SALTCEDAR or TAMARISK

An Invasive Plant heading towards Manitoba: *Tamarix spp*.

The invasion by saltcedar is one of the worst ecological disasters to impact riparian ecosystems in the United States displacing native plants, degrading wildlife habitat, and causing the decline of threatened and endangered species (DeLoach et al. 2000). Peace and Smith (2003) concluded that it is only a matter of time before saltcedar is transported into Canada. Canadian portions of the Great Plains are highly susceptible to invasion.

Commonly referred to as either tamarisk or saltcedar (hereafter called saltcedar), it is an alien invasive phreatophyte (plants that have developed a lifestyle to conform with the seasons of rainfall and or the seasons with the coolest temperatures) that has invaded large areas of the southwestern and northwestern United States (Cleverly et al. 1997; Peace and Smith 2003). It is believed that as many as eight tamarisk species were introduced in the U.S. from Asia for their ornamental values or for planting in wind breaks or to stabilize eroding stream banks. Saltcedar is in the Tamaricaceae family.

Saltcedar refers to the plants' fine, cedar-like foliage and its ability to grow in saline or alkaline soils (Carpenter 1998). Saltcedar is poised to invade areas of southern Canada including Manitoba in the very near future.

BIOLOGY

Saltcedar is an aggressive, woody invasive plant species that has become established over as much as a million acres of floodplains, riparian areas, wetlands and lake margins in the western United States (Carpenter 1998). Saltcedar has also been found growing in dirt stock tanks, railroad rights-of-way, parks, and upland situations. Pearce and Smith (2003) reported *Tamarix ramosissima* and *T. chinensis* are the most common saltcedar species in the northern Great Plains and of further concern is that these species appear to be hybridizing. Lesica and Miles (2001) found saltcedar to be intolerant of shade. Saltcedar has the ability to dominate floodplain habitats due to its ability to tolerate water stress late in the growing season or long-term drought conditions (Cleverly et al. 1997).

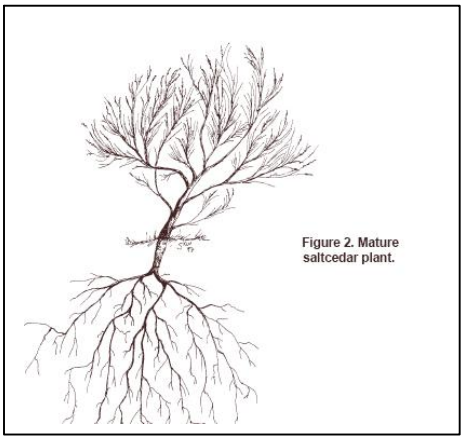


Figure 2. Mature saltcedar plant.

The following description of saltcedar was taken from Carpenter (1998). Saltcedar is a deciduous, loosely branched shrub or small tree. The branchlets are slender with minute, appressed scaly leaves. The leaves are rhombic to ovate, sharply pointed to gradually tapering, and 0.5 -3.0 mm long. The margins of the leaves are thin, dry and membranaceous. Flowers are whitish or pinkish and borne on slender racemes 2-5 cm long on the current year's branches and are grouped together in terminal panicles. The pedicels are short. The flowers are most abundant between April and August, but may be found any time of the year. Petals are usually retained on the fruit.

Saltcedar produces massive quantities of small seeds that can complete germination within 24 hours following contact with water (Carpenter 1998), new plants can also be produced vegetatively. Seeds are wind dispersed and also float on water and germinated along sandbars and riverbanks. Saltcedar also has a self-compatible breeding system (Sexton et al. 2002).

ECOLOGICAL DAMAGE

The invasion by saltcedars is one of the worst ecological disasters to impact riparian ecosystems in the United States displacing native plants, degrading wildlife habitat, and causing the decline of threatened and endangered species (DeLoach et al. 2000). Saltcedars extremely high water usage lowers water tables to levels that can be below the root zone of native trees, it excretes excess salts through leaf glands killing saline intolerant plants (DeLoach et al. 2000). A single large plant can absorb 200 gallons of water a day. Saltcedar has changed the community composition in invaded areas such that the endangered (federally – USA) southwestern subspecies of the willow flycatcher (*Empidonax traili extimus*) now nests significantly in saltcedar as saltcedar has replaced it native nesting trees. Similar to purple loosestrife, saltcedar was introduced into the United States and has been widely planted as an ornamental.

Saltcedar invasions displace native plants, trees and wildlife. In some areas as much as 80% of the total cover consists of saltcedar which has led to dramatic declines in native indigenous woody and herbaceous plant composition and abundance (Hughs 1993). Saltcedar also deleteriously changes community function processes including fire frequency, hydrologic cycles, and soil conditions. Saltcedar is a fire-adapted species that recovers faster after fires than other native riparian species (Busch and Smith 1993). Saltcedar glands excrete numerous salts and minerals, both macro- and micronutrients that increase soil salinity (Berry 1970). Saltcedar aborbs salts and nutrients from deeper soil layers which are concentrated in the leaves and excreted on the soil substrate under the plant. These salts restrict germination of other native species (Egan et al. 1993).

Carpenter (1998) reported that saltcedar crowds out native riparian and wetland vegetation, increases the salinity of surface soil impacting native plants, degrades wildlife habitat, dries up springs, wetlands, riparian areas and small streams by lowering water tables, widens floodplains by clogging drainage channels, increases sediment deposition, and used more water than comparable native plants.

Saltcedar invasions have been reported to be responsible for population declines in riparian bird populations in the Rio Grande (Young and Finch 1997). Waterfowl completely avoid saltcedar infested areas. As saltcedar infestations dominant a riparian region, the biological diversity of native vegetation and native fauna declines (Kauffman 2005).

ECONONIC DAMAGES

Economic damages include losses from irrigation and municipal water, flood control, hydropower, wildlife habitat, and river recreation. It is estimated that the presence of saltcedar in the western United States will cost between $7 US billion and $16 US billion dollars in lost ecosystem function over the next 55 years (Zavaleta 2000).

In North Dakota, the North Dakota Department of Agricultural and North Dakota counties spend close to $145,000 annually on saltcedar control (personal writtten communication, Rachel Seifert-Spilde, Noxious Weeds Specialist, North Dakota Department of Agriculture, September 2005). In Wyoming, herbicide control of saltcedar is estimated at $1,000 US dollars per acre with a total cost of $22.5 million within the county of Big Horn alone (Kauffman 2005).

DISPERSAL MECHANISMS

Natural and human transport mechanisms have contributed to the rapid invasion of saltcedar into the Northern Great Plains with human assisted dispersal (including ornamental plantings, earth moving equipment, construction equipment and recreation vehicles) being the most significant dispersal mechanism (Carpenter 1998; Peace and Smith 2003). Dispersal via wind, downriver rafting of seeds, human transport in recreational vehicles and tractors, recreational boating and anglers, and further human transport for ornamental plantings all serve as dispersal mechanisms (Peace and Smith 2003). Humans are the primary transport mechanism for long-distance dispersal.

Ornamental plantings are a dispersal source for saltcedar (Pearce and Smith 2003). Some of the largest infestations are the result of escapes from urban plantings possibly from the ornamental “Pink Cascade”. Pearce and Smith (2003) reported that as many as 12 species of saltcedar were introduced into North America as ornamentals and that they have been sold in Montana as “Pink Cascade” for several years. Pearce and Smith (2003) also reported that by the late 1800s saltcedar had escaped cultivation and naturalized populations had established in the southwestern U.S.. Saltcedar is also likely being transported from areas such as the Fort Peck Reservoir on the Musselshell River

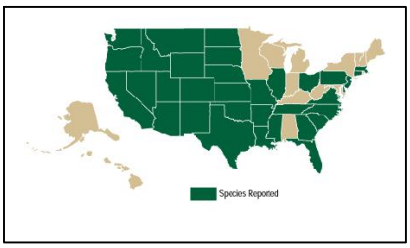
and Lake Sakakawae in North Dakota into novel regions by gardeners digging-out plants for ornamental plantings (Pearce and Smith 2003). Lake Sakakawae is about 150 km downstream and to the east of the Fort Peck Reservoir. Ornamental plantings of saltcedar have also been documented in the City of Minot, North Dakota which is located on the Souris River which flows north into southwestern Manitoba. Flood events will serve to transport seed and plant propagules.

Seed dispersal through wind is also considered a primary transport vector (Pearce and Smith 2003). Dispersal is also through rivers and other riparian systems that transport propagules. Pearce and Smith (2003) estimated saltcedar spreads at 2.5 km/yr by wind and 11 km/year along rivers and waterways (downstream). Seed dispersal towards Manitoba may take place during the summer or winter through prevailing winds.

Robinson (1965) reported that saltcedar has spread to all of the western and Great Plains states, with the greatest concentrations in Texas, Arizona and New Mexico. Robinson (1965) stated that saltcedar was offered for sale to the public in California beginning in the 1850s, collections of tamarisk started to appear in herbaria collections about 1877 and the plant became a concern in the 1920s. In North Dakota, various salcedar species have been sold for many years.

Pearce and Smith (2003) concluded that humans provide the primary vectors of introduction. Vehicle travel from infested areas as well as recreational boaters serve as potential vectors of introduction. Fishermen regularly participate in fishing tournaments at the Fort Peck Reservoir in Montana and potentially transport plant materials and seeds entangled on boats and trailers.

GEOGRAPHIC DISTRIBUTION



In the United States the current distribution runs between Arizona and northern Montana and North Dakota just below the Canadian border (see map on the USDA Plants Database website). It is common in California, Nevada, Utah and western Colorado (Carpenter 1998). Saltcedar was found in Minnesota in 2003 near Hibbings where plants were treated with herbicides. Large infestations of a vigorous wild type of saltcedar has spread into western North Dakota along the Yellowstone and Missouri Rivers from Montana. These plants have been found along the rivers and on the banks several hundred yards away from the rivers. The latter were likely established during spring flooding. Pearce and Smith (2003) reported over 10,000 plants at the delta at Fort Peck Reservoir and that this infestation is the largest in the Great Plains. They reported that there may be as many as 1 million seedlings established on the mudflats in the Fort Peck Reservoir. Saltcedar has also been found along the shores of Lake Sakakawea and in a wildlife management area in Sargent

County. Saltcedar was collected in Benson County in 1968 and in Belfield in Billings County in 1970. Both sources were likely from ornamental plantings. Saltcedar is also likely to occur in Slope and Bowman Counties in the southwestern corner of North Dakota.

Peace and Smith (2003) reported that naturalized saltcedar has yet to be found in Canada however sterile cuttings have been distributed by nurseries in Alberta and British Columbia. Baum (1967) reported that species of saltcedar have been collected in southern British Columbia, Manitoba and Ontario.

It is only a matter of time before saltcedar is transported into Canada (Peace and Smith 2003). Canadian portions of the Great Plains are highly susceptible to invasion. Phenotypic plasticity, ecotypic differentiation and high genetic variation in saltcedar indicate the potential of this species to establish in the colder climates of Canada is very high (Sexton et al. 2002). Saltcedar has established in colder northern regions of the United States including the northern portion of North Dakota near Minot.

MANAGEMENT

Once saltcedar is established it is difficult to control and almost impossible to eradicate (Peace and Smith 2003). Management efforts have included cutting and burning, herbicides to foliage and surface stumps, natural insect predators from Eurasia - these efforts have been unsuccessful (Peace and Smith 2003). Carpenter (1998) suggested that saltcedar can be controlled by the following five methods: 1) herbicides applied to foliage; 2) removing aboveground stems by burning or mechanical means followed by herbicide applications to cut stems; 3) cutting stems close to the ground followed by herbicide applications to cut stems; 4) spraying basal bark with herbicide; and 5) digging or pulling plants. These methods have not been successful.

Grubb et al. (2002) described some of the management techniques used against saltcedar. They reported the most successful management method involves integrating root plowing and burning with repeated herbicide treatments on regrowth. Mechanical methods including mowing, chaining, ripping, and bulldozing have not been successful. Herbicides alone will not control saltcedar invasions. In the United States Dicamba (Banvel), Imazapyr (Arsenal), 2,4-D, and Tebuthiuron (Spike) are labeled for saltcedar control. Larger infestations have been controlled through aerial applications (Kauffman 2005). As well as the above chemicals, metsulfuron methyl (Escort XP), Ammonium salt of fosamine (Krenite S), triclopyr (Garlon 4, Remedy) and glyphosate (Rodeo, Roundup Original) have also been used to control saltcedar however control is not complete Kauffman (2005).

Biological Control

A classical biological control program against saltcedar was initiated by the U.S. by the Department of Agriculture's Agricultural Research Service in 1989 (DeLoach 1996). *Diorhabda elonga* Brulle subspecies *deserticola* Chen, a leaf beetle from central Asia is a potential biological control agent for saltcedar as it has been found to completely defoliate large areas of saltcedar (Kauffman 2005). It has been approved for preliminary releases in the United States (Kauffman 2005). The leaf beetle was released into field cages in 1999 at locations approved by the United States Fish and Wildlife Service. It is believed that the Fukang strain of *D. e. deserticola* has a life history that will allow for safe release and will prevent it from establishing in areas where the endangered (federally – US) southwestern willow flycatcher is nesting in saltcedar (Kauffman 2005).

Other biological control agents being tested in Europe and in quarantine in the United States include the mealybug *Trabutina mannipara* and the leaf feeding beetle *Coniatus tamarisci* (Kauffman 2005).

SPECIES INFORMATION LINKS

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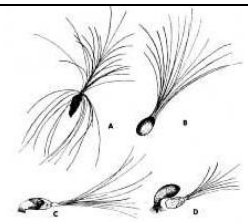
Element Stewardship Abstract for Saltcedar – The Nature Conservancy
http://tncweeds.ucdavis.edu/esadocs/documnts/tamaram.html

PICTURE GALLERIES

	**Organization: USGS Western Wetland Flora: Northern Prairie Wildlife Research Center** **Link:** **http://www.npwrc.usgs.gov/resource/othrdata/westflor/species/5/tamaramo.htm**
	**Organization: USDA Plants Database** **Link:** **http://plants.usda.gov/java/profile?symbol=TAMAR2**
	**Organization: Invasive Aquatic Plants of the San Francisco Delta Region** **Link: http://www.sfei.org/nis/cedar.html**