

Tamarisk Invasion and Fire in Desert Riparian Ecosystems

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Observed increases in riparian wildfire with tamarisk invasion may represent a novel disturbance in desert riparian ecosystems, as riparian zones have long been viewed as barriers to wildfire movement. The potential increase in flammability and fire frequency may negatively impact desert riparian systems which provide stable water sources, sustain desert wildlife populations, and support higher diversity than adjacent upland systems. The introduction of *Diorhabda elongata*, a specialist herbivore, for the biological control of tamarisk, may further enhance wildfire risk and frequency in tamarisk-invaded areas via herbivory-induced foliar desiccation. The potential threat to riparian diversity posed by alteration of fire regimes highlights the need for further research into the role of fire in riparian ecosystems in the Southwestern states of North America. Specifically, there is a lack of empirical data at regional scales on fire patterns in tamarisk-invaded riparian zones, and a weak understanding of the role of fire disturbance in riparian ecosystems. Our work examines the physical and physiological processes underlying flammability and post-fire recovery of tamarisk utilizing gradients of *Diorhabda* herbivory impact and tamarisk density to derive a mechanistic understanding of changes in fire disturbance regimes with the invasion of tamarisk. First, the physical effects of *Diorhabda* herbivory on tamarisk fire behavior (intensity, flame lengths, rate of spread) were examined along a gradient of *Diorhabda* herbivory desiccation (Lovelock NV, 2006) and herbicide desiccation (Valley of Fire Wash NV, 2008). Minor increases in fire intensity, flame lengths and rate of spread were promoted by greater foliar desiccation, representing a potential short-term increase in fire risk following *Diorhabda* herbivory. Second, the physiological effects of *Diorhabda* herbivory and fire on tamarisk mortality were examined along a gradient of *Diorhabda* herbivory and fire intensity (Lovelock NV, 2006). Tamarisk mortality increased as a function of increased fire intensity and *Diorhabda* herbivory stress, which interact synergistically to produce greater mortality together than the sum of their individual impacts. The combination of mortality and physiological stress reduces fine fuels and fire risk in the long-term. Lastly, the flammability (residual fuel structure) and recovery of tamarisk vs. native riparian species were examined in a regional survey of recent riparian burns at 30 sites across the American Southwest (Mojave, Great basin, Sonoran, Colorado Plateau, and Chihuahua desert regions, 2010). Preliminary results suggest that fuel consumption increases and native recovery decreases as a function of tamarisk density. This, in conjunction with foliar level flammability experiments, supports greater relative flammability of tamarisk. The combined investigation of the physical influences of *Diorhabda* herbivory on tamarisk fire behavior, and general patterns in fuel consumption and fire behavior in native riparian species vs. tamarisk provides empirical data to elucidate potential mechanisms underlying the increase in fire in desert riparian ecosystems.