Tamarisk Leaf Beetle Distribution, Genetic Variation, Defoliation and Mortality Impacts on Tamarisk Habitat along the Rio Grande, NM Watershed

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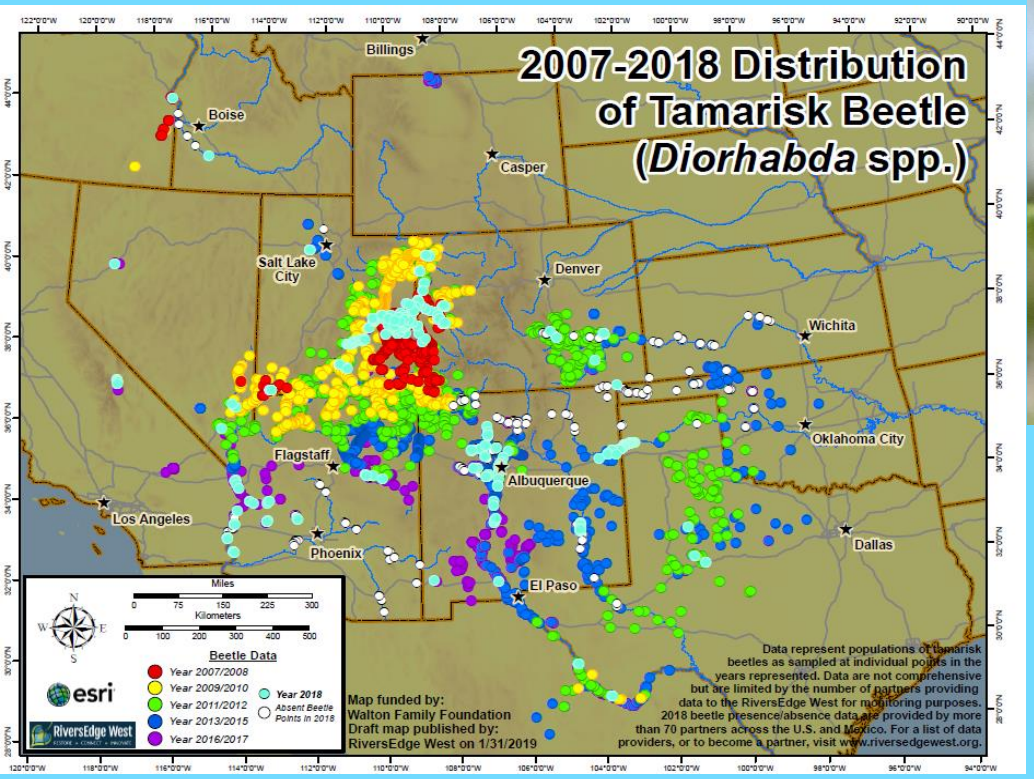
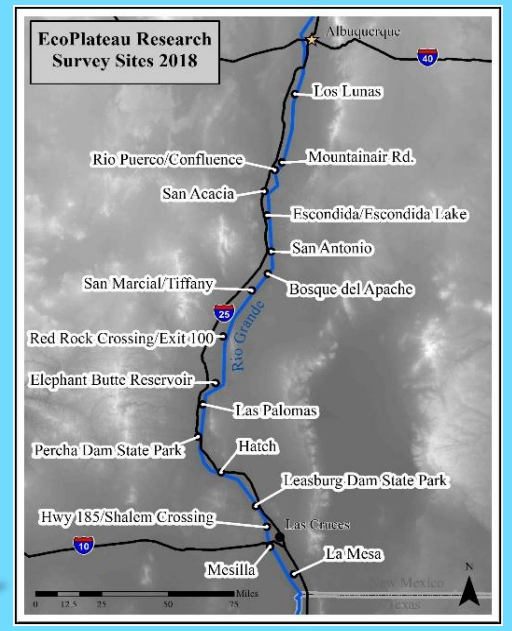
Tamarisk Leaf Beetle (*Diorhabda spp.*) Monitoring 2011-2019

- **2001, Tamarisk Leaf Beetle limited open releases in Utah and Nevada**
- **In 2011 started monitoring tamarisk leaf beetles presence throughout the Rio Grande New Mexico watershed**



Objectives

- Determine Distribution of Tamarisk Leaf beetles throughout the Rio Grande, NM watershed
- Track tamarisk defoliation and mortality
- Determine tamarisk leaf beetle sub-species through genetic analysis



Northern

Mediterranean

Subtropical

Larger

Tamarisk Leaf Beetle Monitoring Methods

Date	GPS Point ID	UTM Coordinates	River mi/km		Sweep 1	Sweep 2	Sweep 3	Sweep 4	Sweep 5	Eggs	Coniatus Spp	Defoliation	Re-foliation	Photo	Comments
		Lat:		Adults										ID:	
				Early Larvae						☐	☐		☐		
		Long:		Late Larvae										Direction	

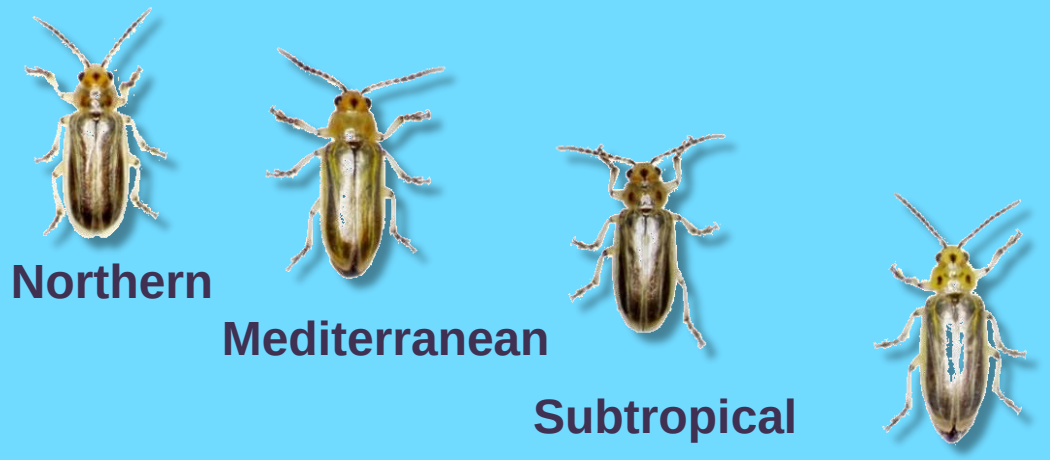
- **Using standard 38 cm diameter sweep nets conducted twenty-five 1-m sweeps through the tamarisk foliage per sampling location.**
- **Sweeps occurred on five separate trees, with five sweeps per tree.**
- **Between every five sweeps the contents of the net were recorded. At each site, sampled at least five locations.**
- **Counted all tamarisk beetles and larval stages, tamarisk weevils, leafhoppers, ants, lady bugs, and spiders for each set of five sweeps per tree.**

Tamarisk Phenology Monitoring Methods

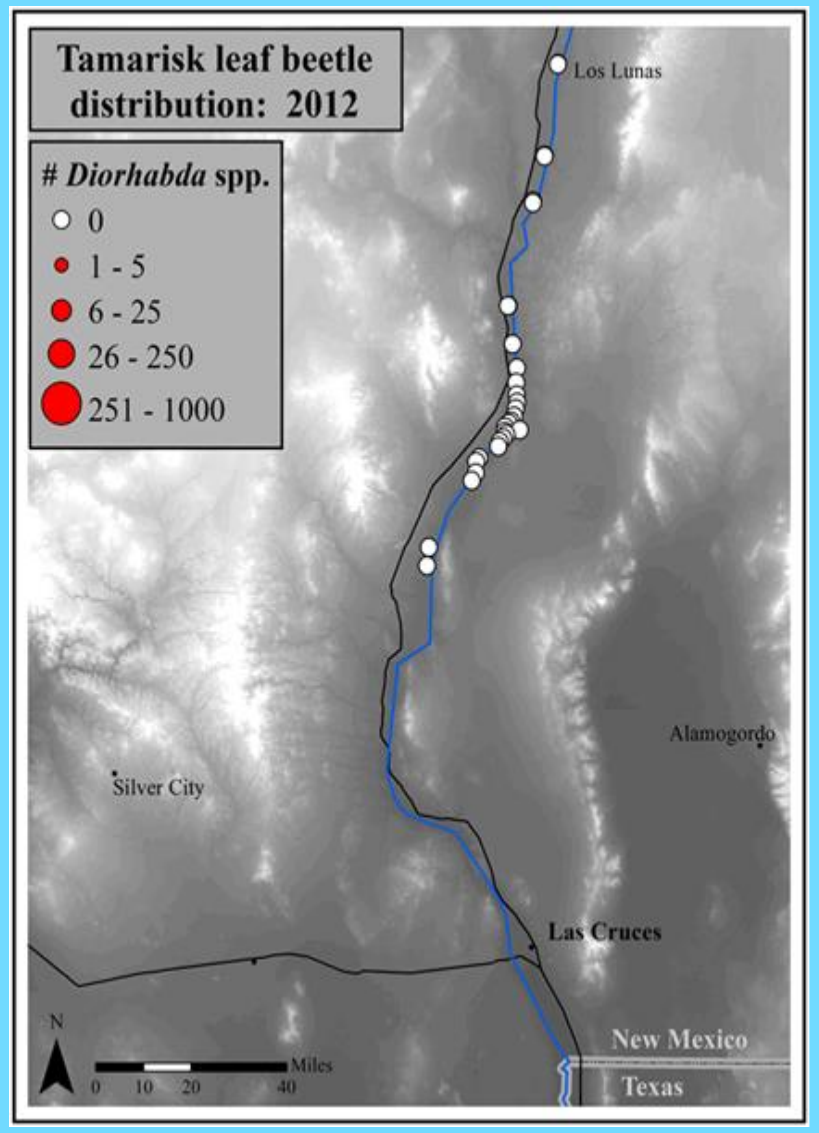
- At each tamarisk tree estimated canopy phenology and the number of tamarisk leaf beetles detected.
- Multi-year data set grouped records according to the tree phenology variables; % dead branches; % flowers; % yellow foliage; % brown/defoliated foliage;
- Calculated the mean number of beetles detected within each percentage grouping (e.g., the mean number of tamarisk leaf beetles with 0% defoliation, 10% defoliation, 20% defoliation, etc.).

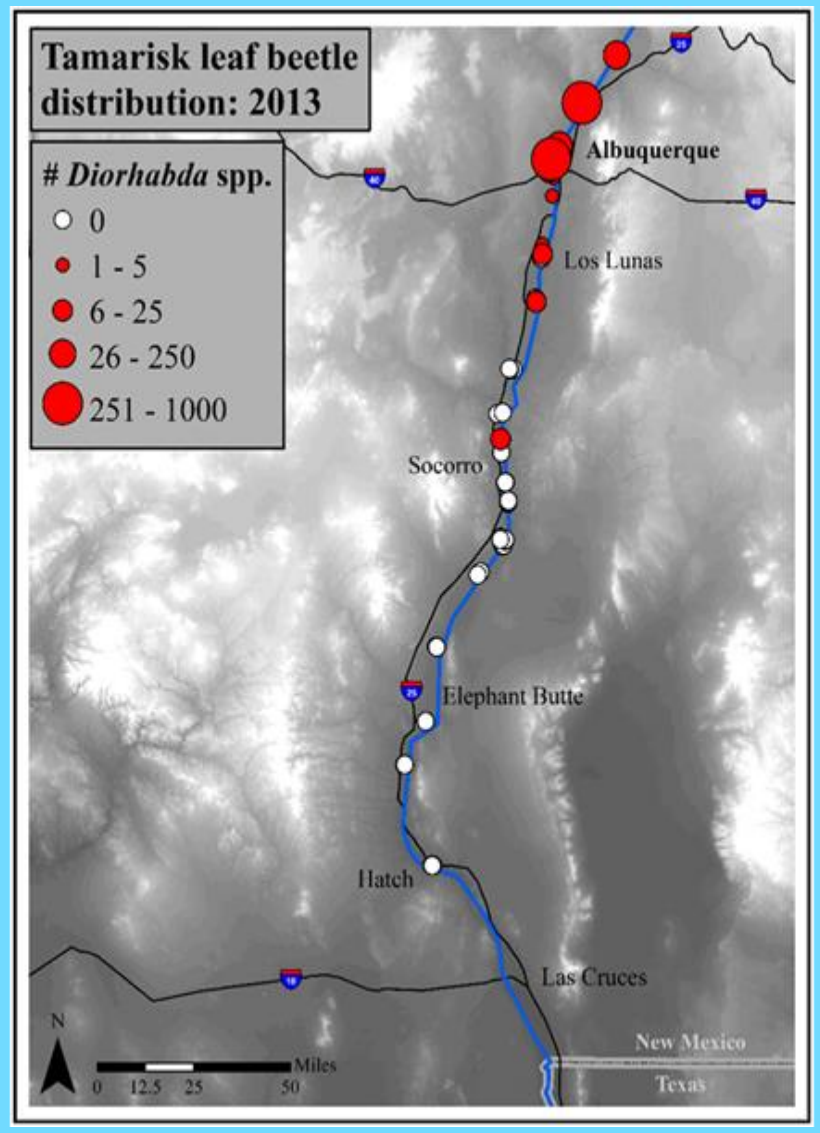
Genetic Sampling

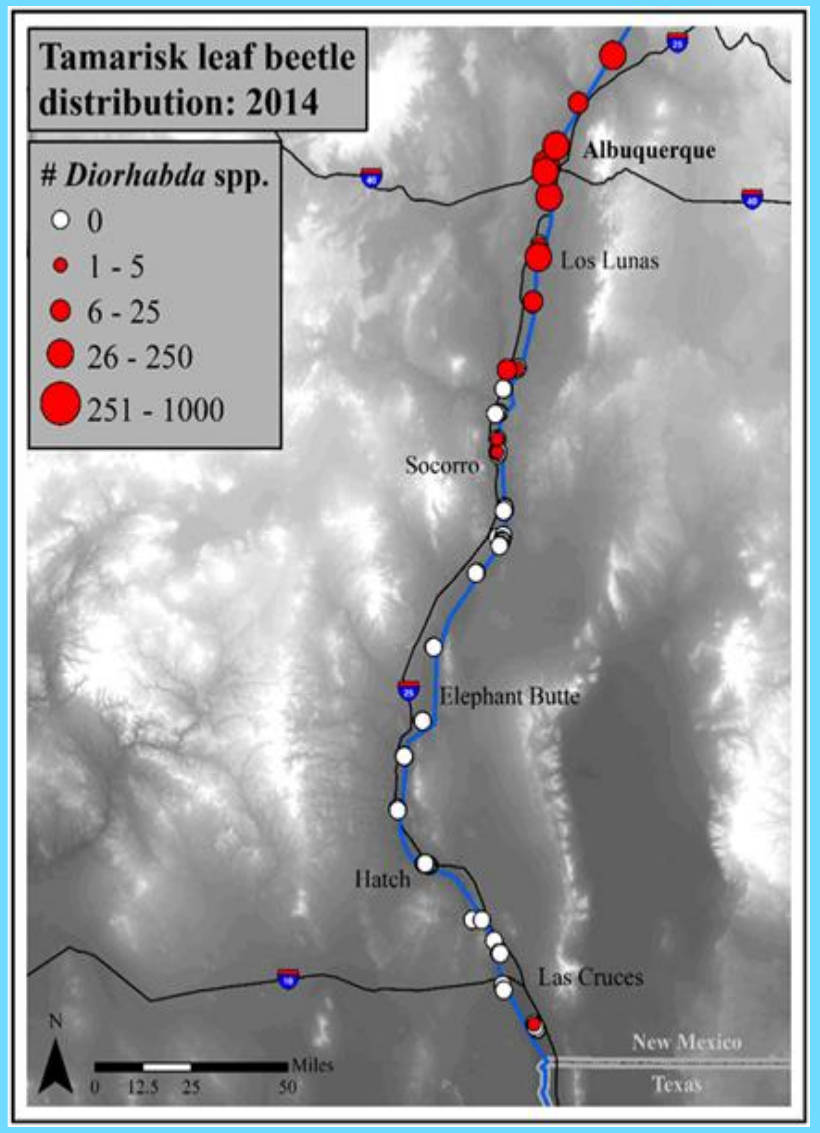
- In order to identify the distribution of tamarisk leaf beetle species at the genetic level individual tamarisk leaf beetles were collected and placed in vials with 95% alcohol and kept in a cooler.
- Determined species and possible hybridization at 12 -17 sites between Los Lunas and La Mesa.
- Five specimens were collected at each site.
- Mitochondrial Cytochrome C Oxidase Subunit 1 (CO1). Sequence was used to identify the species designation of the Diorhabda spp.
- Examined tamarisk leaf beetle hybridization using RADseq (Restriction site associated DNA sequencing) analysis.



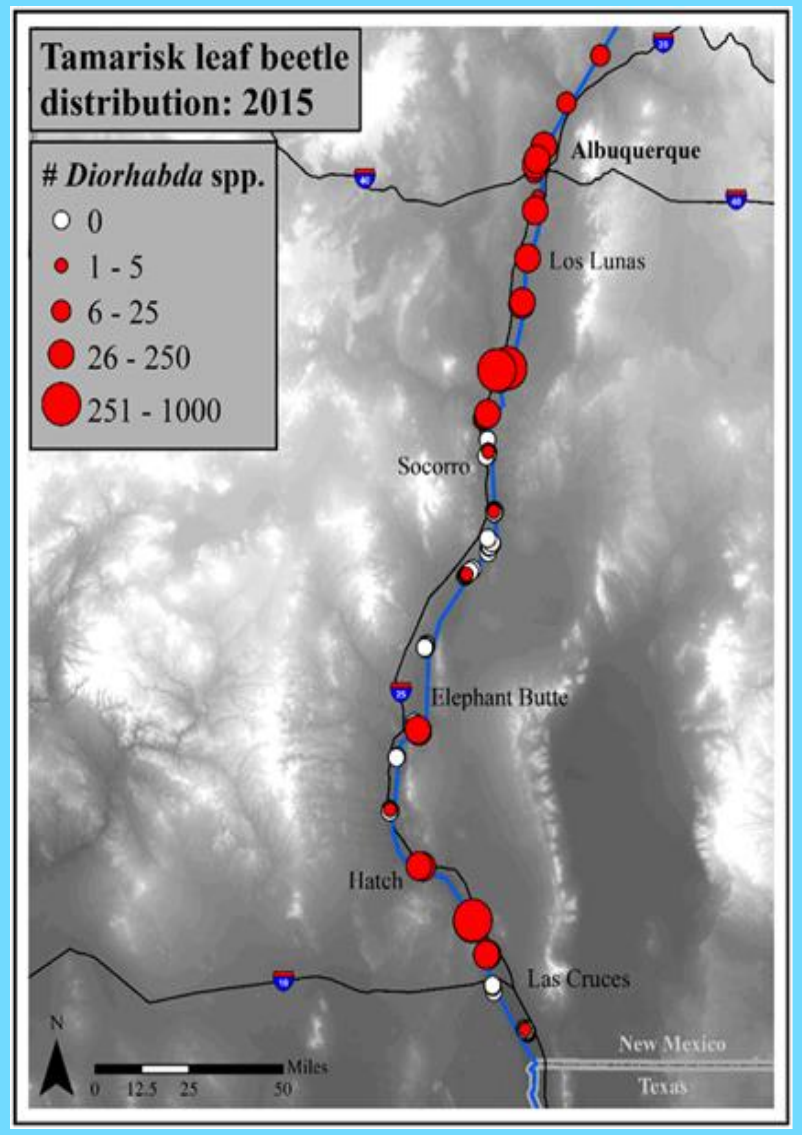
Rio Grande Tamarisk Leaf Beetle Distribution, 2012, 2013, 2014

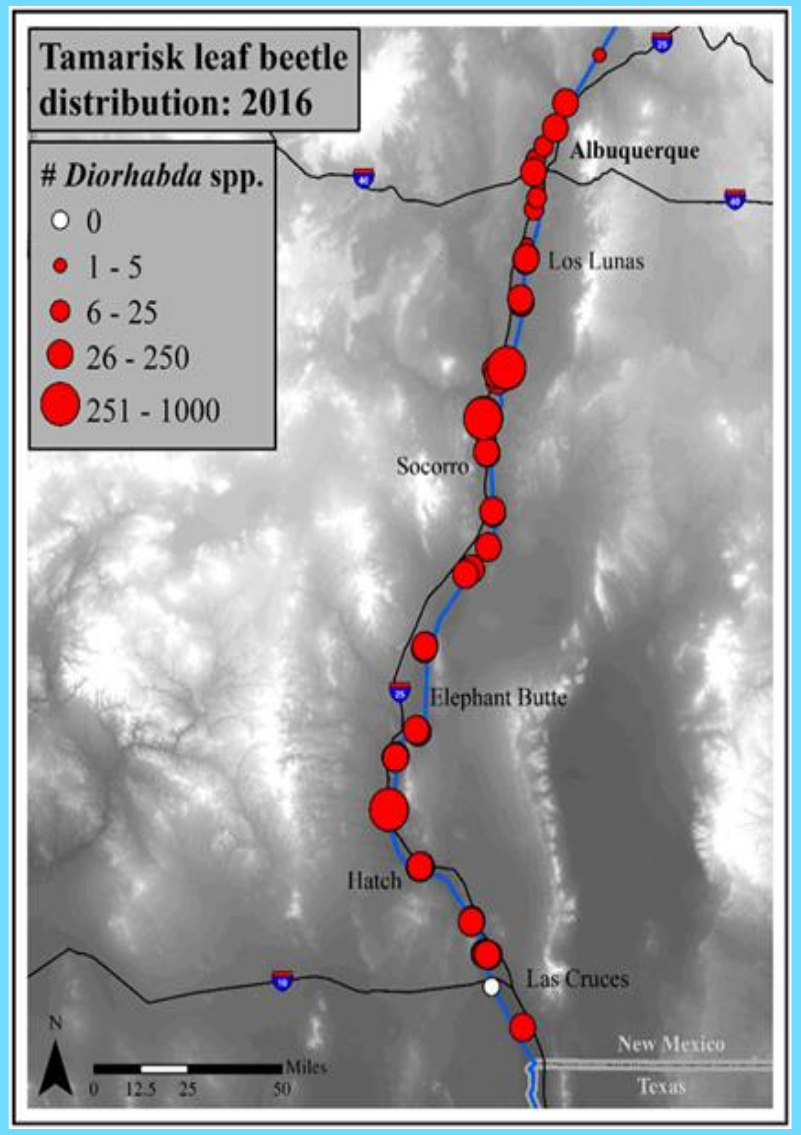


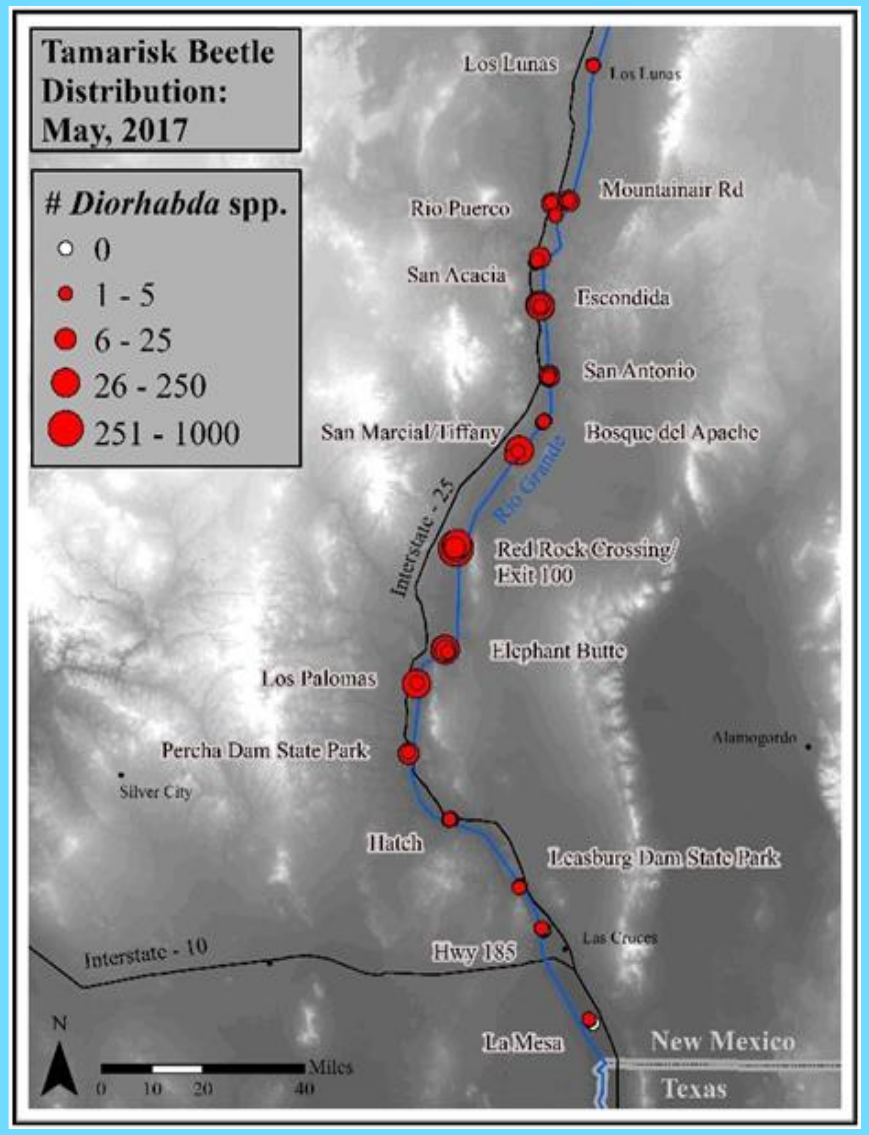




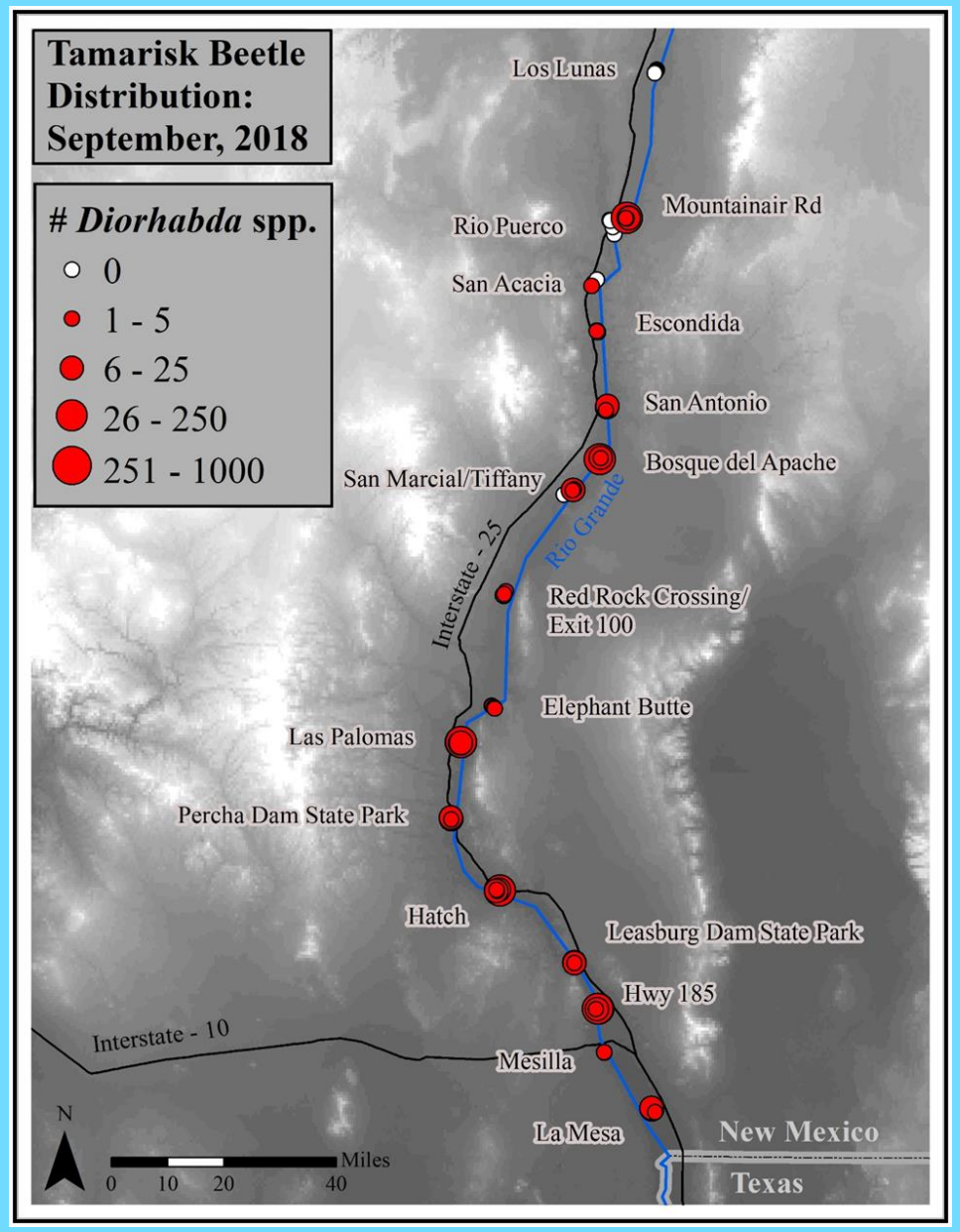
Rio Grande Tamarisk Leaf Beetle Distribution, 2015, 2016, 2017

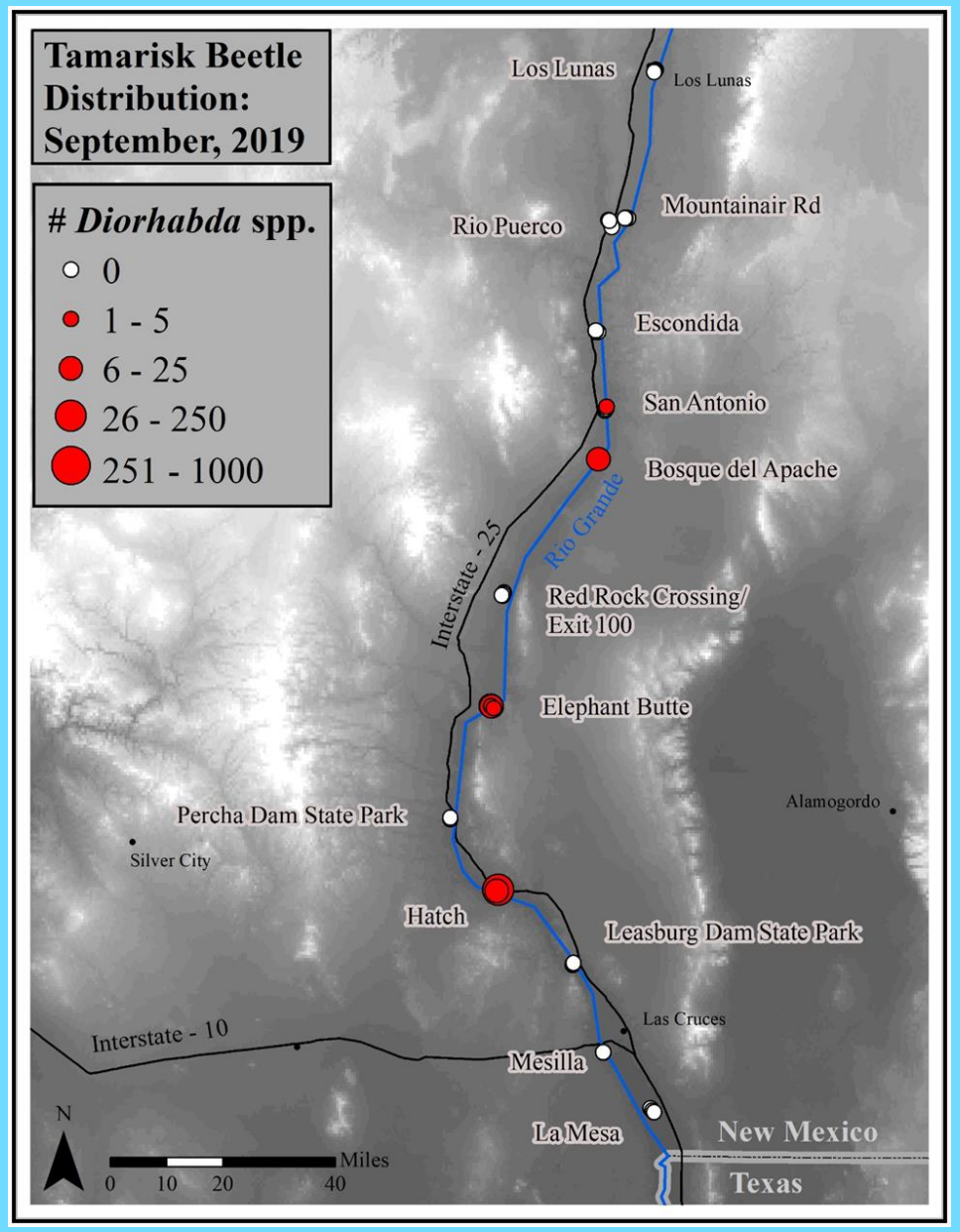




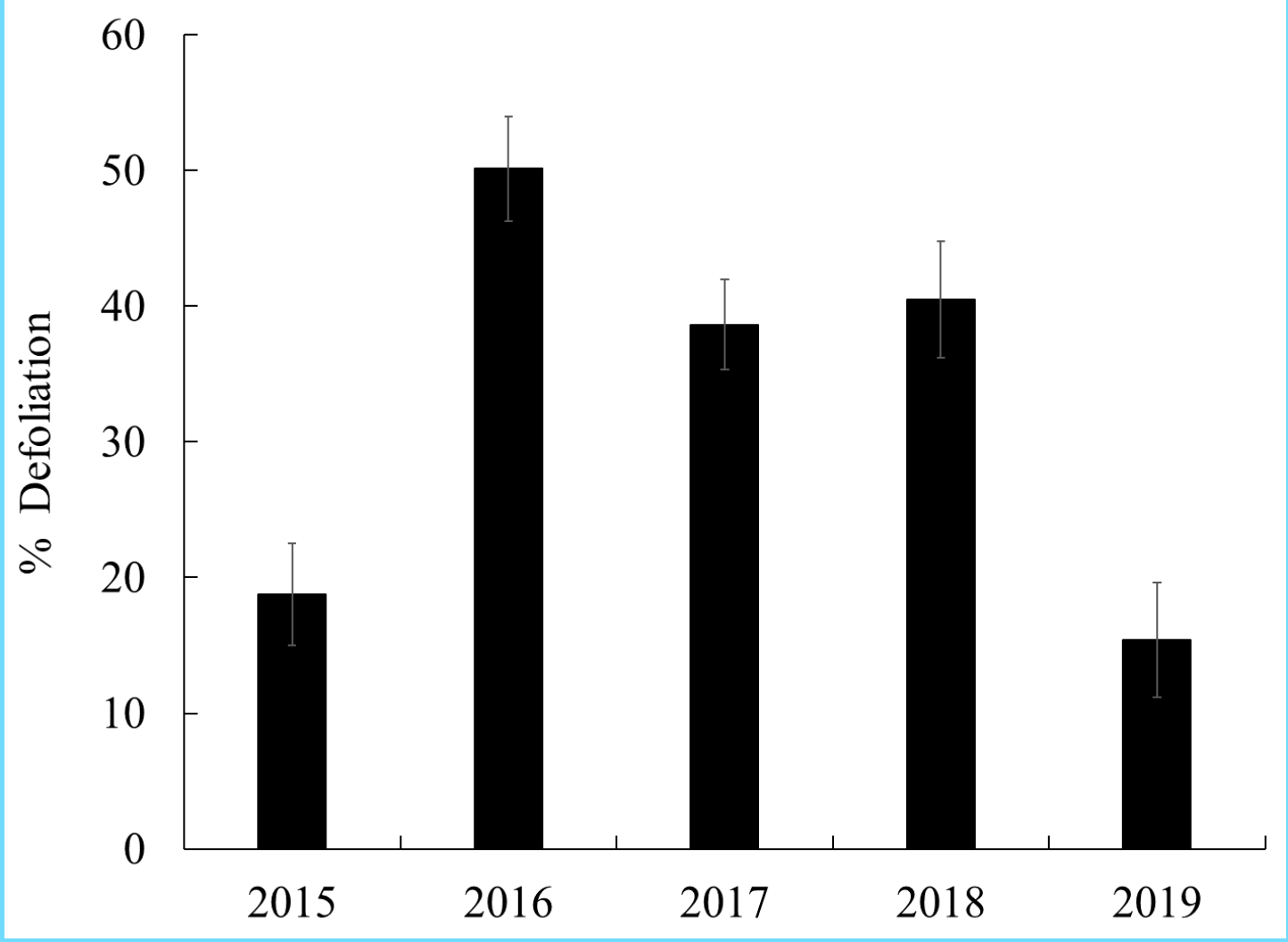


Rio Grande Tamarisk Leaf Beetle Distribution, 2018

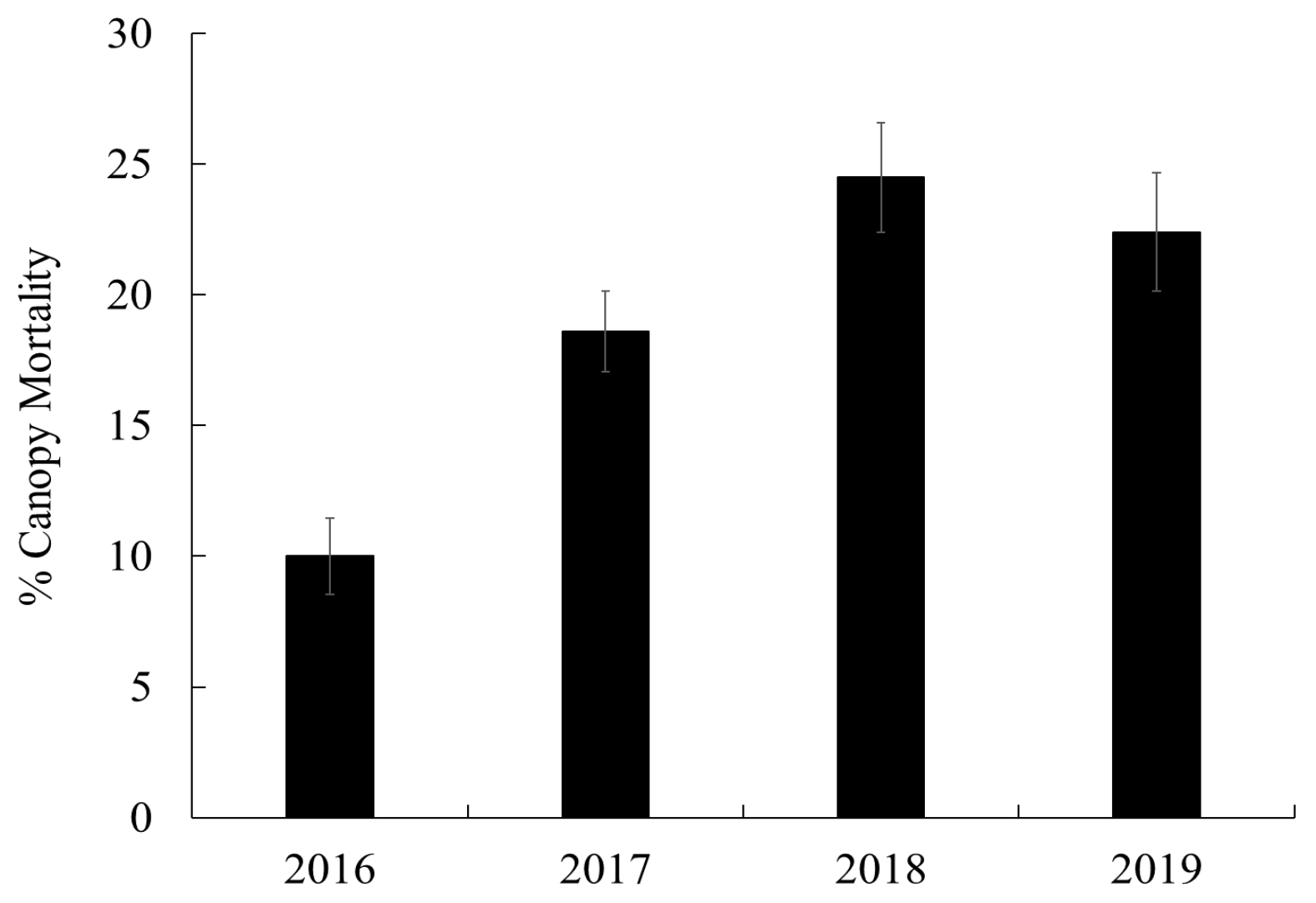




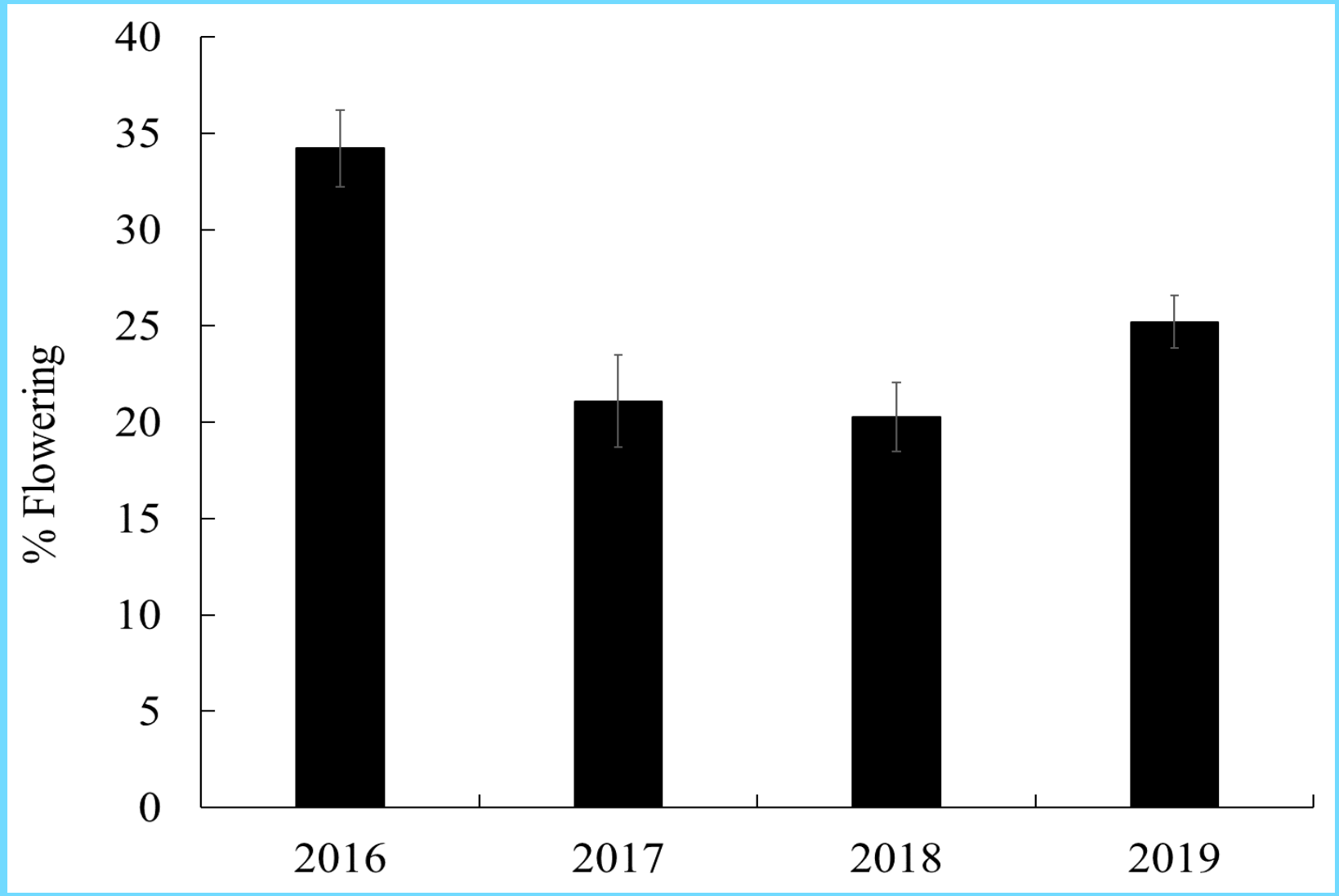
Rio Grande Tamarisk Defoliation Rates (2015-2019)



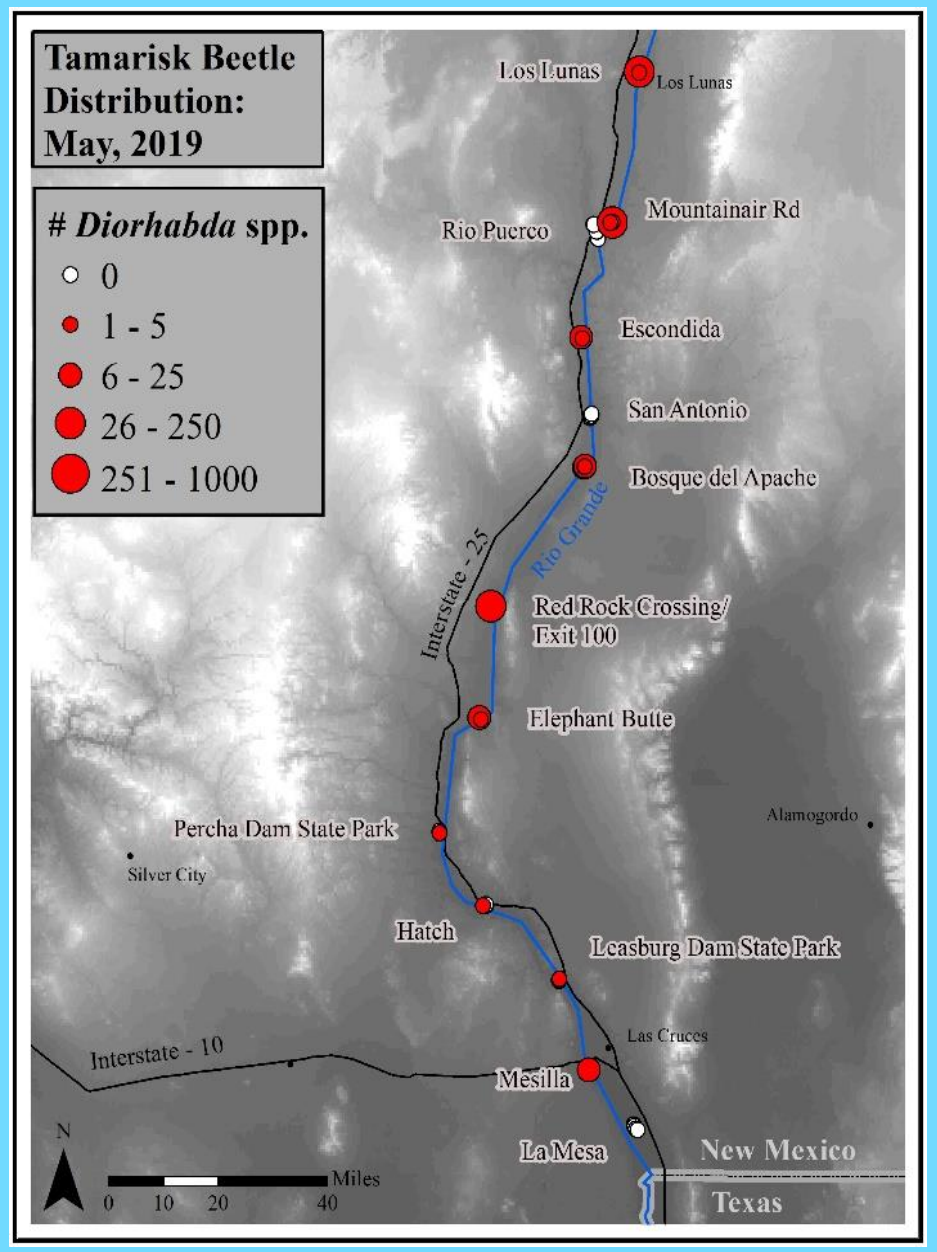
Rio Grande Tamarisk Branch Mortality Rates (2015-2019)

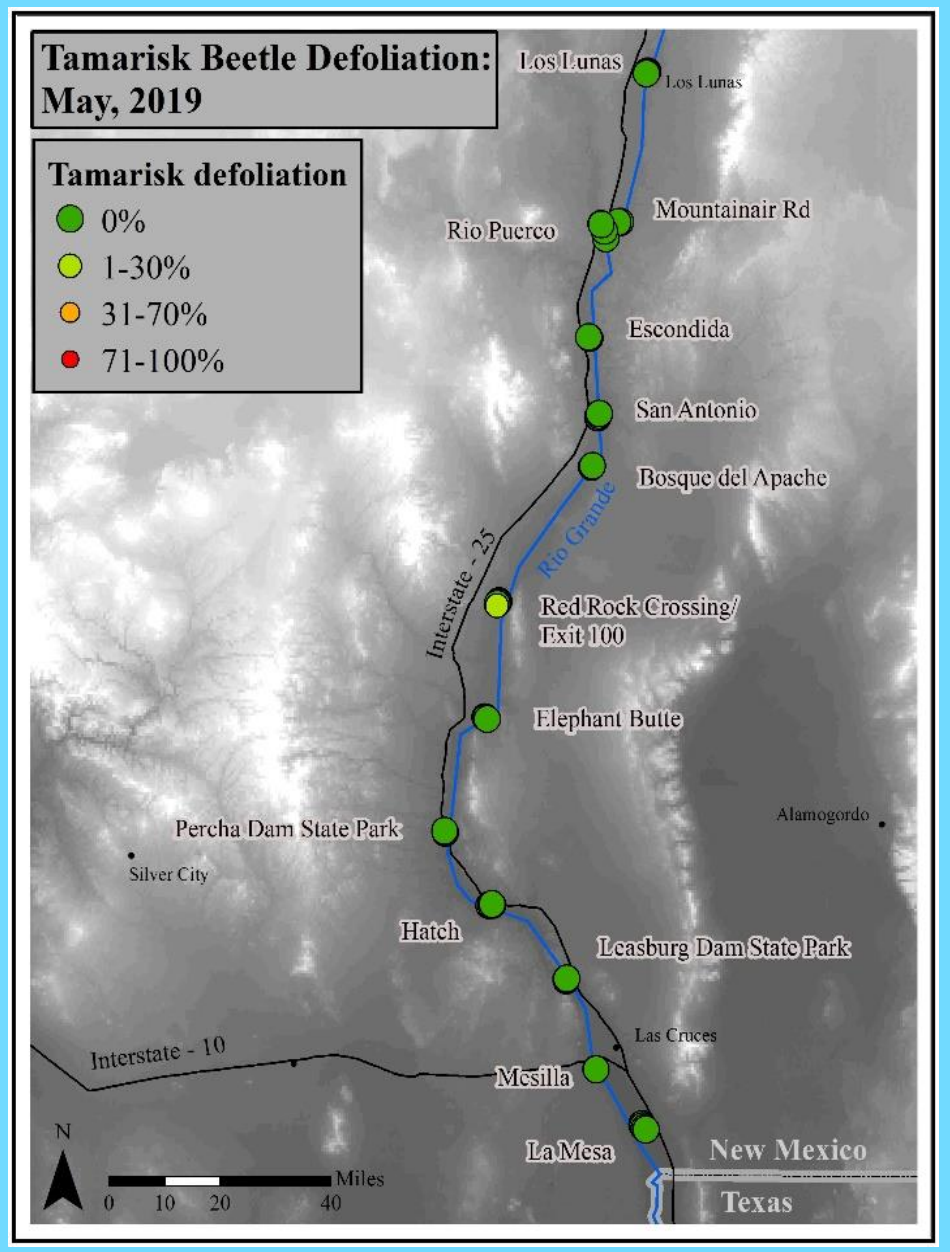


Rio Grande Tamarisk Canopy Flower Rates (2015-2019)

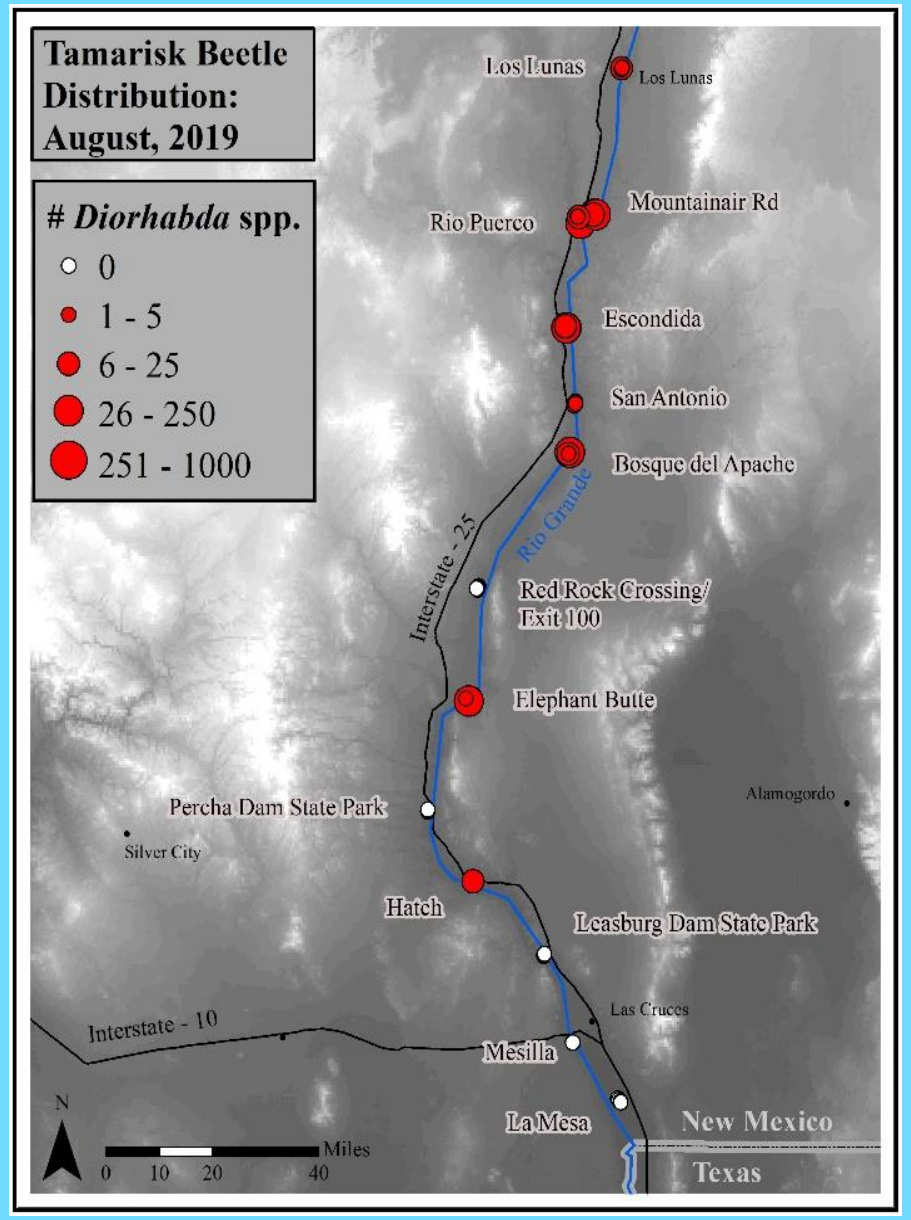


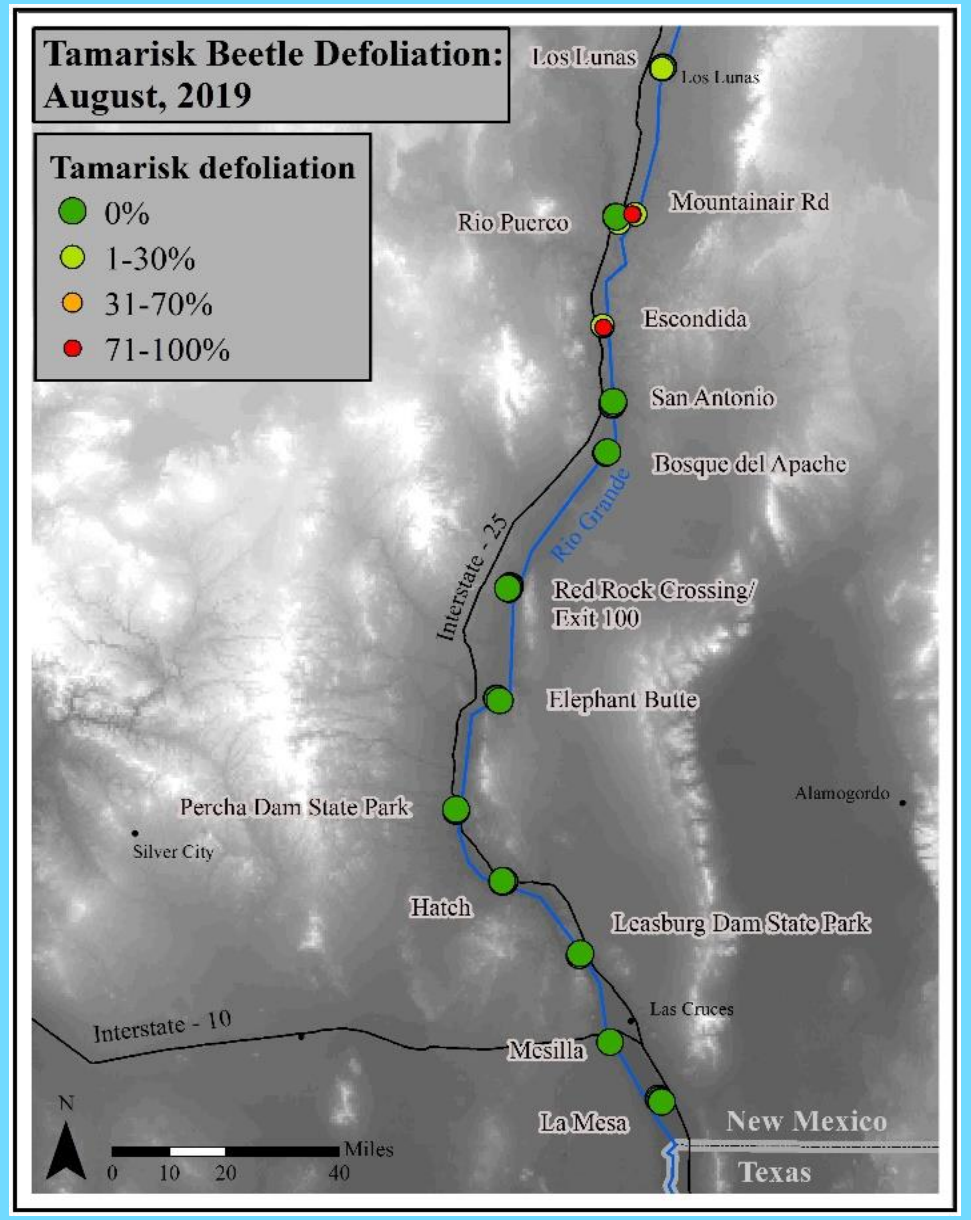
Rio Grande Tamarisk Leaf Beetle May 2019 Distribution and Defoliation Rates



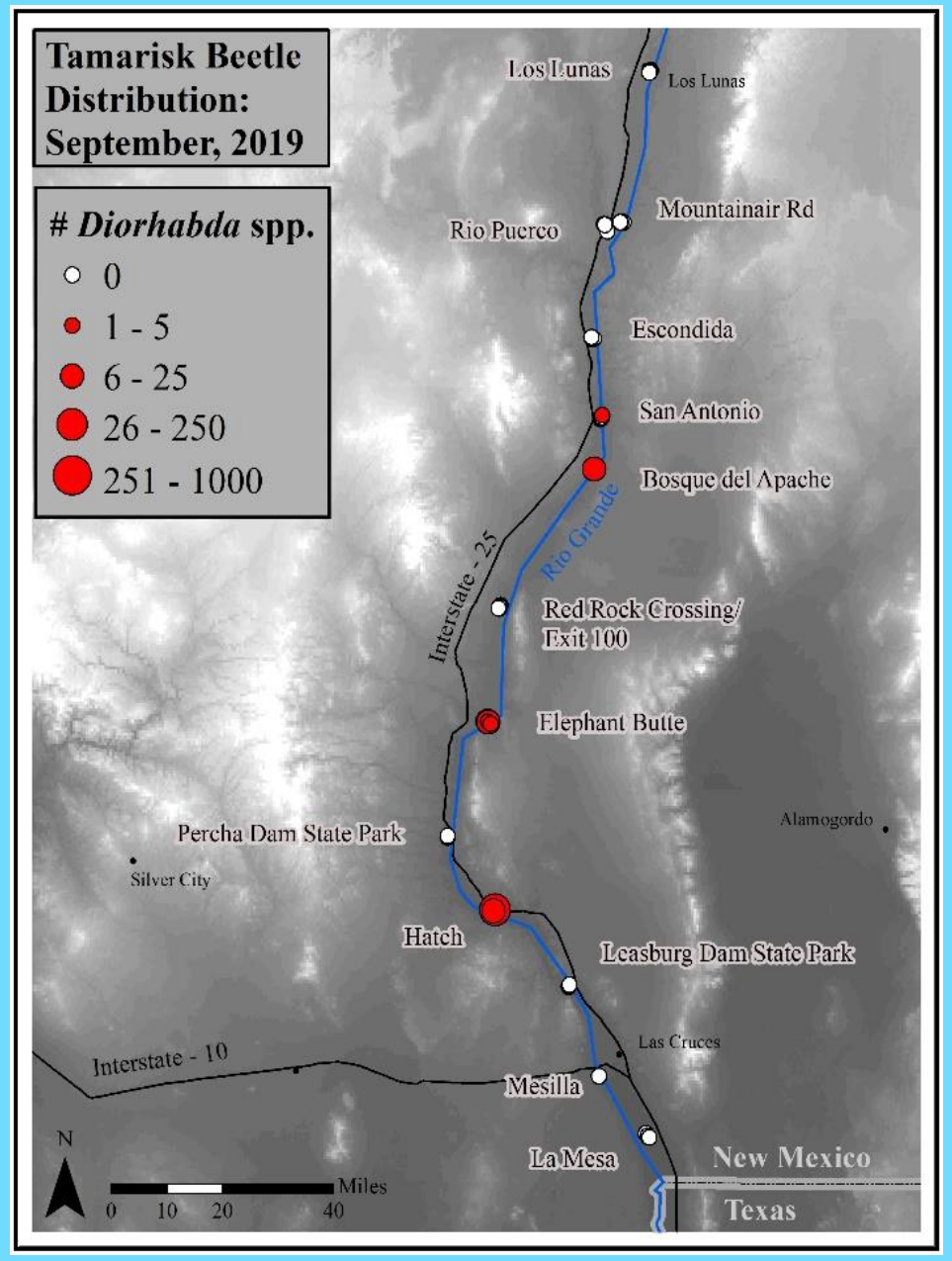


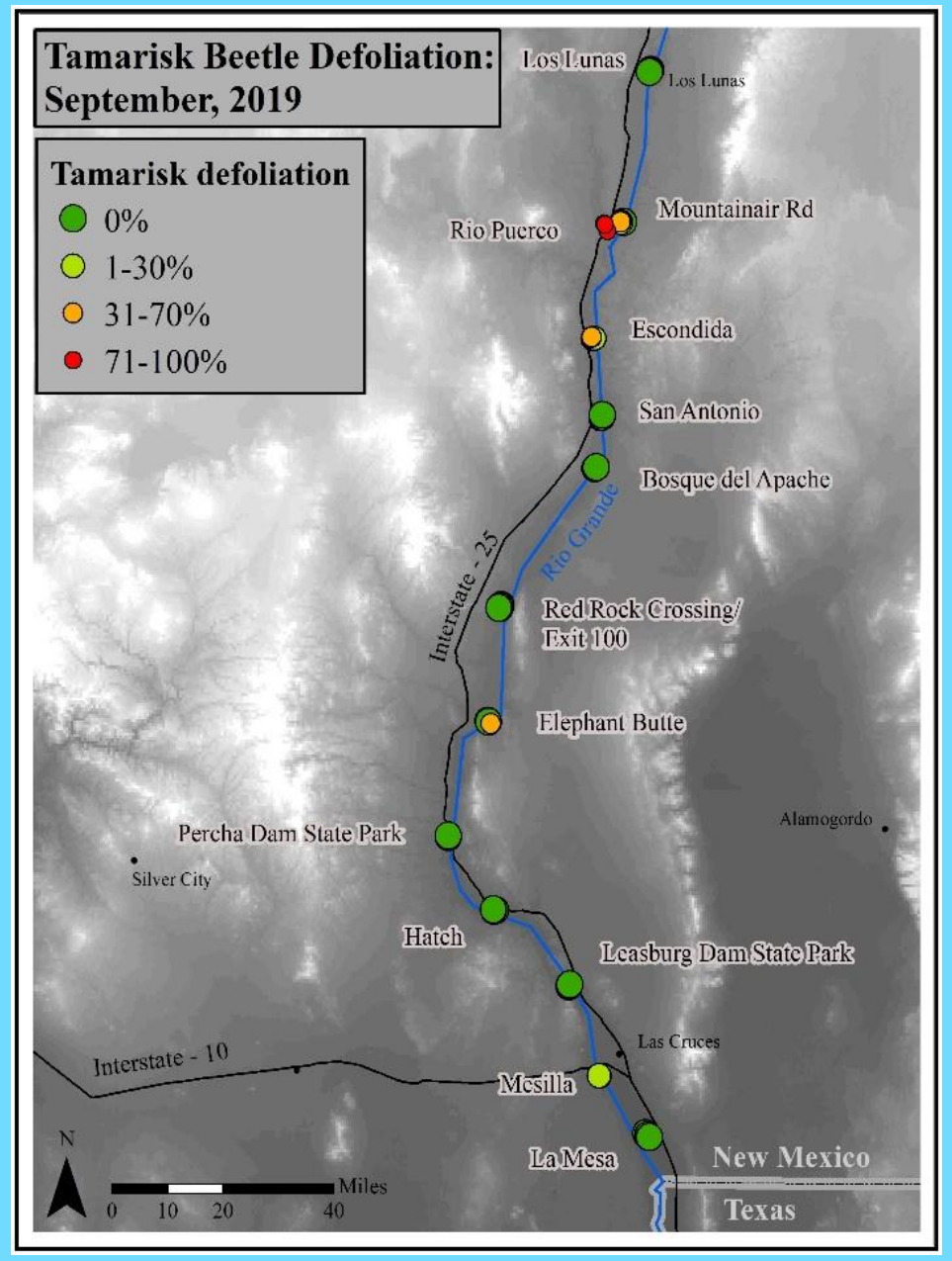
Rio Grande Tamarisk Leaf Beetle August 2019 Distribution and Defoliation Rates



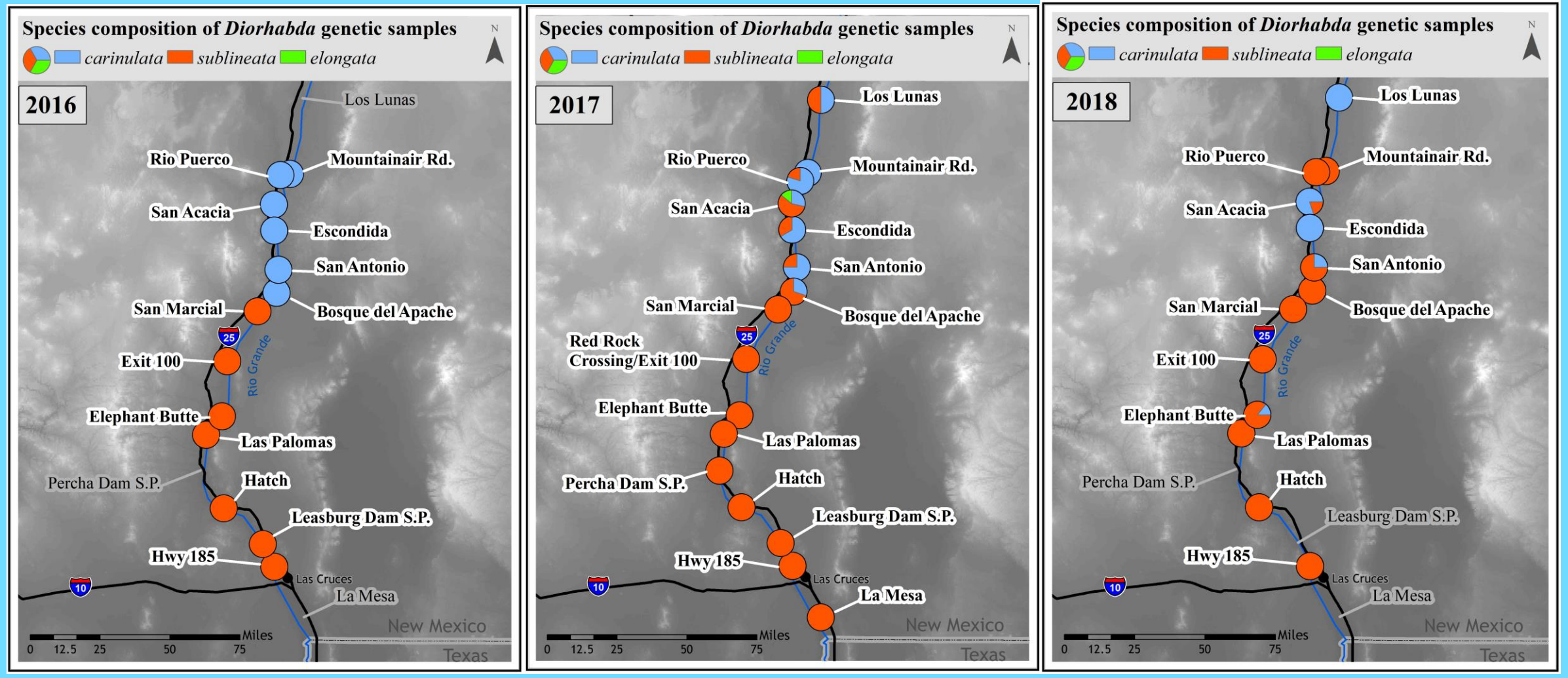


Rio Grande Tamarisk Leaf Beetle September2019 Distribution and Defoliation Rates





Tamarisk Leaf Beetle Species Genetic ID Distribution, 2018



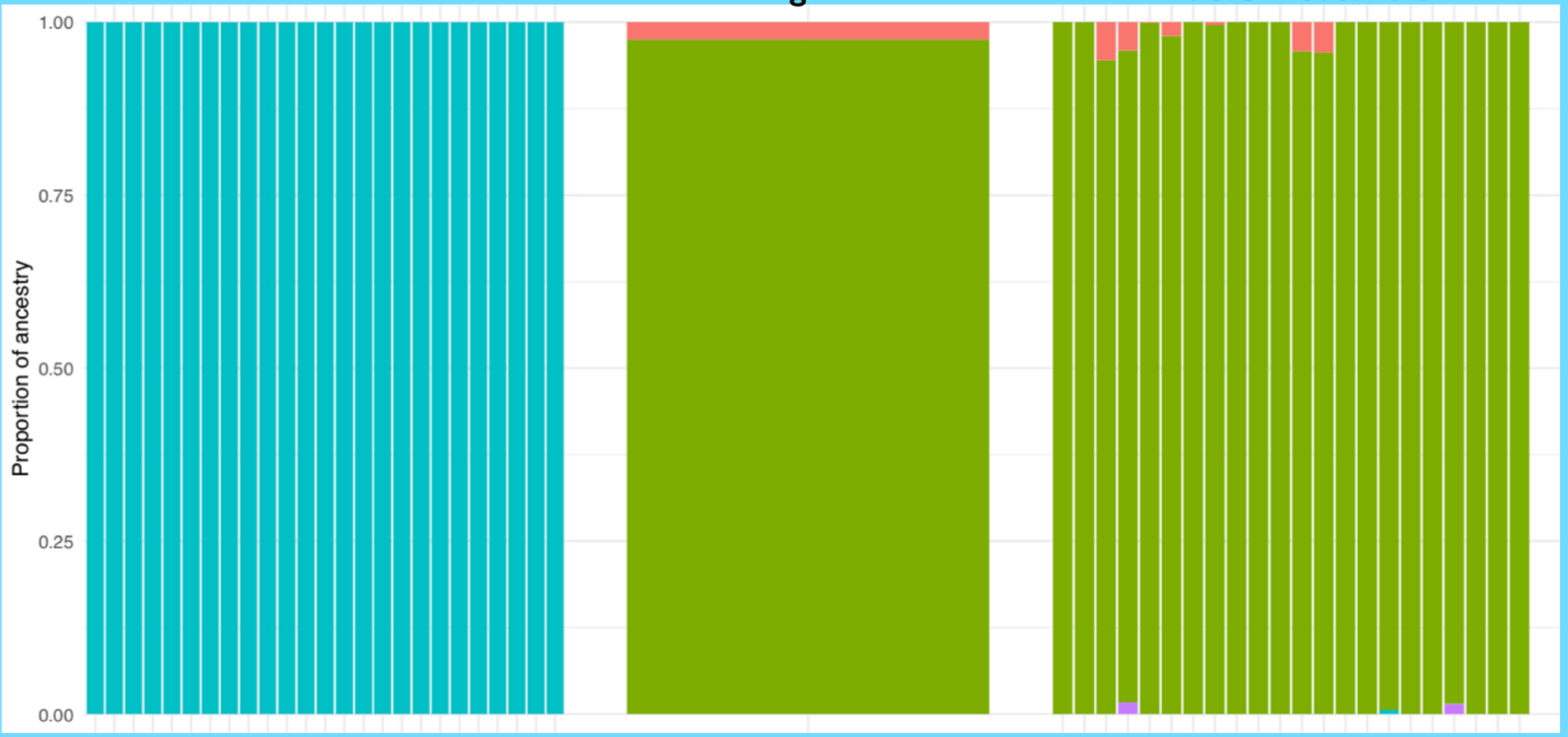
Blue: Northern TLB (*D.carinulata*); **Red: Subtropical TLB** (*D.sublineata*); **Green: Mediterranean TLB** (*D.elongata*)

Tamarisk Leaf Beetle Hybridization, 2017

D. Carinulata CO-I

D. elongata CO-I

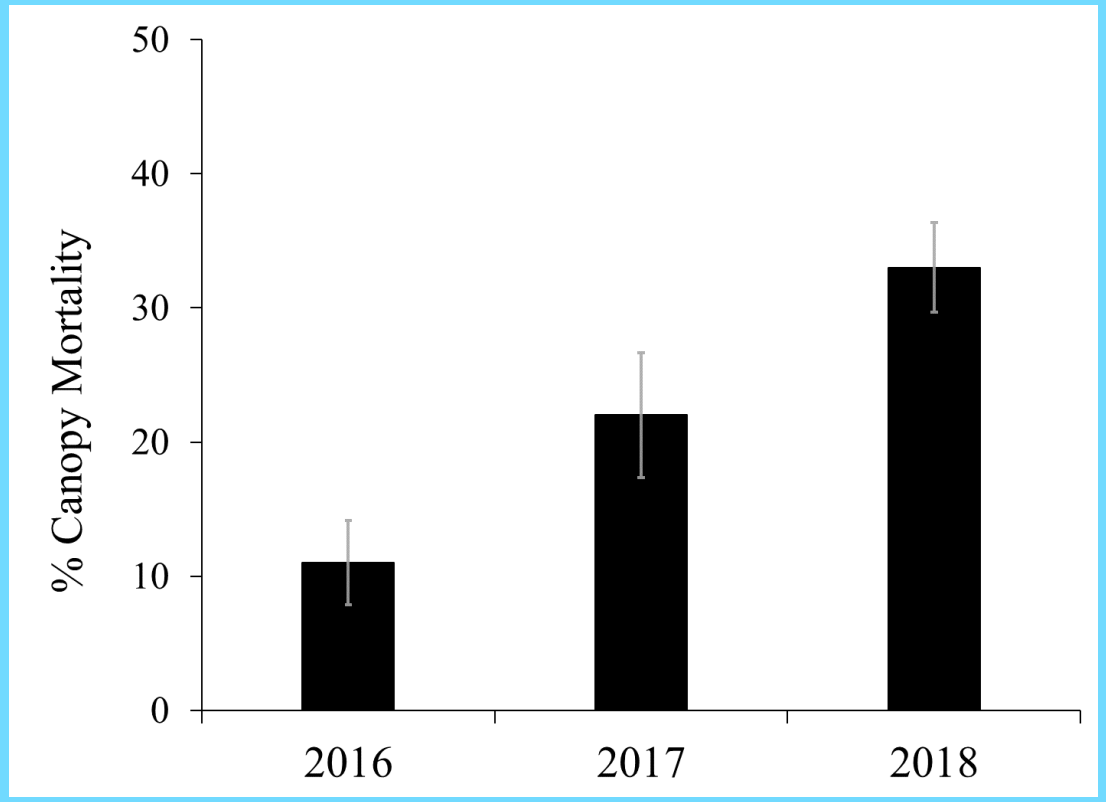
D. sublineata CO-I



Aqua: **Northern TLB** (*D.carinulata*);
Green: **Subtropical TLB** (*D.sublineata*);
Red: **Larger TLB** (*D.carinata*)
Purple: **Mediterranean TLB** (*D.elongata*)

Tamarisk Branch Mortality

- Habitat changes were evaluated by looking at vegetation:
  - Phenology (defoliation branch mortality, flowering)

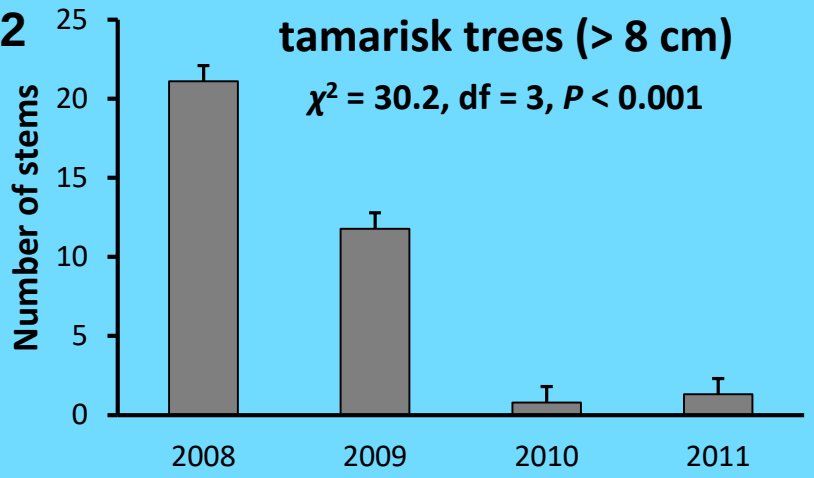


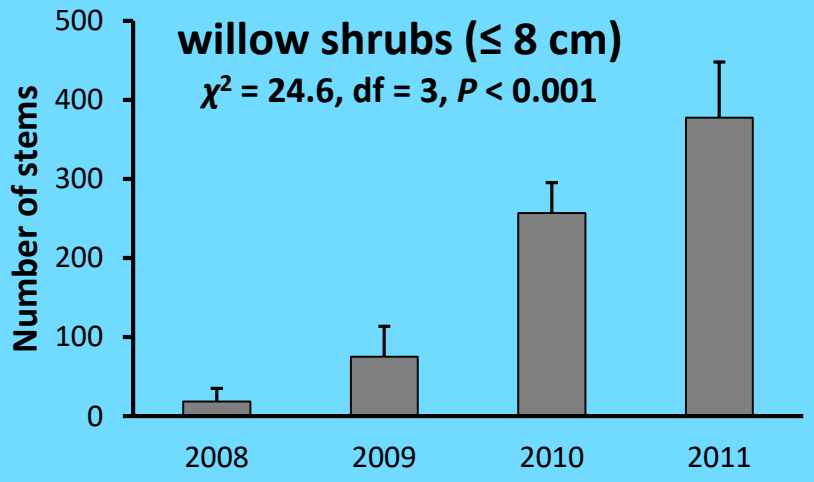
Mean percentage (± SE) of dead branches found in the canopies of tamarisk (Tamarix spp.) trees within the Socorro, NM restoration area, 2016-2018.

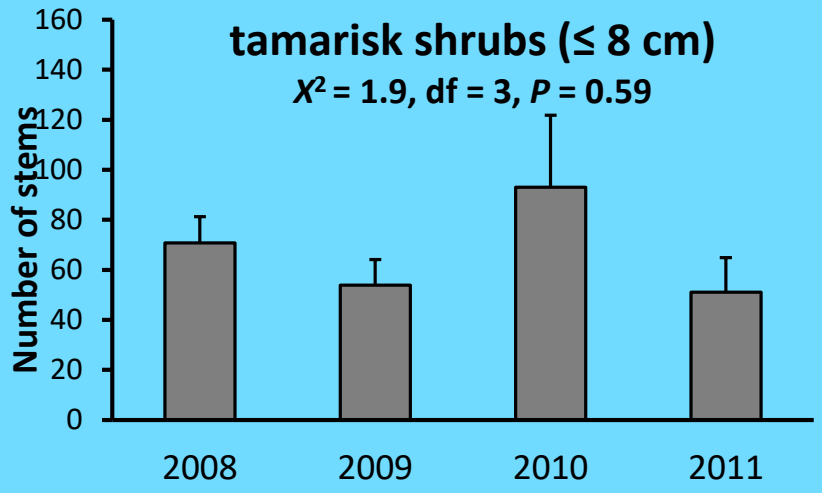
Implications of Riparian Restoration: Biocontrol vs. Removal

SWFL Habitat use shifted between 2008 & 2011

Virgin River, UT: Dobbs et al. 2012





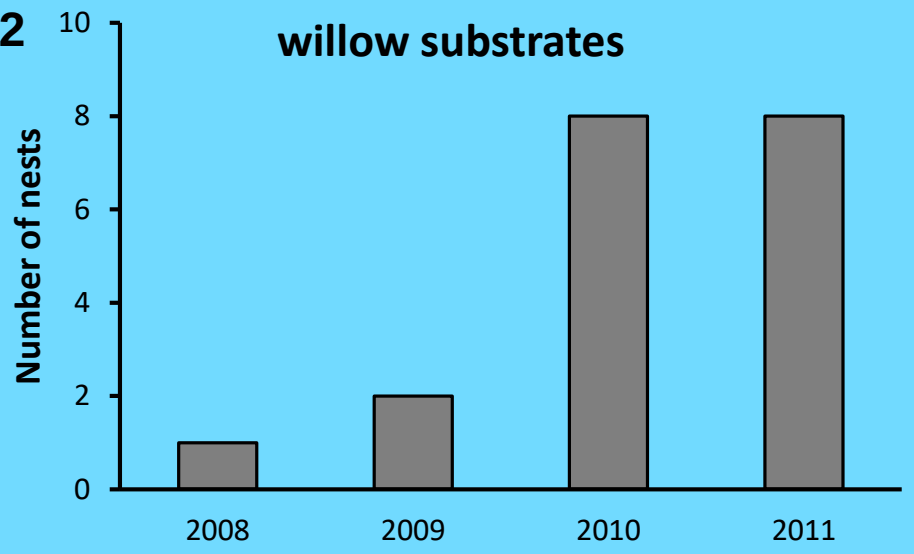


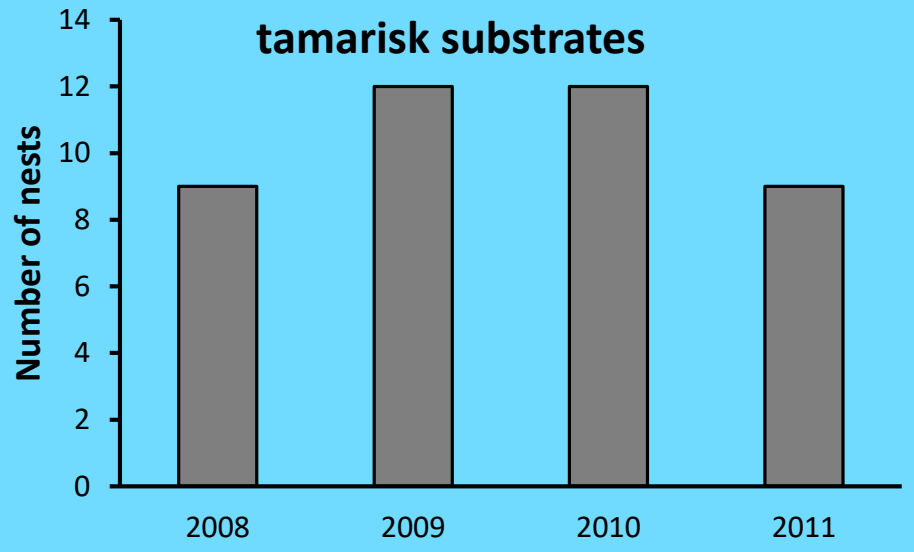
SWFL Nest substrate use shifted between 2008 & 2011

Virgin River, UT: Dobbs et al. 2012

- **2009**
  2 of the 15 (13%) successfully fledged

- **2010**
  6 of the 20 (30%) successfully fledged.





Future Tamarisk Leaf Beetle Monitoring

- **Tamarisk Leaf Beetle Distribution**
- **Genetic Identification**
- **Tamarisk Phenology**
- **Impacts on Avian/Wildlife Communities**
- **Measure Changes to Native Habitat**
- **Microclimate (Temp and RH)**
- **Satellite Imagery (NDVI)**

Acknowledgments

- **Army Corp of Engineers**
- **Tetra Tech**
- **Bosque del Apache NWR**
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