

LESSON 22

Who Drank All the Water?

OBJECTIVES

Students will understand how a noxious weed, saltcedar, uses tremendous amounts of water, affecting other plants and people.

METHOD

Students estimate how much water a saltcedar tree can use in a day and then use jugs to fill a container representing a fraction of the actual amount. They use different lengths of twine to represent root lengths in saltcedar and native willows, to explore how saltcedar can exploit water sources far beyond the reach of native plants.

MATERIALS

- ✎ One or more 1-gallon milk or juice jugs (clean and empty)
- ✎ A larger container or containers that can hold 20 gallons total
(NOTE: These will be filled with water, so you should be able to easily empty them after the lesson. Remember that water is heavy—8 lbs. per gallon—so you should be able to either drain them, lift them, or do the lesson outside where you can simply tip them over and let them empty onto the ground. 5-gallon buckets are probably the best choice in a classroom setting.)
- ✎ Water source for filling jugs
- ✎ 10-ft-long twine, string or rope
- ✎ 100-ft-long twine, string or rope
- ✎ Masking tape or duct tape

BACKGROUND

Saltcedar or tamarisk (*Tamarix ramosissima*) is an attractive deciduous tree (or shrub) with long slender branches and deep pink flowers. It is long-lived (50-100 years) and grows to 6 to 26 feet (2-8m) tall. The branches often form thickets many feet wide. Saltcedar is native to Eurasia. Saltcedar has become extensively established in the southwestern United States and Mexico. It extends north to Massachusetts, Indiana, Missouri, Kansas, Colorado, Nebraska, and Oklahoma. Stands of saltcedar occur in Oregon, Idaho, Montana, Wyoming, and South Dakota. Experts now estimate that saltcedar has infested more than 3.3 million acres in the western United States. It is believed that nurserymen on the East Coast made the first introduction of saltcedar to North America in 1823. It was planted as an ornamental in the western U.S., but by the 1870s, it was reported to have escaped cultivation.

Grade level: 4-8

Subject Areas: Biology

Duration: 30 minutes

Group Size: Class

Setting: Classroom

Season: Any

Conceptual Framework Topics:

Plant water use, competition,
Impacts of invasive plants

In the Great Plains, saltcedar is common along streams, in low undrained areas, and around lakeshores, and is occasionally found on dry hillsides. Its roots may penetrate soil 100 feet to reach water. It has a wide range of tolerance to saline and alkaline soil and water. Saltcedar occurs from below sea level to more than 7,000 feet (2,134 m) in elevation.

Saltcedar is a very great consumer of water: a single large plant can absorb 200 gallons of water a day. This can lower ground water levels, dry up springs and wetlands, and lessen the water yield of riparian areas. Saltcedar's dense roots can slow down stream flow, increasing deposition and sediments along the riverbank. This can lead to saltcedar colonization further into the floodplain, widening the riparian zone, resulting in severe reduction of stream flow or even rechanneling. On the other hand, saltcedar root systems can also lead to flooding by choking the watercourse.

Saltcedar, like many other invasive plant species, has a great reproductive capability. A mature saltcedar plant can produce 600,000 seeds annually, and has the ability to flower during its first year. Seeds are easily dispersed by wind and water, and severed stems and shoots of saltcedar readily root in moist soil. The plant's ability to exploit suitable germinating conditions over a long time period gives saltcedar a considerable advantage over native riparian species.

A very rapid grower, saltcedar can grow 9 to 12 feet in a single season. Under drought, saltcedar survives by dropping its leaves and halting growth. Additionally, its seedlings are very resistant to drying. Under flooding, it can survive immersion for up to 70 days. Mature plants can resprout vegetatively after fire, flood, or treatment with herbicides and can adapt to wide variations in soil and mineral gradients. Saltcedar also deposits salt above and below the ground, forming a saline crust inhibiting other plants from growing in its vicinity. In addition to outcompeting native species, this also enables the saltcedar to cope with high concentrations of dissolved solids.

Saltcedar is difficult or impossible to kill by burning, drought, freezing, hypersalinity, prolonged submersion, or repeated cutting at ground level. However, it can possibly be controlled through a combination of methods.

Because saltcedar can very effectively resprout from roots or cut stems, simple removal of the plant is largely unsuccessful. Cutting or burning followed by herbicide application to the stump has been shown to be effective. Research has indicated that approximately a dozen insect species are available that might be useful in fighting saltcedar, but none are presently available.

PROCEDURE

Before beginning the lesson, review with students how water moves through plants (a good lesson to help with this can be found at:

<http://www.lessonplanspage.com/ScienceExCanWaterTravelThroughPlantStemsM068.htm>).

1. Tell your students they are going to learn about a small tree that was sold in plant nurseries in the U.S. starting almost 200 years ago and continued to be sold up until a few years ago. It became illegal to sell it because it has taken over and invaded so many places on its own that it has become a major pest and a noxious weed. Now it is growing in the eastern part of Montana, among many other places in the west, and causing lots of problems.

Give them some of the background information about saltcedar, but don't tell them how much water it uses—just that it uses a lot. Ask them to give you some examples of problems this might cause in places where water is not very abundant, such as Montana.

2. Show them the 1-gallon jug(s) and ask them how many jugs full of water they think a saltcedar tree can “drink” in one day. Write down the estimates on the board. Then have students begin to fill the jug(s) and empty them into the larger containers, keeping track of the number of jugs full of water and telling them that this will represent the amount of water a single saltcedar tree can use in one day. If they think they have reached the amount, tell them to keep going until 10 or 20 gallons have been emptied. Do they think that is enough? Explain that they would have to repeat filling the containers 10 times to reach the amount used by one tree in one day. Did anyone guess that much?

3. Discuss what kinds of problems they think that could cause for other plants, wildlife and people in the area where these trees invade.

4. Have two students stand at the water containers; one will be a saltcedar plant and the other a willow, a native plant that would naturally grow in the kinds of areas (streamsides, etc.) where saltcedar invades. Ask what will happen when the saltcedar uses all the water out of the water source. What will the plants do? Hand one end of the 100-ft twine to the “saltcedar student” and explain that this represents its roots. Have another student take the roll of twine and walk away until they have reached the end. Now have the “willow student” take the 10-ft roll. Roll out the 10-ft roll and have your students observe where it ends.

5. Discuss with your students what the implications are for the native plants and the saltcedar. How about humans using the water for a well or irrigation? What other animals might be affected? (Fish and other wildlife that might depend on a stream or the plants that grow around it.)

Extensions

Have students research the spread of saltcedar in Montana (see Resources section of guide for suggestions).

Have your students experiment to study transpiration and water loss in plants, using the excellent lesson from NSTA: *Thirsty Plants in Arid Places*
<http://www.nsta.org/publications/article.aspx?id=Z349URi8cV4uSDyFBN2UzAZG6fGEErEhyZ/U90YfQgA=>