# The Influence of Tamarisk Beetle Defoliation (and habitat restoration) on Birds along the Dolores River in SW Colorado

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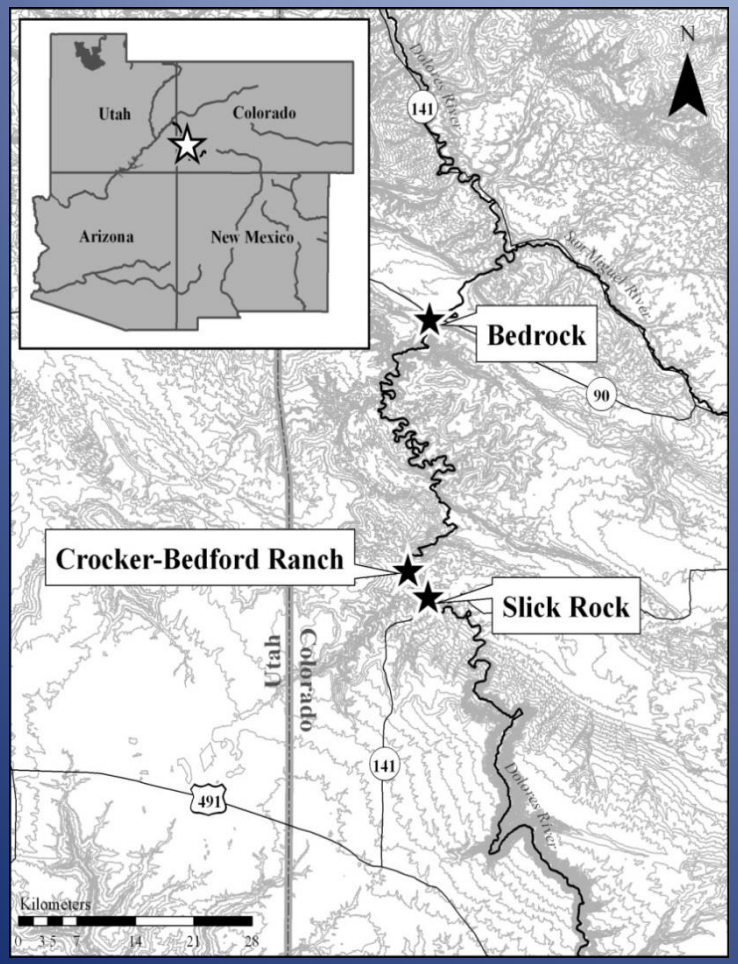
# OUTLINE OF PRESENTATION

INTRODUCTION (*that provides a short background on the study location and our methodologies used from 2009-2016*)

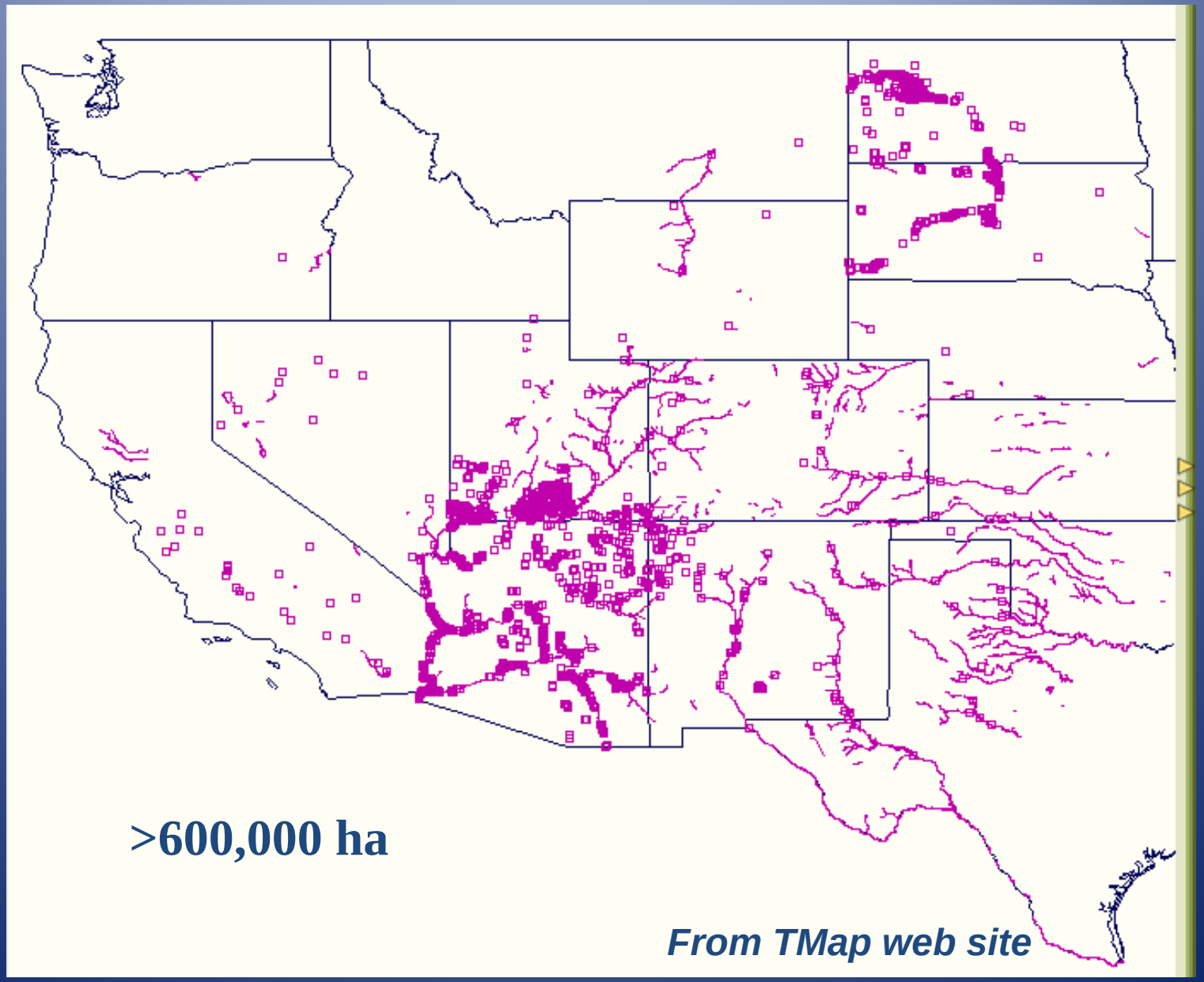
1) Where do birds prefer to forage in Dolores River riparian habitats? (*in relation to availability of plant species*), and what arthropod prey are available to birds? (*what insect orders, where, and how many*)
2) Are tamarisk beetles palatable to birds, and what do birds eat on the Dolores (*in proportion to insect availability*)?
3) Following tamarisk removal, how do birds respond to this habitat alteration?

SUMMARY *(with potential consequences of future riparian restoration)*

# The Study Area

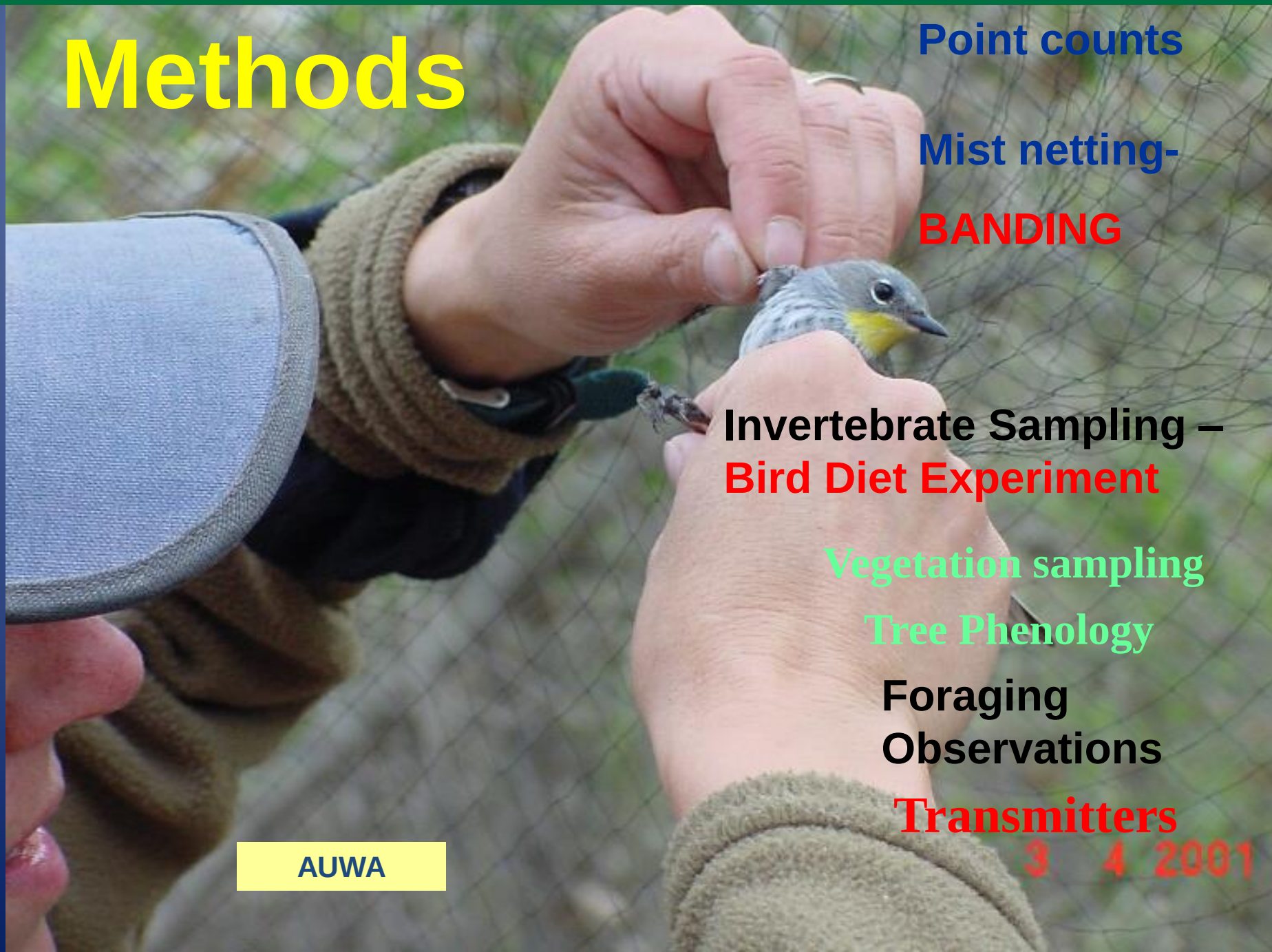



# Overview of Current Tamarisk Distribution



# During our study, beetles reached extraordinarily high numbers, completely denuding tamarisk stands in SW Colorado

Jamison, Bean, Johnson, van Riper - 2018. SW Ent 43:571-584.


Methods
Point counts
Mist netting-
BANDING
Invertebrate Sampling –
Bird Diet Experiment
Vegetation sampling
Tree Phenology
Foraging
Observations
Transmitters
AUWA
3 4 2001

# Arthropod availability


- Sample = 25 vertical sweeps/ plant species
- Identified insects to order, then to morphologically distinct taxa
- Estimated biomass
- Created 10 general arthropod categories
- Calculated percent contribution of arthropod categories by both abundance and biomass

# Avian foraging habitat preference

- Captured birds with mist nets and attached transmitters to observe foraging behavior
  - In what plant species
- Calculated percent use of plant species for 14 bird families
- Compared use with availability of plant species

Cowan, Phillip. *Wilson's Warbler*. 2011. http://www.flickr.com. May 2013.

# Questions Addressed

1) **Where do birds prefer to forage (*in relation to availability of plant species*) and what arthropod prey are available to birds?**

2) Are tamarisk beetles palatable to birds and what do birds prefer to eat?

3) Following tamarisk removal, how do birds respond to this habitat alteration?

# Six most common Birds *(n=29 Species)*

Yellow-breasted Chat (YBCH)

Yellow Warbler (YEWA)

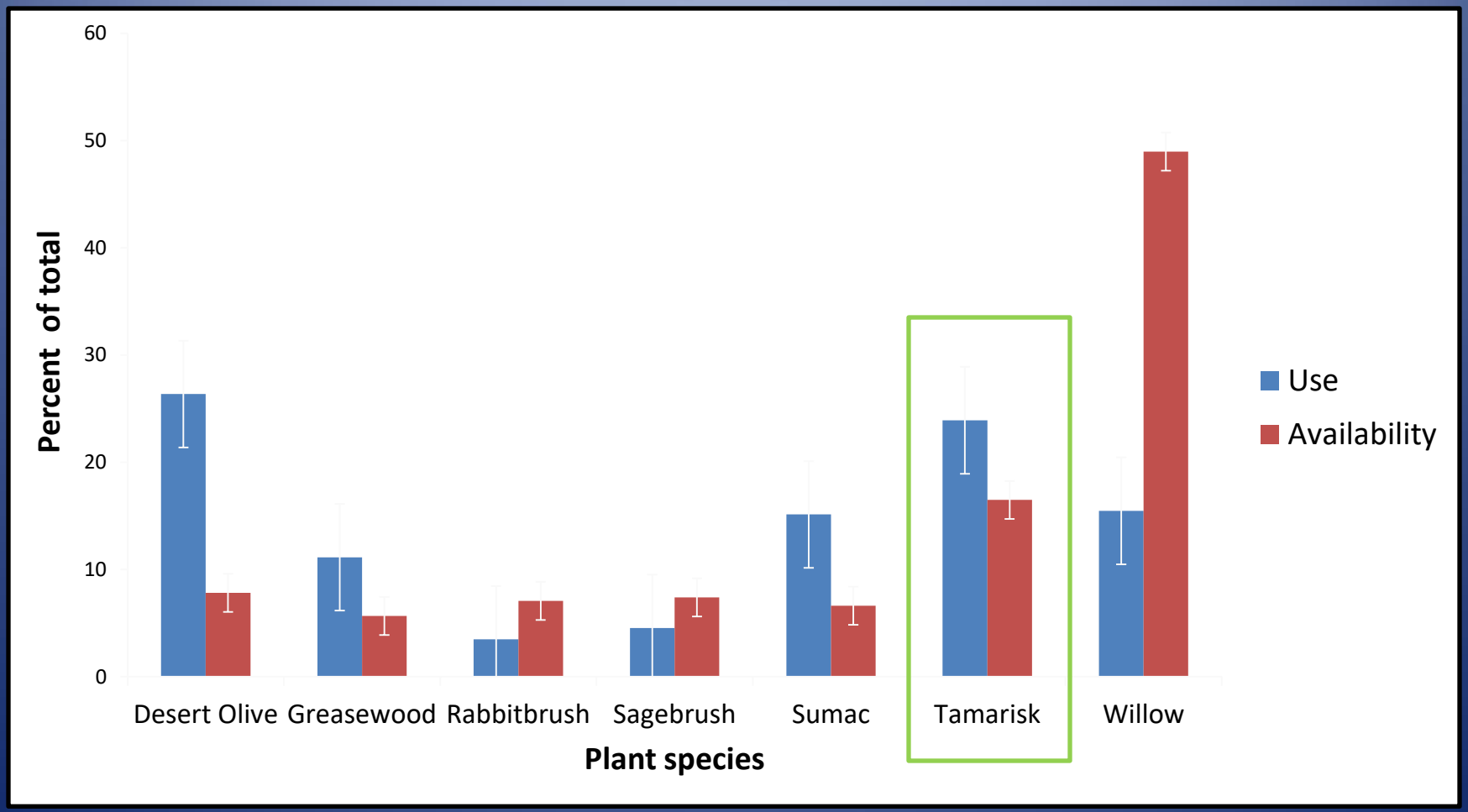
Song Sparrow (SOSP)

Lazuli Bunting (LABU)

Common Yellowthroat (COYE)

Blue Grosbeak (BLGR)

# Bird Selection of Foraging Habitat

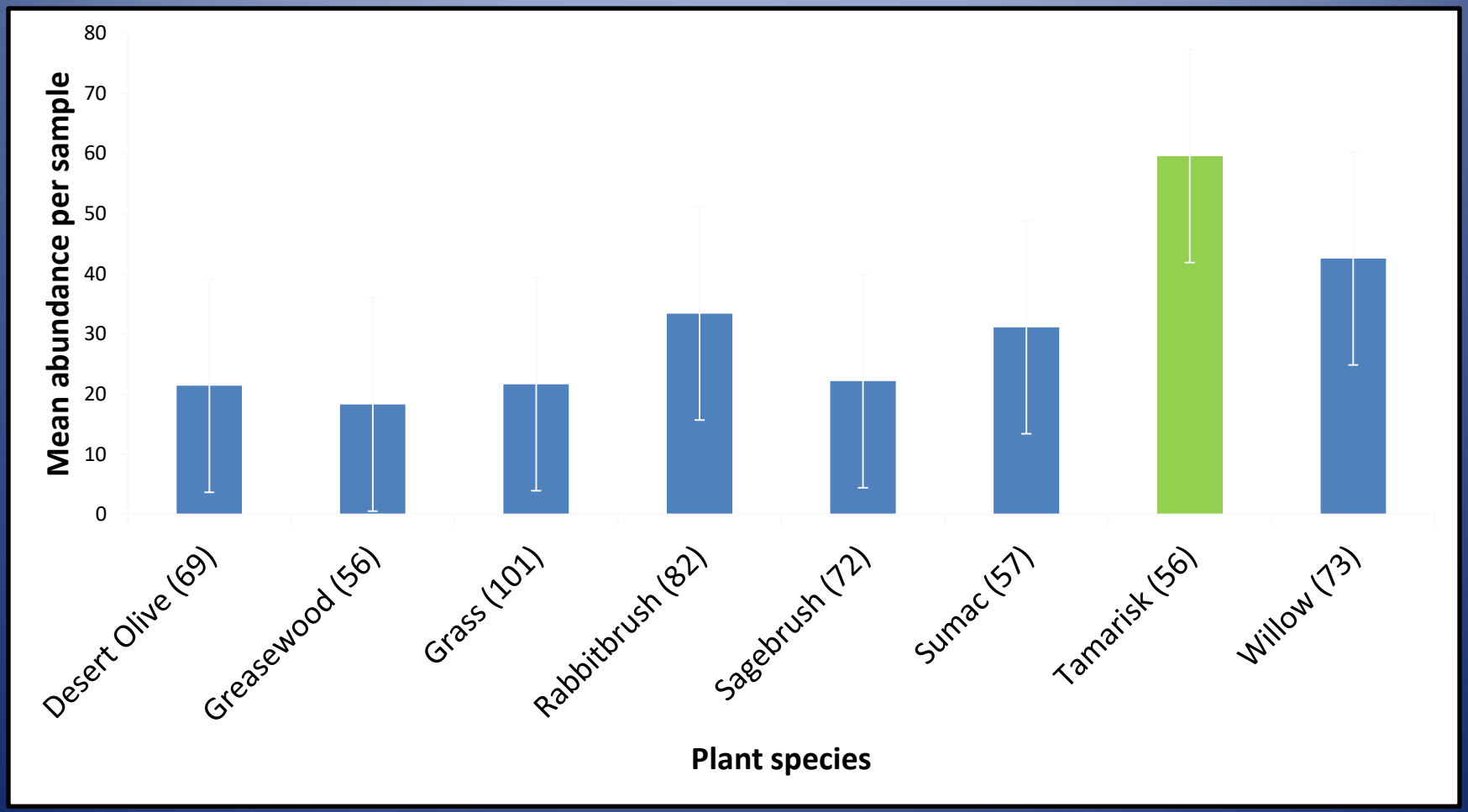


# Bird Foraging Observations (n=916)

| | Tamarisk | Desert Olive | Greasewood | Willow | Sumac | Rabbit Brush | Big Sagebrush |
|---|---|---|---|---|---|---|---|
| Gray Vireo | 7 | 0 | 8 | 17 | 0 | 0 | 2 |
| Warbling Vireo | 0 | 0 | 0 | 3 | 0 | 0 | 0 |
| Blue-gray Gnatcatcher | 229 | 35 | 112 | 33 | 24 | 46 | 35 |
| Orange-crowned Warbler | 0 | 4 | 0 | 5 | 0 | 0 | 0 |
| Virginia's Warbler | 5 | 1 | 0 | 0 | 0 | 0 | 0 |
| Common Yellowthroat | 1 | 0 | 0 | 21 | 0 | 0 | 0 |
| Yellow Warbler | 48 | 29 | 2 | 31 | 11 | 0 | 0 |
| Black-throated Gray Warbler | 22 | 85 | 13 | 4 | 15 | 2 | 2 |
| Yellow-breasted Chat | 40 | 24 | 1 | 11 | 22 | 1 | 2 |
| | | | | | | | |
| Total | 345 | 178 | 128 | 105 | 72 | 49 | 39 |
| Total % | 37.7 | 19.4 | 14.0 | 11.5 | 7.9 | 5.3 | 4.3 |

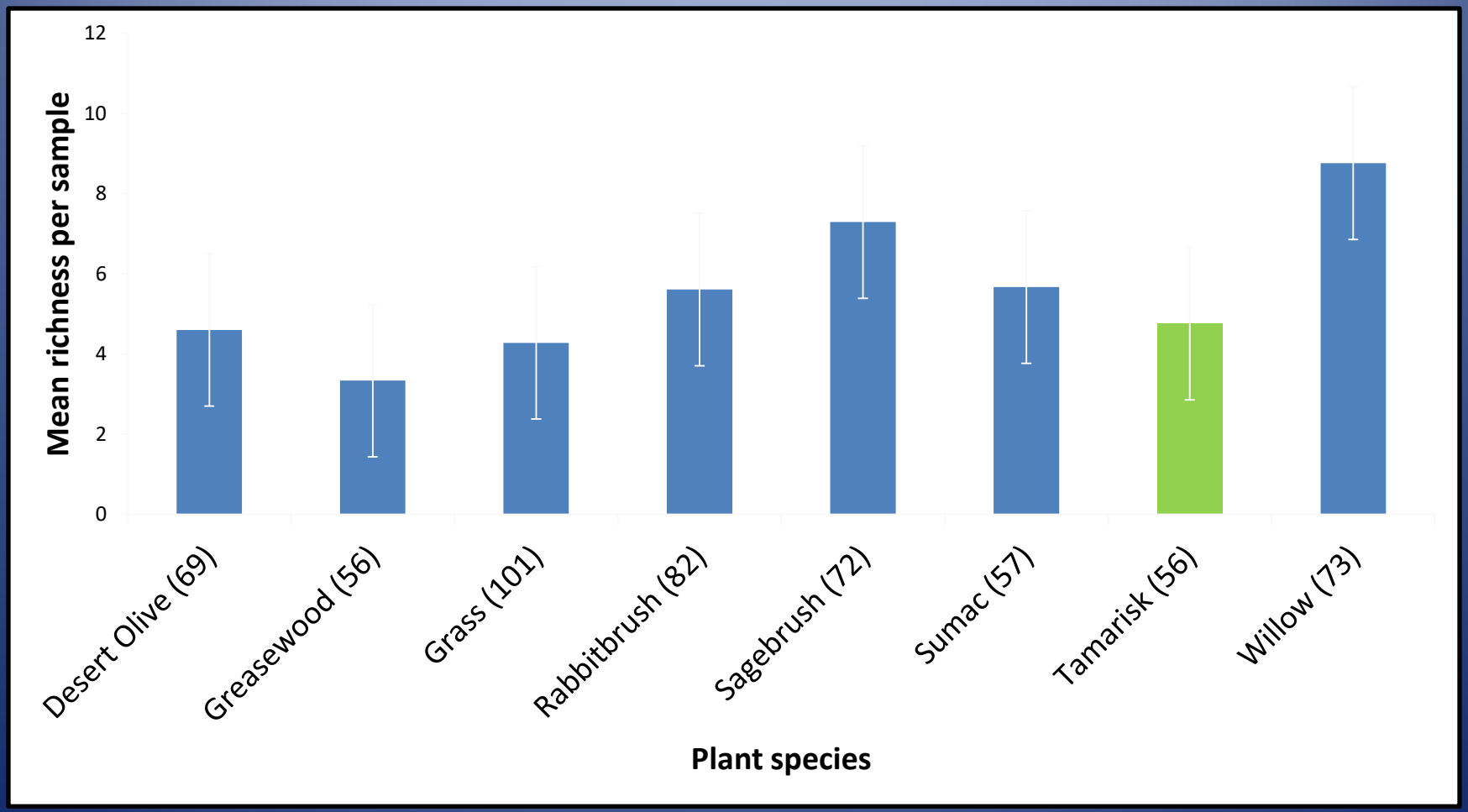
# Arthropods by plant species

## Abundance



# Arthropods by plant species

## Morphospecies richness




*Puckett & van Riper. 2014. USGS OFR: No 2014-1100*

# Presentation Outline

1) Where do birds prefer to forage (in relation to availability of plant species) and what arthropod prey are available to birds?

2) **Are tamarisk beetles palatable to birds and what do birds prefer to eat?**

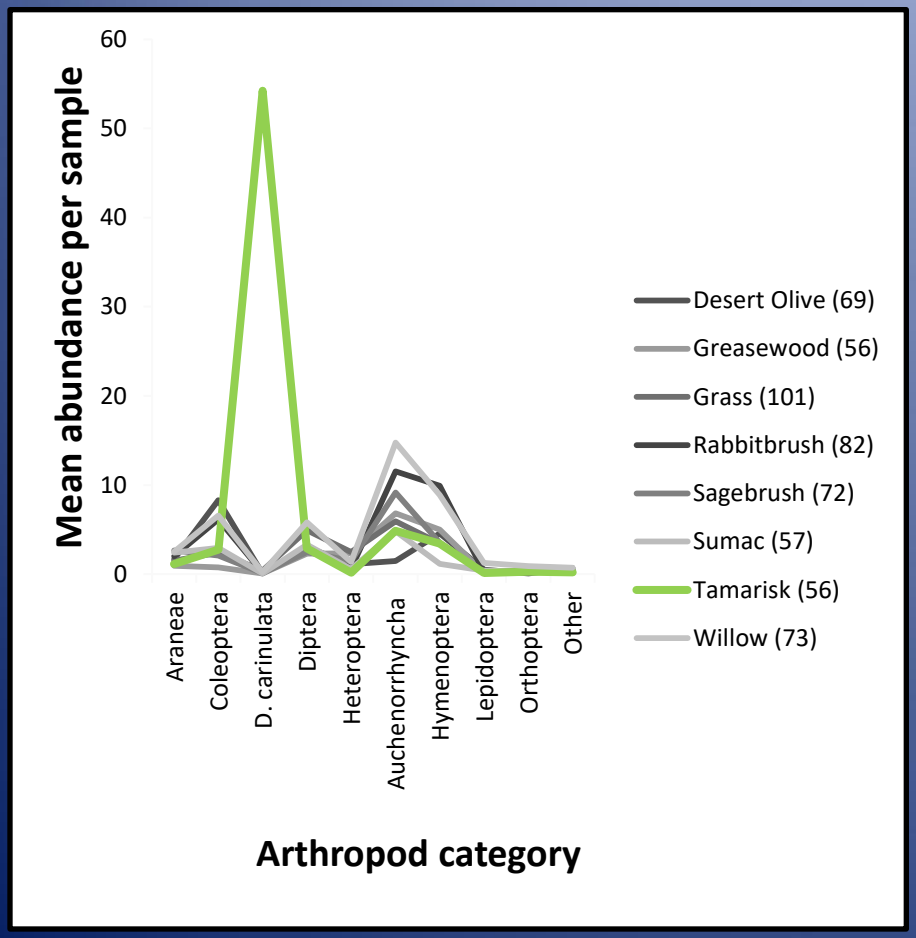
3) Following tamarisk removal, how do birds respond to this habitat alteration?

# Palatability of tamarisk beetles

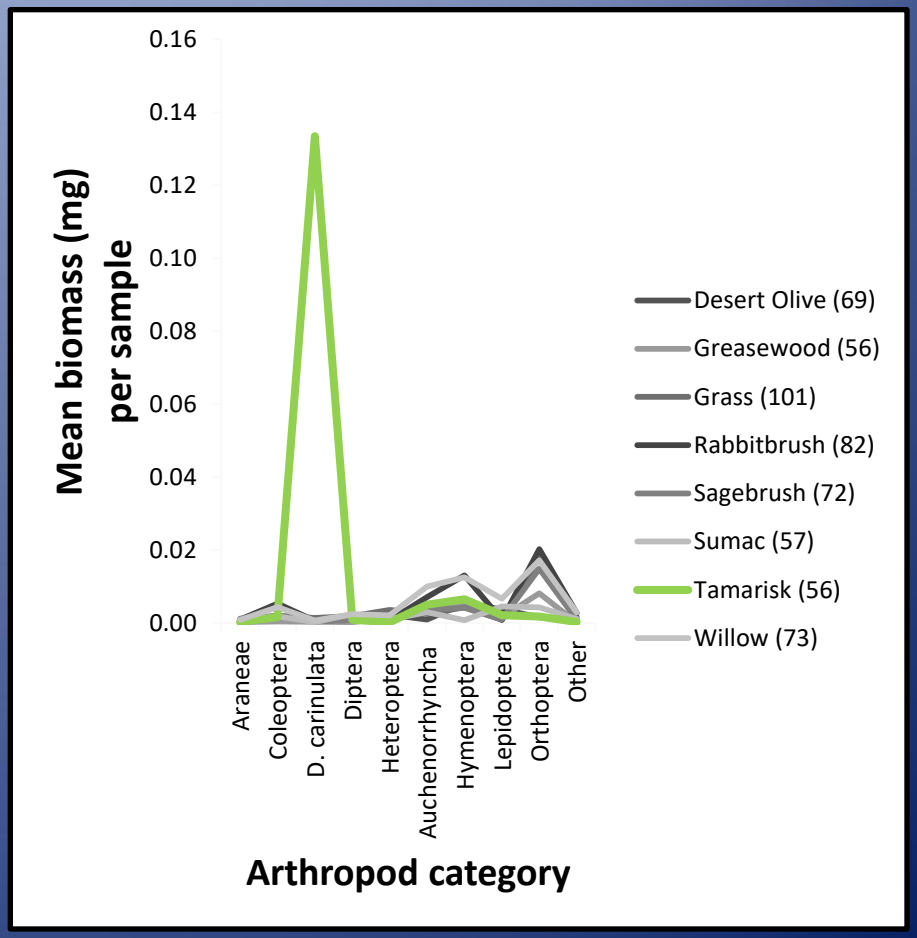
- Palatability often predictable on the basis of:
  - coloration
  - behavior
  - presence of potential defensive compounds in host plants
- *Tamarix gallica*
  - tannnins (~50%)
  - germacrene D (~8%)
  - benzyl benzoate (~4%)

# Arthropod categories

## Abundance

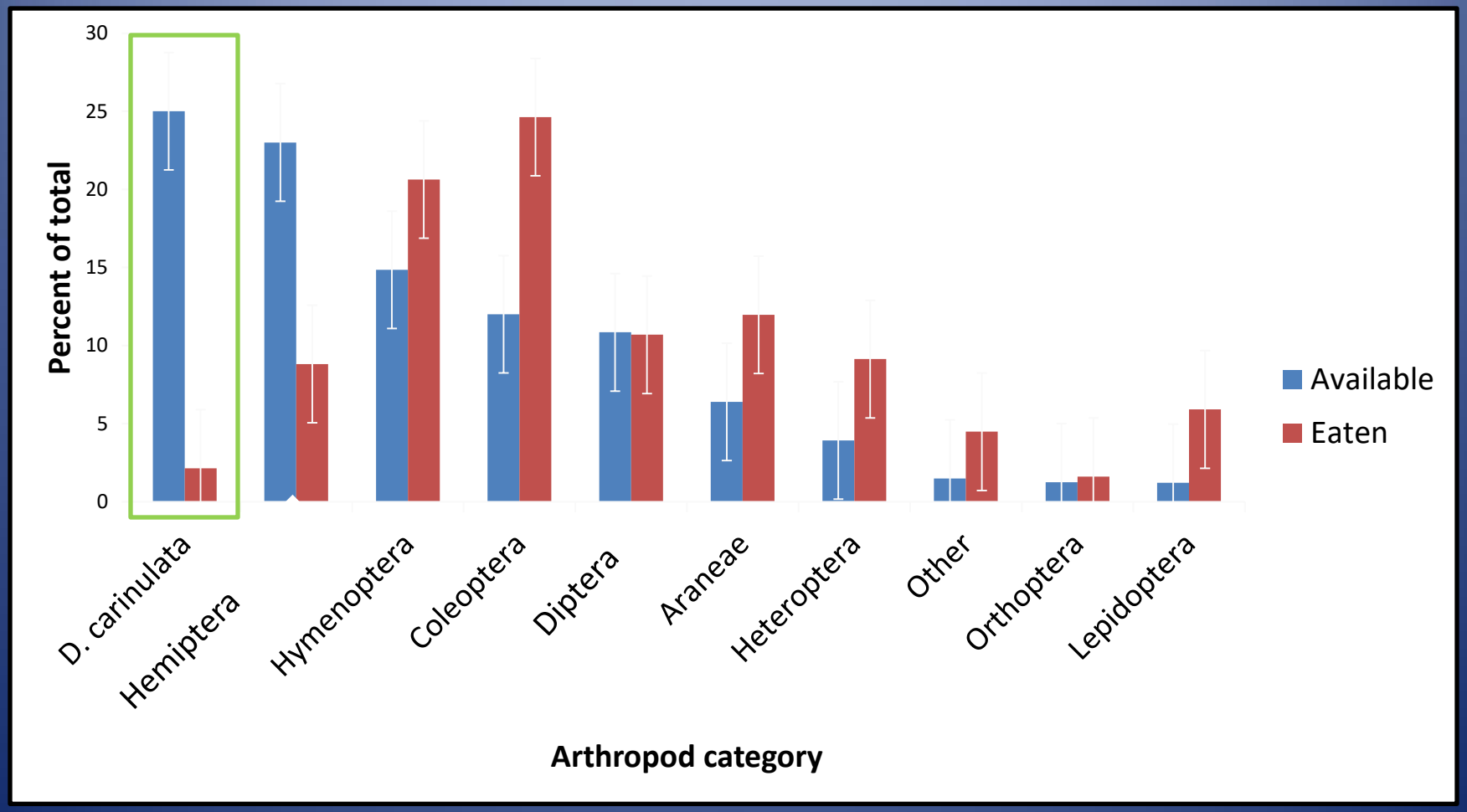



## Biomass (mg)



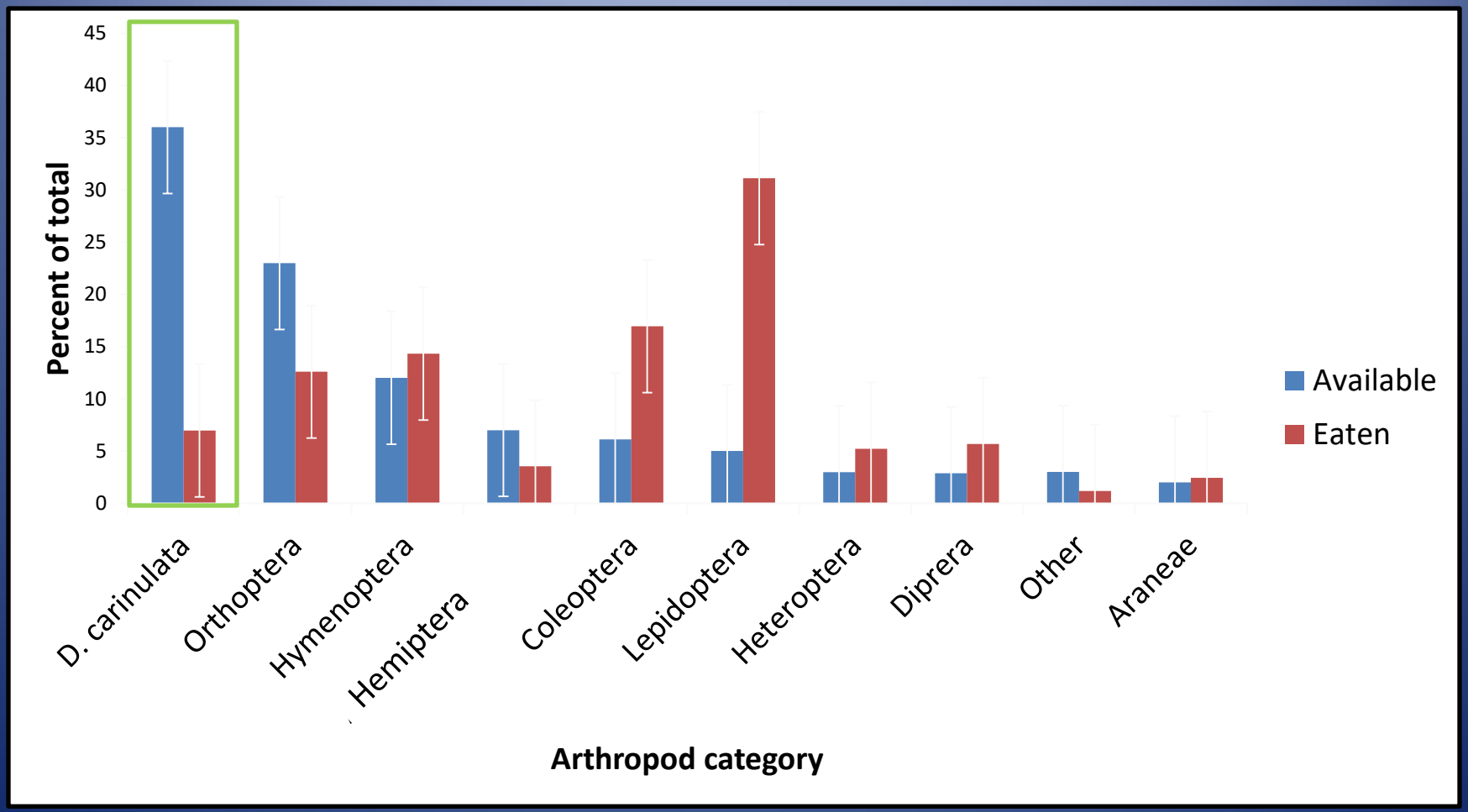
# Selection of arthropod prey (n=126)

## Abundance



# Selection of arthropod prey

## Biomass (mg)




*Van Riper, Puckett, Darrah. 2018. Biol.Invasions 20:3145-3159*

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1) Where do birds prefer to forage (in relation to availability of plant species) and what arthropod prey are available to birds?

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# Tamarisk Removal – Fall 2011

May 2009

September 2011

# Changes in Tamarisk Cover 2009-14

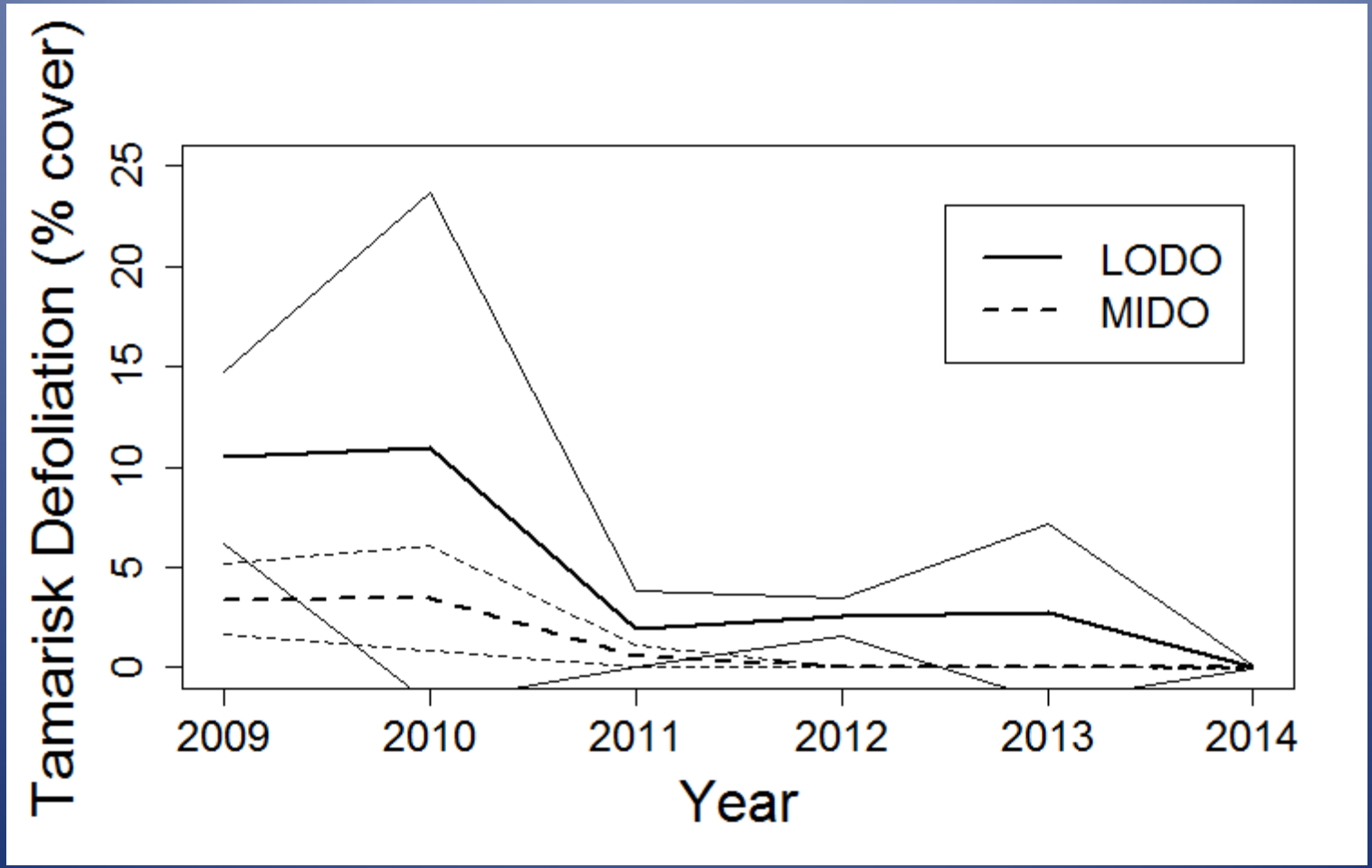
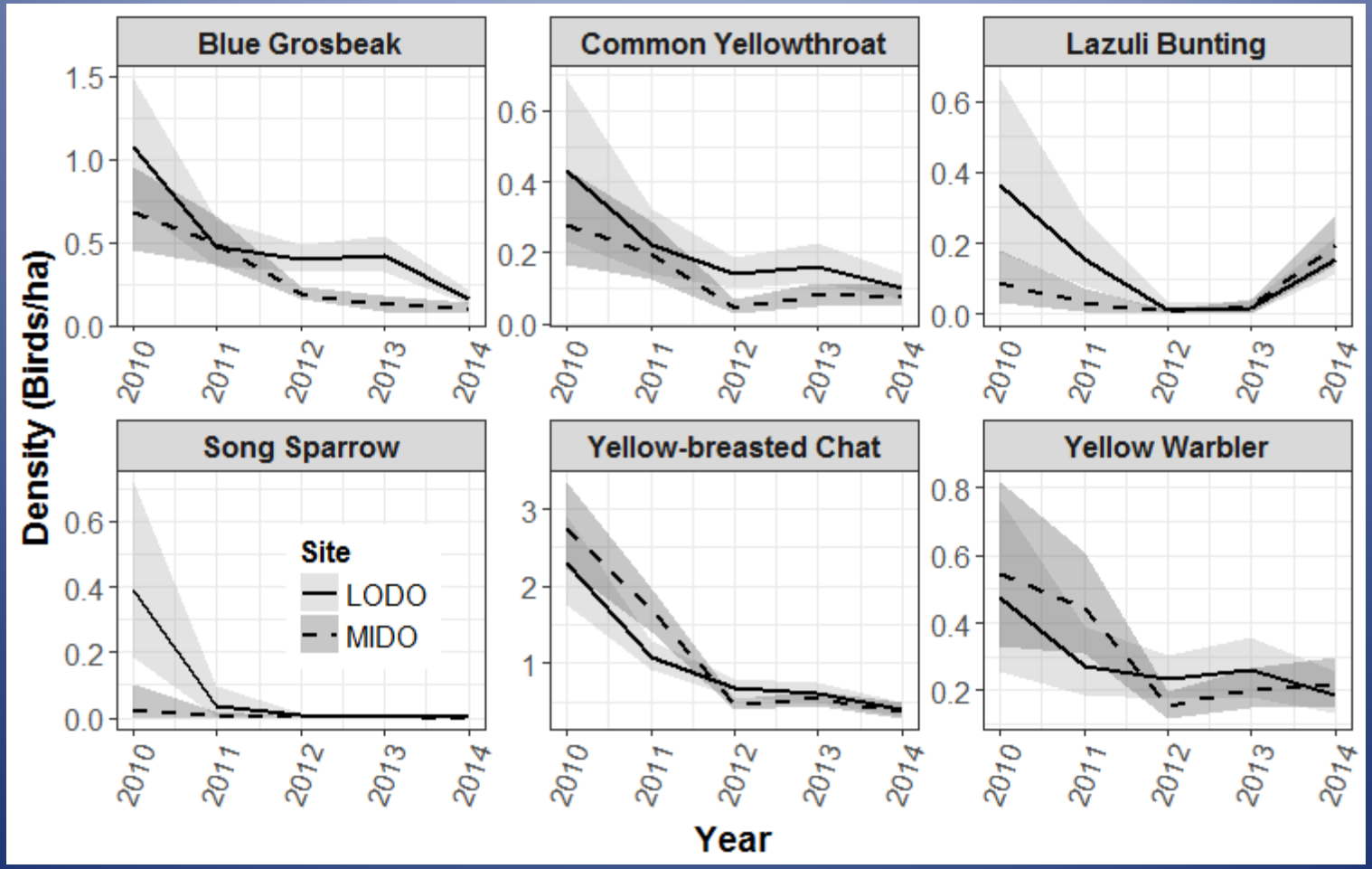


**Table 1**. Mean (±SE) stem densities (# per hectare) per year of nine woody plant species at two sites (Middle Dolores [MIDO] and Lower Dolores [LODO]) along the Dolores River in southwestern Colorado.

| Site / Year | Willow | Tamarisk | Desert Olive | Rabbitbrush | Sumac | Greasewood | Big Sage |
|---|---|---|---|---|---|---|---|
| | Salix gooddingii | Tamarix spp. | Forestiera neomexicana | Ericameria spp. | Rhus trilobata | Sarcobatus spp. | Artemisia tridentata |
| MIDO | | | | | | | |
| 2010 | 105.9 (17.5) | 19.9 (15.1) | 27.8 (8.7) | 18 (4.4) | 20.3 (7.9) | 3 (1.5) | 16.5 (7.8) |
| 2011 | 84.6 (7.9) | 7.5 (5.4) | 17.6 (6.9) | 17.5 (5.2) | 18.5 (7.5) | 3.7 (3.0) | 14.9 (5.1) |
| 2012 | 62.3 (29.7) | 0 | 14.6 (6.8) | 5.1 (3.0) | 16.8 (6.1) | 4.7 (4.0) | 7.7 (3.3) |
| 2013 | 67.3 (27.5) | 0 | 10.2 (5.1) | 5.9 (2.8) | 9.0 (3.9) | 0.2 (0.2) | 1.8 (0.8) |
| 2014 | 56.8 (28.3) | 0.7 (0.6) | 15.5 (7.5) | 8.1 (3.1) | 17.8 (4.5) | 2.3 (2.3) | 7.6 (5.3) |

# Changes in Bird Numbers




*Darrah & van Riper 2018. Biol Invasions 20:709-720*

# Conclusions

- Birds did frequently forage in tamarisk. Forming 18% of all available plant substrate, tamarisk was selected 25% of the time by birds.

- When Tamarisk leaf beetles were super-abundant in our Dolores study areas, they constituted over 60% of all arthropod numbers and biomass, but beetles comprised only a small percentage (2%) of the diets of birds and provided less than 5% of total insect biomass.

- When tamarisk (leaves/plants) are removed from a landscape, the majority of bird species greatly decline in numbers.

# Future Considerations

1. Tamarisk provides an important vegetation component for birds in a riparian ecosystem.
2. If tamarisk is removed, revegetation with similar stature plant species will be necessary to maintain/improve avian population levels.
3. It is important to monitor changes in the vegetation composition and insect prey abundance across the ecosystem, to properly assess restoration influences on birds.


THANK
YOU

# TAMARISK HABITAT IS…

**Often considered "low quality", "poor", "inferior", "suboptimal" for birds and other wildlife**

- **It has thus been hypothesized that this lower habitat quality is a result limited food resources**
- **Reduced migrant & breeding birds**
- **Poor bird survivorship and reproductive success**

Three life-stages of the tamarisk leaf beetle (*Diorhabda carinulata*).
*A*-First instar larva; *b*-Third instar larvae; c-Adult beetles
– all possible bird food resources