

Tamarisk Beetle Distribution And Potential Impacts



RiversEdge West

RESTORE + CONNECT + INNOVATE

Ben Bloodworth
Program Coordinator

Photo credit: Bob Wick BLM

Tamarisk Beetle - *Diorhabda* spp.



Beetles will not eradicate *Tamarix*

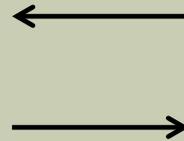


An ecological relationship is established between the herbivore and the plant

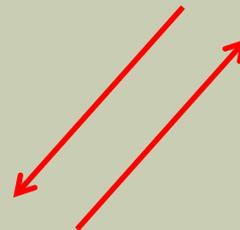


Beetles will shift ecological relationships and likely develop some kind of equilibrium

Biology of
Tamarix

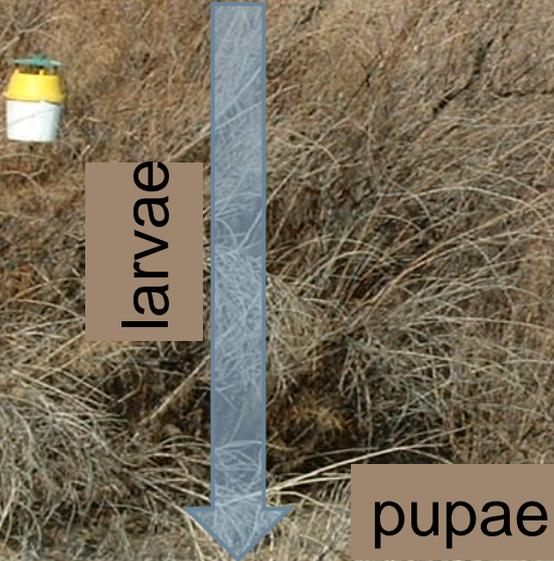


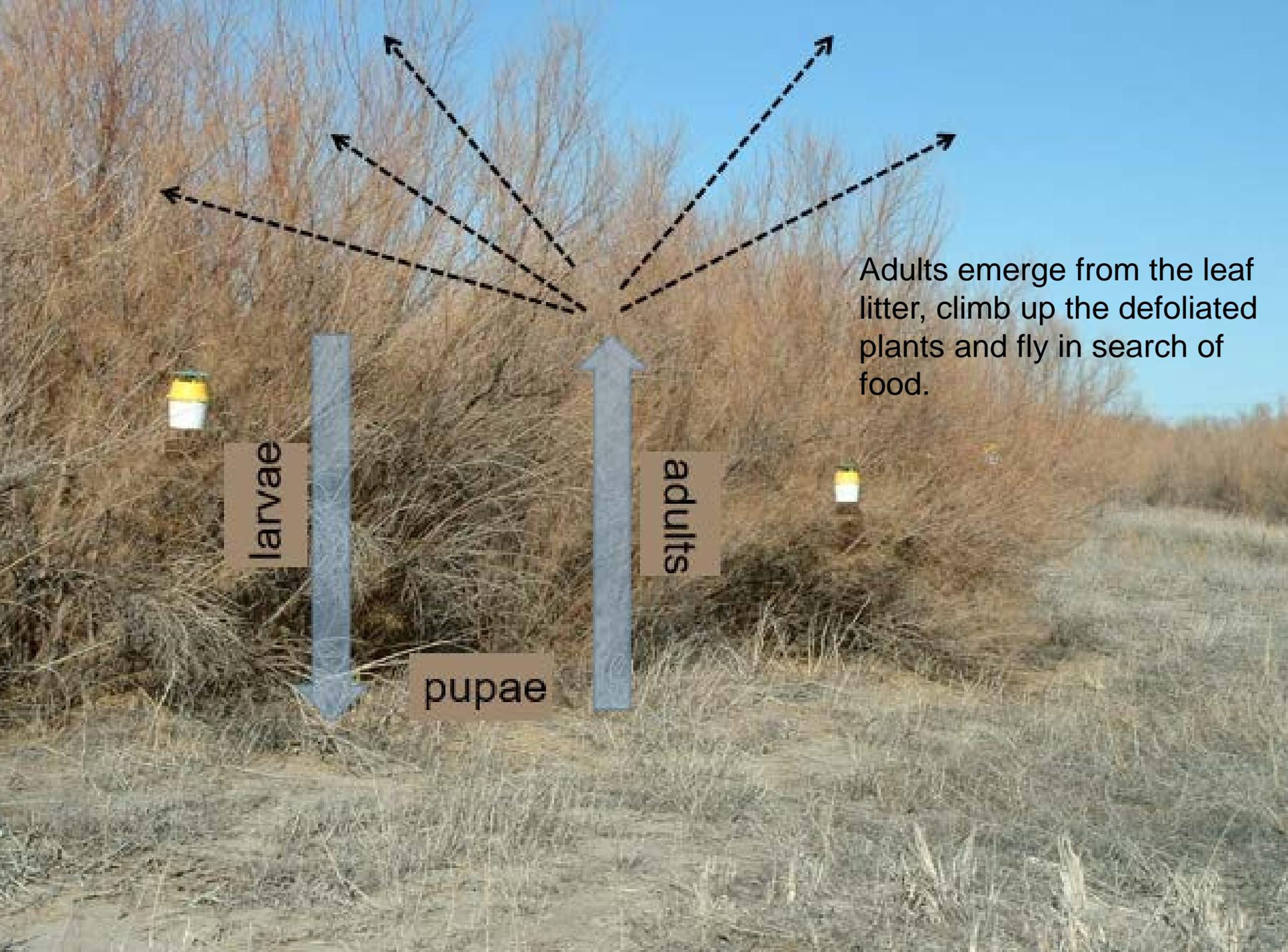
Biology of
Diorhabda



biotic and abiotic ecosystem components

Beetles drop from host plant
and pupate in the leaf litter





larvae

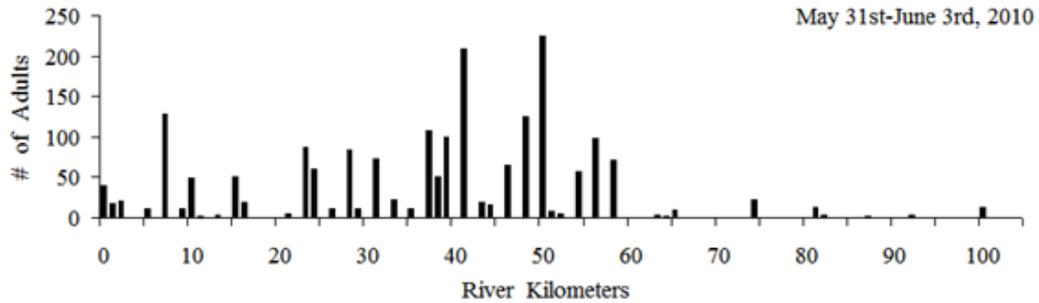
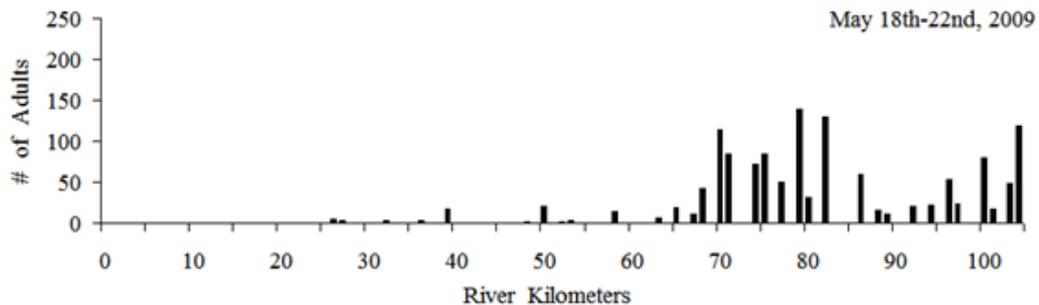
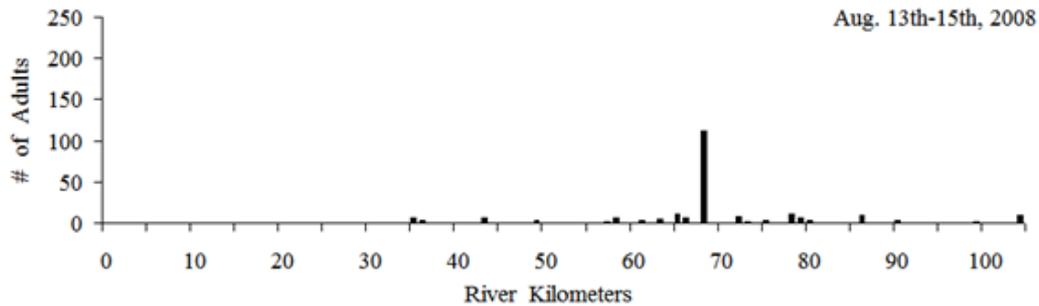
pupae

adults

Adults emerge from the leaf litter, climb up the defoliated plants and fly in search of food.

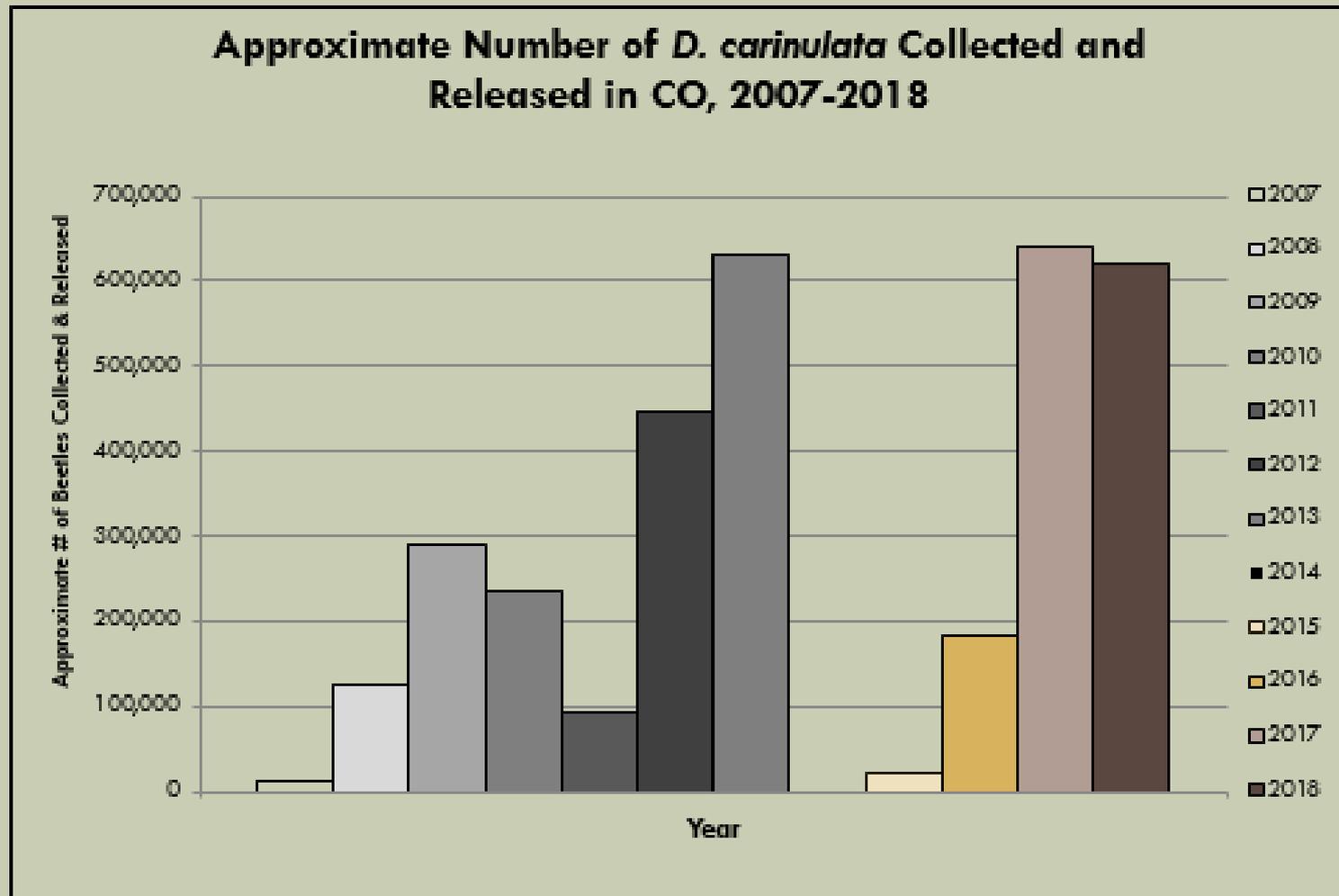


Beetles will defoliate *Tamarix* and the timing and frequency will be variable.

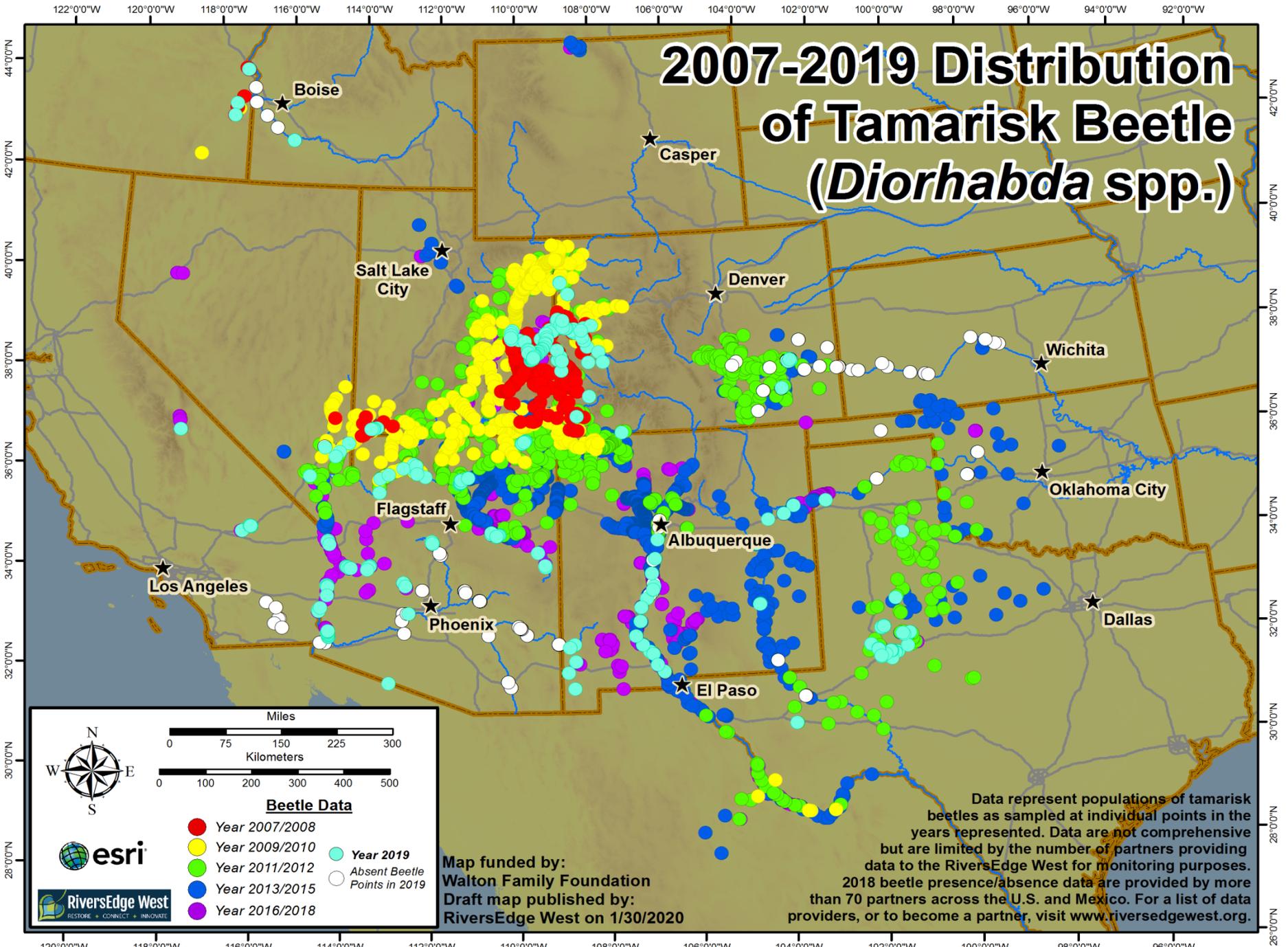


Beetles will move over large distances, periodically defoliating tamarisk stands, as illustrated by their movements on the Dolores River.

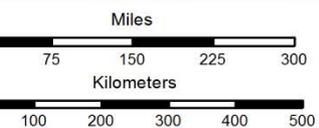
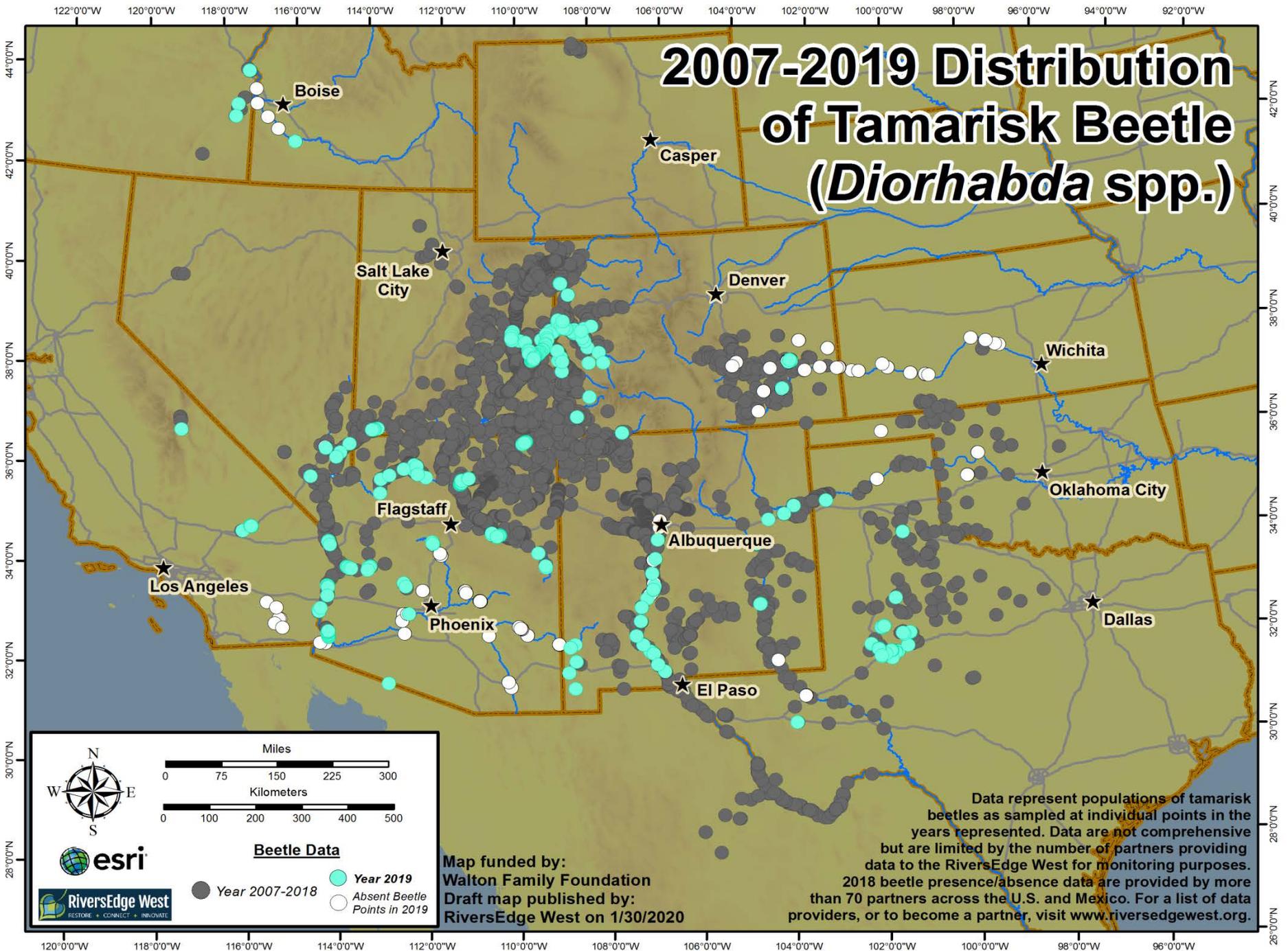
We see a steady rise in populations across western CO with widespread defoliation across sites in 2017 and 2018.



2007-2019 Distribution of Tamarisk Beetle (*Diorhabda* spp.)



2007-2019 Distribution of Tamarisk Beetle (*Diorhabda* spp.)



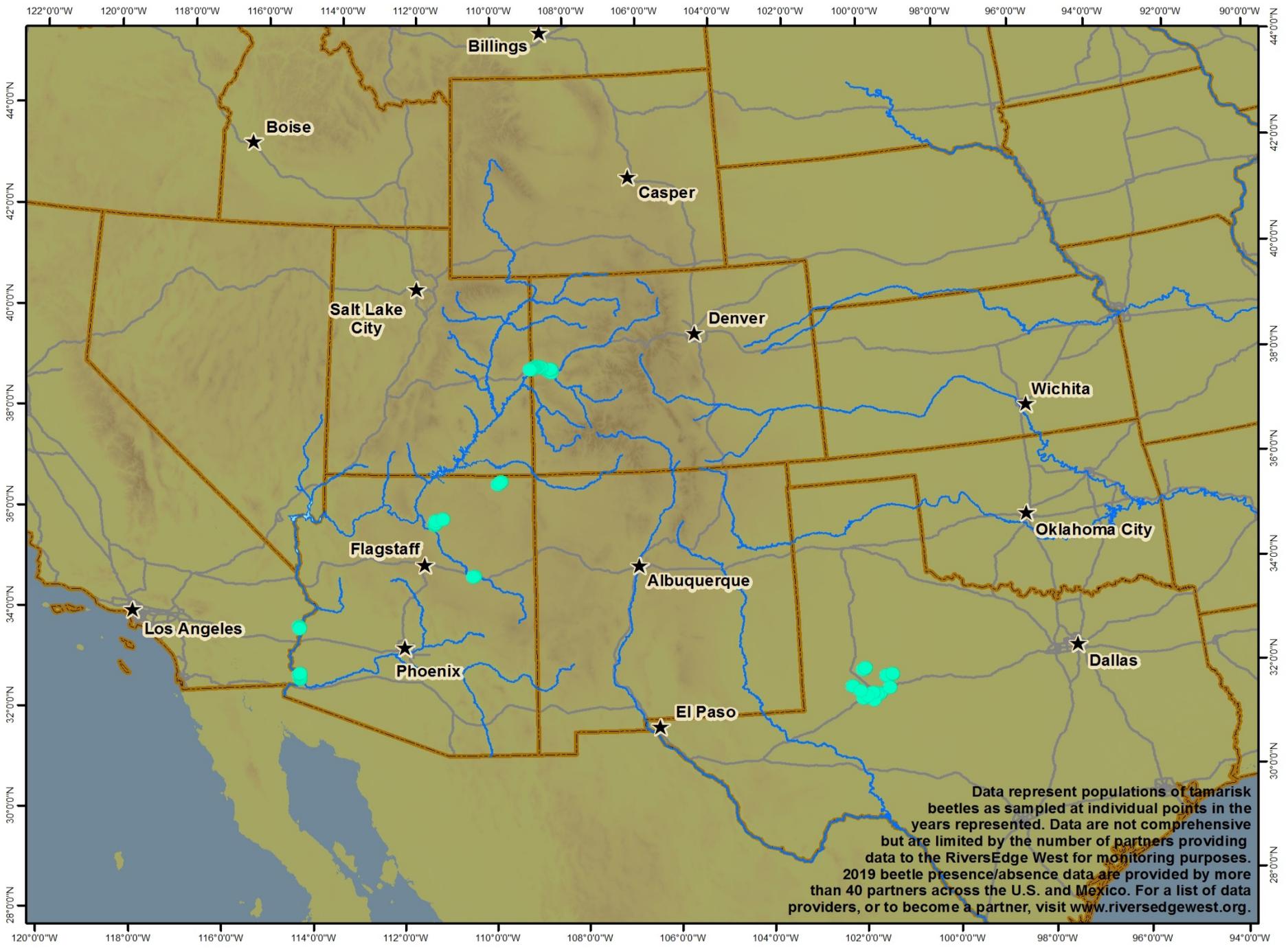
Beetle Data

- Year 2007-2018
- Year 2019
- Absent Beetle Points in 2019



Map funded by:
Walton Family Foundation
Draft map published by:
RiversEdge West on 1/30/2020

Data represent populations of tamarisk beetles as sampled at individual points in the years represented. Data are not comprehensive but are limited by the number of partners providing data to the RiversEdge West for monitoring purposes. 2018 beetle presence/absence data are provided by more than 70 partners across the U.S. and Mexico. For a list of data providers, or to become a partner, visit www.riversedgewest.org.



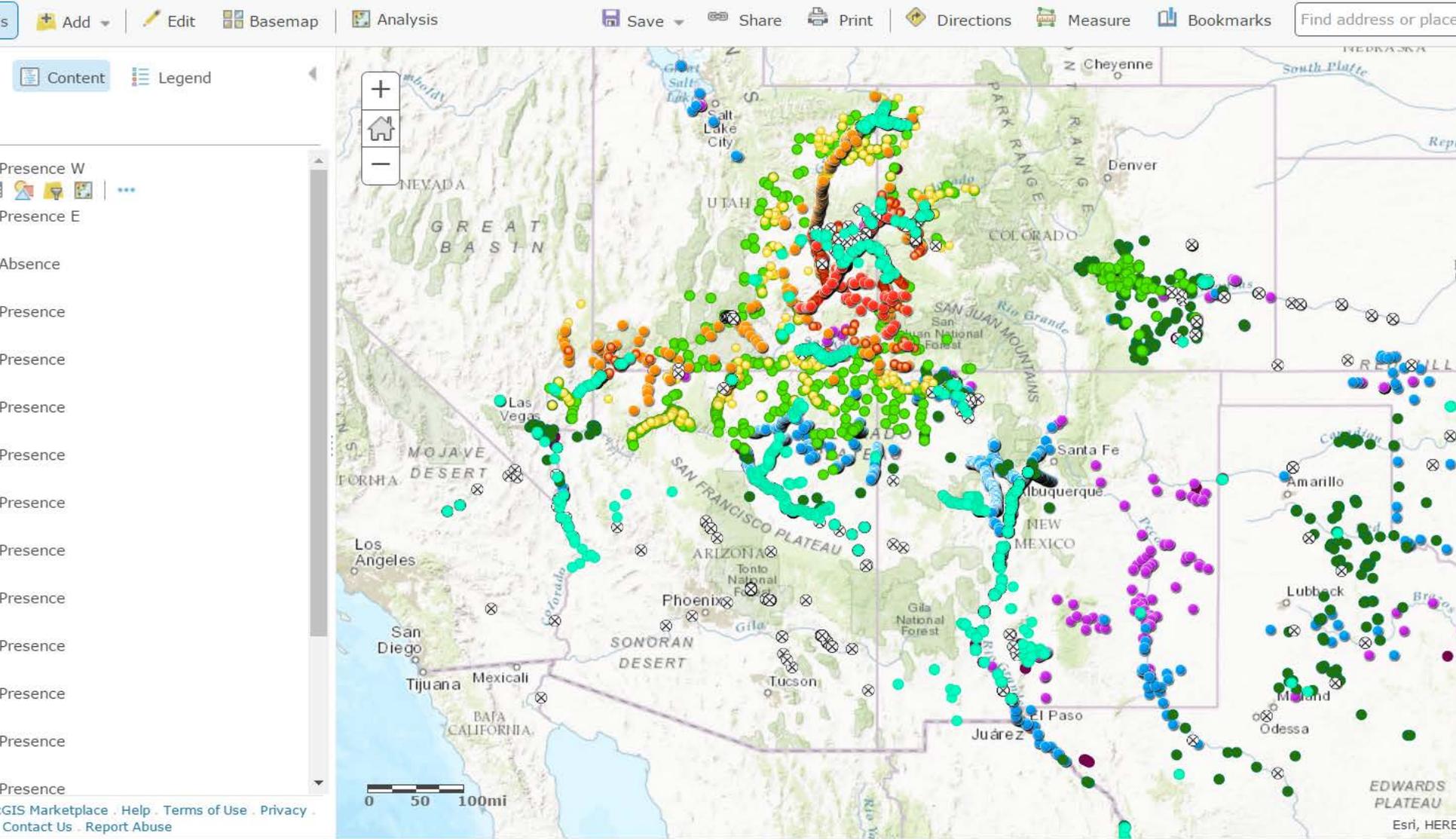
Data represent populations of tamarisk beetles as sampled at individual points in the years represented. Data are not comprehensive but are limited by the number of partners providing data to the RiversEdge West for monitoring purposes. 2019 beetle presence/absence data are provided by more than 40 partners across the U.S. and Mexico. For a list of data providers, or to become a partner, visit www.riversedgewest.org.

TC ArcGIS Online Map

tamariskcltn.maps.arcgis.com/home/webmap/viewer.html?webmap=b6a6028781034008888783d5b47e8c39

Tamarisk Coalition's 2016 Tamarisk Beetle Distribution Map

New

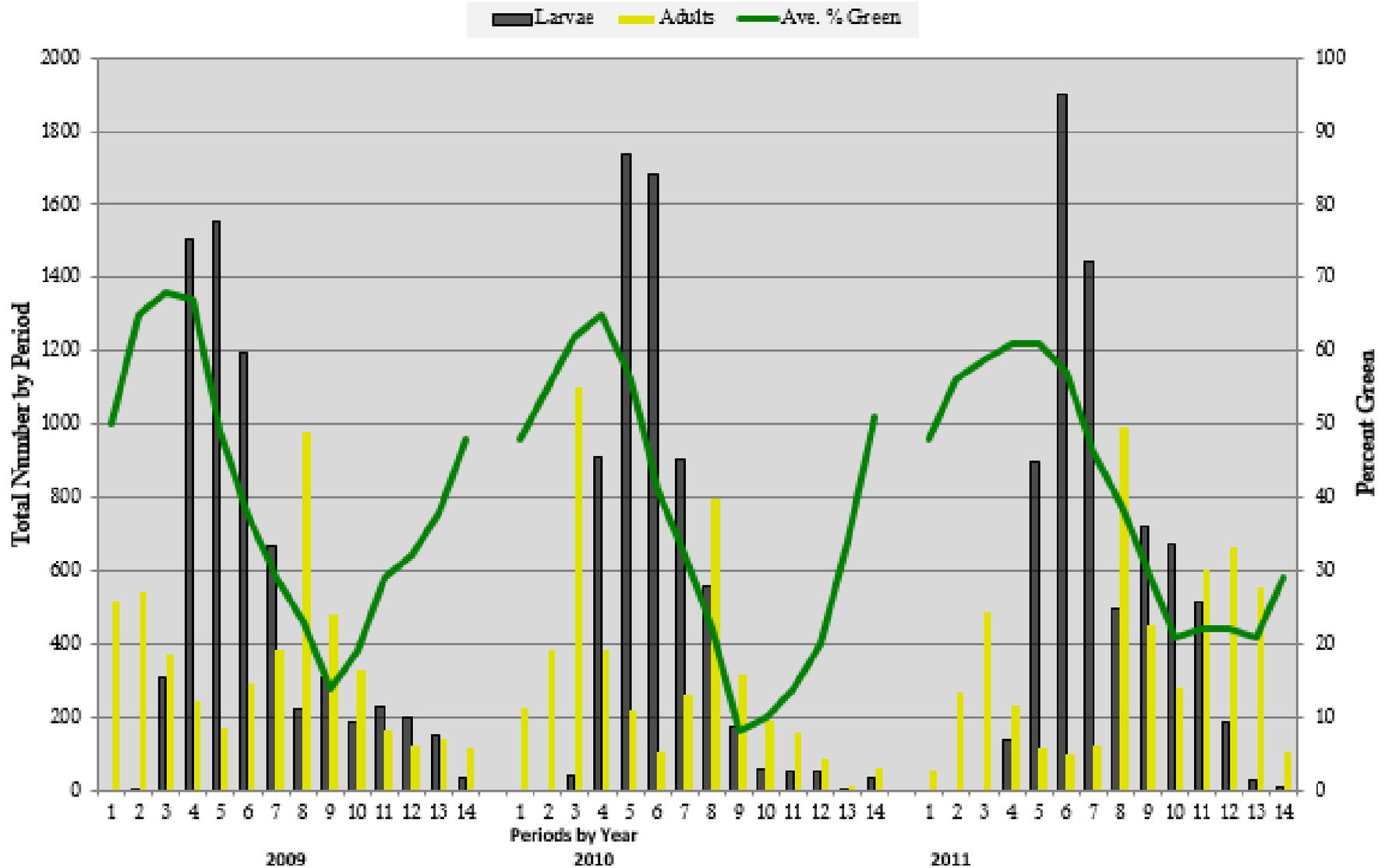


Beetles and larvae defoliating tamarisk



Courtesy of Dr. Dan Bean, Palisade Insectary

Beetle/Tamarisk Interaction: Green to Brown 2009 - 2011





Colorado
River near
Moab, Utah

2007 pre-beetle

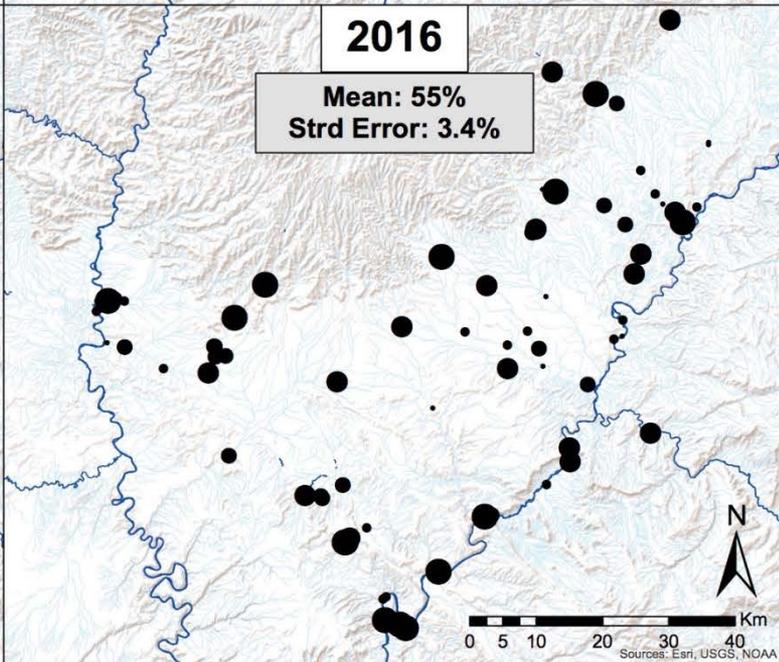
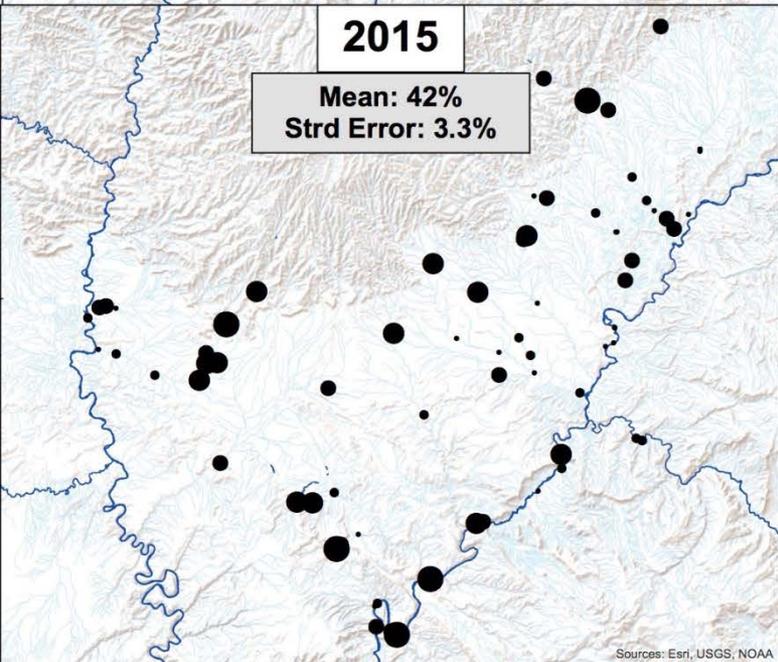
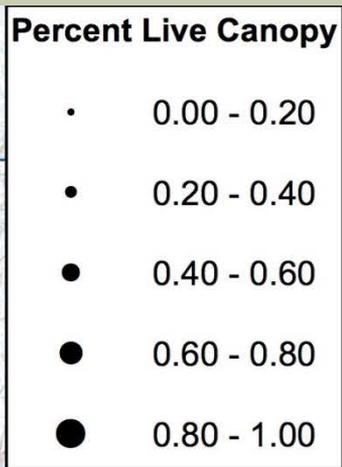
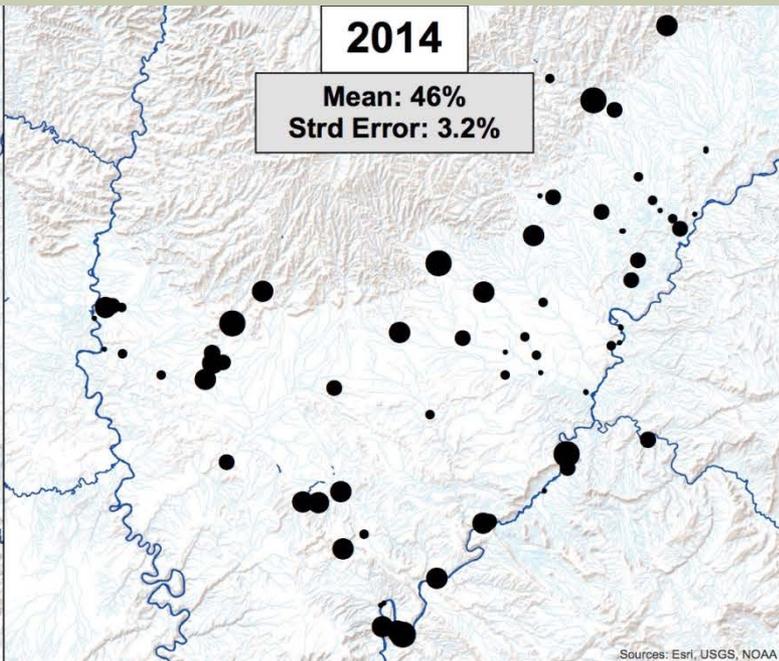
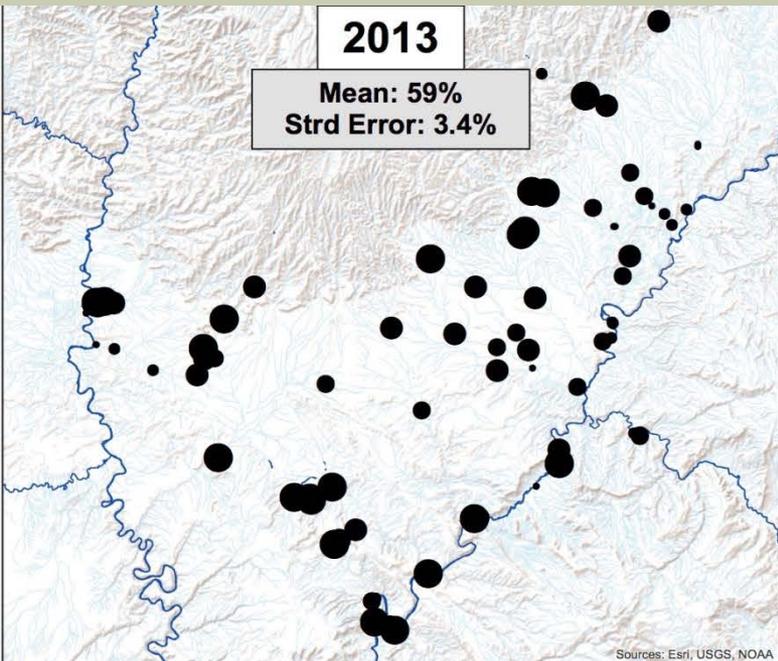


Stan Young ranch along East Salt Creek in Mesa County before and after beetles released.

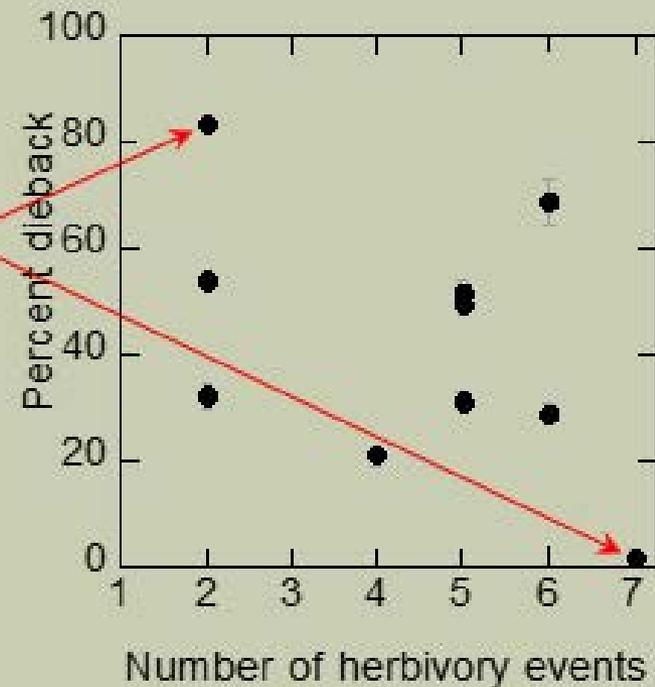
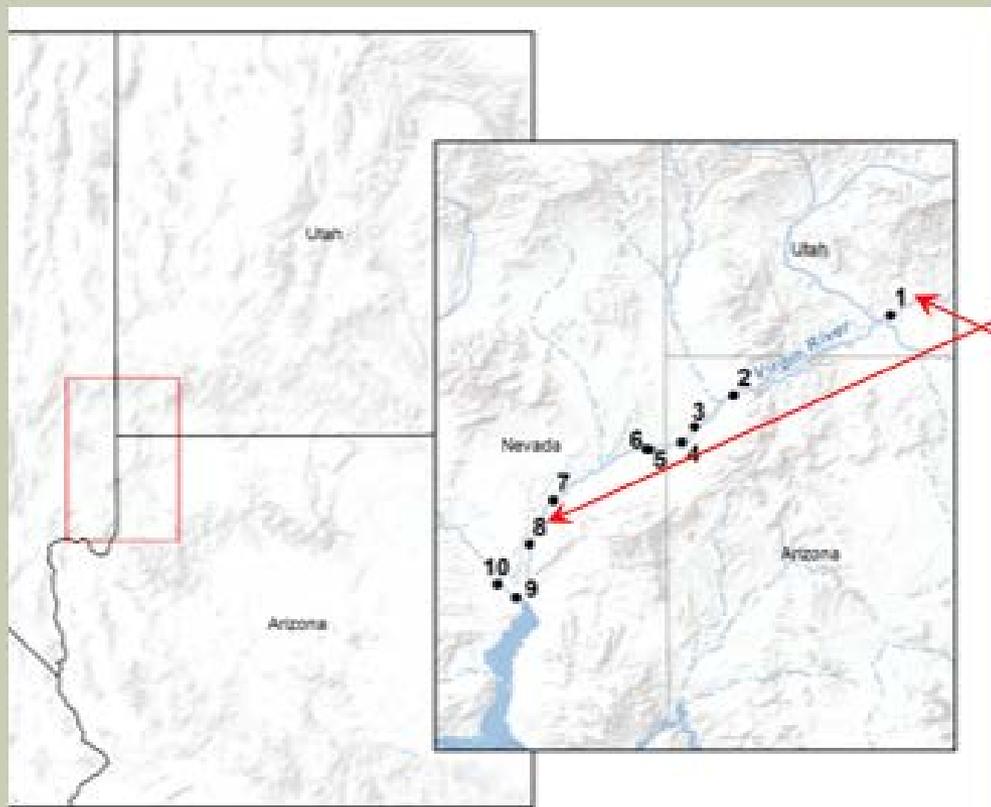
2010 post-beetle







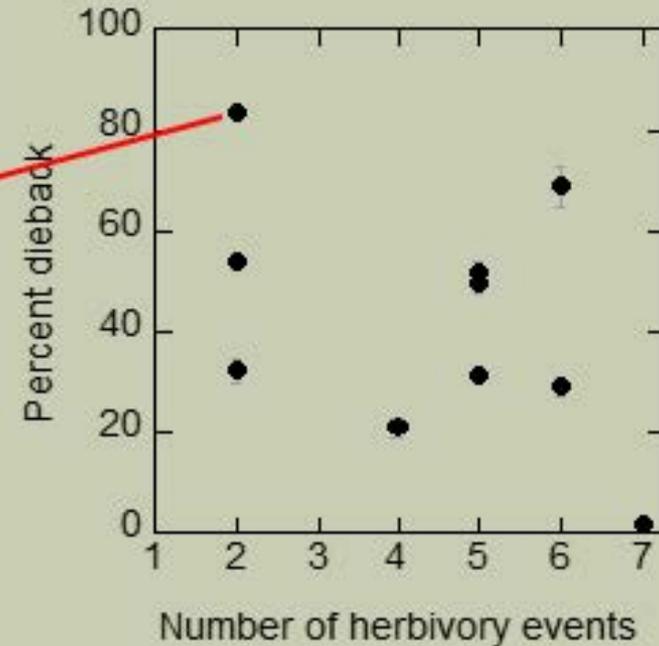
Patterns of mortality are highly variable across the landscape



1000 tamarisk trees monitored ($n = 100 / \text{site}$)

No relationship between herbivory events and dieback

Patterns of mortality are highly variable across the landscape



1000 tamarisk trees monitored (n = 100 / site)

No relationship between herbivory events and dieback

***Tamarix* response will include a depletion of carbohydrate reserves, decreased canopy cover and decreased flowering**

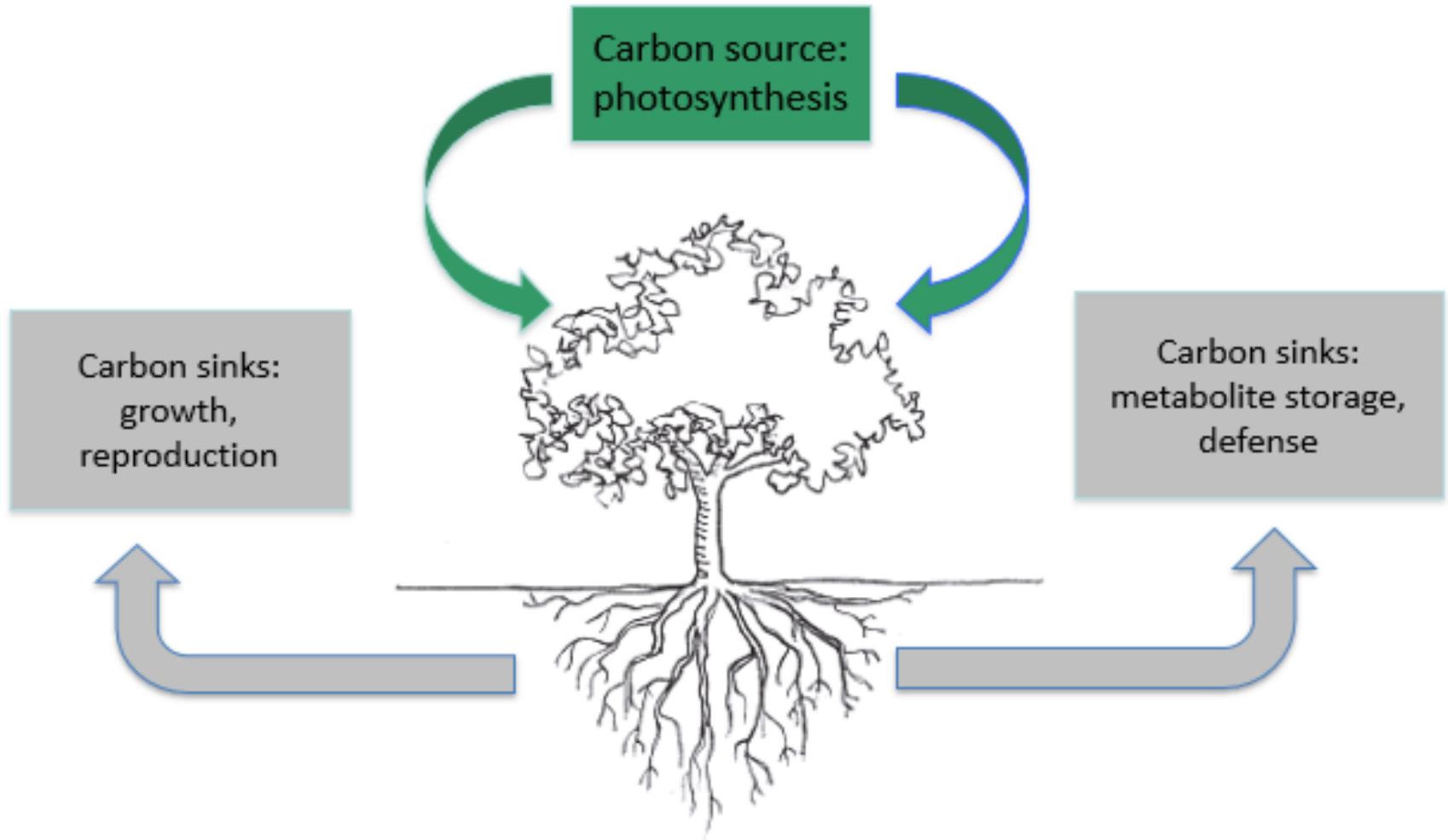


Owl Draw, Utah



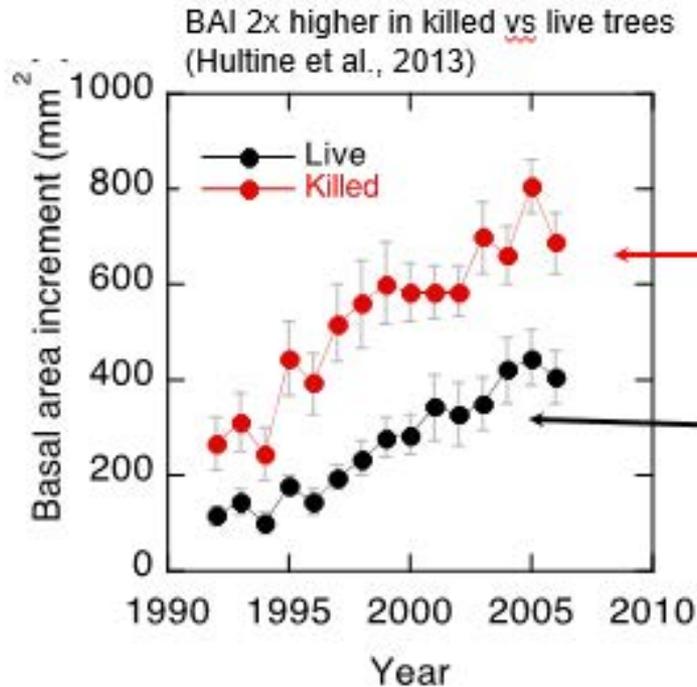
Dolores River, Utah

The plant carbon budget is a balance between sources and sinks



Growth versus carbon storage

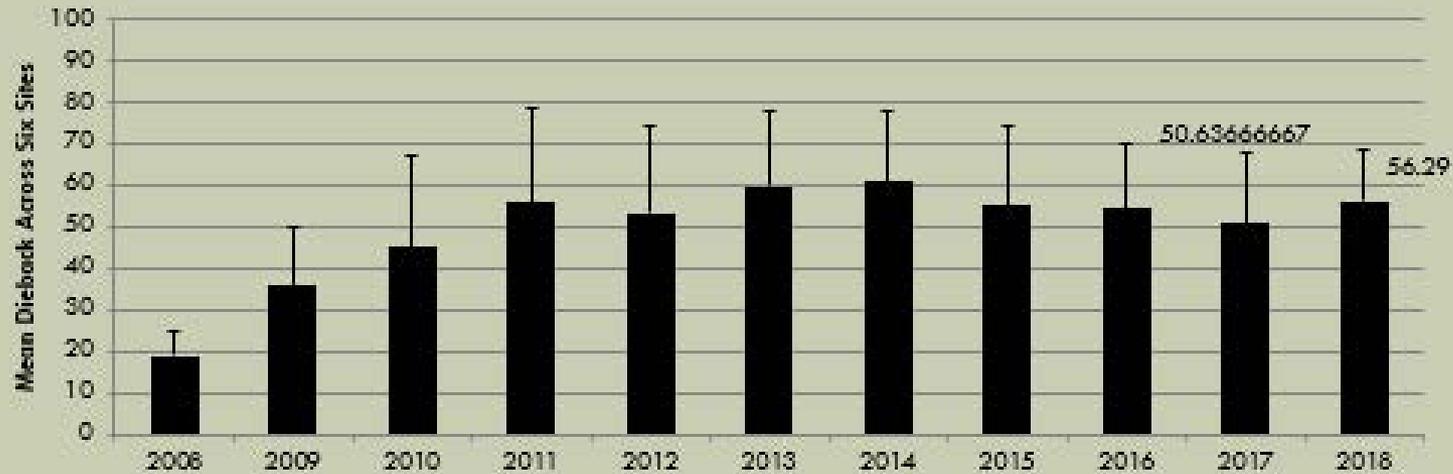
- Traditional hypothesis: “spillover” of available photosynthates (Chapin et al., 1990)



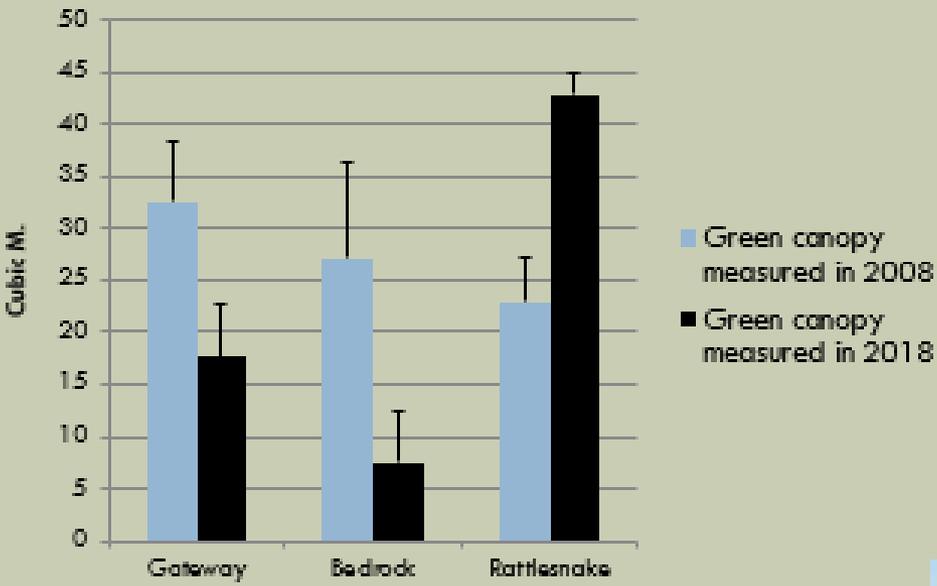
- Contemporary hypothesis: Allocation of photosynthates is highly regulated (Sala et al., 2012)

Tamarisk Dieback Across Sites 2008- 2018

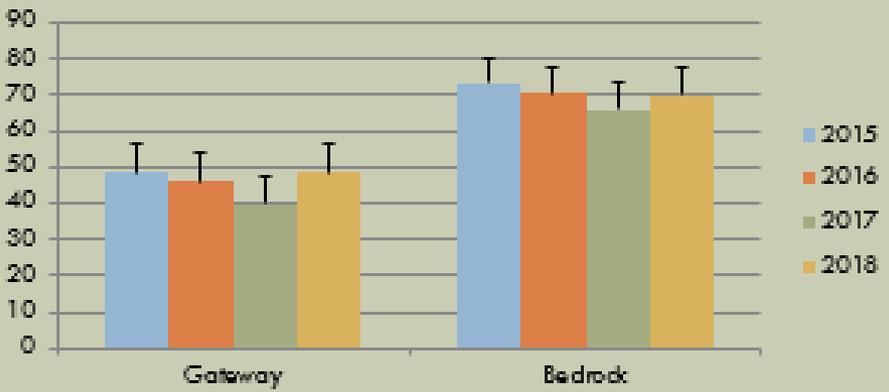
Mean Dieback Across Tamarisk Sites With Multiple Defoliations



Monitoring Results Gateway and Bedrock

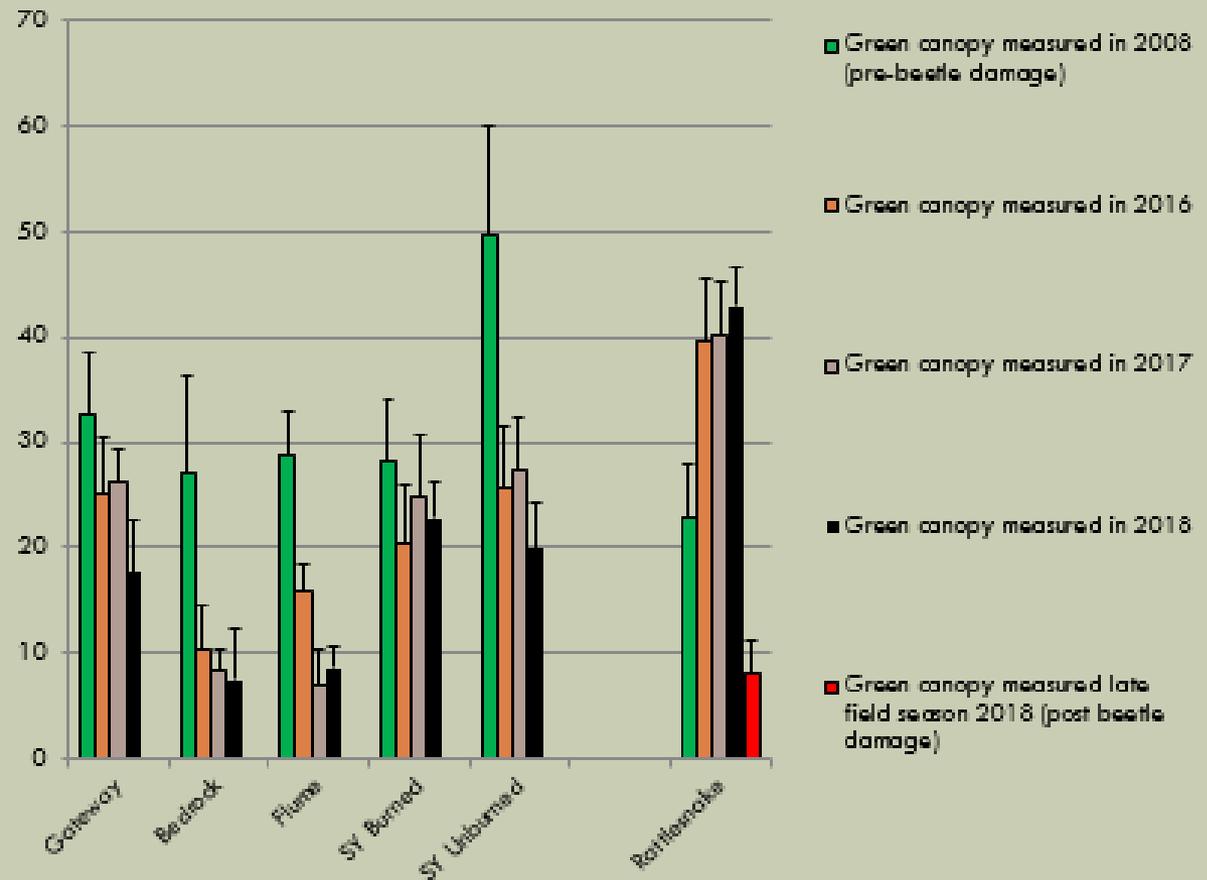


Mean Tamarisk Dieback



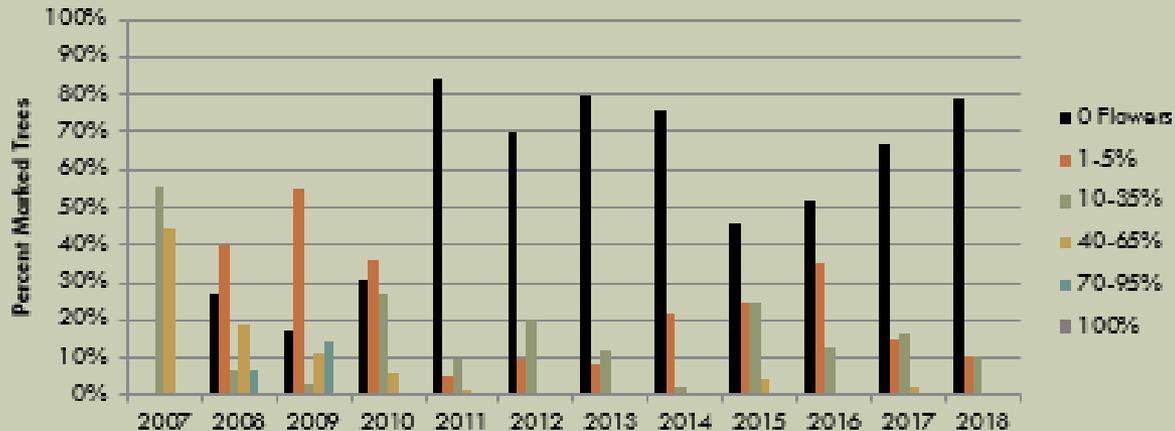
Canopy Volume 2008 vs. 2016-2018

- As of 2018 mean canopy volume has decreased by an average of 46% at damaged sites (at least three defoliations) from measurements recorded in 2008.
- Whereas we see a 50% increase at the Rattlesnake Gulch from measurements taken in 2008.

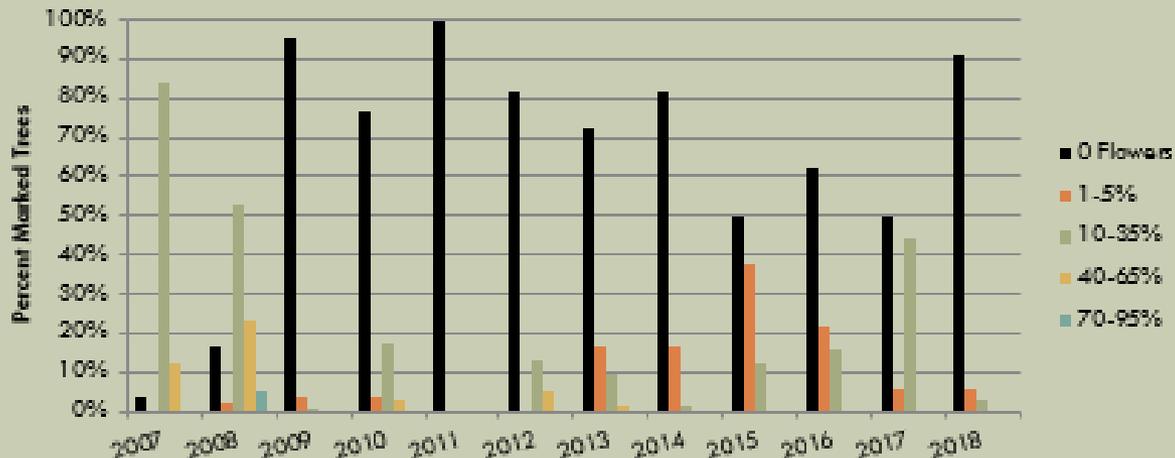


Flower Decline

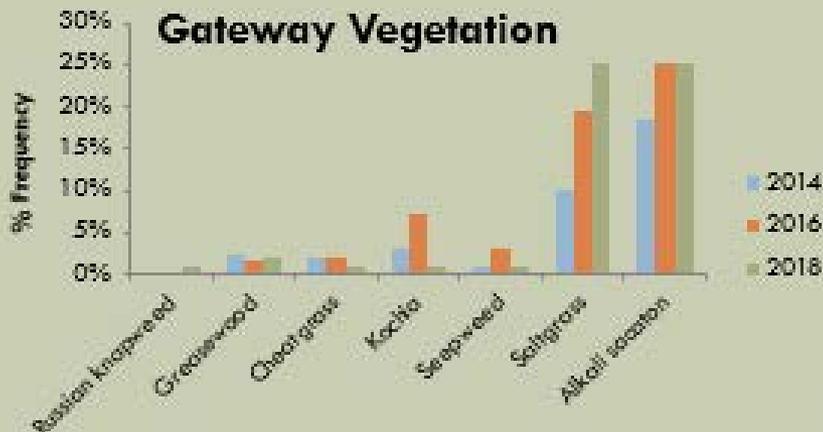
Percent Blooms on Marked Tamarisk, Gateway Site, 2007-2018



Percent Blooms on Marked Tamarisk, Bedrock Site, 2007-2018



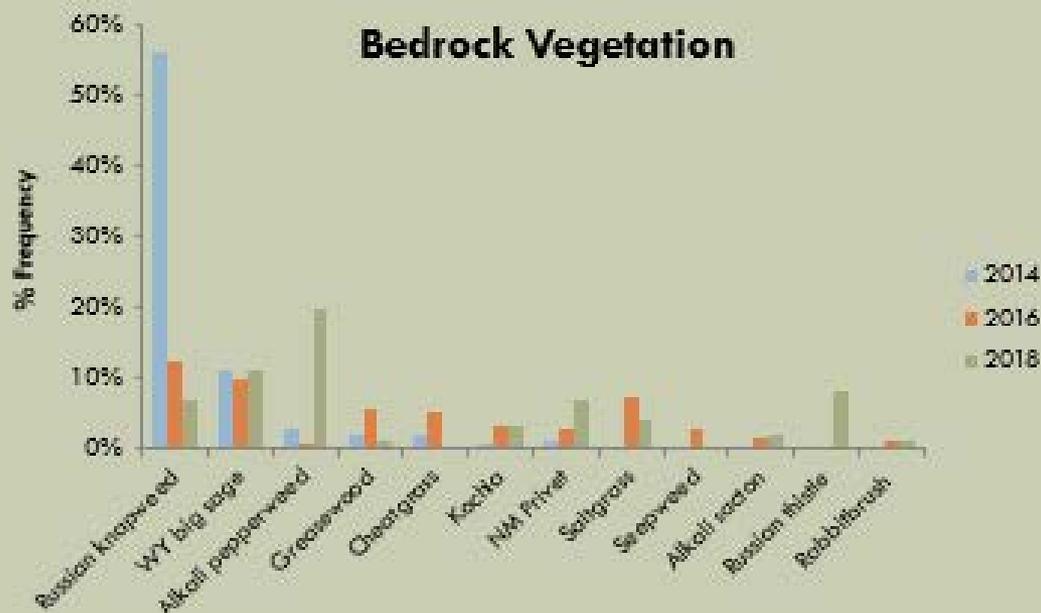
Site Level Vegetation Composition



Invaders to keep an eye on:

Russian knapweed

Russian thistle
Cheatgrass
Kochia



Salix coming up under defoliated *tamarix*



Valley of fire wash, S. Nevada Sept 2008



Valley of fire wash, S. Nevada Sept 2008

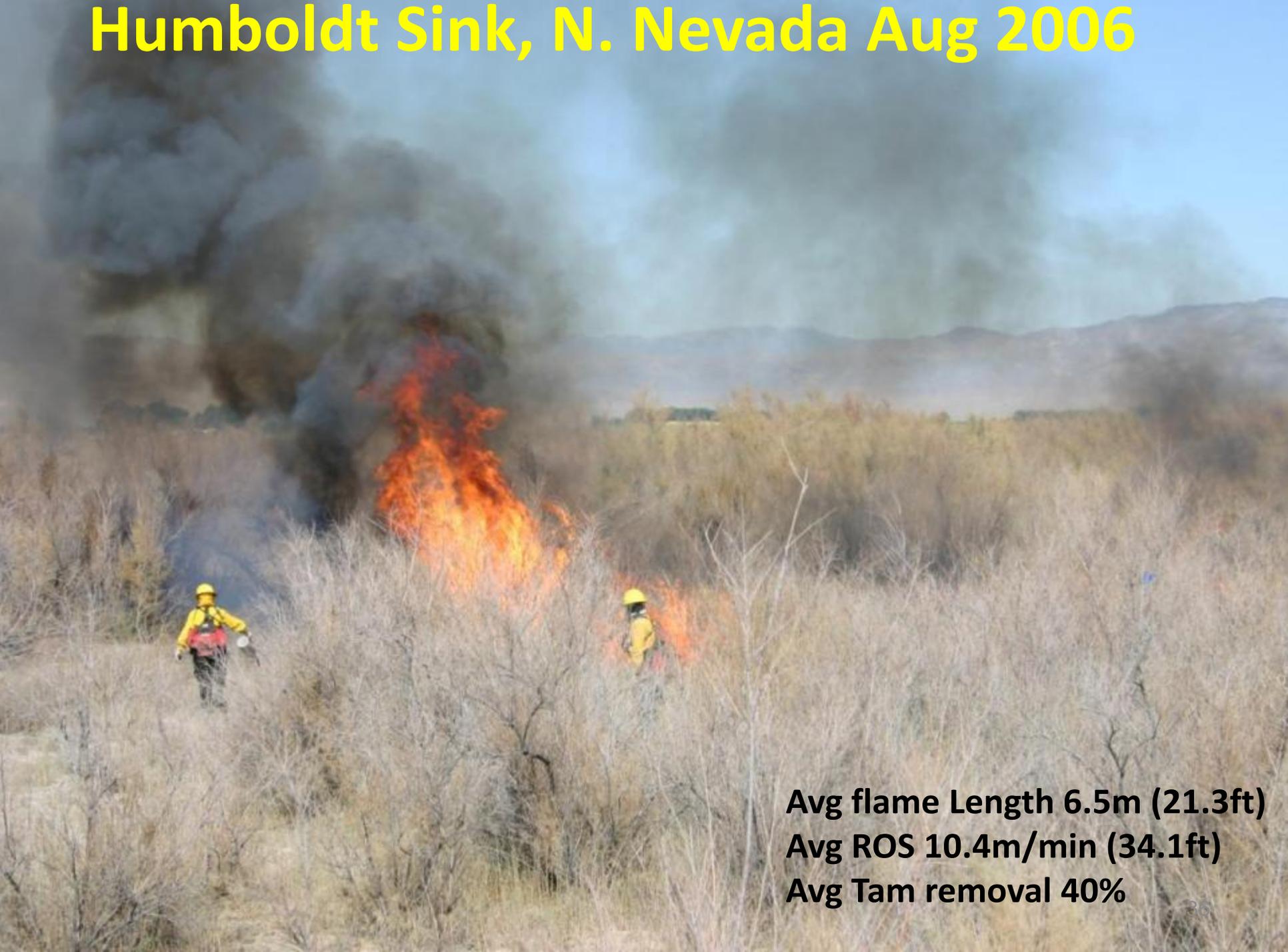


Avg flame Length 35m (114.8ft)

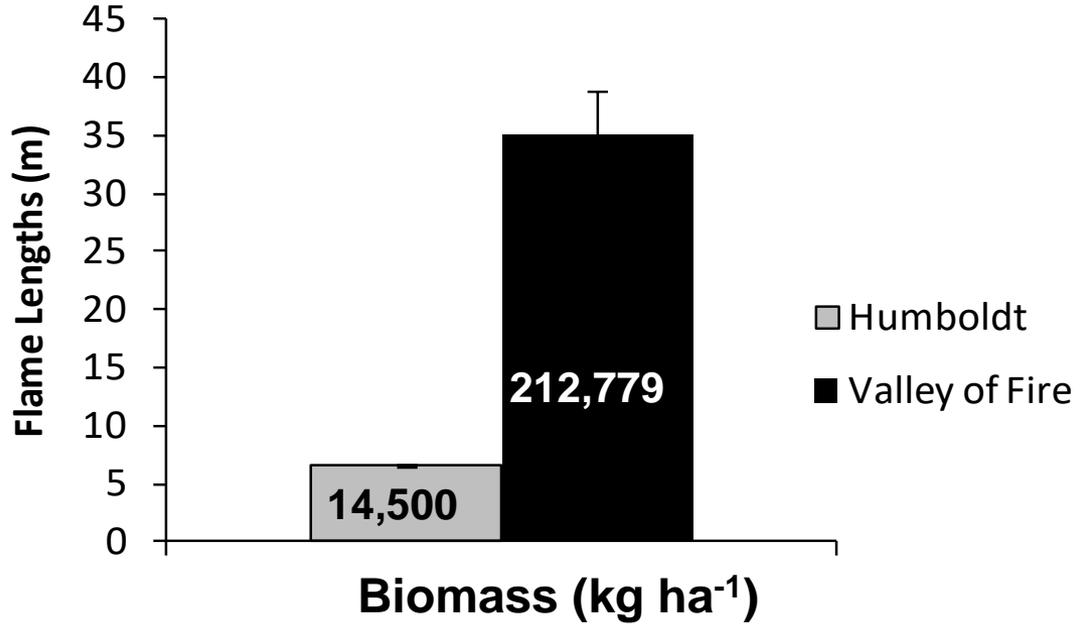
Avg ROS 11.7m/min (38.4ft)

Avg Tam removal 55%

Humboldt Sink, N. Nevada Aug 2006



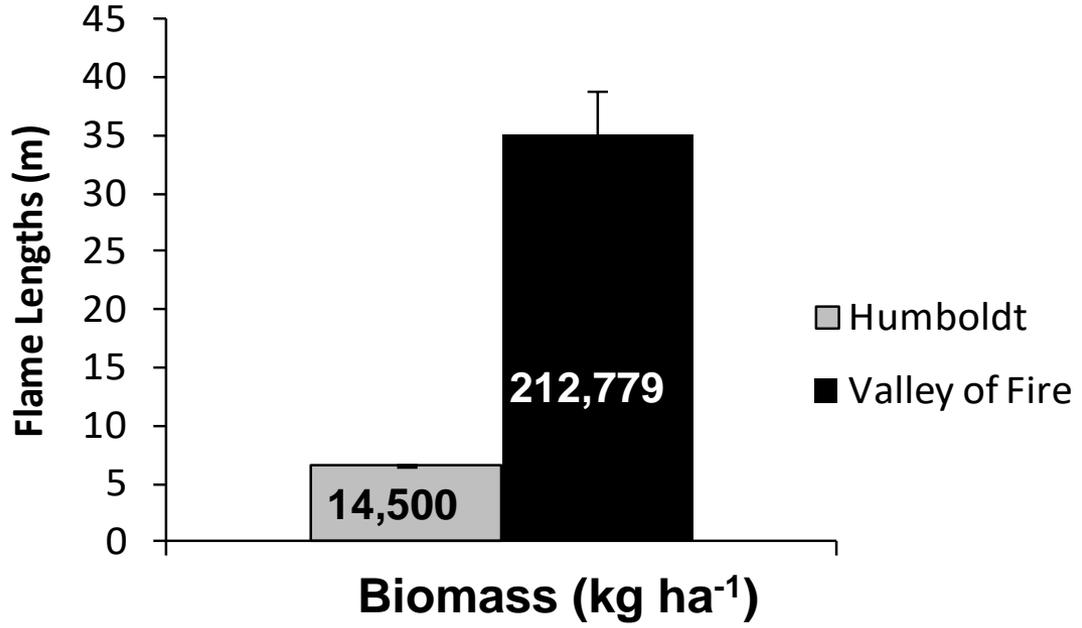
**Avg flame Length 6.5m (21.3ft)
Avg ROS 10.4m/min (34.1ft)
Avg Tam removal 40%**



Anova: $p < 0.001$



***Tamarix* fire intensity is biomass dependent**



Anova: p < 0.001



Tamarix fire intensity is biomass dependent

Should expect > frequent fires with > extreme behavior in areas following initial defoliation

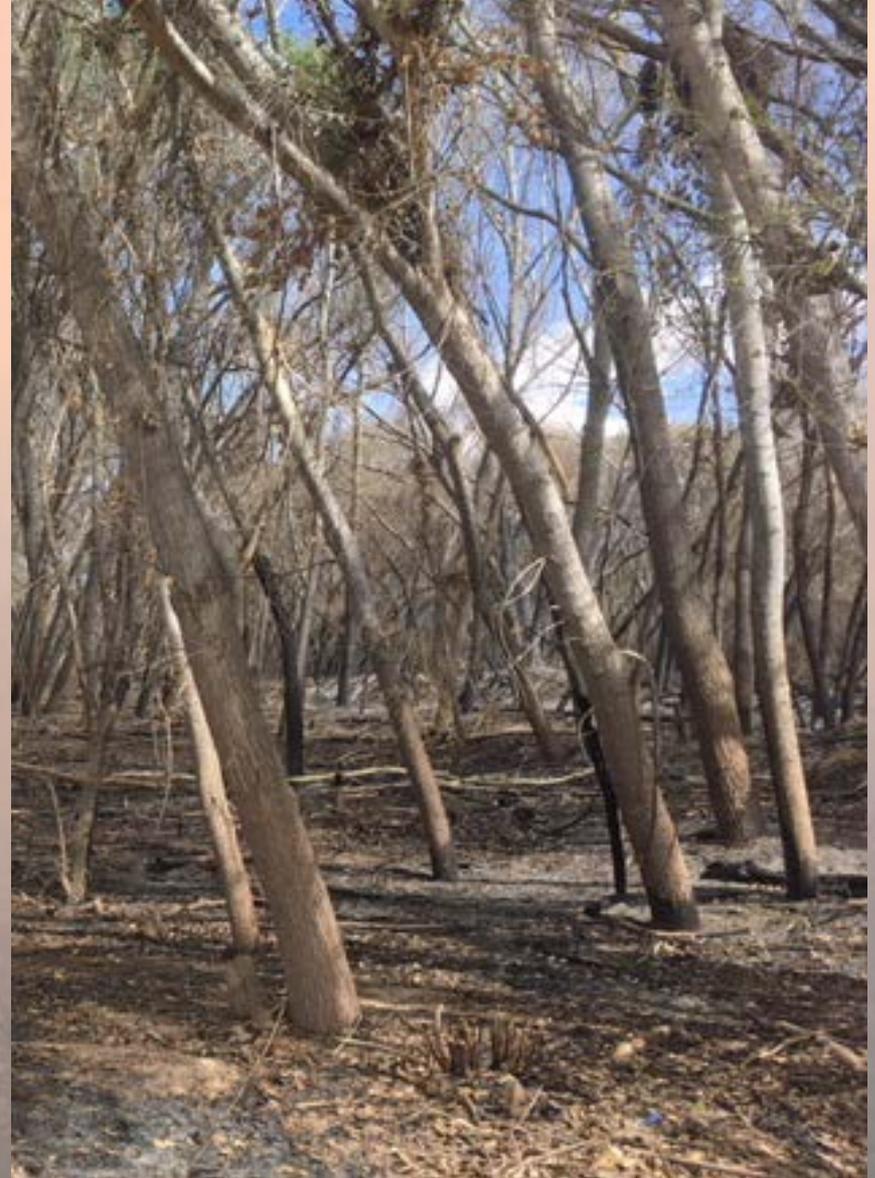
Fire frequency and intensity should decrease as foliage drops and trees die back

St. George Utah
June 1, 2014
(photo by Maysen Fielding)

Fort Thomas Fire 2018

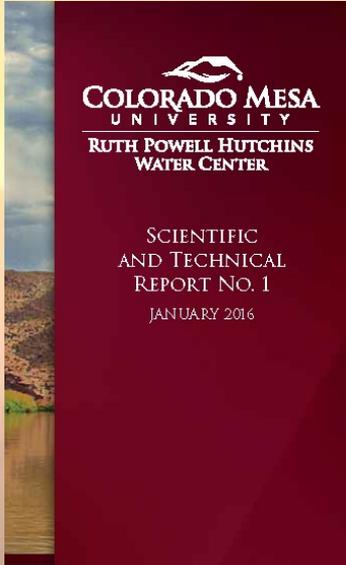


Unmanaged



Understory thinned

Expert Panel Report



COLORADO MESA UNIVERSITY
RUTH POWELL HUTCHINS WATER CENTER

SCIENTIFIC AND TECHNICAL REPORT NO. 1
 JANUARY 2016

Tamarisk beetle (*Diorhabda* spp.) in the Colorado River basin: synthesis of an expert panel forum

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Diorhabda spp.) (Figure 1) was not agent by the U.S. and cooperates to manage a native plant that is prolific considered undesirable by us. The beetle was extensively voracious before the first d then into the wild in 2001, in Bean et al. 2013). The station was observed at test tects occurring along the at various sites in western Texas n, other populations have assistance and through natural s have quickly expanded ight the Upper Colorado, Mojave Lake, Arizona, and Mexico, covering most of all but the southern portion. Tamarisk Coalition 2014). With ranging from Clatskanie, Oregon, Idaho, Wyoming, he has quickly become a part in the West (Bean et al. 2012; efficacy of the beetle, which ated defoliation, is apparent rest states, where there are 11 tamarisk (Bean et al. 2007, and Bean 2012; Nagler et al.

species present in North as its own physiological dulation and range expansion.



Figure 2—Map showing the distribution of the tamarisk beetle in the Colorado River Basin. Red dots indicate locations where tamarisk beetles were present at some point during monitoring visits between 2007-2014, whereas white dots indicate locations where beetles were absent in 2014.

Map by the Tamarisk Coalition

widespread defoliation of a dominant woody species (Figure 3) are of interest to the resource management and

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ig panelists, presenters, members.

thank the Walton Family Foundation for providing the funding for this panel and report, Southwest center for moderating the panel discussion and Colleen Whitaker for providing the notes and technical aid for providing a presentation for the panel and suggestions regarding interactions of the discussion, Tim Carlson, Peter Siskionev, and Stacy Bealigh for framing the discussion, and the gracious and nice TC is extremely appreciative for the time and effort dedicated to the panel discussion and report panelsists: Dan Bean, Osvel Hinojosa-Huerta, Matt Johnson, Rebecca Manners, Pat Shafroth, and Anna Sher Bateman, Tom Dudley, and Gabriela Katz for providing paper reviews that greatly improved the final document, and finally, we would like to thank Hannah Holm and Cig Richards of Colorado Mesa University's Ruth Powell Hutchins Water Center for publishing the report as the final document in the Science and Technical Report Series.



Figure 3—Tamarisk defoliated by tamarisk beetle along the Colorado River near Potash, Utah. Photo was taken approximately one year after beetle establishment in the area.

Photo by the Tamarisk Coalition

restoration challenges concerning soil chemistry and altered hydrology, replacement of tamarisk with other non-native species (Hultine et al. 2010), and temporary increases in wildfire potential (Dun 2013a). As the beetle has expanded its range, multi-disciplinary research and monitoring to document the impacts and interactions of the tamarisk beetle on riparian ecosystems (e.g., Bateman et al. 2010; Bateman and Johnson 2015). However, because the beetle's establishment in riparian ecosystems is a relatively new event, research on the impacts and effects is still emerging. Thus, there is a continual need to synthesize research and observations to develop an understanding of potential

including riparian restoration strategies. As previous synthesis efforts have largely addressed the issues concerning tamarisk and water use (Tamarisk Coalition 2009; Shafroth et al. 2010), the panel did not include this topic in the discussion. The overall goal was to provide report perspectives to inform riparian restoration practices and policy for riparian management in the CRB (e.g., U.S. Bureau of Land Management, U.S. Bureau of Reclamation, Lower Colorado Multi-Species Conservation Program (MSCP), U.S. Fish and Wildlife Service, tribal, state and regional agencies). Information provided by this expert panel may also be useful for other watersheds and states in the West

Executive Summary

In 2009, the U.S. Department of Agriculture approved the release of a biological control agent, the tamarisk beetle (*Diorhabda* spp.), to naturally control tamarisk populations and provide a less costly, and potentially more effective, means of removal compared with mechanical and chemical methods. The invasive plant tamarisk (*Tamarix* spp.; subfamily) occupies hundreds of thousands of acres of river floodplains and terraces across the western half of the North American continent. Its abundance varies, but can include dense monocultures, and can alter some physical and ecological processes associated with riparian ecosystems. The tamarisk beetle now occupies hundreds of miles of rivers throughout the Upper Colorado River Basin (UCRB) and is spreading into the Lower Basin. The efficacy of the beetle is evident, with many areas repeatedly experiencing tamarisk defoliation. While many welcome the beetle as a management tool, others are concerned by the ecosystem implications of widespread defoliation of a dominant woody species. As an example, defoliation may possibly affect the nesting success of the endangered southwestern willow flycatcher (*Empidonax traillii* extimus). In January 2015, the Tamarisk Coalition convened a panel of experts to discuss and present information on probable ecological trajectories in the face of widespread beetle presence and to consider opportunities for restoration and management of riparian systems in the Colorado River Basin (CRB). An in-depth description of the panel discussion follows.

Panel Findings

To summarize, the panel's primary findings/conclusions are:

- Tamarisk beetles are expected to spread throughout the entire CRB, and tamarisk presence, distribution and abundance will likely decline as a result.
- The expected effects of this tamarisk decline on native plant species are dependent upon a number of environmental factors that may be useful in predicting outcomes. Most important is the degree to which the system has changed from historical conditions, including diameter of the river, soil conditions, and the state of the remaining native plant community.
- Over time, the beetle should reduce wildfire risk and intensity.
- As impacts of the beetle become more evident, decreased bank stability due to loss of tamarisk may lead to increased channel mobility.
- Increased geomorphic dynamics is more likely to occur along systems that retain their natural flow regime. Geomorphic recovery may be rapid where the difference is manageable between the peak discharge of large floods, and small floods is great.
- The impact of the tamarisk beetle on wildlife will depend on the particular response of the site, how successfully desirable native plants establish, and the ability of particular wildlife taxa to utilize alternative riparian habitats that may include a mixed riparian community of natives and remaining tamarisk.
- In the short term, there may be risk to some wildlife taxa that utilize tamarisk-dominated habitats. However, over the long term, some systems should experience benefits to wildlife abundance and diversity, particularly systems where restoration is implemented.
- Tamarisk is not expected to be eradicated by the beetle. Thus, tamarisk will continue to be present in the watersheds where it occurs, although it is anticipated to be at lower levels as a result of the biological control of the beetle.



Figure 1—Close-up of an adult tamarisk beetle (*Diorhabda* spp.). (Photo by Ed Comstock)

- Approved conservation plans for the Lower Colorado River, and elsewhere in Arizona, often assume tamarisk will be a permanent component of future riparian vegetation. This assumption might not be valid in the future due to long-term defoliation impacts.
- Biological control of tamarisk in the CRB, with or without water control and restoration measures can play an important role in making southwestern riparian ecosystems more diverse and functional than when the plant community is dominated by a single species.

The panel concluded that as the tamarisk beetle moves into the Lower Colorado River Basin (LCRB), the selection of management actions to support a transition to a healthy riparian system will depend on the unique suite of characteristics of each sub-basin and the goals of basin managers. The panel emphasized the importance of basin-specific planning, the necessity of monitoring and inventorying riparian management, and that adaptive management practices will be essential for success relative to varying goals. The panel developed a framework to assist managers in selecting appropriate management strategies and identified future research needed to further inform restoration approaches and management decisions.



RiversEdge West

RESTORE + CONNECT + INNOVATE

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