Part IV. Plant Assessment Form

For use with "Criteria for Categorizing Invasive Non-Native Plants that Threaten Wildlands" by the California Exotic Pest Plant Council and the Southwest Vegetation Management Association

Table 1. Species and Evaluator Information

Species name (Latin binomial)**:**	*Tamarix ramosissima, T. gallica, T. chinensis*
Synonyms:	*Tamarix pentandra* for *T. ramosissima*
Common names:	Saltcedar, French tamarisk, Chinese tamarisk
Evaluation date (mm/dd/yy)**:**	2/8/03
Evaluator #1 Name/Title:	Joe DiTomaso
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Evaluator #2 Name/Title:	enter text here
Affiliation:	enter text here
Phone numbers:	enter text here
Email address:	enter text here
Address:	enter text here

Section below for review committee use—please leave blank

Review committee members:	Carla Bossard, John Randall, Peter Warner, Doug Johnson, John Hall, Dana Backer, Cindy Roye, Matt Brooks
Committee review date:	2/10/03
List date:	enter text here
Re-evaluation date(s):	enter text here

Table 2. Criteria, Section, and Overall Scores

1.1	Impact on abiotic ecosystem processes	**A**	**Rev'd, Sci. Pub'n**
1.2	Impact on plant community	**A**	**Rev'd, Sci. Pub'n**
1.3	Impact on higher trophic levels	**A**	**Rev'd, Sci. Pub'n**
1.4	Impact on genetic integrity	**D**	**No Information**

"Impact"

Enter four characters from Q1.1-1.4 below:

AAAD

Use matrix determine the score; enter below:

A

2.1	Role of anthropogenic and natural disturbance	**A 3**	**Rev'd, Sci. Pub'n**
2.2	Local rate of spread with no management	**A 3**	**Other Pub. Mat'l**
2.3	Recent trend in total area infested within state	**B 2**	**Other Pub. Mat'l**
2.4	Innate reproductive potential	**A 3**	**Rev'd, Sci. Pub'n**
2.5	Potential for human-caused dispersal	**B 2**	**Rev'd, Sci. Pub'n**
2.6	Potential for natural long-distance dispersal	**A 3**	**Rev'd, Sci. Pub'n**
2.7	Other regions invaded	**C 1**	**Other Pub. Mat'l**

"Invasiveness"

For questions at left, recall that an A gets 3 points, a B gets 2, a C gets 1, and a D or U gets=0. Enter the sum total of all points for Q2.1-2.7 below:

17

Use matrix to determine score and enter below:

A

"Plant Score"

Using matrix, determine the Overall Score and Alert Status from the three section scores and enter them below:

High

No Alert

3.1	Ecological amplitude	**A**	**Other Pub. Mat'l**
3.2	Distribution	**B**	**Other Pub. Mat'l**

"Distribution"

Use matrix determine the score; enter below:

A

Worksheet A. Complete this worksheet to answer Question 2.4.

Reaches reproductive maturity in 2 years or less	**No: 0 pt**
Dense infestations produce >1,000 viable seed per square meter	**Yes: 2 pts**
Populations of this species produce seeds every year.	**Yes: 1 pt**
Seed production sustained over 3 or more months within a population annually	**Yes: 1 pt**
Seeds remain viable in soil for three or more years	**No: 0 pts**
Viable seed produced with *both* self-pollination and cross-pollination	**Yes: 1 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**
9 pts	**Total Unknowns 0**
A (6+ pts)	

Table 3. Documentation

Question 1.1 Impact on abiotic ecosystem processes
Identify ecosystem processes impacted: Very high water use and increased deposition of salts on soil surface. The longer the community has been invaded by saltcedar the more xeric in nature are the plant species which occupy the understory. Such deposits of salt-encrusted needles can inhibit other species germination. Saltcedar has been blamed for increasing flooding by forming a partial barrier to floodflow, which can cause floodwater to disperse and inundate areas that otherwise would not be flooded. With the invasion of saltcedar there has been an apparent increase in the frequency of fire in riparian ecosystems.
Rationale: Evapotranspiration rates of saltcedar are among the highest of any phreatophyte evaluated in southwestern North America, including native riparian trees. Saltcedar has been reported to contain 41,000 ppm dissolved solids in the guttation sap.
Sources of information: Lovich, J. *Tamarix ramosissima*. In, Invasive Plants of California's Wildlands. Eds., C. Bossard, J. Randall, and M. Hoshovsky. UC Press, Berkeley; Brotherson, J.D. and D. Field. 1987. Tamarix: impacts of a successful weed. Rangelands 9:110-112; Busch, D.E. and S.D. Smith. 1992. Fire in a riparian shrub community: postburn water relations in the *Tamarix-Salix* association along thelower Colorado River. Gen. Tech. Rep. Int USDA For. Serv. Intermt. Res. Stn. 289:52-55; Kerpez, T. A. and N. S. Smith. 1987. Saltcedar control for wildlife habitat improvement in the southwestern United States. USDI. Fish and Wildlife Serv. Resource Publ. 169. p. 1-16.; see DiTomaso, J.M. 1998. Impact, biology, and ecology of saltcedar (*Tamarix* spp.) in the southwestern United States. Weed Technology 12:236-336 for other references.
Question 1.2 Impact on plant community composition, structure, and interactions
Identify type of impact or alteration: Saltcedar replaced two phreatophytic grass species, saltgrass (*Distichlis stricta*) and alkali sacaton (*Sporobolus airoides*) in a southwestern riparian zone. In some areas it makes up 70-80% of the vegetative cover, substantially displacing native vegetation and reducing the value of this critical wetlands complex for wildlife. In one river system, little regeneration of cottonwoods occurred in the past 30-35 years in a saltcedar-infested area. In the lower Colorado River, saltcedar replaced up to 90% of the riparian communities historically dominated by cottonwood-willow forests. Once established, periodic burning, clearing, and flooding have allowed saltcedar communities to remain young and to form nearly impenetrable thickets.
Rationale: Saltcedar can form stands considerably more dense than naturally occurring riparian vegetation.
Sources of information: Howe, W.H. and F.L. Knopf. 1991. On the imminent decline of Rio Grande cottonwoods in central New Mexico. The Southwestern Naturalist 36:218-224; Lovich, J. *Tamarix ramosissima*. In, Invasive Plants of California's Wildlands. Eds., C. Bossard, J. Randall, and M. Hoshovsky. UC Press, Berkeley; Weeks, E.P., H.L. Weaver, G.S. Campbell, and B.D. Tanner. Water use by saltcedar and by replacement vegetation in the Pecos River floodplain between Acme and Artesia, New Mexico. Pp. G1-G33; see DiTomaso, J.M. 1998. Impact, biology, and ecology of saltcedar (*Tamarix* spp.) in the southwestern United States. Weed Technology 12:236-336 for other references.
Question 1.3 Impact on higher trophic levels
Identify type of impact or alteration: The majority of birds do not use saltcedar in high proportions compared with native plant communities. Frugivores and insectivores, abundant in native riparian vegetation, almost completely avoid saltcedar. Studies showed that several species had a higher affinity for the cottonwood-willow association, including common flicker, yellow-bellied sapsucker, porcupine and beaver. With the exception of desert woodrat and desert cottontail, no native mammal species are known to feed upon saltcedar. Then consumed by wildlife, only young growth is utilized.
Rationale: Although certain wildlife species may find saltcedar beneficial to their survival, the encroachment of saltcedar has most certainly altered the native habitat that was apparently of great benefit to wildlife. Although the southwestern willow flycatcher can nest in saltcedar, infestation have a negative impact on most other birds that would normally use the native vegetation.
Sources of information: Numerous papers on the impact of insects, birds, and mammals. See both Lovich, J. *Tamarix ramosissima*. In, Invasive Plants of California's Wildlands. Eds., C. Bossard, J. Randall, and M. Hoshovsky. UC Press, Berkeley and DiTomaso, J.M. 1998. Impact, biology, and ecology of saltcedar (*Tamarix* spp.) in the southwestern United States. Weed Technology 12:236-336 for review and peer-reviewed reference citations.
Question 1.4 Impact on genetic integrity
Identify impacts: None
Rationale: No native species within the family in North America. Unlikely to cross with any native species.
Sources of information: None
Question 2.1 Role of anthropogenic and natural disturbance in establishment
Describe role of disturbance: The development of water management programs that severely impact natural river flows has greatly contributed to spread of saltcedar. These alterations include reservoir and dam construction, river diversions, flow regulations, and irrigation projects. Historically, the flow of these rivers peaked in the late

spring and early summer from snowmelt. These changes in channel geometry and streamflow created conditions unfavorable for the regeneration and survival of native riparian species. As a result, rapid colonization and expansion of saltcedar occurred throughout the western river systems. In addition to altering streamflow, clearing and plowing of floodplains and associated agricultural activity also aided saltcedar colonization during the 1800s. Saltcedar has also been reported to rapidly infest riparian areas exposed to heavy grazing. Once established, seed dispersal and plant fragments can become established in otherwise undisturbed areas.
Rationale: Establishment can occur on disturbed and undisturbed sites, but disturbance can increase the rate of establishment.
Sources of information: See both Lovich, J. *Tamarix ramosissima*. In, Invasive Plants of California's Wildlands. Eds., C. Bossard, J. Randall, and M. Hoshovsky. UC Press, Berkeley and DiTomaso, J.M. 1998. Impact, biology, and ecology of saltcedar (*Tamarix* spp.) in the southwestern United States. Weed Technology 12:236-336 for review and peer-reviewed reference citations.
Question 2.2 Local rate of spread with no management
Describe rate of spread: Doubling rate between 1920 and 1960 without management was about 6 years.
Rationale: Infestations went from 4,000 ha in 1920 to 362,000 ha in 1960. Recent estimates indicate infestations in the southwestern United States to exceed 600,000 ha .
Sources of information: Brotherson, J.D. and D. Field. 1987. Tamarix: impacts of a successful weed. Rangelands 9:110-112; see DiTomaso, J.M. 1998. Impact, biology, and ecology of saltcedar (*Tamarix* spp.) in the southwestern United States. Weed Technology 12:236-336 for review and peer-reviewed reference citations.
Question 2.3 Recent trend in total area infested within state
Describe trend: Recent trend in increase of saltcedar is about at a rate of 3 to 4% per year.
Rationale: Much of the riparian area in the southwestern US has been occupied by saltcedar and the rate of increase there has slowed down. However, the rate of increase in other areas where it is just becoming established, particularly in more northern regions is probably greater.
Sources of information: Brotherson, J.D. and D. Field. 1987. Tamarix: impacts of a successful weed. Rangelands 9:110-112; see DiTomaso, J.M. 1998. Impact, biology, and ecology of saltcedar (*Tamarix* spp.) in the southwestern United States. Weed Technology 12:236-336 for review and peer-reviewed reference citations.
Question 2.4 Innate reproductive potential
Describe key reproductive characteristics: Seedlings mature rapidly and produce small, white or pinkish flowers often by the end of the first year of growth. A single large tamarisk tree produces a half million seeds a year. Saltcedar had one major and one minor peak of seed production over a 5.5 month period. Seeds remain viable for several weeks and will germinate on saturated soils or while afloat. It can vegetatively resprout after fire, severe flood, or treatment with herbicides and it is able to accommodate wide variations in soil and mineral gradients in its environment.
Rationale: A good deal of evidence indicates that saltcedar can reproduce very effectively both asexually and sexually.
Sources of information: Brotherson, J.D. and D. Field. 1987. Tamarix: impacts of a successful weed. Rangelands 9:110-112; Shrader, T.H. Selective management of phreatophytes for improved utilization of natural food-plain resources. Irrigation and Drainage pp. 16-44; see DiTomaso, J.M. 1998. Impact, biology, and ecology of saltcedar (*Tamarix* spp.) in the southwestern United States. Weed Technology 12:236-336 for review and peer-reviewed reference citations.
Question 2.5 Potential for human-caused dispersal
Identify dispersal mechanisms: Planted as an ornamental, as a shade tree, and for erosion control. Not nearly as widely planted today as in the past. Can still be purchased via the internet.
Rationale: It was planted as an ornamental shrub or shade tree, or to create wind breaks, or to stabilize eroding stream banks. It did not escape cultivation until around the 1870s. In the early 1900s, farmers were using this plant for erosion control. It became clear by the 1920s that saltcedar was becoming a serious problem.
Sources of information: Neill, W.M. 1985. Tamarisk. Fremontia 12:22-23; Brotherson, J.D. and V. Winkel. 1986. Habitat relationships of saltcedar (*Tamarix ramosissima*) in central Utah. Great Basin Naturalist 46: 535-541; see Lovich, J. *Tamarix ramosissima*. In, Invasive Plants of California's Wildlands. Eds., C. Bossard, J. Randall, and M. Hoshovsky. UC Press, Berkeley and DiTomaso, J.M. 1998. Impact, biology, and ecology of saltcedar (*Tamarix* spp.) in the southwestern United States. Weed Technology 12:236-336 for more details and citations.
Question 2.6 Potential for natural long-distance dispersal
Identify dispersal mechanisms: The tiny seeds have high viability and long hairs allowing for wind distribution, but may also be carried and deposited along sandbars and riverbanks by water. Stem and root fragments can also float downstream after fragmentation by mechanical damage or flooding and initiate new infestations.
Rationale: Seeds weight about 0.1 mg and can travel long distances in the wind. Flooding can move stem and root fragments very long distances.

Sources of information: Brotherson, J.D. and D. Field. 1987. Tamarix: impacts of a successful weed. Rangelands 9:110-112; Neill, W.M. 1985. Tamarisk. Fremontia 12:22-23; See both Lovich, J. *Tamarix ramosissima*. In, Invasive Plants of California's Wildlands. Eds., C. Bossard, J. Randall, and M. Hoshovsky. UC Press, Berkeley and DiTomaso, J.M. 1998. Impact, biology, and ecology of saltcedar (*Tamarix* spp.) in the southwestern United States. Weed Technology 12:236-336 for review and other citations.
Question 2.7 Other regions invaded
Identify other regions: Today, saltcedar infestations are common in most river systems over much of Utah, Nevada, Arizona, New Mexico, Colorado, Oklahoma, and Texas. Saltcedar is continuing to spread northward into Montana and Canada and southward into northwestern Mexico. Populations have been reported from as high as 2,135 m in the southern Rocky Mountains, but typically occur below 500 m.
Rationale: Seems to be weedy in areas similar to those in the southwestern US.
Sources of information: See both Lovich, J. *Tamarix ramosissima*. In, Invasive Plants of California's Wildlands. Eds., C. Bossard, J. Randall, and M. Hoshovsky. UC Press, Berkeley and DiTomaso, J.M. 1998. Impact, biology, and ecology of saltcedar (*Tamarix* spp.) in the southwestern United States. Weed Technology 12:236-336 for review and other citations.
Question 3.1 Ecological amplitude
Describe ecological amplitude, identifying date of source information and approximate date of introduction to the state, if known: Tamarisk was first brought to North America in the 1800s, from southern Europe or the eastern Mediterranean region.
Rationale: Although saltcedar is typically found around aquatic or riparian areas, it has also been observed in scrublands, although not in dense stands.
Sources of information: Neill, W.M. 1985. Tamarisk. Fremontia 12:22-23; See both Lovich, J. *Tamarix ramosissima*. In, Invasive Plants of California's Wildlands. Eds., C. Bossard, J. Randall, and M. Hoshovsky. UC Press, Berkeley and DiTomaso, J.M. 1998. Impact, biology, and ecology of saltcedar (*Tamarix* spp.) in the southwestern United States. Weed Technology 12:236-336 for review and other citations.
Question 3.2 Distribution
Describe distribution: Saltcedar forms dense stands in many riparian areas around the state, particularly in Southern California, where it infests most riparian communities. It is also in many smaller, isolated water sources that are scattered about the desert.
Rationale: Saltcedar is a facultative phreatophyte, which accounts for its primary infestations in riparian and aquatic regions, but occasional occurrence in drier regions.
Sources of information: Neill, W.M. 1985. Tamarisk. Fremontia 12:22-23; See both Lovich, J. *Tamarix ramosissima*. In, Invasive Plants of California's Wildlands. Eds., C. Bossard, J. Randall, and M. Hoshovsky. UC Press, Berkeley and DiTomaso, J.M. 1998. Impact, biology, and ecology of saltcedar (*Tamarix* spp.) in the southwestern United States. Weed Technology 12:236-336 for review and other citations. Many sources of personal observations.

Complete the worksheet that corresponds to your state using the letter codes and instructions in Section 3.

Worksheet C - California Ecological Types

(*sensu* Holland 1986)

Major Ecological Types	Minor Ecological Types	Code
Marine Systems	marine systems	**score**
Freshwater and Estuarine Aquatic Systems	lakes, ponds, reservoirs	**C. 5-20%**
	rivers, streams, canals	**B. 20-50%**
	estuaries	**score**
Dunes	coastal	**score**
	desert	**score**
	interior	**score**
Scrub and Chaparral	coastal bluff scrub	**score**
	coastal scrub	**D. presen**
	Sonoran desert scrub	**score**
	Mojavean desert scrub (incl. Joshua tree woodland)	**D. presen**
	Great Basin scrub	**score**
	chenopod scrub	**score**
	montane dwarf scrub	**score**
	Upper Sonoran subshrub scrub	**C. 5-20%**
Grasslands, Vernal Pools, Meadows, and other Herb Communities	coastal prairie	**score**
	valley and foothill grassland	**score**
	Great Basin grassland	**score**
	vernal pool	**score**
	meadow and seep	**D. presen**
	alkali playa	**score**
	pebble plain	**score**
Bog and Marsh	bog and fen	**score**
	marsh and swamp	**score**
Riparian and Bottomland	riparian forest	**B. 20-50%**
	riparian woodland	**B. 20-50%**
	riparian scrub (incl.desert washes)	**B. 20-50%**
Woodland	cismontane woodland	**score**
	piñon and juniper woodland	**score**
	Sonoran thorn woodland	**score**
Forest	broadleaved upland forest	**score**
	North Coast coniferous forest	**score**
	closed cone coniferous forest	**score**
	lower montane coniferous forest	**score**
	upper montane coniferous forest	**score**
	subalpine coniferous forest	**score**
Alpine Habitats	alpine boulder and rock field	**score**
	alpine dwarf scrub	**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).