National Park. National Park Service, Grand Canyon National Park, Arizona.

Tesky, J.L. 1992. *Tamarix aphylla*. In Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences laboratory, Missoula, Montana (Producer). Available online at: http://www/fs.fed.us/database/feis/; accessed September 23, 2004.

[USDA] U.S. Department of Agriculture, Natural Resources Conservation Service. 2005. The PLANTS Database, Version 3.5. Available online at: http://plants.usda.gov. Data compiled from various sources by Mark W. Skinner. National Plant Data Center, Baton Rouge, Louisiana.

Warner, P.J., C. Bossard, M.L. Brooks, J.M. DiTomaso, J.A. Hall, A. M. Howald, D.W. Johnson, J.M. Randall, C.L. Roye, M.M. Ryan, and A.E. Staton. 2003. Criteria for Categorizing Invasive Non-Native Plants that Threaten Wildlands. Available online at: www.caleppc.org and www.swvma.org. California Exotic Pest Plant Council and Southwest Vegetation Management Association. 24 p.

Welsh, S.L., N.D. Atwood, L.C. Higgins, and S. Goodrich. 1987. A Utah Flora. Brigham Young University, Provo, Utah. 610 p.