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# Tamarisk Leaf Beetle Species and Habitat Analysis with Management Implications for the Middle Rio Grande, NM

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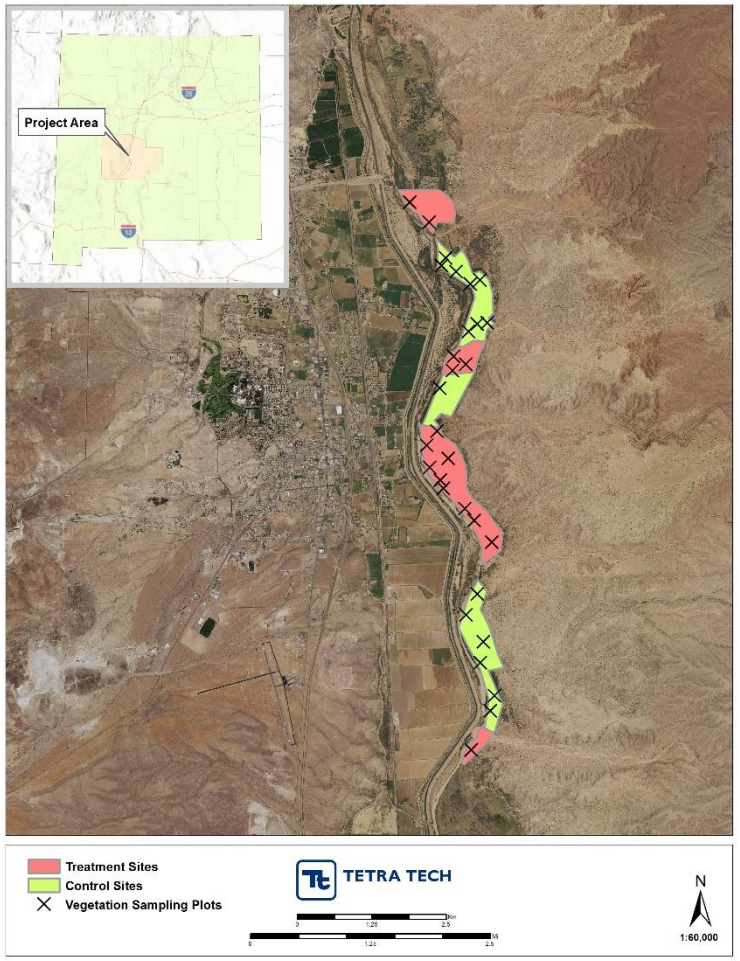
# Introduction

- The Tamarisk Leaf Beetle (TLB) has been documented in the Middle Rio Grande since approximately 2011
- The Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program) has coordinated annual monitoring within the MRG in order to determine distribution, identification of the species, and capture overall habitat changes
- Arrival of TLB in the Socorro Reach:
  - *Diorhabda carinulata*, northern tamarisk beetle, 2015
  - *D. sublineata*, subtropical beetle, 2017
  - *D. elongata*, Mediterranean, 2017

# Study Location and Objectives

- The Study Location was chosen due to the potential significance of convergence of the different species.
- Socorro County and the Save Our Bosque Task Force have been performing fuel reduction efforts in the County due to a number of fires occurring over the past 10-15 years. The study was originally designed to evaluate post-treatment changes to sites that were going to have tamarisk removed.
- Study Objective:
  - Determine effects of bird habitat structure and vegetation community responses at tamarisk dominated sites affected by biological treatment
- While treatments were not implemented, the study:
  - evaluated pre-treatment conditions
  - analyzed TLB affected sites using remote sensing
  - evaluated monitoring criteria in order to meet study objective

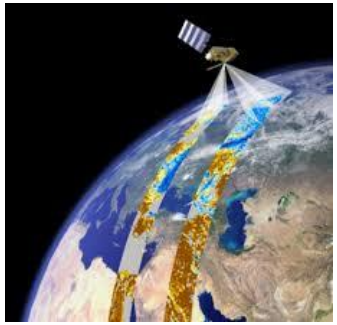


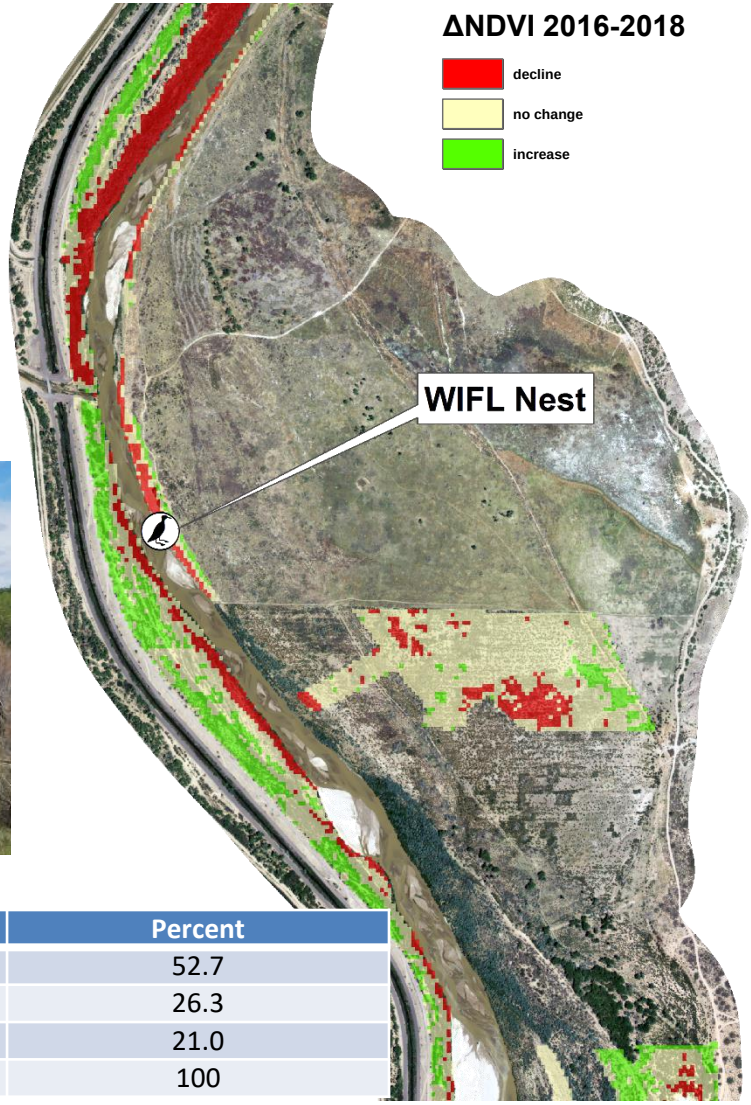
# Southwestern Willow Flycatcher and Yellow-Billed Cuckoo Surveys

- Both Southwestern willow flycatcher (*Empidonax traillii extimus)* (flycatcher) and Yellow-billed cuckoo (*Coccyzus americanus)* (cuckoo) surveys are conducted annually on the Rio Grande by the U.S. Bureau of Reclamation (USBR)
- Portions of the project area outside of the USBR survey area were surveyed as part of the study
- USBR Study Results, 2017 and 2018
  - Migrating flycatcher stopover in the project area in May but did not nest 2017-2018
  - Cuckoo utilize the area for foraging, stopover and have established territories (2017-2018)
- Cuckoos were also detected east of the levee within the study area
- Normalized Difference Vegetation Index (NDVI) is highly correlated with avian species richness, as noted in flycatcher and cuckoo habitat models (USBR Habitat Suitability Models (both species), USGS Open File Report 2016-1120)

# Tamarisk Leaf Beetle Study: Results

- Remote sensing (RS) analysis was used to look at TLB effects change over time analyzing spatial and temporal patterns of the area. dNDVI 2016-2018 values:
- Tamarisk stands: **-5.7% decline**
- Non-tamarisk stands: **3.3% increase**





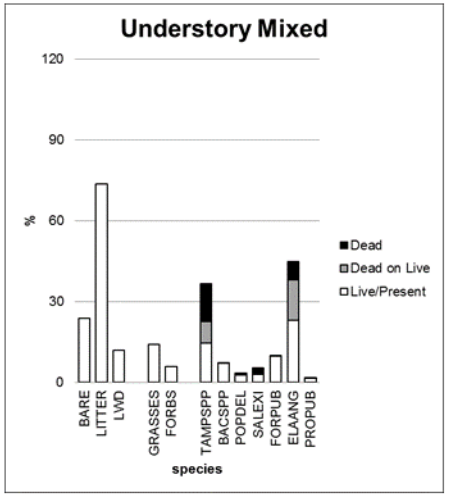

| | Number of Pixels | Acres | Percent |
|---|---|---|---|
| No Change | 53814 | 1,329 | 52.7 |
| Decline | 26821 | 663 | 26.3 |
| Increase | 21550 | 533 | 21.0 |
| Total | 102185 | 2,525 | 100 |

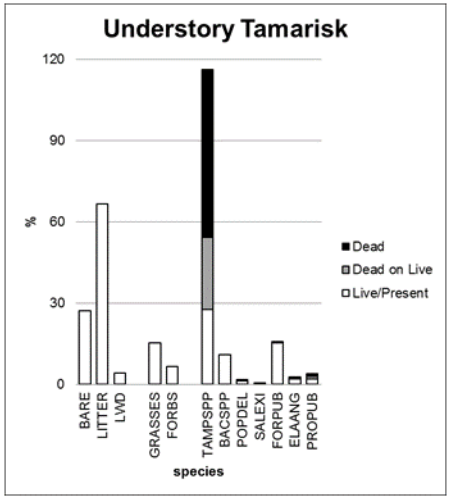
# Vegetation

- Detailed veg mapping in the field/line intercept methodology within a total of 30 representative sites were selected based on dominant canopy types
- Hink and Ohmart (2016) polygon feature class vegetation cover types
- Subsets of the major cover types present were evaluated:
  - Tamarisk dominated sites (>60% tamarisk)
  - Russian olive dominated sites (>60% Russian olive)
  - Mixed stands containing variable proportions of native and non-native vegetation

# Vegetation

- Results yielded information regarding herbaceous, understory and canopy vegetation
  - Higher percentage of dead material in the tamarisk understory
  - Fire behavior tamarisk
- Stand types are also tied to TLB use and the avian breeding habitat conditions



# Bird Monitoring and Response to Tamarisk Leaf Beetles (*Diorhabda spp.*) and Russian Olive/Tamarisk Mechanical Control

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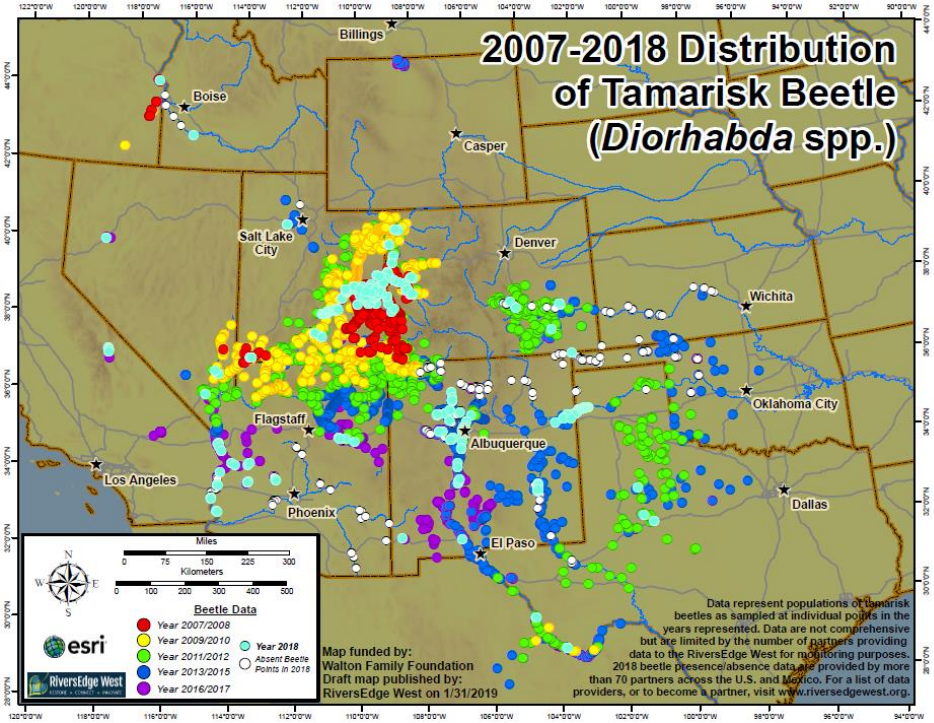
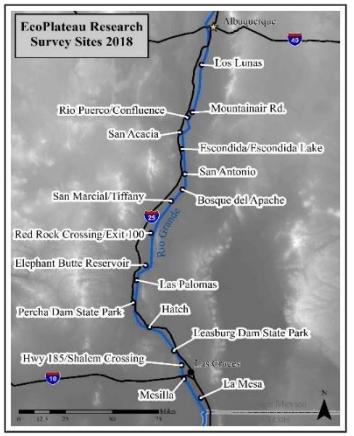
- 2001, TLB limited open releases in Utah and NV
- In 2011, started monitoring TLB presence throughout the Rio Grande New Mexico watershed



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

- Determine Distribution of TLB throughout the Rio Grande, NM watershed
- Track tamarisk defoliation and mortality
- Determine TLB sub-species presence through genetic analysis




Northern

Mediterranean

Subtropical

Larger

# Bird Response to Tamarisk Leaf Beetle Defoliation and Mortality

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# Russian Olive and Tamarisk Mechanical Control

# Rio Grande Avian Surveys

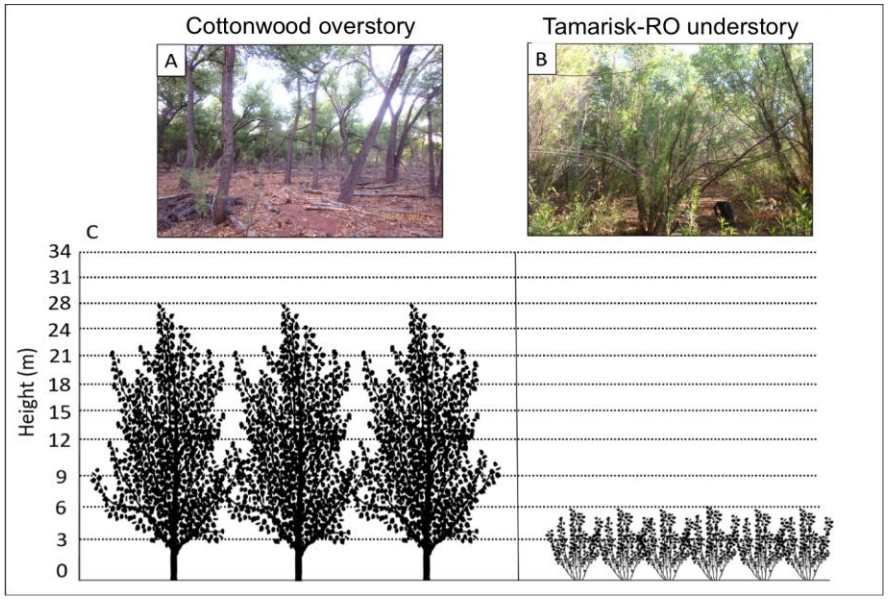
- **Background:**
- >50 percent of landbirds that breed in the US southwest are directly dependent on riparian habitats, (Knopf et al. 1988).
- Invasion by non-native species into ecosystems is the second greatest ecological threat worldwide (Levine et al. 2003).
- Tamarisk, Russian olive and other invasive plants in the southwestern U.S. are identified as threats to migratory bird populations on nearly all federal, state and local conservation and management plans.

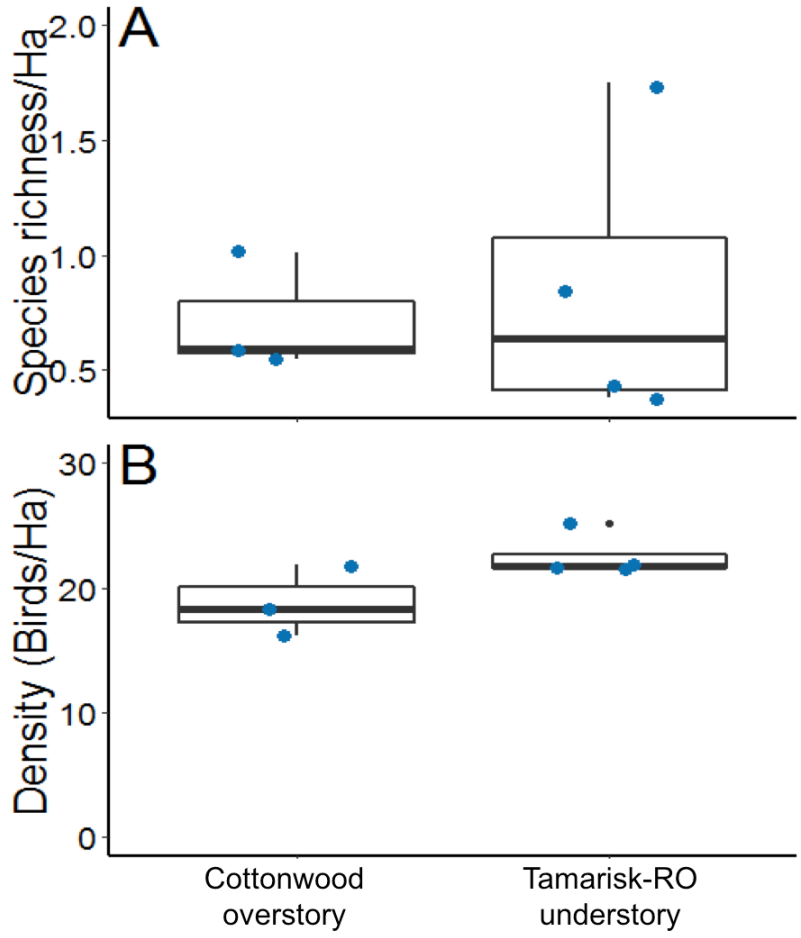
- **Objectives:**
- Bird-habitat relationships, with particular focus on avian responses to tamarisk beetle biocontrol in sites that are dominated by tamarisk and sites with a tamarisk component that are otherwise dominated by native vegetation.
- How birds respond to tamarisk and Russian olive removal treatment sites prior to treatment and after treatment. Treatments sites will also be compared to control sites.

# Avian Survey Methods

- At the Socorro Study sites:
- Fixed-radius point count 150 m apart
- All points were sampled at a minimum of two, and if warranted three times, per season.
- Calculated bird species richness of each site by summing the number of species detected within each site.
- Modeled overall and species-specific bird densities (birds/Ha) using the Distance package, which accounts for differences in detectability between bird species and habitats.
- Vegetation characteristics were quantified by estimating the vegetation structure.
- Vegetation characteristics of the study sites were summarized using two principal components analyses (PCA).

# Avian Survey Results

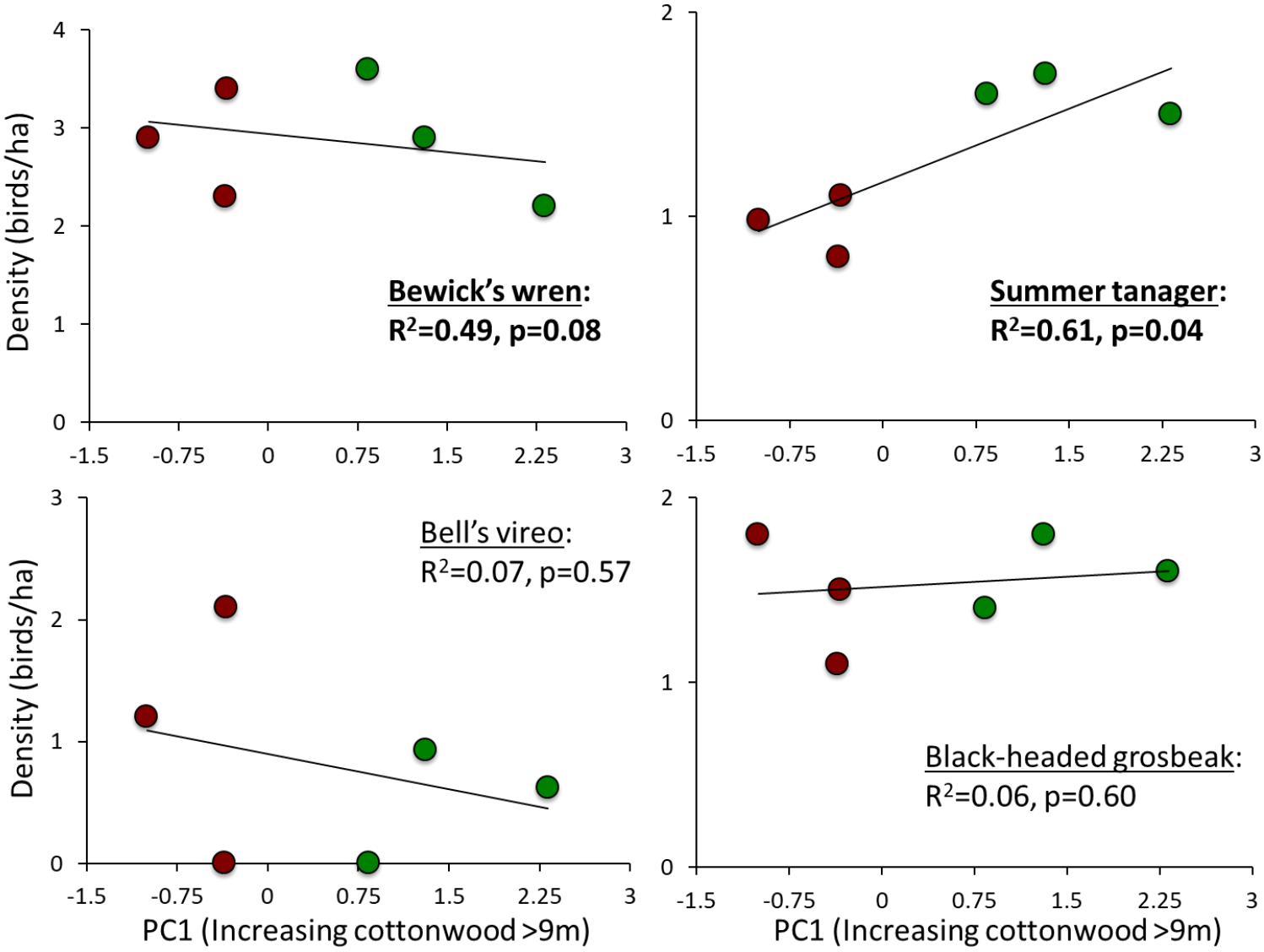



*Species richness/Ha for cottonwood overstory and mixed Tamarisk-Russian olive (RO) understory habitats.*

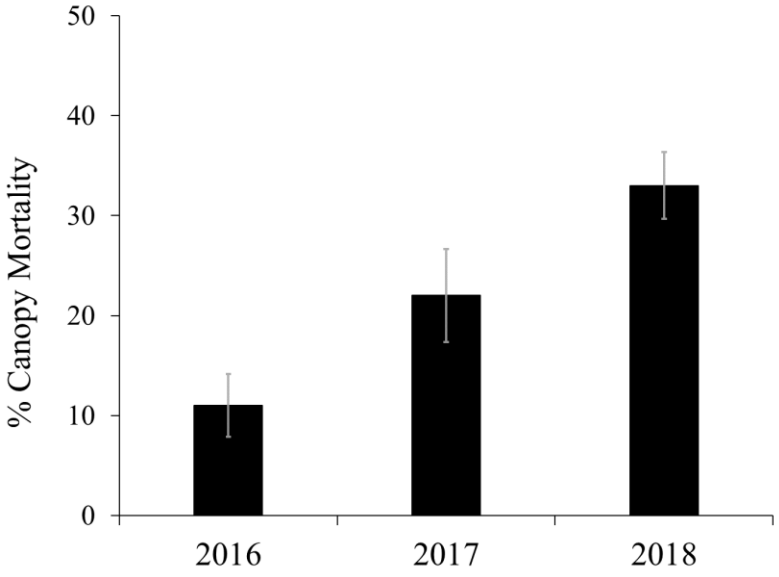
**Density estimates (birds/Ha) for each site for species with >30 detections and overall bird densities which included all birds detected within 100m during point surveys.**

| Habitat type | Cottonwood overstory | | | Mixed tamarisk-Russian olive understory | | | |
|---|---|---|---|---|---|---|---|
| Site | 1 | 2 | 3 | 4 | 5 | 6 | p (R2) |
| Vegetation Structure PC1 | 1.31 | 2.32 | 0.84 | -0.36 | -1 | -0.34 | |
| Ash-throated flycatcher | 0.54 | 0.77 | 0.68 | 0.49 | 0.6 | 1.13 | 0.80 (0.01) |
| Bell's vireo | 0.93 | 0.62 | 0 | 0 | 1.2 | 2.1 | 0.57 (0.07) |
| Bewick's wren | 1.3 | 1.4 | 1.4 | 1.6 | 1.8 | 1.8 | 0.08 (0.49) |
| Brown-headed cowbird | 2.9 | 2.2 | 3.6 | 2.3 | 2.9 | 3.4 | 0.88 (0.005) |
| Black-headed grosbeak | 1.8 | 1.6 | 1.4 | 1.1 | 1.8 | 1.5 | 0.60 (0.06) |
| Common yellowthroat | 0 | 0.5 | 0.78 | 0.2 | 1.6 | 2.1 | 0.17 (0.34) |
| Gambel's quail | 0.74 | 1.6 | 3.2 | 2.1 | 3.7 | 4 | 0.20 (0.3) |
| Lucy's warbler | 1.5 | 2.7 | 2.5 | 3.8 | 2.3 | 3.5 | 0.42 (0.13) |
| Mourning dove | 0.32 | 1.1 | 0.7 | 1.1 | 0.9 | 0.76 | 0.65 (0.04) |
| Spotted towhee | 2.2 | 1.8 | 2.8 | 1.6 | 2.5 | 1.9 | 0.005 (0.89) |
| Summer tanager | 1.7 | 1.5 | 1.6 | 0.8 | 0.98 | 1.1 | (0.04) 0.61 |
| White-winged dove | 0.4 | 0.65 | 0.98 | 0.91 | 0.42 | 0.3 | 0.75 (0.02) |
| Yellow-breasted chat | 2.8 | 2.7 | 2.7 | 2.2 | 3.7 | 5 | 0.29 (0.22) |
| Overall | 16.1 | 18.3 | 21.8 | 21.6 | 21.5 | 21.9 | 0.12 (0.41) |
| Species Richness/Ha | 0.55 | 0.59 | 1.01 | 0.85 | 0.38 | 0.42 | 0.94 (0.26) |


Density (birds/ha)
Bewick's wren:
R2=0.49, p=0.08
Summer tanager:
R2=0.61, p=0.04
Bell's vireo:
R2=0.07, p=0.57
Black-headed grosbeak:
R2=0.06, p=0.60
PC1 (Increasing cottonwood >9m)
PC1 (Increasing cottonwood >9m)

# Tamarisk Branch Mortality

- At the Socorro Study Sites:
- Habitat changes were evaluated by looking at vegetation:
  - Phenology (defoliation and mortality)
  - Composition
  - Structure
    - Focused on canopy (as a complement to transects)




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

# Tamarisk Habitat Restoration and Enhancement

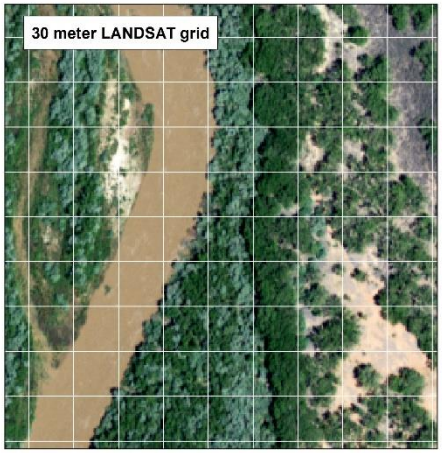
- Tamarisk shrubs valuable when mixed with native vegetation
- Reduce tamarisk density by 60-70 %
  - Prioritize tamarisk trees for removal
  - Leaving tamarisk shrubs in understory
- Replant thinned areas with mix of native species that provide understory structure
  - e.g., Goodding's willow, seep-willow

# Russian Olive Habitat Restoration and Enhancement

- Total vegetation cover exhibits greater influence on bird communities than vegetation composition in riparian habitats profoundly impacted by Russian olive (Fisher et al. 2012).
- Riparian bird communities tend to suffer as vegetation cover exceeds 60-70% (Fisher et al 2012, Mahoney et al. 2018).
- It is still unclear whether restoration efforts would improve avian habitat in areas domination by Russian olive


# Monitoring Recommendations

- Critical components
  - Annual TLB monitoring at subset of sites
  - Avian surveys including flycatcher and cuckoo
  - Vegetation - canopy cover; total cover; microclimate, etc
- Continued analysis using RS to look at landscape and plot level
  - Sentinel-2 temporal/spatial resolution
  - Plot level analysis/time series
  - Combination
- Monitoring efforts should focus on bird use of habitat types related to management efforts such as biocontrol and restoration efforts in the short term (<10 years) and long term (10-20 years)

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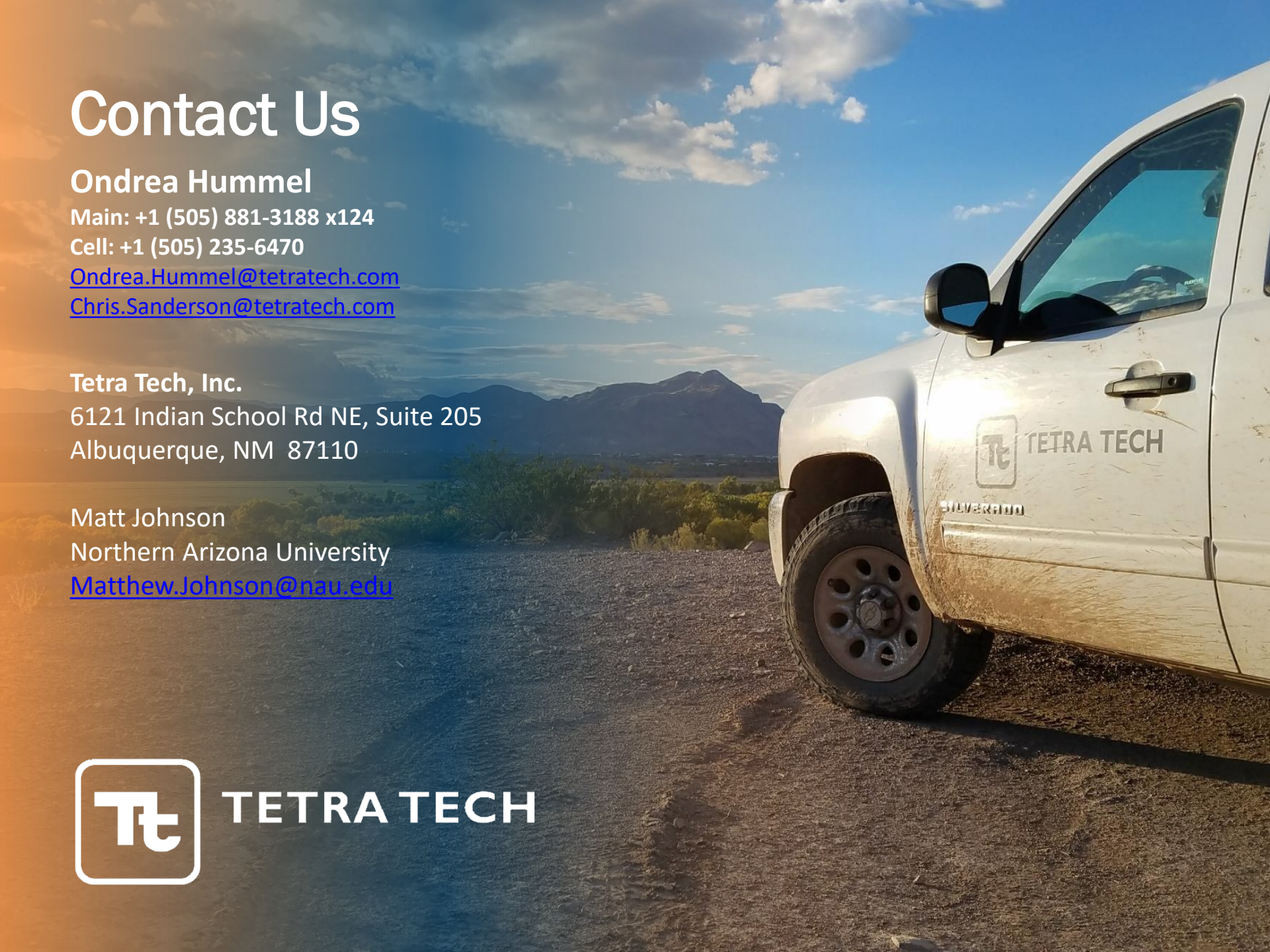


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