LOCAL MONITORING EFFORTS RELATED TO VEGETATION AND TAMARISK BEETLE ACTIVITY

Table Summarizing efforts by various local entities from 2007 to the present, and a list of known publications resulting from this work. Information compiled by Matt McEttrick for Rim to Rim, meant to be updated as new project information evolves.

GRAND COUNTY Area of focus	**Findings**
Beetle monitoring (census and status) 2007-2013	More browning over time
Beetle x resprouts x mature tamarisk 2010 – 2012	Beetles prefer mature tamarisk over re-sprouts
Tamarisk Weevil monitoring 2012	Tracked locations of new potential biocontrol
Adult/Larvae counts and browning 2012-2016	Need minimum population size for browning to occur. More larvae = more browning
Revegetation tracking 2009 – 2013	Data on native/non native vegetation (annual/biennial/perennial)
Tamarisk Mortality 2008 - 2012	Beetles present longer periods, observed higher percent tamarisk death. Herbicide helpful for fully killing tamarisk.
Tamarisk Mortality 2013 - 2017	Changed methods to point intercept per Anna Sher to look at spatial patterns and environmental controls. Part of paper by AL Henry

Tim Graham Area of focus	**Findings**
Tamarisk beetle monitoring 2014-2019	Beetles emerge from diapause, survive until mid/late June, then there is a second peak from larvae maturing, and depending on the year there may be 2nd and 3rd larval generations. Controls on these dynamics are climate and forage availability.
Understory regrowth 2011-2016	Veg recruitment increased every year 2011-2016, but there were many differences between sites. Difficult to discern a clear overall pattern of response to tamarisk defoliation, likely are other important controls that need to be examined (similar to Henry et al).

Rim to Rim Restoration Area of focus	**Findings**
Vegetation Reponse to Tamarisk and Olive Removal Activities and subsequent other work 2007 - Present	Important to start at restored areas and work outward in phases rather than trying to restore the entire landscape at once. Time for recovery of native plant large cleared areas > 3 years. At sites along mainstem Colorado, relative native cover (native cover/total cover) *decreased* in years with more days above 32F and 90F and, relative native cover *increased* in years with higher peak river flows and more days below 32F the preceding year. Warming

	trends may inhibit native recovery.
Bureau Of Land Management Area of focus	**Findings**
Examined effects of different combinations of removal methods and treatments for tamarisk removal 2010	In all cases found that secondary invasion of understory weeds was a problem, particularly Russian knapweed. Broadcast burning showed most native regrowth and least negative impact on Pofr, (see Sher 2017 as well). BLM will be collecting data at these sites in 2020 again.

Papers Incorporating Local Beetle and Vegetation Monitoring Data

Spatial modeling improves understanding patterns of invasive species defoliation by a biocontrol herbivore (Henry et al., 2018) (in association with Grand County*)*	More dead canopy with increasing age of tamarisk. With longer beetle presence, more live canopy (indicating compensatory growth) Slope, distance from release site and elevation were biggest environmental controls on % live canopy Older tamarisk stands are at higher risk of mortality from beetle herbivory, target these sites in years after heavy defoliation for best chance at reveg success and to prevent heavy regrowth.
Secondary invasions of noxious weeds associated with control of invasive Tamarix are frequent, idiosyncratic and persistent (Gonzalez et al., 2017)	Tumbleweed and kochia peaked immediately after tamarisk removal and persisted over time, even after herbicide application. Russian knapweed and cheatgrass were most successful at biocontrol sites, and progressively spread as the canopy layer opened. Strategies to control tamarisk affect secondary invasions differently among species and time since disturbance is an important factor affecting response.
Native species recovery after reduction of an invasive tree by biological control with and without active removal (Sher et al., 2017)	Reduction of tamarisk by biological control that leaves some canopy intact can facilitate recovery of the native plant community, especially when low disturbance mechanical biological and chemical control are combined. Once niches are restored, native plants can recolonize.