Weeds, Water and Cattle

As beef producers face unprecedented drought conditions, our weed researchers in the West are sounding the alarm on invasive plants and the role they play in depleting our already threatened water resources.

Story & photos by ***Ed Haag***

You can't grow anything without water, and that includes beef cattle and the plants that feed them. Unfortunately, invasive species also consume water and, what we are finding is that many of them are far better at tapping the wet stuff than the plants we depend on to nourish our livestock.

Robert Parker, Washington State University (WSU) Cooperative Extension weed scientist, is well aware of the ability of invasive plants to consume the moisture meant for desired cultivars. He points out that weeds are opportunistic and in general are excellent water scavengers, especially during times of scarcity.

"That is why weed control is even more important in years that there is a water shortage," Parker says. "When moisture is in short supply, research shows that weeds can reduce crop yields more than 50% through moisture competition alone."

He points out that early emergence in annual weeds such as common lamb's-quarter and extensive moisture-gathering root systems in perennial weeds such as Canada thistle are just two of the opportunistic adaptations that allow many of our more common invasive plants to outcompete conventional grain and forage crops for water. In addition, the fact that weeds such as kochia and Russian thistle have a high degree of drought tolerance only enhances their ability to compete with desired cultivars.

Water hungry competitors

Parker notes that while some invasive plants may be drought-tolerant, it doesn't necessarily mean that they are light water users when it can be accessed.

"Some common annual weeds growing in association with cultivated crops use up to three times more water to produce a pound of dry matter as do the crops," he says, citing examples. "Common lamb's-quarter requires 658 pounds (lb.) of water to produce one pound of dry matter; common wild sunflower requires 623 pounds; and common ragweed, 912 pounds, compared with 349 pounds for corn and 557 pounds for wheat."

He goes on to point out that translated into gallons, lamb's-quarter requires nearly 79 gallons (gal.) of water to produce 1 lb. of dry matter, and ragweed 109 gal., as compared with only 42 gal. for corn.

In terms of yield loss, Parker calculates that the amount of water used by an infestation of lamb's-quarter, if it were conserved through adequate weed control practices, could produce an additional 1.9 tons per acre of corn or 1.2 tons per acre of wheat.

When water use by invasive annuals is compared on a plant-to-plant basis with grain and forage crops, the conclusions are no less striking. It is estimated that one wild sunflower plant uses about the same amount of moisture as two and one-half corn plants. One common wild mustard plant consumes as much moisture as four wheat plants, and one Russian thistle uses enough water to grow three sorghum plants.

►Opportunistic and excellent water scavengers, especially during times of scarcity, weeds can consume moisture meant for desired cultivars.

Two invasive thistles, one big problem

Russian thistle is a particularly fierce competitor, with roots that develop much faster than those with which it is competing. "This allows these faster-developing roots to reach deeper soil moisture first," Parker says, noting that in a two-year field study, Russian thistle plant under northwest climatic conditions used an average of 18 gal. of water while competing with a grain crop (mid-April to early August) and an additional 26 gal. from crop harvest to killing frost (October).

Another invasive thistle that is an equally tenacious water user on rangelands from Washington State to California is the yellow star thistle (see "Yellow Star Thistle" beginning on page 198 of the February *Angus Journal*).

"Yellow star thistle is a major problem on California's annual grass rangelands," says Joseph DiTomaso, University of California–Davis (UC Davis) weed scientist. "Recent studies show that yellow star thistle significantly alters water cycles and depletes soil moisture reserves in annual grasslands and foothill woodland ecosystems in California."

Rangeland scientists report similar yellow star thistle effects on Oregon's perennial grasslands.

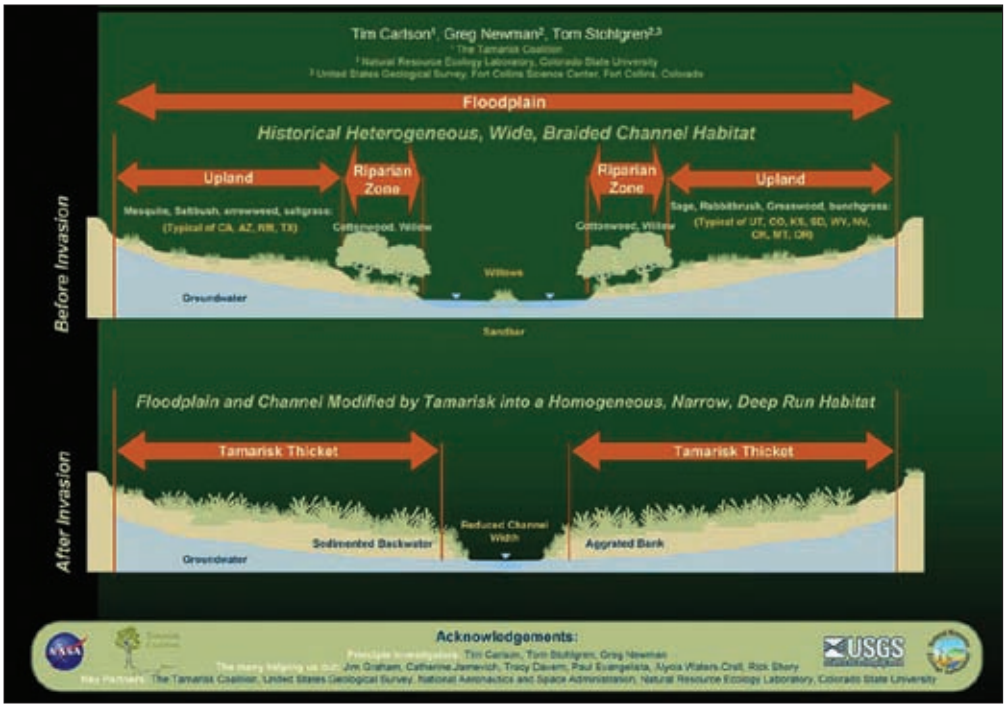
One study released in 2004 showed that a depletion of soil moisture by yellow star thistle can result in a loss of 15%-

25% of mean annual precipitation. Like the Russian thistle, the yellow star thistle has the ability to access deep soil moisture reserves earlier than associated competing native species such as blue oak and purple needlegrass, often creating for the indigenous plants drought-like conditions even in years with normal precipitation.

It is estimated that approximately 46,000 acre-feet (15 billion gal.) of water is lost from the Sacramento River watershed each year through transpiration by yellow star thistle, with one highly infested county alone accounting for an estimated loss of 26,400,000 gal. of water per year.

DiTomaso adds that in a state that has suffered from drought more years than not, the economic and environmental implications of California's 14-million-acre yellow star thistle infestation are being felt by all.

"Because of its high water usage, yellow star thistle increases water conservation costs and threatens both human economic interests and native plant ecosystems," he says.



200 gal. per tree per day

While yellow star thistle poses a very real water-use threat to the coastal rangelands, another water-guzzling invasive is expanding its territory throughout the central and Intermountain West.

Tamarisk, or salt cedar, a deciduous shrub, or small tree, receives the prize for individual water consumption. A single adult plant, ranging in height from 5 feet (ft.) to 30 ft., can consume 200 gal. per day. First introduced to the western United States in the early 19th century for use as an ornamental, it was then planted, in huge numbers, during the 1930s in response to widespread soil erosion. Now established in an estimated 1.5 acres of bottomland adjacent to lakes, rivers and streams from Mexico to Canada and into the Plains states, the water-loving, seed-spreading invasive has successfully supplanted native cottonwoods and willows in many of the areas it now occupies.

Reported in 23 states on the Global Invasive Species Data Base, the Central Asian transplant prefers hot, arid climates and alkaline soils common in the western U.S., and like all successful invasives, it is opportunistic, usually establishing itself after a major disturbance of the existing riparian ecosystem.

While the suppression of native species by overgrazing, drought and fire can all lead to the establishment of tamarisk, the most common vehicle is a temporary or permanent change in the hydrology. Late flooding is particularly advantageous to the invasive plant. Because it produces seed later in the season than native riparian plants, tamarisk can take advantage of disruptive flooding at times of the year when native vegetation is not dispersing seed.

Once germinated, the tamarisk seedlings develop into dense stands, as many as 3,000 plants per acre, that quickly outcompete native species for light, nutrients and water.

In addition to crowding out the competition, tamarisks have extensive root systems — to depths of 150 ft. and more — that draw excess salts from the groundwater. These salts are then concentrated in the leaves and deposited on the ground with the leaf litter. Through this mechanism, surface soil salinity levels are increased to the point that the only seeds capable of germinating are from other tamarisks.

►**"Recent studies show that yellow star thistle significantly alters water cycles and depletes soil moisture reserves in annual grasslands and foothill woodland ecosystems in California," says Joseph DiTomaso, University of California–Davis (UC Davis) weed scientist.**

A nightmare for ranchers

Ranchers who are forced to share water and range resources with the spreading tamarisk are faced with multiple problems, says Peter Mueller, project director of The Nature Conservancy's (TNC's) North San Juan Mountain Program in Colorado.

Mueller has witnessed firsthand the effect of tamarisk and another invasive tree species, Russian olive, on local cattlemen. During the last eight years his organization, in concert with the Bureau of Land Management (BLM), county weed

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management programs, Marathon Oil Co., the Fish and Wildlife Foundation, and the Tamarisk Coalition with the cooperation of local ranchers and landholders have been involved in an eradication program targeting a 120-mile stretch of the San Miguel River located near the resort town of Telluride.

In October 2008 the river was declared tamarisk- and Russian olive-free after decades of dominance by the two species.

"When tamarisk moves in, there is a definite degradation in water quality, in the access to the water and in the surrounding grasses," Mueller says. "None of these changes are good for livestock."

He notes that the tamarisk's ability to transform both the hydrology and the ecosystem of an area can be particularly problematic for ranchers who rely on regular access to water and grazing land for their cattle. With root systems that extend to depths greater than 100 ft. and the ability to draw literally hundreds of gallons of water per plant per day out of the ground, tamarisk infestations routinely alter hydrologic cycles by lowering groundwater level and drying up springs and riparian areas that would normally be used for watering and seasonal grazing.

On rivers and streams these same root systems allow tamarisk to grow further back from the river, occupying a larger area, and using more water across the floodplain than native cottonwoods and willows.

This is significant because the upper floodplain terraces adjacent to the riparian

corridor typically occupy an area several times larger than the riparian zone itself. These areas, normally inhabited by native bunch grasses suitable for seasonal grazing, are vulnerable to tamarisk encroachment as the salinity of the soil increases and the available moisture is drawn down below the grasses' shallow root systems.

Chainsaws and bugs

After almost a decade of often grueling work eradicating the invasive trees from the 120-mile stretch of river bottom, Mueller is the first to admit that battling tamarisk is both labor-intensive and expensive. The Nature Conservancy-led program involved volunteers, staff from the various participating agencies and nonprofits, as well as a large number of contractors using chainsaws, clippers, heavy equipment and herbicides to remove the ubiquitous invasives. The price tag for the San Miguel project was $1.3 million, not including volunteer labor and resources.

As Mueller and his eradication team move into Phase 2 of their project, the elimination of tamarisk and Russian olive from the nearby Dolores River watershed, he and his colleagues are hoping for some long-term assistance from their latest ally in their war on invasive trees — a tamarisk-eating beetle from Eurasia.

"This bug has proved itself in other release areas," Mueller says. "We certainly could use the help."