Minnesota Noxious Weed Risk Assessment

Developed by the Minnesota Noxious Weed Advisory Committee

Assessment information

Common name: Saltcedar, tamarisk

Scientific name: *Tamarix ramosissima* Ledeb.

Family name: Tamaricaceae

Current reviewer name and organizational affiliation: Emilie Justen, Minnesota Dept of Agriculture
Date of current review: November 16, 2020

Species description

Photos

Photo caption: Saltcedar flowers are pink. Photo credit: Dave Hanson, Minnesota Department of Transportation

Photo caption: Saltcedar leaves are scale-like, similar to white cedar. Photo credit: Dave Hanson, Minnesota Department of Transportation.

Why the plant is being assessed

- Saltcedar has been documented as invasive in western states along river corridors. It is listed as a noxious weed in 10 states.
- It can change soil composition and chemistry.
- Unknown threat to north-eastern states.
- Has been sold and there are cultivars sold in the nursery industry. *Tamarix ramosissima* 'Pink Cascade' and 'Summer Glow' are grown and sold by several nurseries in Minnesota and Wisconsin as well as by larger retail outlets.

Identification, biology, and life cycle

- Perennial tree or shrub.
- Saltcedar are shrubs or shrub-like trees with numerous large basal branches, reaching 13 to 26 feet in height, but usually less than 20 feet. Leaves are scale-like, 1.5 to 3.5 mm long, with salt-secreting glands. The foliage is deciduous (Zouhar 2003).
- Flowering branches are racemes and are mostly primary or secondary branches. The inflorescence is a panicle of several small, perfect flowers, subtended by a small bract. Panicle branches of small-flowered saltcedar are 0.4 to 0.8 inches (1-2 cm) long and 3 to 5 mm wide and flowers have 4 sepals and 4 petals.

Panicle branches of French tamarisk (*Tamarix gallica*) and saltcedar are 0.8 to 3 inches (2-8 cm) long and 3 to 5 mm wide, and flowers have 5 sepals and 5 petals. Petals of all species may be persistent or deciduous after anthesis. Saltcedar fruit is a capsule, bearing many tiny seeds (<0.5 mm in diameter and <0.5 mm long) with apical pappi. The weight of a mature saltcedar seed is about 0.00001 gram (Zouhar 2003).

- Saltcedar has a deep, extensive root system that extends to the water table, and is also capable of extracting water from unsaturated soil layers (a facultative phreatophyte). Saltcedar has a primary root that grows with little branching until it reaches the water table. In areas where mature plants are spaced 25 feet (7.6 m) or more apart, their roots may be intermixed and occupy the entire area. The location of the water table during root formation influences the morphology of the root system. In areas with shallow water tables, more extensive lateral development was observed. When the water table rose above the surface, adventitious roots appeared along the stem. Mature saltcedar plants are able to reproduce from adventitious roots, even after the aboveground portion of the plant has been removed (Zouhar 2003).

Current distribution

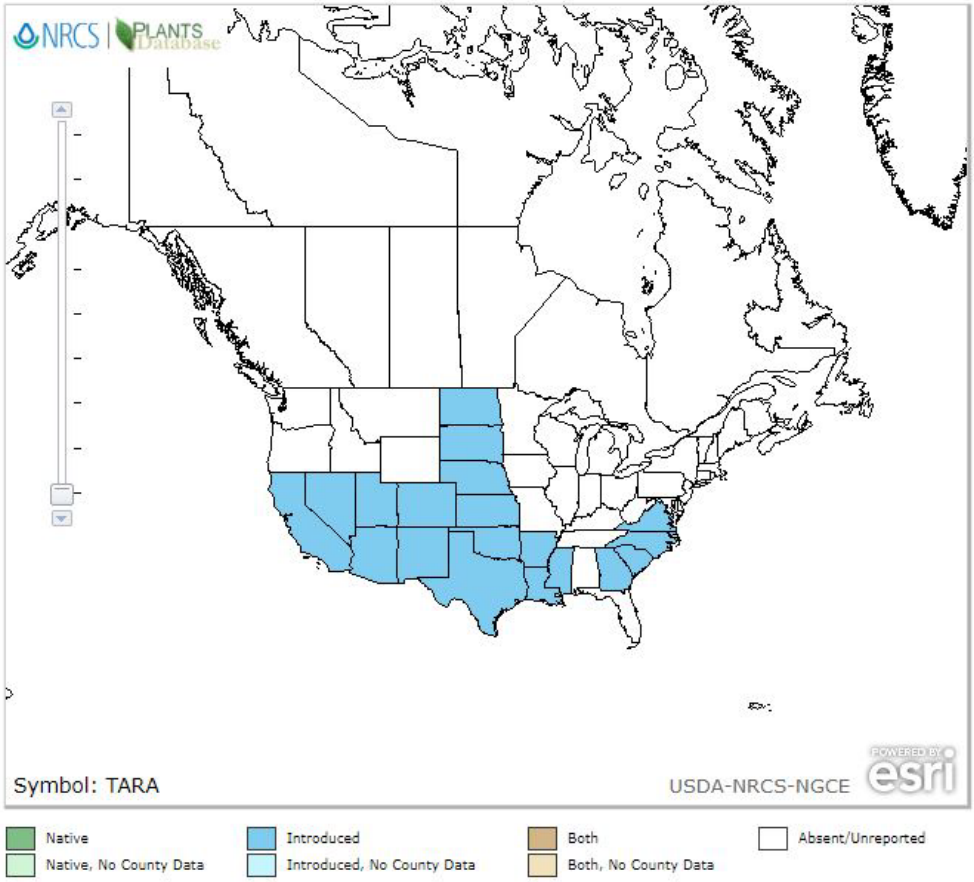

Photo caption: National level map of *Tamarix ramosissima* distribution from USDA Plants accessed March 20, 2020.

Saltcedar is found in many western states. It is also documented in North Carolina and Georgia.

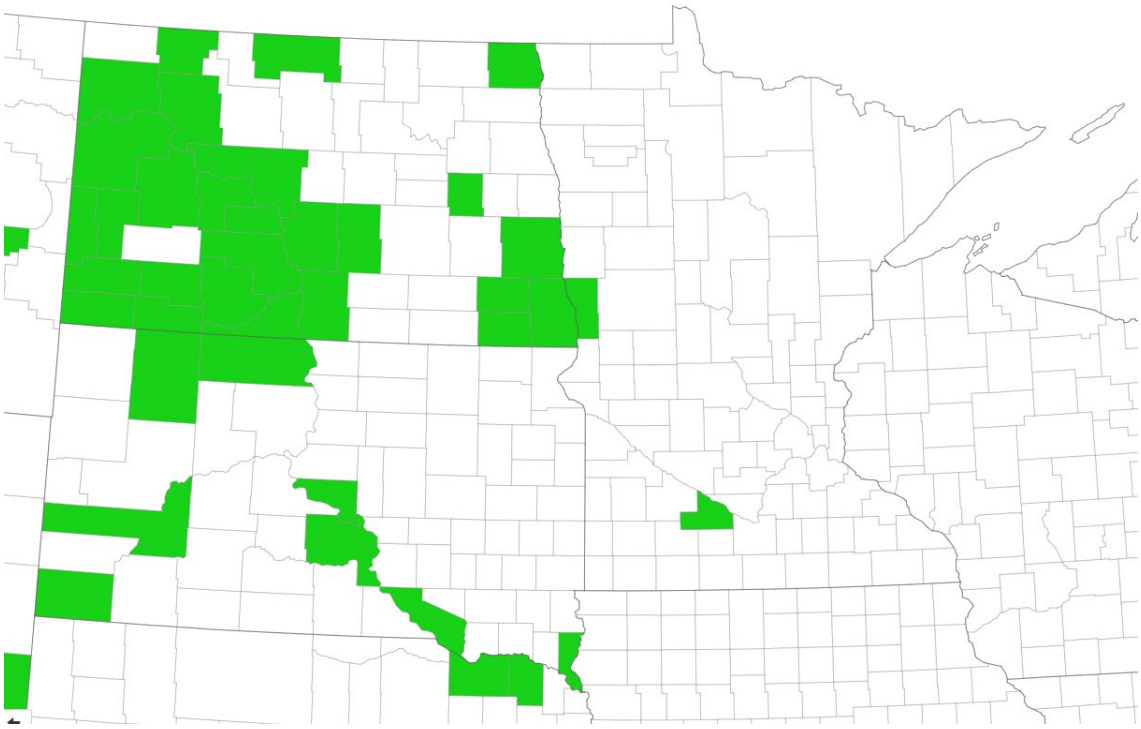

Photo caption: State level tamarisk distribution by county map from EDDMapS accessed August 12, 2020. Saltcedar has been documented in two counties in Minnesota. It was documented as naturalizing in Wilkin County, Minnesota near the North Dakota border. The Wilkin County site with a naturalized plant on public land, was treated by cut stump and has been monitored. The Brown County report is on private land and is a landscape planting and not naturalizing.

Current regulation

Not currently regulated in Minnesota.

Risk assessment

Box 1:

Is the plant species or genotype non-native?

Answer: Yes
Outcome: Go to Box 3
Saltcedar is native from western Europe and the Mediterranean to North Africa, northeastern China, India and Japan. It was introduced to western United States for sale as an ornamental shrub and a windbreak species in the 1800s (Zouhar 2003).

Box 2:

Does the species pose significant human or livestock concerns or have the potential to significantly harm agricultural production?

Question 2A: Does the plant have toxic qualities that pose a significant risk to livestock, wildlife, or people?
Outcome: Outcome: Decision tree does not direct to this question.

Question 2B: Does the plant cause significant financial losses associated with decreased yields, reduced quality, or increased production costs?
Outcome: Outcome: Decision tree does not direct to this question.

Box 3:

Is the species, or a related species, documented as being a problem elsewhere?

Answer: Yes
Outcome: Go to Box 6
Saltcedar has been documented as a problem in many southwestern U.S. states. South Dakota and North Dakota have listed saltcedar on their noxious weed lists.

Box 4:

Are the species' life history and growth requirements understood?

Answer: ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***
Saltcedar is a shrub or shrub like tree with deciduous foliage. Flowering branches are racemes and flowers produce many tiny seeds with pappi. Saltcedar has deep, extensive root systems that extend to the water table. It is competitive in areas where salinities are elevated or water tables are depressed (Zouhar 2003). It can also regulate photosynthesis and leaf conductance during drought, increasing its competitiveness in arid and semiarid regions (Mounsif et al. 2002).

Saltcedar accumulates salt in glands in its leaves, which it then excretes onto the leaf surface resulting in foliage covered in salt (Mozingo 1987, Zouhar 2003). The salt covered leaves then accumulate on the soil surface, and as the soil salinity increases, germination and establishment of many native species becomes impaired (Busch and Smith 1995).

Saltcedar is adaptable to many environmental conditions and can be long lived. In New Mexico, specimens 75-100 years old have been documented (Horton 1977).

Box 5:

Gather and evaluate further information

Outcome: Decision tree does not direct to this question.

Box 6:

Does the species have the capacity to establish and survive in Minnesota?

Question 6A: Is the plant, or a close relative, currently established in Minnesota?
Answer: Yes
Outcome: Go to Box 7
Northern range in the U.S. is southeastern Montana along the Bighorn, Powder, and Yellowstone rivers, though it routinely died back to the ground (Lesica and Miles 2001). In colder northern climates, plant physiology may be affected, including slower seedling growth, lower seedling densities, and later flowering resulting in a less

certain invasive potential (Hudson 1999). It has been suggested that the invasive potential of northern populations could increase in populations that persist long enough to experience multiple episodes of selection (Sexton et al 2002).

Saltcedar plants are found in Minnesota in places where they have been planted as ornamentals. For example, saltcedar are seen in the Twin Cities metro area planted in yards (Van Riper 2020; Justen 2020).

Question 6B: Has the plant become established in areas having a climate and growing conditions similar to those found in Minnesota?

Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

Saltcedar is hardy to zone 3 and has been documented in southeastern Montana though its invasive potential in colder climates is uncertain (Zouhar 2003). Climate modeling studies in the Pacific Northwest have predicted that 20% of that region could be suitable saltcedar habitat (Kerns et al 2009).

Question 6C: Has the plant become established in areas having a climate and growing conditions similar to those projected to be present in Minnesota under future climate projections?

Outcome: Decision tree does not direct to this question.

Box 7:

Does the species have the potential to reproduce and spread in Minnesota?

Question 7A: Are there cultivars of the plant that are known to differ in reproductive properties from the species?

Answer: No

Outcome: Go to Questions 7B

Two cultivars are propagated and sold in Minnesota but are not known to differ in reproductive properties from the species (Calkins 2020).

Question 7B: Does the plant reproduce by asexual/vegetative means?

Answer: Yes

Outcome: Go to Question 7C

Saltcedar develops adventitious roots from aboveground plant portions, meaning it can produce new plants vegetatively from stems that break off from parent plants (Gary and Horton 1965, Merkel and Hopkins 1957, Zouhar 2003). Sprouting capability is reduced if stem pieces dry out (Hansen et al. 1995).

Question 7C: Are the asexual propagules - vegetative parts having the capacity to develop into new plants - effectively dispersed to new areas?

Answer: Yes

Outcome: Go to Question 7I

It can produce new plants vegetatively from stems that break off from parent plants, carried in sediment in floods, and buried (Zouhar 2003).

Question 7D: Does the plant produce large amounts of viable, cold hardy seeds? For woody species, document the average age the species produces viable seed.

Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***
A large plant may produce several hundred thousand seeds in a single growing season (Merkel and Hopkins 1957). Warren and Turner (1975) estimated the number of viable seeds reaching the soil surface was about 100 seeds per square inch over one growing season. Though it produces a large amount of seed, the seeds are short lived and do not form a persistent seed bank (Zouhar 2003).

Question 7E: For species that produce low numbers of viable seeds, do they have a high level of seed/seedling vigor or remain viable for an extended period (seed bank)?
Outcome: Decision tree does not direct to this question.

Question 7F: Is the plant self-fertile?
Answer: ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***
Saltcedar flowers are bisexual, likely pollinated by insects (Zouhar 2003).

Question 7G: Are sexual propagules – viable seeds – effectively dispersed to new areas? List and consider all vectors.
Answer: ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***
Seeds have small hairs on the seed coat and are dispersed by wind and water (Merkel and Hopkins 1957).

Question 7H: Can the species hybridize with native species (or other introduced species) and produce viable seed and fertile offspring in the absence of human intervention?
Answer: ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***
It can hybridize with another non-native saltcedar, *T. chinensis* (Zouhar 2003).

Question 7I: Do natural controls, species native to Minnesota, which have been documented to effectively prevent the spread of the species in question?
Answer: No
Outcome: Go to Box 8
No evidence found of natural controls native to Minnesota.

Box 8:

Does the species pose significant human or livestock concerns or have the potential to significantly harm agricultural production, native ecosystems, or managed landscapes?

Question 8A: Does the plant have toxic qualities, or other detrimental qualities, that pose a significant risk to livestock, wildlife, or people?
Answer: No
Outcome: Go to Question 8B
Cattle and sheep will browse on young seedlings but will tend to browse on native plants first, giving saltcedar a competitive advantage (Hansen et al 1995, Stromberg 1997).

Question 8B: Does, or could, the plant cause significant financial losses associated with decreased yields, reduced crop quality, or increased production costs?
Answer: Yes

Outcome: Go to Box 9
Burch et al (2007) state: "Saltcedar infestations reduce forage and alter livestock and wildlife habitat. It is relatively unpalatable to most classes of livestock and wildlife and it has been rated as poor in energy and protein value. It provides fair to good cover for cattle and wildlife species such as elk, deer, small mammals, upland game birds, and waterfowl for a short time, then with increasing infestation the area becomes unusable for livestock or wildlife. There are sites with heavy infestations of saltcedar with understories that are either bare or composed of almost exclusively invasive plants."

Question 8C: Can the plant aggressively displace native species through competition (including allelopathic effects)?
Answer: ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***
Well documented in Western states since the early 1900s along Colorado River (Haase 1972). It is one of the most widespread and troublesome invasive plants along river corridors in southwestern U.S., reducing recreational usage of parks, wildlife refuges, and riparian areas (Haase 1972, Zouhar 2003). It has replaced many native species, partly because of its adaptation to increased soil salinity (Stromberg 1993, Stromberg and Chew 1997, Warren and Turner 1975, Zouhar 2003).

Question 8D: Can the plant hybridize with native species resulting in a modified gene pool and potentially negative impacts on native populations?
Outcome: Decision tree does not direct to this question.

Question 8E: Does the plant have the potential to change native ecosystems (adds a vegetative layer, affects ground or surface water levels, etc.)?
Answer: ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***
Studies have shown that saltcedar has a high transpiration rate and the species uses more water than native vegetation, drawing down water tables, desiccating floodplains, and lowering flow rates of rivers (Brotherson and Field 1987, Busch and Smith 1995, Hansen et al 1995, Smith et al 1998, Zavaleta 2000, Zouhar 2003). Saltcedar dries up springs and pools, eliminating habitat for fish and other animals and can make the habitat more xeric (Brotherson et al 1984, Zouhar 2003). Because saltcedar deposits salt excreted from its leaves into the soil, the species can change the salinity of soils which can inhibit growth and germination of native species (Anderson 1995, Hansen et al 1995).

Question 8F: Does the plant have the potential to introduce or harbor another pest or serve as an alternate host?
Outcome: Decision tree does not direct to this question.

Box 9:

Does the species have clearly defined benefits that outweigh associated negative impacts?

Question 9A: Is the plant currently being used or produced and/or sold in Minnesota or native to Minnesota?
Answer: Yes
Outcome: Go to Question 9B
The plant is not native, but two cultivars are currently being sold in Minnesota (Calkins 2020).

Question 9B: Is the plant an introduced species and can its spread be effectively and easily prevented or controlled, or its negative impacts minimized, through carefully designed and executed management practices?

Answer: No

Outcome: Go to Box 9C

Two cultivars are sold in the industry. Though it is not a high value crop, there have been observations of single plants in managed landscapes.

Question 9C: Is the plant native to Minnesota?

Answer: No

Outcome: Question 9D

It is native to Europe and Asia (Zouhar 2003).

Question 9D: Is a non-invasive, alternative plant material or cultivar commercially available that could serve the same purpose as the plant of concern?

Answer: No

Outcome: Question 9E

Limited sales and economic usefulness. Observed in landscape planting around metro (Van Riper 2020, Justen 2020).

Question 9E: Does the plant benefit Minnesota to a greater extent than the negative impacts identified at Box #8?

Answer: No

Outcome: Go to Box 10

Negative impacts outweigh its limited nursery sales in Minnesota.

Box 10:

Should the species be regulated as Prohibited/Eradicate, Prohibited/Control, or Restricted Noxious Weed?

Question 10A: Is the plant currently established in Minnesota?

Answer: Yes

Outcome: Go to Question 10D

Observations of landscape plantings around metro (Van Riper 2020, Justen 2020), and documented naturalizing in Wilkin County in western Minnesota (EDDMapS 2020).

Question 10B: Would prohibiting this species in trade prevent the likelihood of introduction and/or establishment?

Answer: Yes. ***This information is supplemental and is not part of the flow chart pathway for this risk assessment.***

Neighboring states North Dakota and South Dakota have established populations along the Missouri River and prohibiting from sale in Minnesota would also help the Upper Midwest region prevent further establishment.

Question 10C: Does this risk assessment support this species being a top priority for statewide eradication if found in the state?
Outcome: Decision tree does not direct to this question.

Question 10D: Does the plant pose a serious human health threat?
Answer: No
Outcome: Go to Question 10F

Question 10F: Is the plant known to cause significant ecological or economic harm and can the plant be reliably <u>eradicated</u> (entire plant) on a statewide basis using existing practices and available resources considering the distribution, reproductive biology and potential for spread?

- *For distribution, note if the distribution is well documented, the number and acreage of known infestations and how widespread they are in the state. Note if there are infestations in border areas.*
- *For reproductive biology, note if there are reproductive biology factor that make the plant easier to control and eradication more likely (for example, long pre-reproductive period, self-incompatible pollination, short-lived seed bank).*
- *For potential for spread and re-invasion of controlled areas, note its potential to spread beyond places where it is being controlled such as deliberate planting by people, wildlife vectors, re-infestation from border states, or other factors that facilitate spread.*
- *For known management tools, note what management tools are available, potential non-target impacts, and the reasonableness of state management or mandating that landowners throughout the state use the management tools to eradicate or control existing plants.*
- *For available resources, consider the capacity of state and local personnel and availability of funding to respond to new and existing infestations.*

Answer: No
Outcome: Go to Question 10G
Distribution in Minnesota is not well documented. Infestations occur in North Dakota and South Dakota in the Missouri River Watershed and it is well documented in western states to cause significant ecological harm. It has also been documented in Wilkin County, which is in the Red River Watershed, as well as eastern North Dakota counties. It poses a threat to the Red River Watershed District. There are limited available resources to eradicate known landscape populations. Because the distribution is unknown and two cultivars are still sold in the nursery trade, mandating eradication is not feasible.

Question 10G: Is the plant known to cause significant ecological or economic harm and can the plant be reliably <u>controlled</u> to limit spread on a statewide basis using existing practices and available resources? Would the economic impacts or other hardships incurred in implementing control measures be reasonable considering any ongoing or potential future increase of ecological or economic harm?

- *Also consider all bullet points listed under 10F when evaluating 10G*

Answer: No
Outcome: Go Question 10H

Distribution in landscape plantings is unknown. Enforcement as a Prohibited Control species would likely be difficult and there are limited resources to support enforcement.

Question 10H: Would prohibiting this species in trade have any significant or measurable impact to limit or reduce the existing populations or future spread of the species in Minnesota?
Answer: Yes
Outcome: LIST THE PLANT AS A RESTRICTED NOXIOUS WEED
Though it has limited nursery sales, it has been observed as a landscape plant and the extent of its population in the landscape is unknown. Prohibiting from nursery sales would prevent future populations from entering the landscape. Prohibiting from nursery sales would not likely have a large economic impact on the nursery industry.

Question 10I: Are there any other measures that could be put in place as Special Regulations which could mitigate the impact of the species within Minnesota?
Outcome: Decision tree does not direct to this question.

Final outcomes of risk assessment (2020)

NWAC Listing Subcommittee

Outcome: List as a Restricted Noxious Weed
Comments: The subcommittee recognizes the difficulty of predicting whether Minnesota's environmental conditions would be favorable for landscape level invasion of saltcedar. With confirmed reports in eastern North Dakota, saltcedar poses a risk to the Red River valley.

NWAC Full Committee

Outcome: List as a Restricted Noxious Weed
Comments: Vote was 11-4 on the recommendation to list.

MDA Commissioner

Outcome: List as a Restricted Noxious Weed
Comments: No comments

Risk Assessment Current Summary (04-26-2021)

- Saltcedar has been found to reduce forage and impact livestock and wildlife habitat. Studies have shown that saltcedar has a high transpiration rate and the species uses more water than native vegetation, drawing down water tables, desiccating floodplains, and lowering flow rates of rivers. Saltcedar can increase salinity of soils and has replaced many native species in areas.
- The subcommittee debated whether saltcedar might pose a risk to Minnesota and recognized the difficulty of predicting threat based on environmental conditions. After debate, the subcommittee supported listing as a Restricted Noxious Weed.
- A commissioner's order to list saltcedar as a Restricted Noxious Weed was signed on 04/26/2021. The species will be added to the Minnesota Noxious Weed List on 01/01/2023.

References

Brotherson, J. D., J. G. Carman, and L. A. Szyska. 1984. Stem-diameter age relationships of *Tamarix ramosissima* in central Utah. Journal of Range Management. 37(4): 362-364.

Brotherson, J. D. and D. Field. 1987. Tamarix: impacts of a successful weed. Rangelands. 9(3): 110-112.

Burch, D., M. Coffin, R. Siefert-Spilde, R. Moehring, and S. Franklin. 2007. Missouri River Watershed Coalition Saltcedar Management Plan. Montana State University Center for Invasive Plant Management. Available: http://msuinvasiveplants.org/documents/archives_cism/MRWC/about-us-saltcedar-plan.pdf. Accessed 10 July 2020.

Busch, D. E., S. D. Smith. 1995. Mechanisms associated with decline of woody species in riparian ecosystems of the southwestern U.S. Ecological Monographs. 65(3): 347-370.

Calkins, James. 2020. Minnesota Nursery and Landscape Association. Personal communication with Emilie Justen.

EDDMapS. 2020. Early Detection & Distribution Mapping System. The University of Georgia - Center for Invasive Species and Ecosystem Health. Available online at http://www.eddmaps.org/ Accessed August 12, 2020.

Gary, H. L. and J. S. Horton. 1965. Some sprouting characteristics of five-stamen tamarisk. Research Note RM-39. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 7 p.

Haase, E. F. 1972. Survey of floodplain vegetation along the lower Gila River in southwestern Arizona. Journal of the Arizona Academy of Science. 7: 75-81.

Hansen, P. L., R. D. Pfister, K. Boggs, B. Cook, J. Bradley, J. Joy, and D. K. Hinckley. 1995. Classification and management of Montana's riparian and wetland sites. Miscellaneous Publication No. 54. Missoula, MT: The University of Montana, School of Forestry, Montana Forest and Conservation Experiment Station. 646 p.

Horton, J. S. 1977. The development and perpetuation of the permanent tamarisk type in the phreatophyte zone of the Southwest. In: Johnson, R. Roy; Jones, Dale A., tech. coords. Importance, preservation and management of riparian habitat: a symposium: Proceedings; 1977 July 9; Tucson, AZ. General Technical Report RM-43. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 124-127.

Hudson, L. E. 1999. Climatic and hydrologic effects on the establishment of *Tamarix ramosissima* in the cold desert of northern Wyoming (Bighorn Lake). Missoula, MT: The University of Montana. 40 p. Thesis.

Justen, Emilie 2020. Noxious Weed Law Coordinator, Minnesota Department of Agriculture. Personal observation 8 July 2020.

Kerns, B., B. Naylor, M. Buonopane, C. Parks, and B. Rogers. 2009. Modeling Tamarisk (*Tamarix* spp.) habitat and climate change effects in the Northwestern United States. Invasive Plant Science and Management 2(3): 200-215.

Lesica, P. and S. Miles. 2001. Tamarisk growth at the northern margin of its naturalized range in Montana, USA. Wetlands 21(2): 240-246.

Merkel, D. L. and H. H. Hopkins. 1957. Life history of the saltcedar (*Tamarix gallica* L.). Transactions of the Kansas Academy of Science 60(4): 360-369.

Mozingo, H. N. 1987. Shrubs of the Great Basin: A natural history. Reno, NV: University of Nevada Press. 342 p.

Mounsif, M., C. Wan, and R. E. Sosebee. 2002. Effects of top-soil drying on saltcedar photosynthesis and stomatal conductance. Journal of Range Management 55(1): 88-93.

Sexton, J. P., J. K. McKay, and A. Sala. 2002. Plasticity and genetic diversity may allow saltcedar to invade cold climates in North America. Ecological Applications 12(6): 1652-1660.

Smith, S. D., D. A. Devitt, A. Sala, J. R. Cleverly, and D. E. Busch. 1998. Water relations of riparian plants from warm desert regions. Wetlands. 18(4): 687-696.

Stromberg, J. C. 1993. Fremont cottonwood-Goodding willow riparian forests: a review of their ecology, threats, and recovery potential. Journal of the Arizona-Nevada Academy of Sciences 27(1): 97-110.

Stromberg, J. C. 1997. Growth and survivorship of Fremont cottonwood, Goodding willow, and saltcedar seedlings after large floods in central Arizona. The Great Basin Naturalist 57(3): 198-208.

Stromberg, J. C. and M. K. Chew. 1997. Herbaceous exotics in Arizona's riparian ecosystems. Desert Plants 13(1): 11-17.

Van Riper, Laura. 2020. Terrestrial Invasive Species Program Coordinator, Minnesota Department of Natural Resources. Personal communication with Emilie Justen 29 June 2020.

Warren, D. K. and R. M. Turner. 1975. Saltcedar (*Tamarix chinensis*) seed production, seedling establishment, and response to inundation. Journal of the Arizona Academy of Science 10: 135-144.

Zavaleta, E. 2000. Valuing ecosystem services lost to Tamarix invasion in the United States. In: Mooney, Harold A.; Hobbs, Richard J., eds. Invasive species in a changing world. Washington, DC: Island Press: 261-300.

Zouhar, K. 2003. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us/database/feis/plants/tree/tamspp/all.html. Accessed 11 May 2020.