

## ***Tamarix* Biocontrol and the Restoration of Riparian Ecosystems**

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*Tamarix spp.*, occupy over one million acres in North America. *Tamarix* is the third most common woody plant in western U.S. riparian areas. *Tamarix* detrimentally impacts ecosystems and biodiversity. It displaces native riparian plants; transpires significant amounts of water; dessicates and salinates soils; increases erosion and sedimentation; increases risk of wildfire and lowers habitat quality for wildlife species.

Conventional control methods can be expensive and unsustainable. Control programs can actually promote secondary resurgence of other invasive weeds. Biocontrol of *Tamarix* is a more environmentally benign and cost-effective alternative.

Classical biocontrol research begins with looking for agents in a weed pest's native range, in this case in Asia, southern Europe and north Africa. Eventually three candidate insects, Chrysomelidae: *Diorhabda carinulata*, Curculionidae: *Coniatus tamarisci*, and Pseudococcidae: *Trabutina mannipara*, were approved for study by the Technical Advisory Group for the Biological Control of Weeds (TAG) with U.S. Fish and Wildlife Service concurrence. *Diorhabda carinulate*, also known as the tamarisk leaf beetle, from central Asia was approved for release in 1996.

A potential conflict emerged with the listing of the Southwestern Willow Flycatcher (*Empidonax traillii extimus*) as an endangered subspecies in 1995. The loss of its habitat, the typically cottonwood/willow riparian woodlands, enhanced by the invasion by *Tamarix*, are factors in the bird's decline. The flycatcher has been found to nest in *Tamarix*.

Ironically, the success of *Diorhabda* at defoliating *Tamarix* caused conflict with conservationists trying to protect the flycatcher. The biocontrol program was halted by the U.S. Fish and Wildlife Service for consultation under the Endangered Species Act. The premises were that defoliation caused by the beetle could expose flycatcher nests to excess heat; tamarisk may be eradicated too quickly before native plants could replace the lost habitat; the habitat would be too degraded for native plants and that the beetles may be toxic.

The beetle was studied in a number of sites throughout the western United States. *Diorhabda* did indeed prove to be successful at defoliating tamarisk in northern areas where the research was conducted. However, below the 38° parallel (San Francisco), the beetle's daylength-induced diapause caused it to enter into overwintering too early to allow survival until the following spring, and control at these sites failed. *Diorhabda carinulata* appears to be evolving a delayed

response to daylength cues to diapause and is establishing further south than the original releases.

Where successful, the initial impact of *Diorhabda* on *Tamarix* defoliation was rapid and dramatic. However, foliage re-growth occurred in a few weeks; die-back was gradual and mortality was slow. But even without mortality, benefits accrued. Canopy cover by *Tamarix* declined sooner and the subsequent season's cover and duration were reduced. Seasonal evapotranspiration was reduced by 65% in year one and by 90% in year two. The beetles even served as an additional food source, and bird diversity and abundance increased.

Well-intentioned but perhaps misguided conservationists are resisting the implementation of biocontrol of *Tamarix*, believing that *Tamarix* forests are needed for flycatcher survival. However, despite the flycatcher nesting in *Tamarix* in a few locations, over 90% of flycatcher nests are in native or mixed native/exotic vegetation. *Tamarix*'s trend is to create monocultures and flycatcher nests are absent in *Tamarix* monocultures. The data suggests that even as little as 30% native element sustains riparian birds but drops rapidly as *Tamarix* dominance goes over 80%. Additionally, flycatchers have responded well to native riparian recovery, showing increased fledgling success in restored habitats over *Tamarix* dominated sites. Fire may be the biggest factor promoting both *Tamarix* dominance and sensitive species decline.

Help to resolve the conflict by facilitating active restoration of native habitat in areas where the flycatcher is present is being provided by The Walton Family Foundation and coordinated by the Tamarisk Coalition, a non-profit alliance working to restore riparian lands.