Functional shifts in ecological drivers in grassland ecosystems

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Ecological drivers

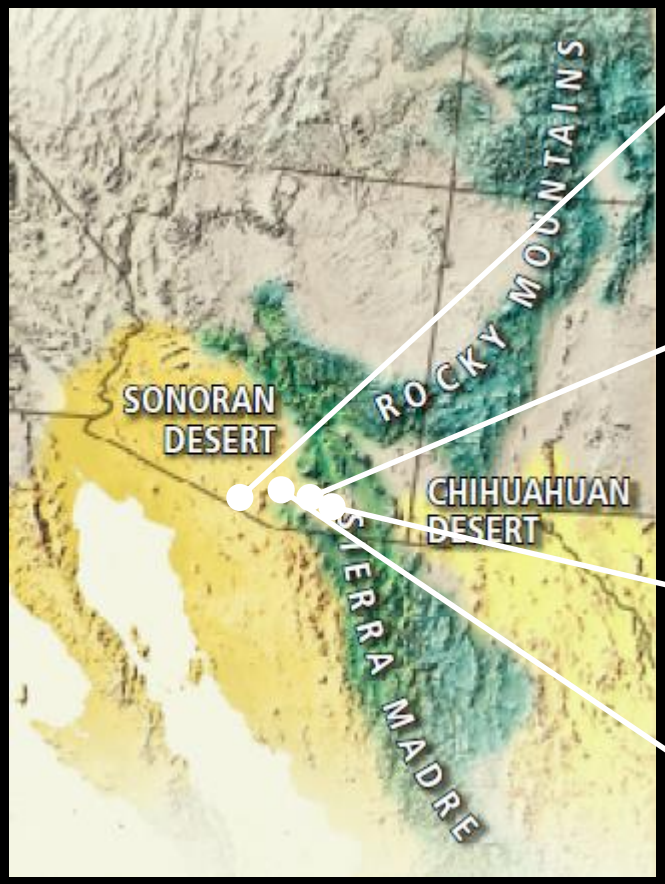
Invasions by nonnative plants

Changes due to other processes

Objectives

- Describe changes in plant communities in response to invasions by nonnative plants
- Describe responses of animals to changes in the plant community
- Summarize effectiveness of restoring ecological drivers in these altered ecosystems

Study areas: high species richness



Buenos Aires National Wildlife Refuge

Las Cienegas National Conservation Area

Fort Huachuca Military Reservation

Saguaro National Park

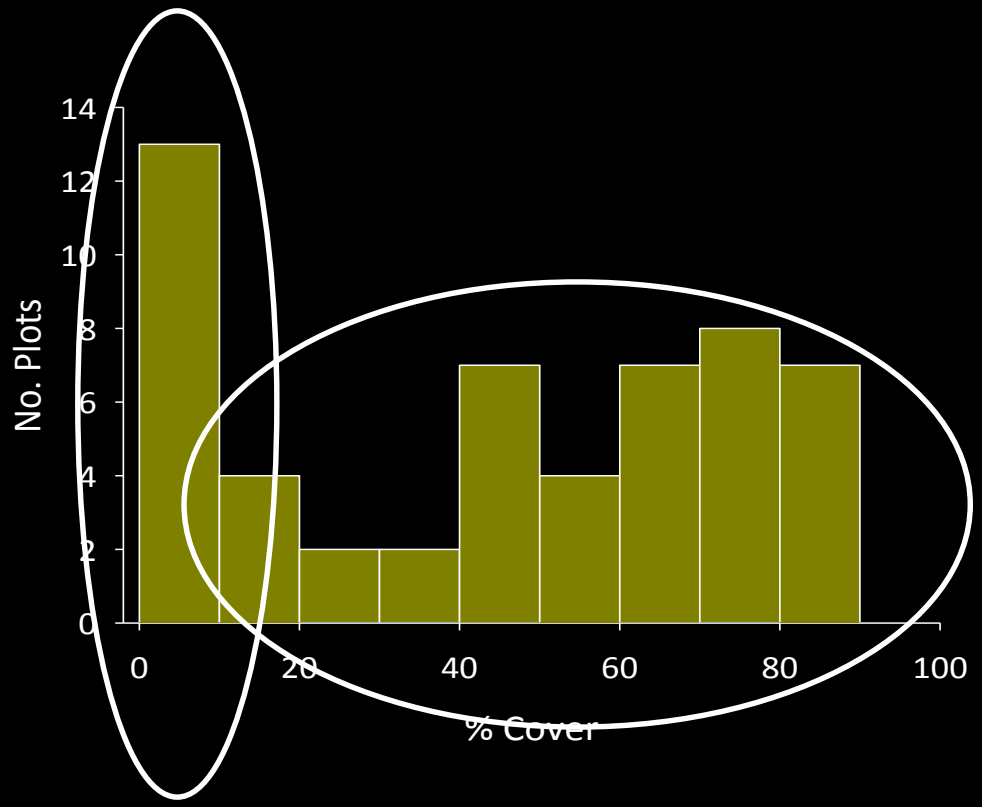
Target taxa

- Plants
- Insects
- Reptiles
- Songbirds
- Small mammals

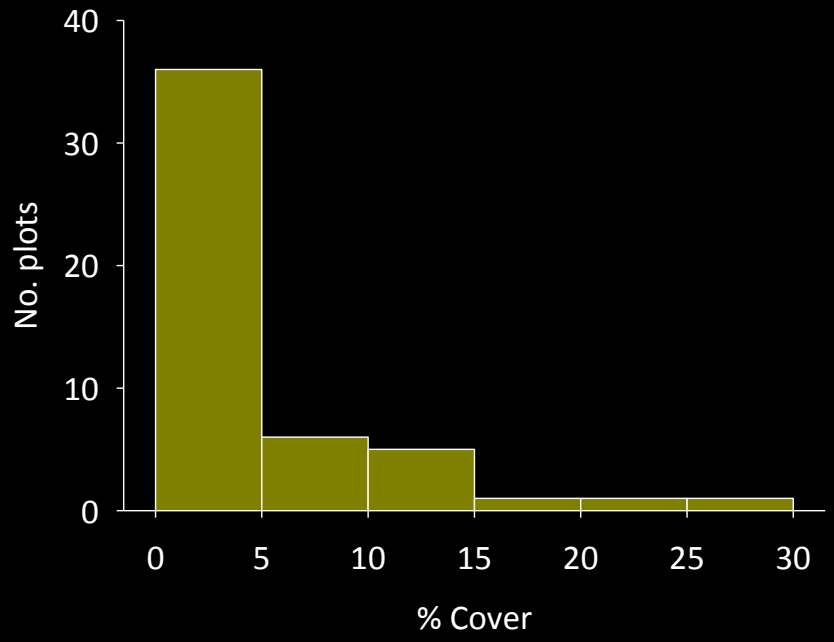
Design theme

- Establish plots along an invasion gradient
- Plot sizes varied from 1-10 ha

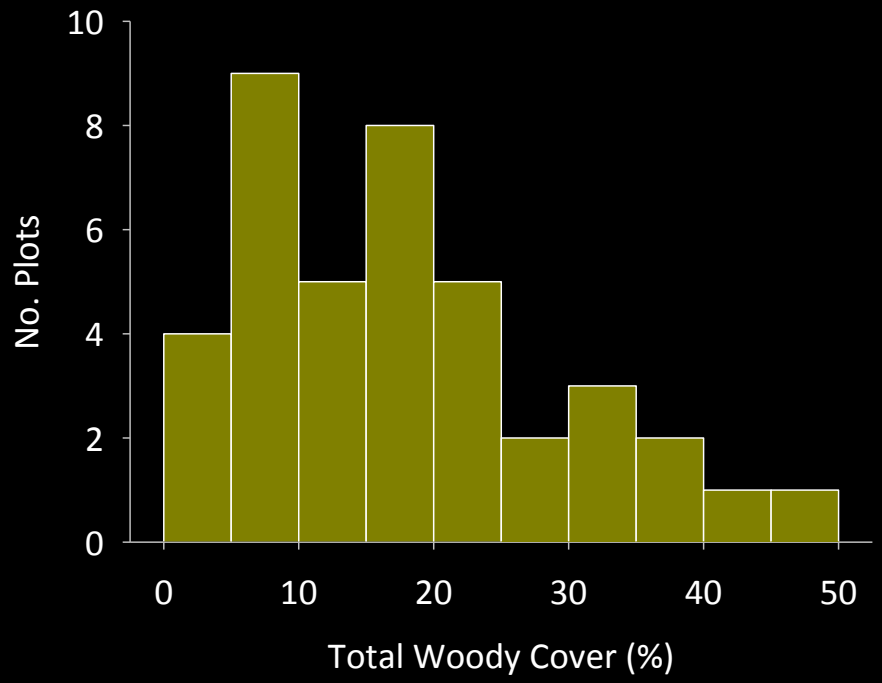
Lehmann lovegrass



Buffelgrass



Velvet mesquite



Plant sampling

- Non-woody: foliar cover and biomass
- Woody plants: density
- 257 species

Insect sampling

- Pitfall-trap arrays
- 94,209 individuals
- 698 morphospecies
- 13 orders, 91 families

Reptile sampling

- Line transects
- 180 individuals

Small mammal sampling

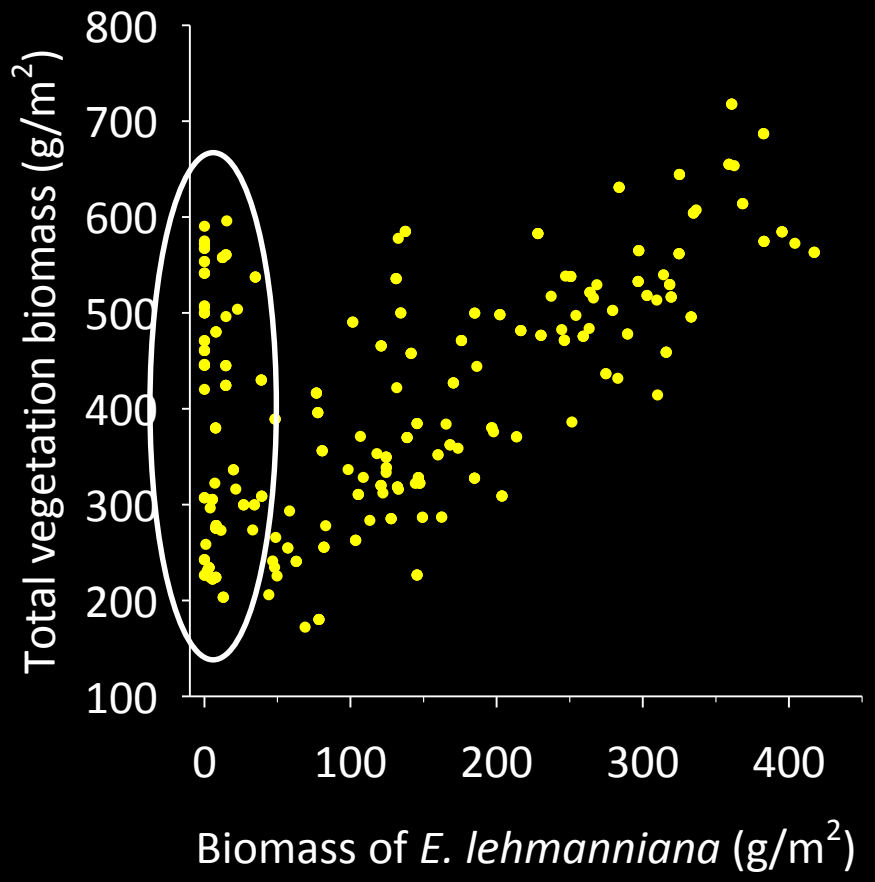
- Live-capture arrays
- 155,000 trap nights
- >10,000 individuals
- 24 species

Bird sampling

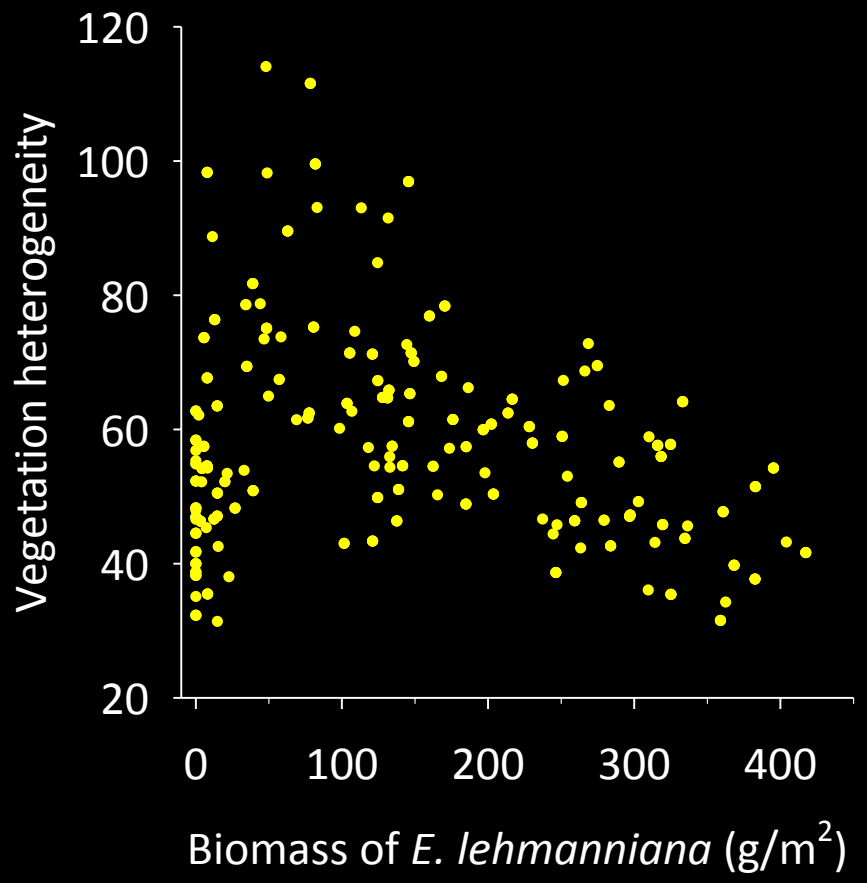
- Variable circular plots
- 2,160 plot-surveys
- 19,720 detections
- 73 species

Results: plants

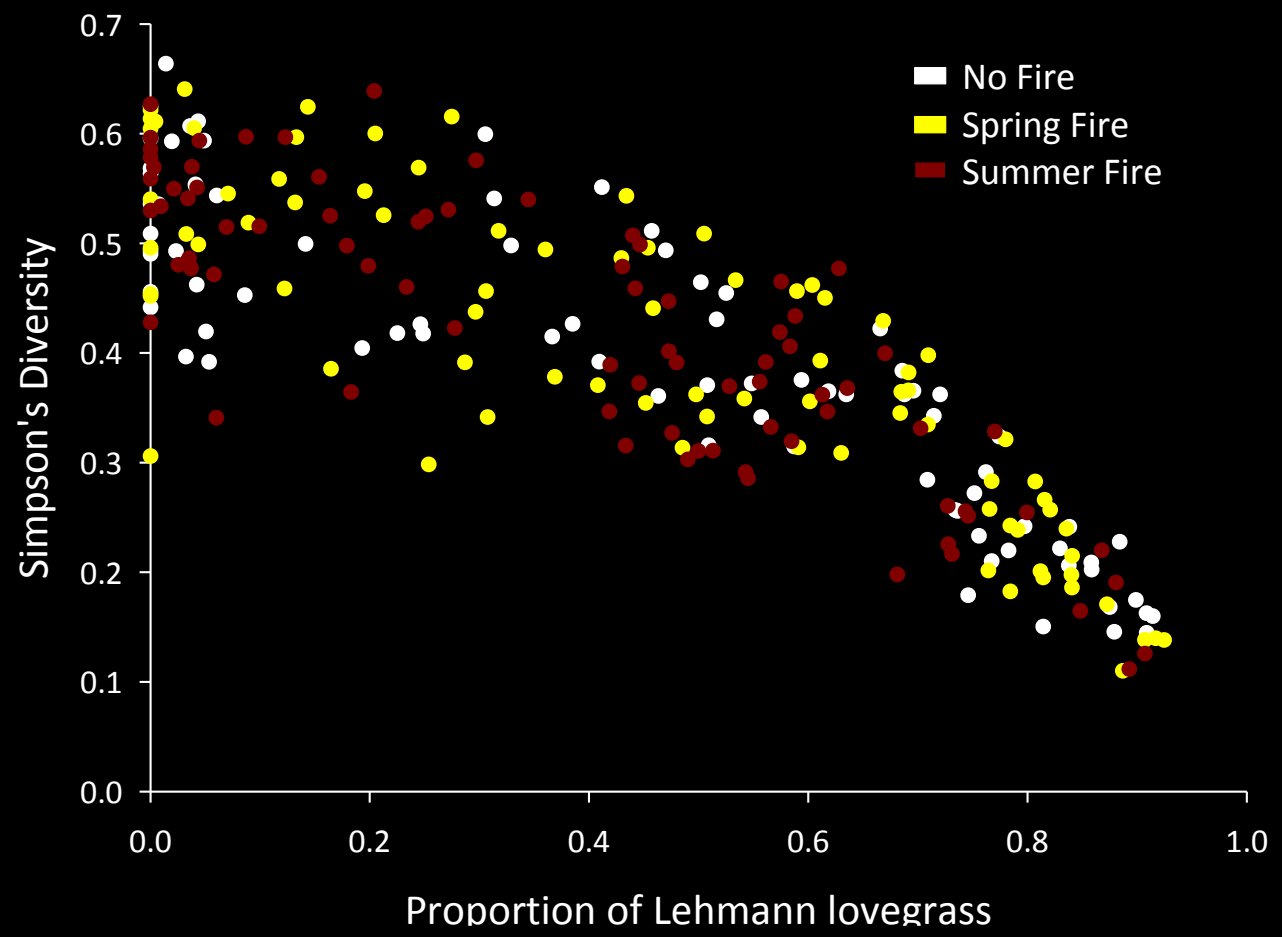
Vegetation biomass increases along invasion gradient



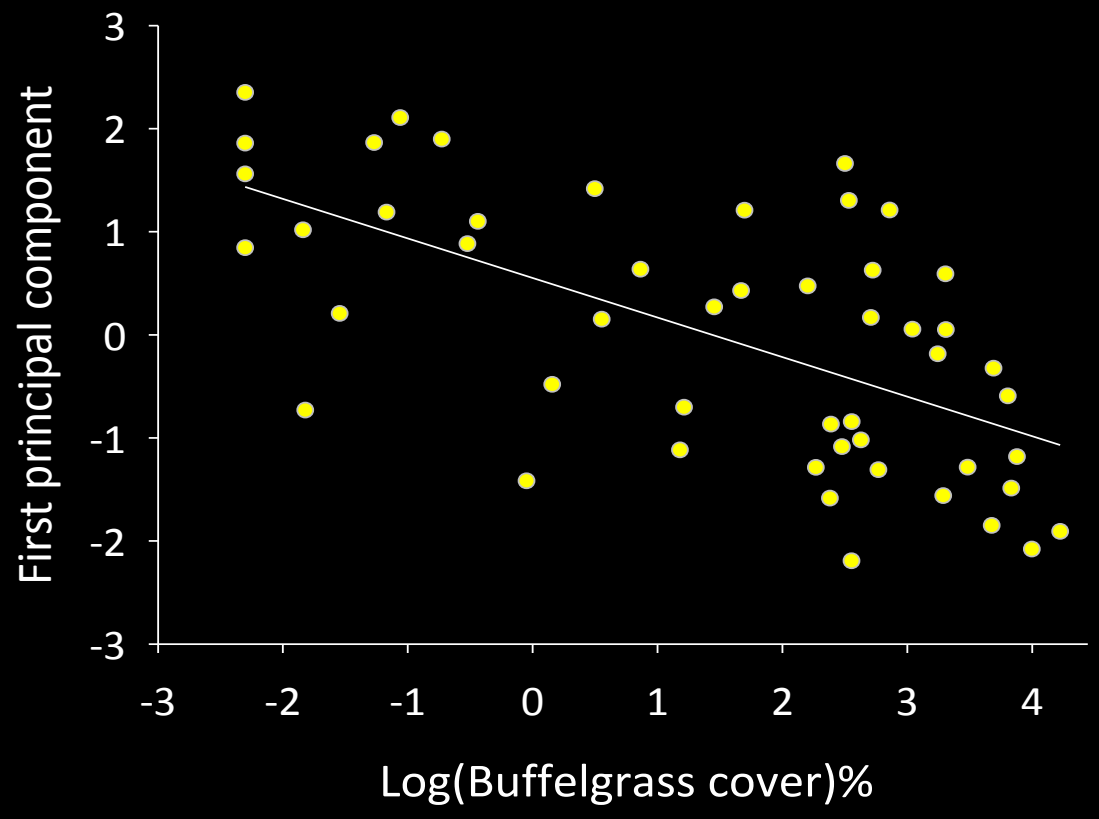
Vegetation heterogeneity decreases



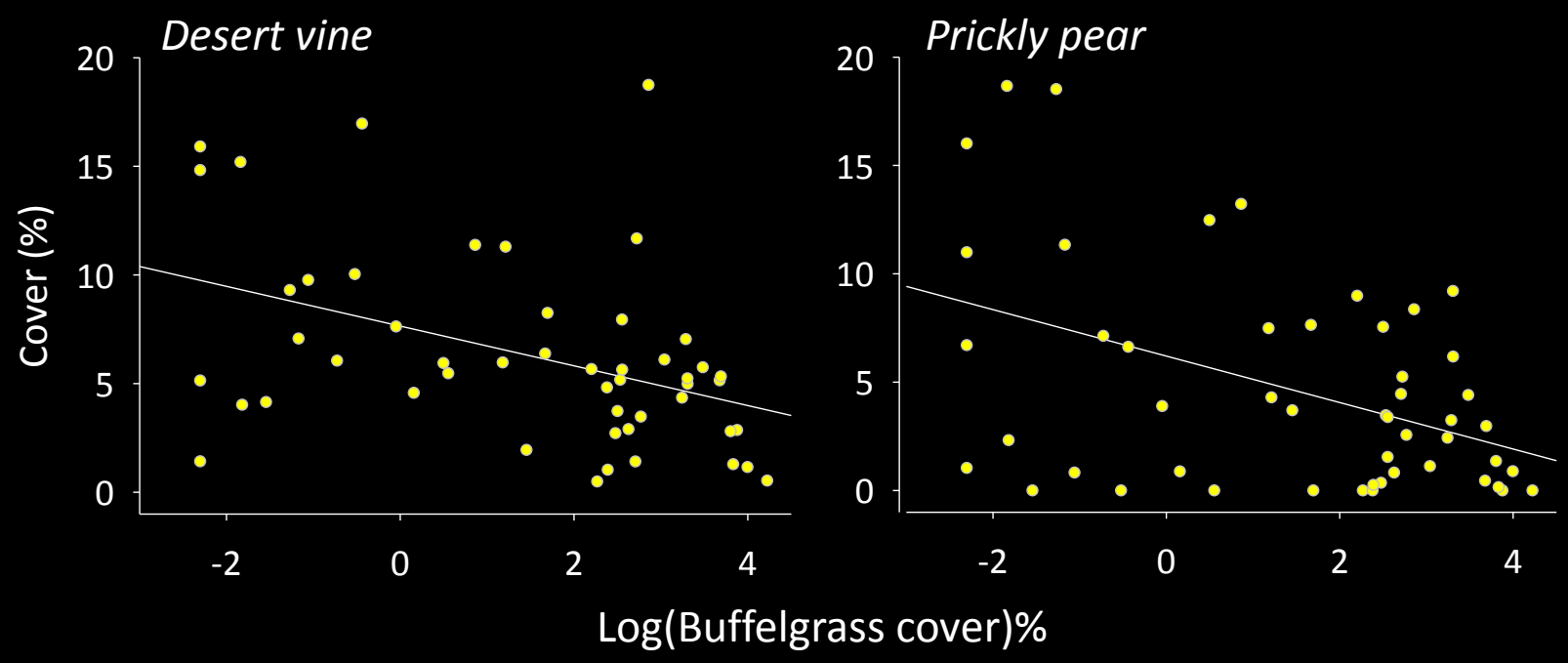
Plant diversity decreases



Plant community composition changes

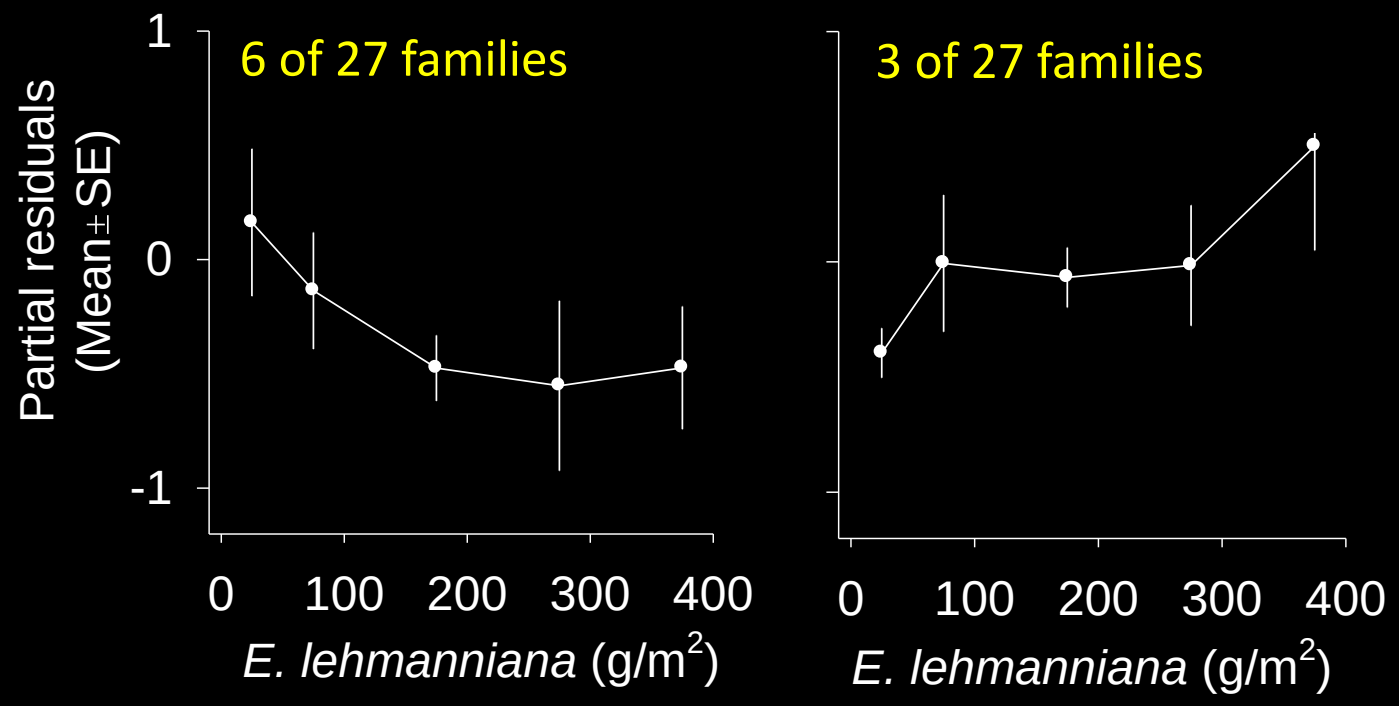


Common forage plants decrease

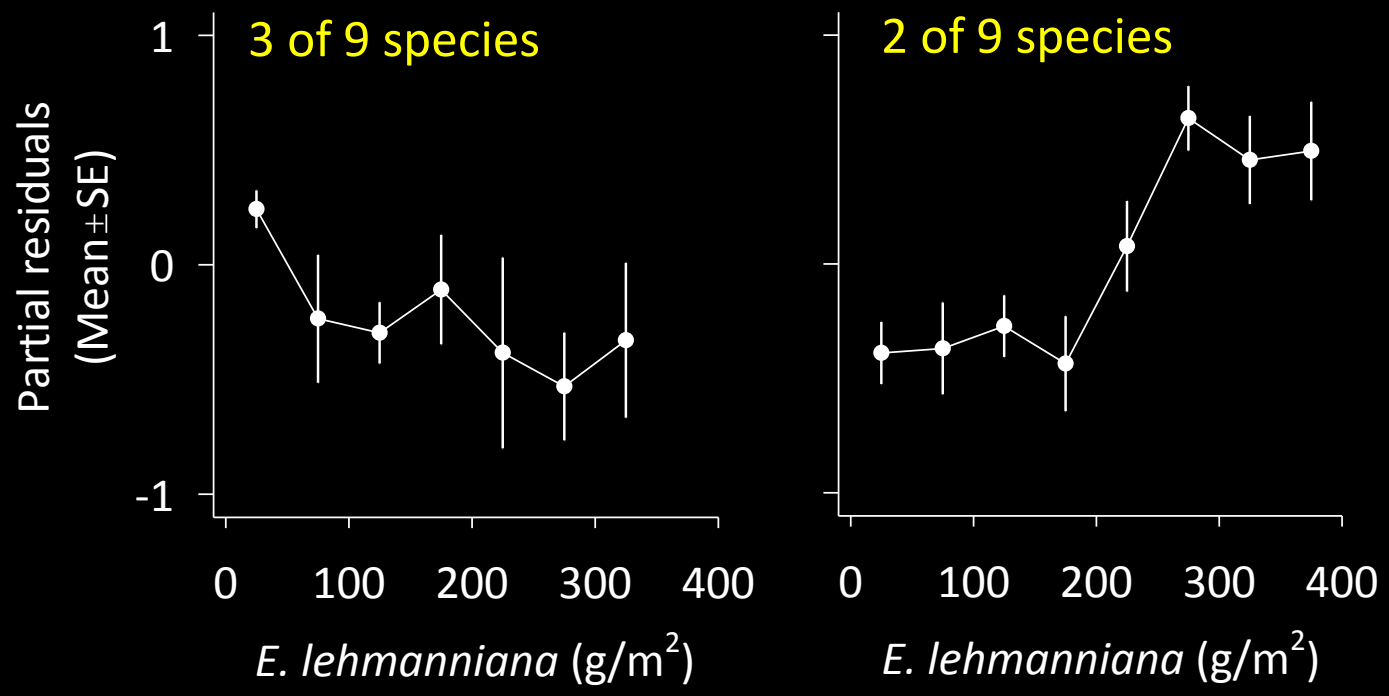


Results: animals

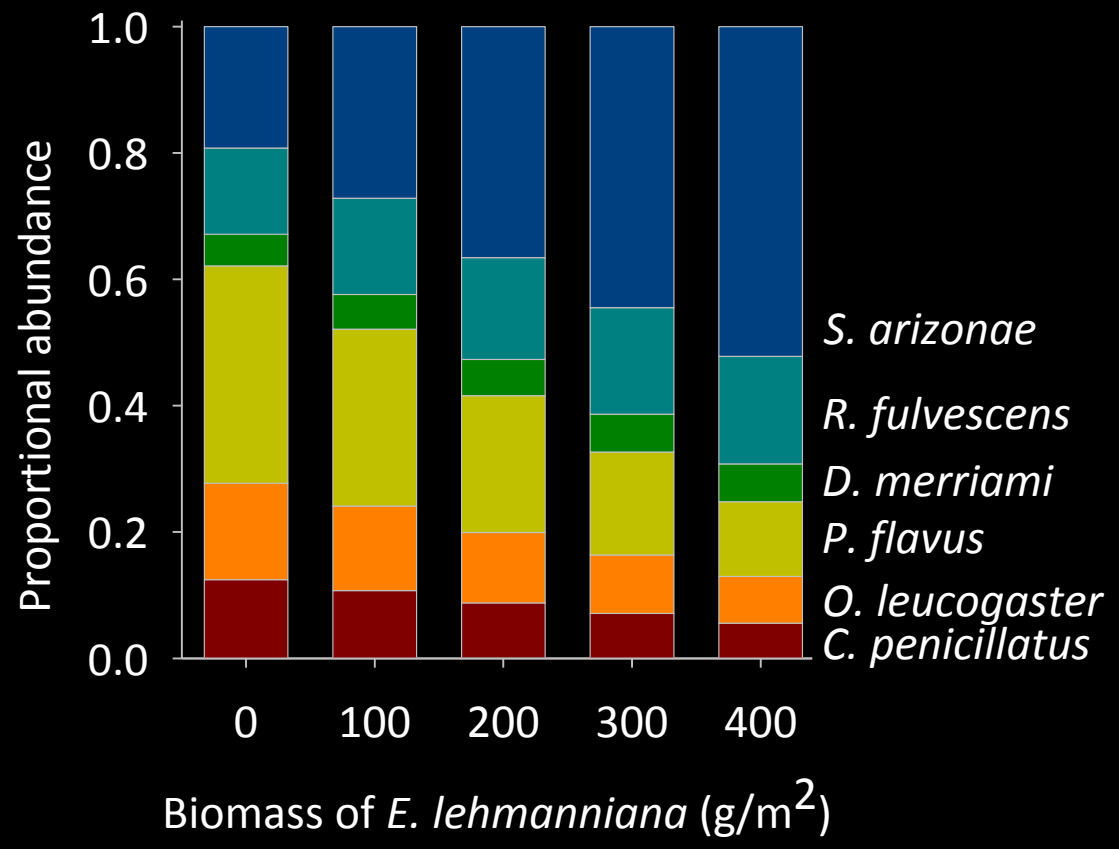
Insect abundances



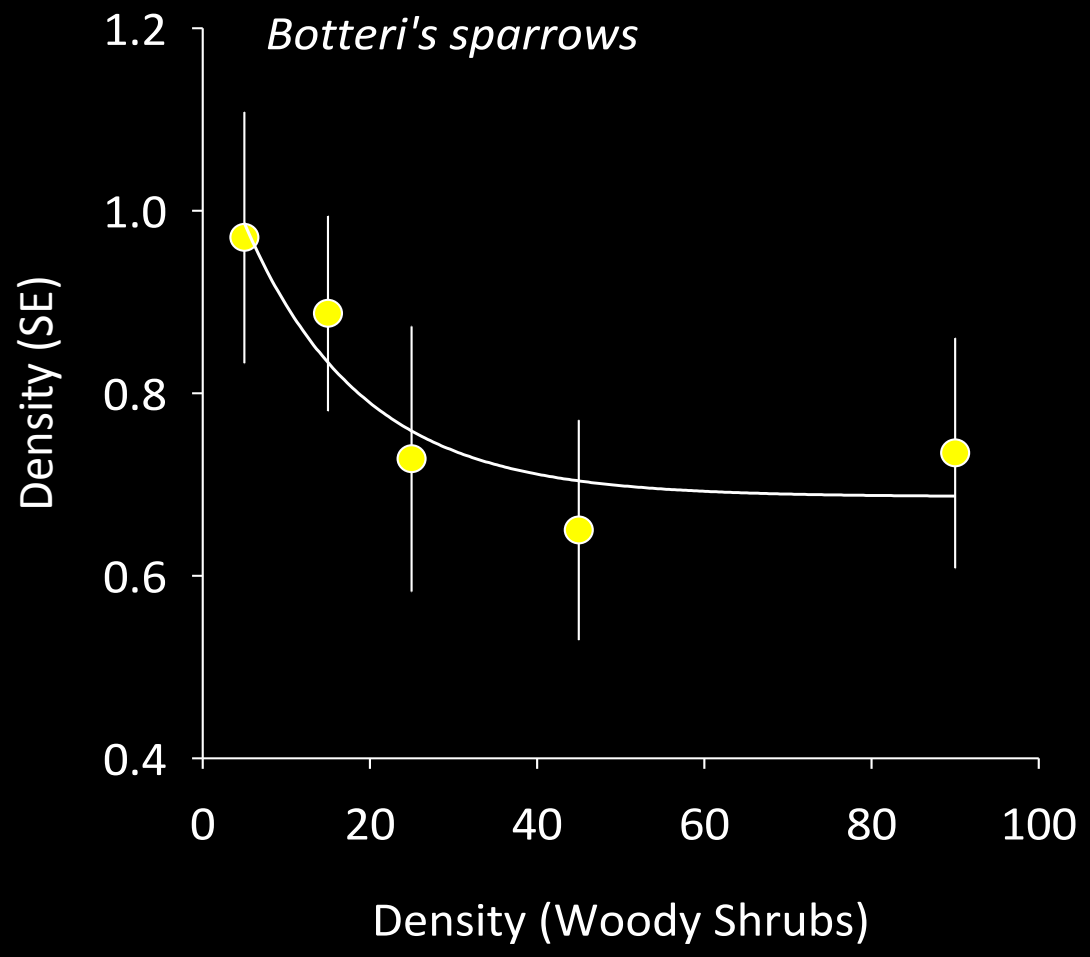
Mammal abundances



Mammal community composition



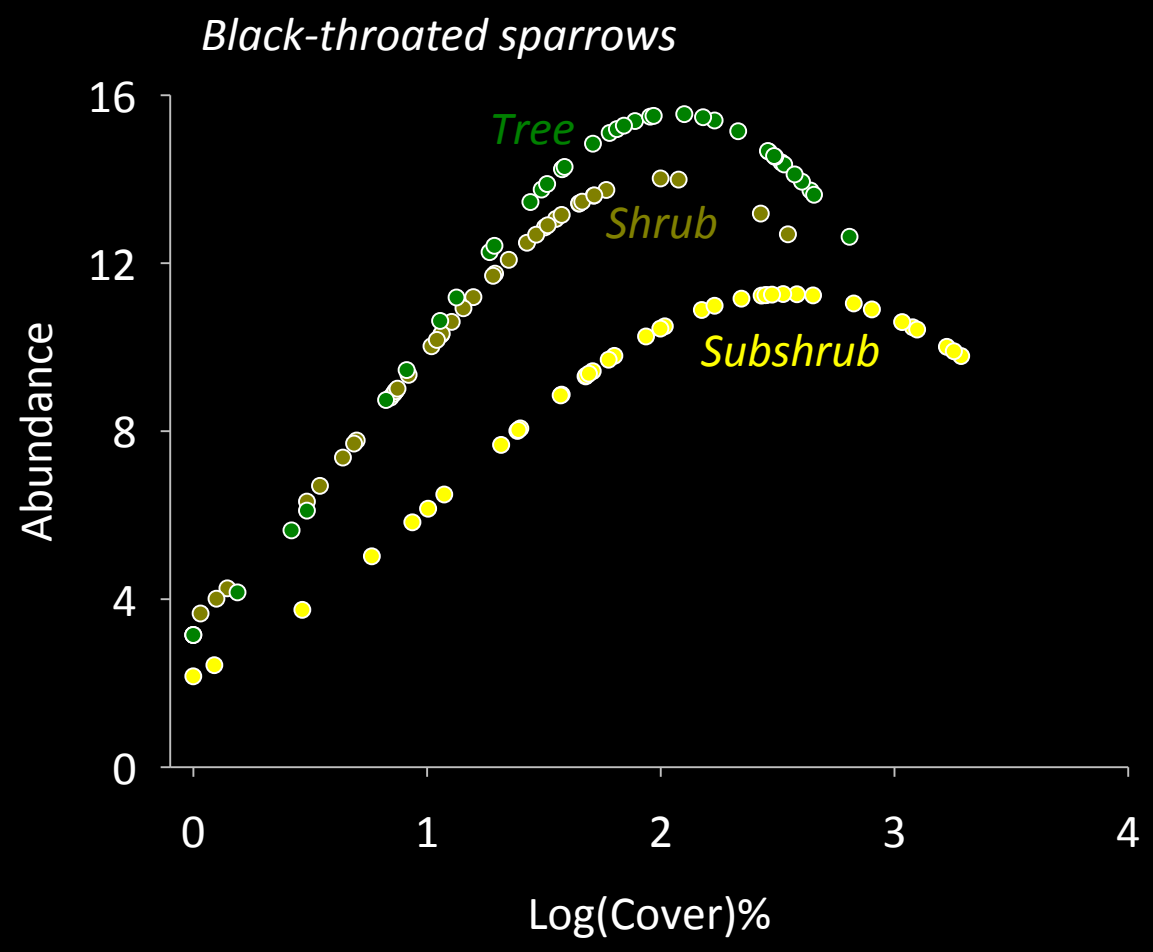
Bird abundances



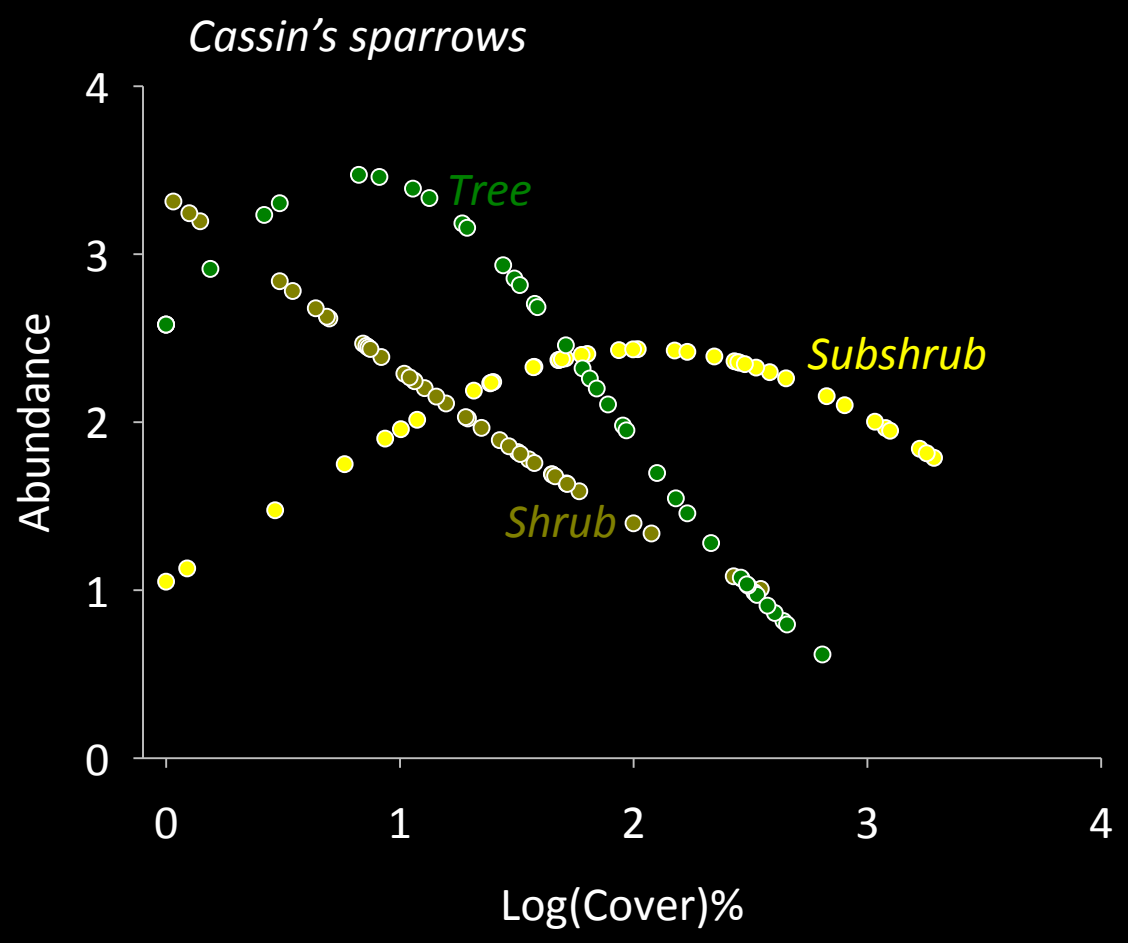
Which vegetation layers affect bird abundance?

Species	Woody	Grass	Ground
Blue grosbeak	○		
Botteri's sparrow	○	●	
Ash-throated flycatcher	○		○
Canyon towhee	○		●
Lucy's warbler	○		●
Black-throated sparrow	○	○	●
Eastern meadowlark	○	●	●
Cassin's sparrow	○	●	●
Lark sparrow	●	○	●
Brown-headed cowbird	●	●	●
Bewick's wren	●	●	●
Northern mockingbird	●	●	●

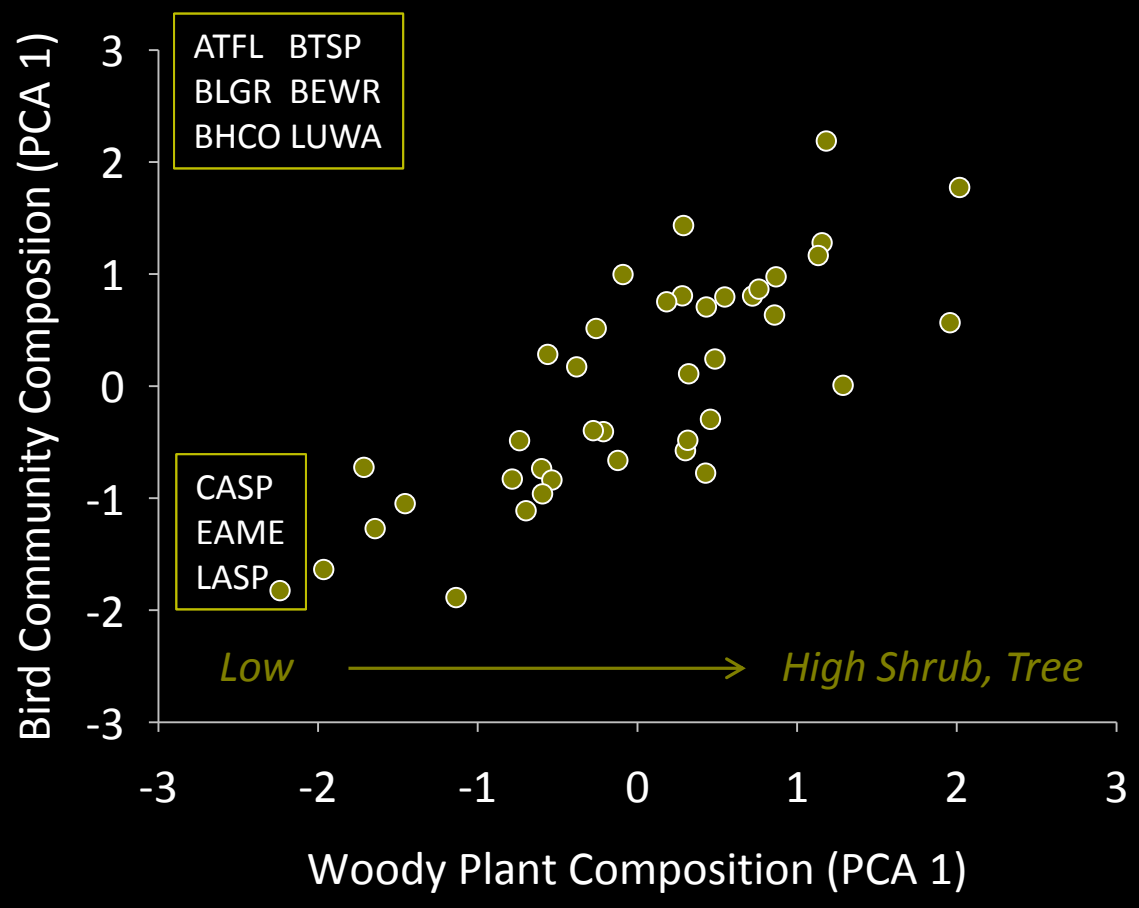
Bird abundances



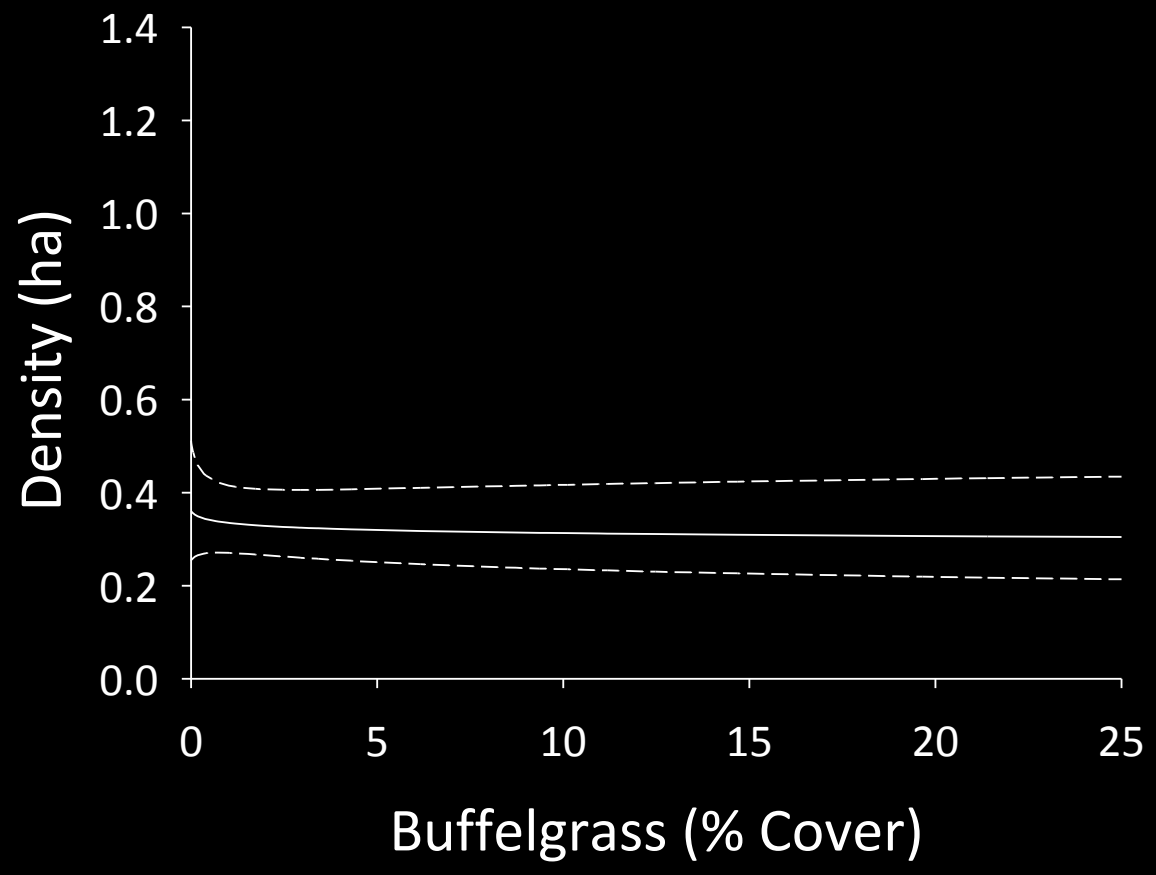
Bird abundances



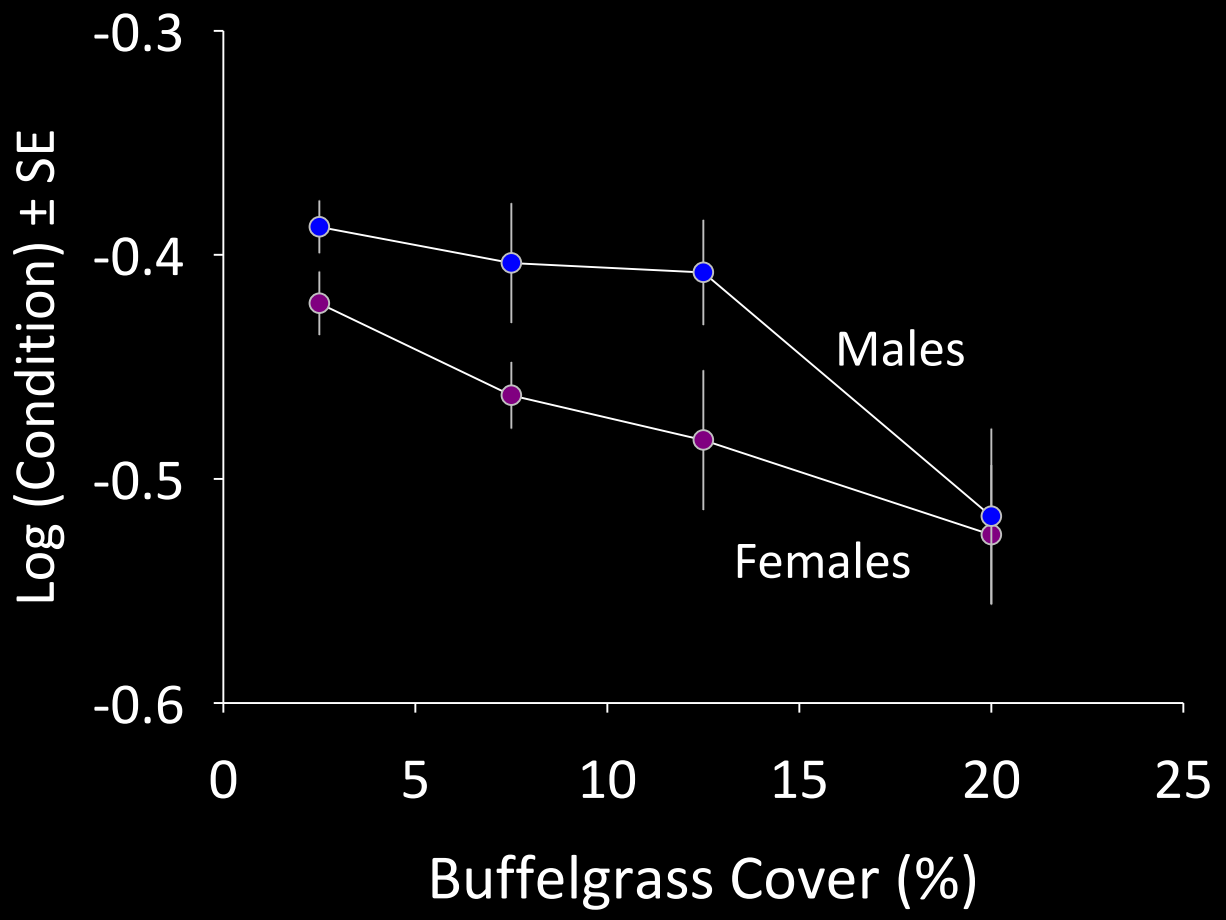
Bird community structure



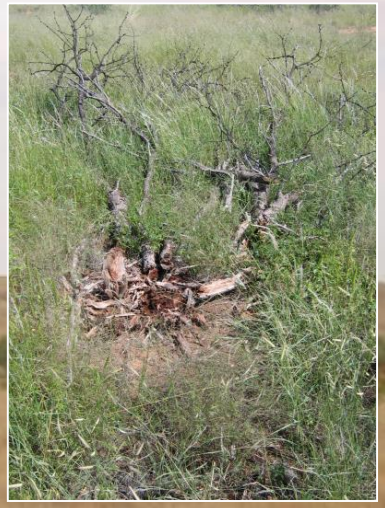
Tortoise density



Tortoise body condition

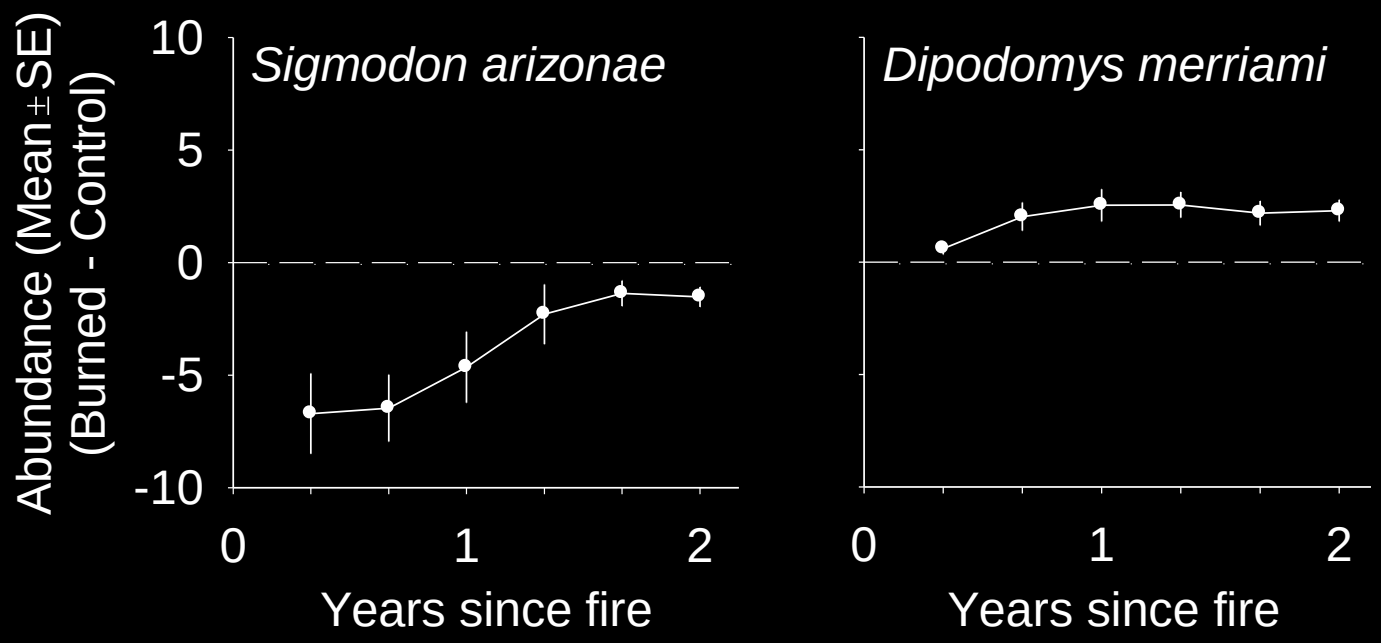


Restoring ecological drivers

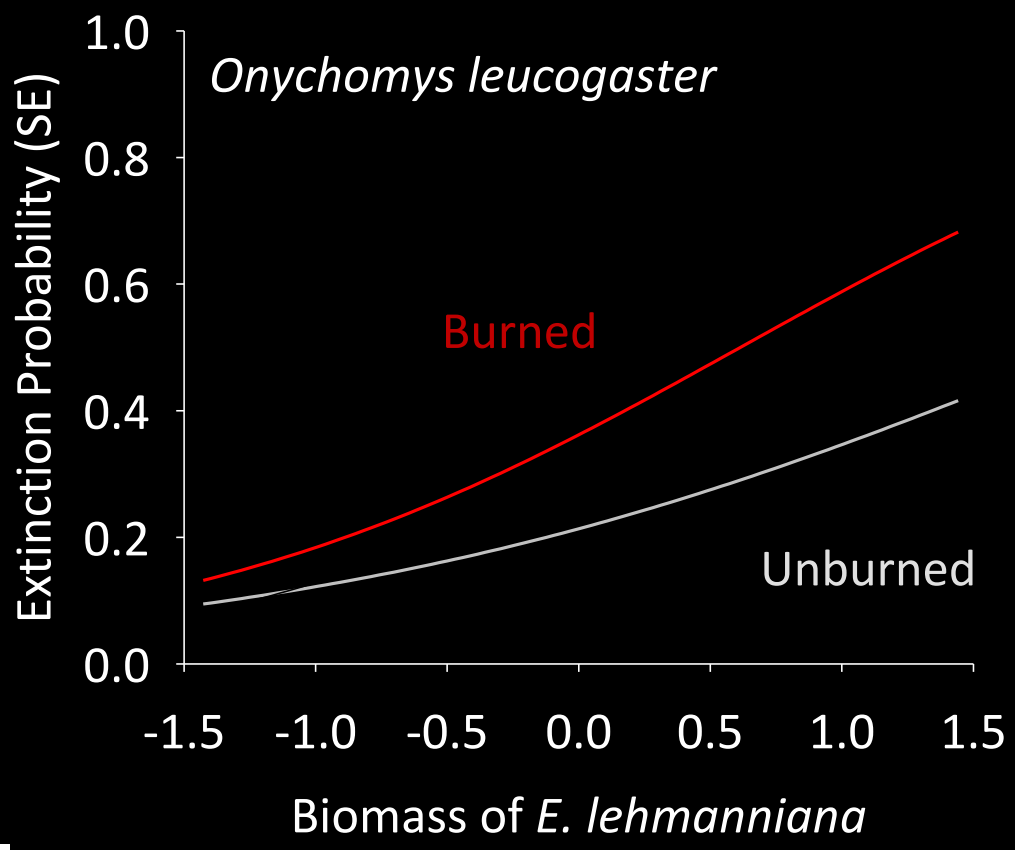


Fire: 50 plots
Mechanical: 10 plots
Herbicide: 4 plots
Control: 45 plots

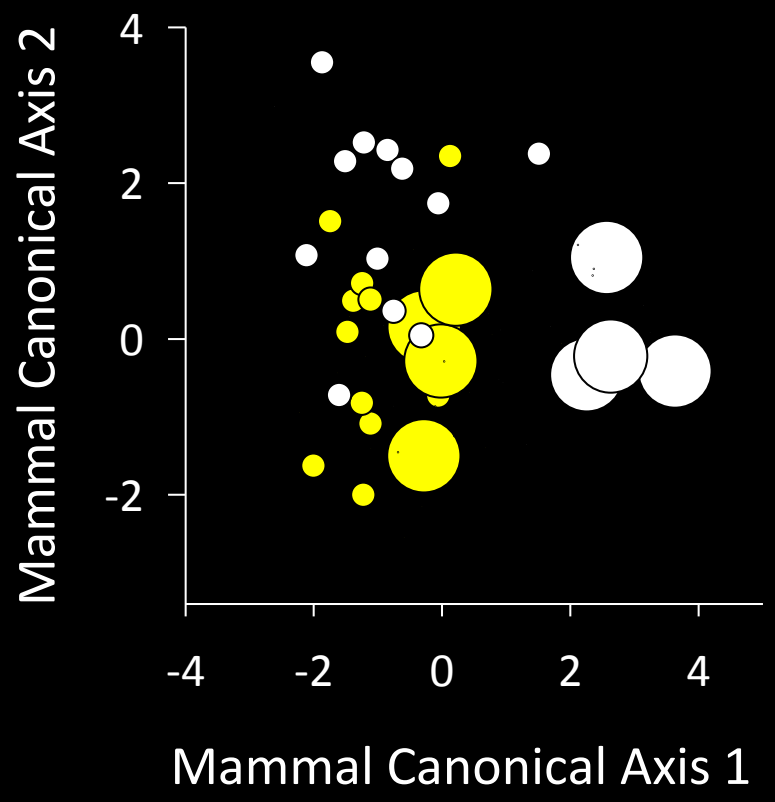
Mammal abundance vs. fire



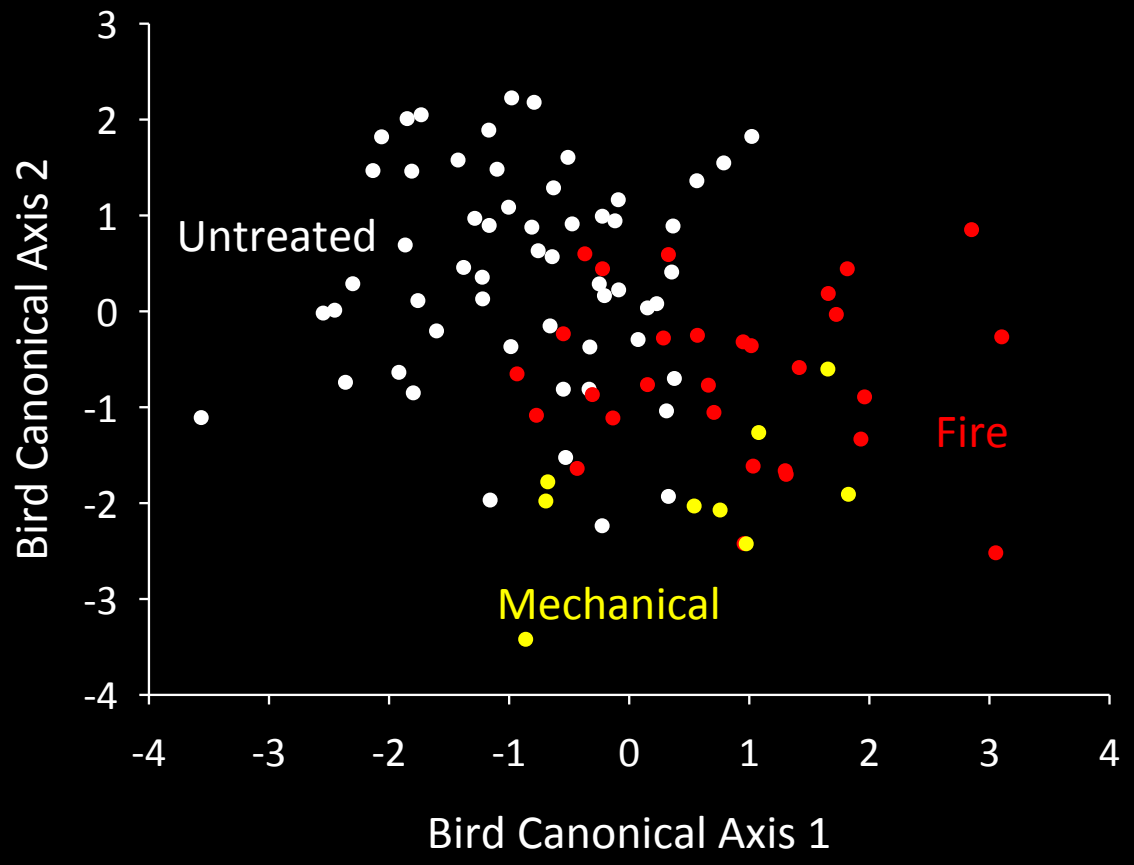
Changes in population dynamics



Did fire restore altered grasslands?



Treatments change bird species composition



Conclusions

- Composition of plant and animal communities changes along invasion gradients
- Fire does not alter dominance of nonnative grasses
- Restoration treatments shift composition of bird and mammal community towards composition in native-dominated grasslands

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