

## The battle at the Grand Canyon: Tamarisk tries to edge out native trees

By Gabriel LaHue

Down beneath the red rim of the Grand Canyon, along the banks of the storied Colorado River, a fierce battle has been taking place. One competitor has a few critical advantages and seems to be heading towards a decisive victory, leading to its widespread vilification and government efforts to help the underdog. Invasive tamarisk (*Tamarix spp.*) or salt cedar has been edging out the native willow (*Salix gooddingii*) and cottonwood (*Populus fremontii*) species, prompting National Park Service [campaigns](#) to remove the non-native shrubs. Tamarisk has several traits that allow it to outcompete the willow and cottonwood species: the ability to extract water from drier soils, deeper and faster growing roots, and high salt tolerance.

All higher plants have an internal network of pipes that transport water from their roots to their leaves, but if plants have to pull too hard to extract water from the soil, air bubbles can form in these pipes leading to a permanent break in the water column (not unlike what happens if a water pump tries to pull water from too great a depth). [Tamarisk](#) can continue to pull water from mostly dry soils, even when the internal piping systems of cottonwood and willow have already been rendered useless by air bubbles.

In addition to the ability of tamarisk to extract more water from each cubic foot of soil, tamarisk has more soil from which to extract water because its roots grow deeper. While the roots of cottonwood and willow may extend 9 – 12 feet, tamarisk roots may extend up to 18 feet. This is particularly important since groundwater levels have dropped near the Colorado River due to the changing water flow regimes associated with water releases from Glen Canyon Dam. Before the construction of the dam, flood flows from winter rains and spring snowmelt upriver would replenish groundwater, allowing it to be extracted by native plants during the drier summer months. However, controlled releases from Glen Canyon Dam have largely eliminated flood flows and the associated groundwater recharge. As the water table drops, the deeper-rooted tamarisk may be able to still access the water even when the cottonwood and willow trees no longer can.

If tamarisk's advantages of being able to extract more water from each cubic foot of soil and being able to reach deeper into the soil for water weren't enough, tamarisk is also able to survive in much more [saline](#) soils than either cottonwood or willow. While tamarisk shows only a minor change in performance in salinity levels up to 4 grams per liter, cottonwood and willow already begin to grow more poorly at only 1 gram per liter (for reference, sea water is about 35 grams per liter). Tamarisk's higher tolerance is at least in part due to its ability to store salt in its leaves.

So, what does this mean for the Colorado River, the Grand Canyon, and the struggling native trees? One bright spot in this story is that some of the vilification of tamarisk hasn't stood up over time to science. As UC Davis graduate student and ecohydrologist Tara Seely explained to her classmates in a course focused on the geology and ecology of the Grand Canyon, people used to think that tamarisk used far more water than the native cottonwood and willow trees, exacerbating problems of low river flows and water scarcity for Colorado River water users (an ecohydrologist is someone who studies the interactions of water and ecosystems). However, more recent [research](#) has revealed that the water use of tamarisk is not

much different from cottonwood and willow. Furthermore, the total water use by tamarisk along the lower Colorado River is only 1% of the river's total discharge.

While tamarisk may not be using dramatically more water than the native trees, it certainly is displacing these trees and creating a series of other ecological problems. Tamarisk usually establishes as a monoculture (a block of only one plant type) and this presents problems for native plants and animals that depend a diverse community to fulfill their needs. Widespread establishment of tamarisk in an area can change soil salinity and increase the frequency of fires. For these reasons, the National Park Service is attempting to eradicate tamarisk from the Grand Canyon and tip the scales back toward the native trees. Tamarisk has been removed by chemical control, girdling, hand-pulling, and cutting. Some argue that these efforts are insufficient and that the Colorado River's original flow regime needs to be partially restored to give the native species the conditions in which they thrive. Only time will tell whether these efforts will be enough to vanquish this invasive and well-adapted enemy and restore the willow and cottonwood trees to their rightful place.

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**References:**

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**Link 1:**

<https://www.nps.gov/resources/2016.htm?id=5B8020FE-155D-451F-67C9FC2D20EA22FA>

**Link 2 and 4:**

<http://onlinelibrary.wiley.com/doi/10.1029/2010WR010317/epdf>

**Link 3:**

<http://www.sciencedirect.com/science/article/pii/S0140196301908390>