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Impact of Tamarix leaf beetles, Diorhabda carinulata, on Evapotranspiration and Groundwater Levels in Southwestern United States

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Tamarisk (saltcedar; Tamarix spp) was introduced to the U.S. more than a century ago from Eurasia and has become an invasive species in the western United States. Mono-species environment of tamarisk thickets now dominates rivers and stream corridors, springs and ponds with negative impacts on: (1) groundwater levels, (2) flood regimes, (3) erosion patterns, (4) fire frequency, (5) ecosystem diversities, and (6) habitat quality for wildlife. Chemical and mechanical methods of tamarisk eradication have been partially effective and prove to be expensive and cause irrepressible damage to natural resources. In the late 1960s, biological control program began in order to reduce the risk of damaging native plants. In 2001, Diorhabda elongata (Brullé) sensu lato leaf beetles (Coleoptera: Chrysomeliadae), now commonly referred to as Diorhabda carinulata, whose larvae and adults feed on leaf foliage and petioles, which results in desiccation and eventual loss of leaves, was released for open field tests followed by other releases in several locations in the western US. In 2006, Diorhabda carinulata were released at St. George, Utah and have become well established along the Virgin River. Between 2009 and 2010, the beetles have moved approximately 15 miles from Littlefield, AZ to the Riverside Bridge near Bunkerville, NV. The beetles are expanding their habitat and have been found near Lake Mead and further south.

To understand potential changes in water balance due to tamarisk defoliation, an eddy covariance tower and ground water monitoring well were installed along the river in the early spring of 2010 near the Riverside Bridge, Mesquite, NV. ET was calculated using the eddy covariance method and the White method. Data collected in 2010 established a baseline since the beetles arrived at the site in late 2010 and established a healthy population to cause noticeable defoliation during the 2011 growing season. Repeated defoliations observed at the site in 2011 and 2012 clearly show that post-defoliation ET values and magnitude of diurnal groundwater level fluctuations decreased compared to the pre-defoliation values. However, the magnitude of effects of defoliation was dependent on the growth stage of tamarisk at the time of defoliation. Also, ET recovered within a month as tamarisk established new leaves. Results from this study suggest that long-term changes in ET are highly dependent on repeated defoliation occurrences over several years.