***Tamarix chinensis* Lour.** tamarisk
TAMARICACEAE

Synonyms: *Tamarix pendandra* Pallas
Tamarix ramosissima Ledebour
Tamarix gallica L. var. *micrantha* Ledebour
Tamarix pentandra Pallas ssp. *tigrensis* (Bge.) Hand.-Mazz.

General Description.—*Tamarix chinensis* Loureiro is commonly known as tamarisk or saltcedar. Occasionally it grows with a defined trunk as a tree but generally it grows as a multiple-stemmed shrub up to 6 m tall. The bark of larger trunks, or stems, is reddish-brown to dark brown or blackish. The leaves, that are only 1.5 to 3.5 mm long and appear scale-like, are deciduous. The tiny flowers are five-merous, having five sepals, five petals, five stamens, and a five carpellate pistil, and are arranged on a flowering stalk that is 2 to 7 cm long. The petals are 1 to 2.3 mm long, and persistent in fruit. They are frequently a shade of pink but may be white or red. The sepals are 0.5 mm to 1.3 mm long. The scale-like leaves and shape of the shrub are reminiscent of a juniper or cedar and this accounts for the common name "saltcedar." This shrub has been the subject of considerable taxonomic confusion. McClintock (1951) stated "there is probably not another genus of plants as well known as the tamarisks in which the species is so poorly understood or separated on more obscure characters." For most species, the tiny floral organs and the use of a microscope, or at least hand lens, are essential for identification (Allred 2002). *Tamarix pentandra* var, *pentandra* Pallus has been mistakenly applied to this species within North America. Actually, *T. pentandra* Pallus is synonymous with *T. hispida* Willd. that is distributed throughout central Asia (Baum 1978). Other confusion has resulted from this species being referred to as a sub-species of *T. gallica* L., which is a unique taxon originally from Europe, and now also naturalized within the United States (Allred 2002, Baum 1978). Although Baum's treatment (1978) described *T. chinensis* Loureiro and *T. ramosissima* Ledebour as unique taxa placing them in two different sections, recent chloroplast and nuclear DNA studies suggest the two entities should be merged (Allred 2002). These two names are synonymized in the Utah Flora (Welsh and others 1993). *Tamarix chinensis* has a chromosome number of 2n = 24 (Welsh and others 1993).

Range.—Tamarisk is a common, wide-ranging species that has been collected across Asia from western Turkey through Mongolia, Afghanistan, and China to Korea and Japan. It was introduced into the Western United States and has become naturalized.

Ecology.—Tamarisk grows in generally moist sites at seeps, streams, and along river banks and roadsides (Dick-Peddie 1993). It tolerates saline soils and also contributes to salinization of the soils in which it grows. It forms equally dense stands in both the Western United States and in central China where it is an apparent native (author's personal observation). It has an extensive root system and uses such large volumes of water that streams and ponds become dry. Studies in the Southwestern United States show that tamarisk stands have far less biodiversity than stands of native riparian vegetation. Miles of riverbank can be almost monotypic with dense tamarisk stands that have 50 percent fewer small mammal species as well as fewer reptile and amphibian species than native riparian stands (Olson 1999). Although bees visit the flowers (Epple 1995) the diversity of insects is also low, and nestling birds rely on insects brought to the nests by their parents. Although some birds can nest in

the shrubs the trunks are not large enough to provide habitat for animals such as wood-peckers, owls, chickadees, and squirrels. The tiny, hairy seeds provide poor nutrition and are largely indigestible.

Reproduction.—Tamarisk generally flowers in April through August. The pink, fragrant flowers are insect pollinated. The seeds, which are small, mature in summer and fall and are dispersed by birds and by water. However, the seed may have limited longevity under humid conditions. Seeds retain high viability if stored in sealed containers with desiccant at temperatures between 3 to 27 ^{o}C but lose viability if stored at "moderate humidity" (Wilgus and Hamilton 1962, Baskin and Baskin 2001). Germination temperature appears to be flexible. Freshly matured seeds germinated from 87 to 98 percent when kept at constant temperatures between 19 to 43 ^{o}C. Percent germination did not appear related to temperature; 96 percent germinated at 19 ^{o}C and 91 percent at 43 ^{o}C (Wilgus and Hamilton 1962, Baskin and Baskin 2001). Vegetative reproduction by suckers and rooting branches is copious.

Growth and Management.—Tamarisk is an aggressive, invasive species. Its invasive behavior is illustrated by its colonization of the Pecos River Valley in New Mexico (Allred 2002). In 1912, a few seedlings were observed at Lake McMillan. By 1915 the shrub covered 600 acres and extended up and down the riverbanks. By 1926 it covered 12,300 acres and extended to 57,000 acres by 1960 (Allred 2002). It out-competes many native species and is difficult to eradicate once established (USDA Forest Service 1988). The extremely deleterious impact of this species on the riparian and wetland areas of the Southwest has led to intense study on how to control and reverse its spread. There are four general methods--biological control, physical removal by hand or by machine, herbicides, and fire--that can be used to control tamarisk, and each has shortcomings. The most appropriate method, or combination of methods, depends upon the particular site. Biological controls for tamarisk are not yet commercially available, although a variety of insects have been investigated--from grasshoppers to leaf hoppers. Two species specific to tamarisk, a mealybug (*Trabutina mannipara*) from Israel and a leafbeetle (*Diorhaba elongata*) from China, have received advance testing (DeLoach and others 1996, DeLoach, 1994). Physical cutting and removal of tamarisk will only be successful if the roots are removed or killed. By itself, cutting tamarisk by hand (that is by chain saw, weed eater, or axe) is not often an effective treatment. Cutting tamarisk tends to just cause more shoots to grow. However, there was a report of successful control where large tree stumps (20 to 25 cm diameter) had been cut back to the soil surface and then covered by a black, liner material (Cinnamon 1990). Purely mechanical removal is also sometimes successful if there is enough standing vegetation to substantially shade the resprouting tamarisk. For example, in Nevada (Busch and Smith, 1995) when tamarisk had been completely cleared above ground in a stand of willows, there was essentially no grow back during the 4 years follow up. Tamarisk is sensitive to numerous herbicides (Kunzman and Bennett 1990, Sisneros 1991). At the present time, the most successful approach to control tamarisk is by cut-stump herbicide or cut-stump/frill herbicide treatments (Neill 1990, Hughes 1996). This approach is quite costly but it is very controlled, does not affect non-target organisms, and causes the least environmental impact. The tamarisk shrubs should be cut to within 2.5 cm of the ground surface (Cinnamon 1990) and a systemic herbicide applied to the stump within a few minutes after cutting. The time between cutting and herbicide treatment should be as short as possible. Leaving the cut stump for 2 to 5 days before herbicide treatment reduces success rate from greater than approximately 88 percent tamarisk death to less than 10 percent (Hays and Mitchell 1990). Fire is often ineffective. The high water and salt content of tamarisk makes it difficult to burn. Too light (low temperature) a fire will permit, or even encourage, tamarisk to re-sprout and become even denser. If the fire burn is so hot it kills the tamarisk, it is likely that the fire will leave the soil bare and in such a poor condition that it cannot support grasses and desirable vegetation. In the horticultural trade, tamarisk is propagated from hardwood cuttings in the spring or softwood cuttings in the summer (Tykač 1990). Plants grown for a long time in containers often do not establish after transplanting (Tykač 1990).

Benefits.—Tamarisk were once planted for erosion control and as wind breaks (Baum 1978, Allred 2002). It is not significantly grazed or browsed. The tannin substances in the vegetation are likely to make it unpalatable. Tamarisk has commercial value in the landscape and horticultural trade. It is a popular ornamental shrub although its use in the United States is now generally discouraged. Many cultivars exist that have been chosen for flower color and growth form (Bailey and others 1976, Tykač 1990). *Tamarix* species, although not specifically *T. chinensis*, have been used for fuel and building materials by Native American tribes in the Western United States (Moerman 1998).

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