

# Integrated eco-evolutionary investigation of small mammal community dynamics in Kansas.

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Konza Prairie LTER Site  
Photo: Barb Van Slyke

# Overview of my research based on Kansas small mammals

- Trophic ecology
  - Intra- and interspecific resource dynamics.
  - Role of consumers: Ecosystem drivers?
- Evolutionary ecology
  - Resolving the distribution of genetic diversity
- Community ecology
  - Responses to environmental change
- Disease ecology
  - Parasite/pathogen biodiversity and distribution

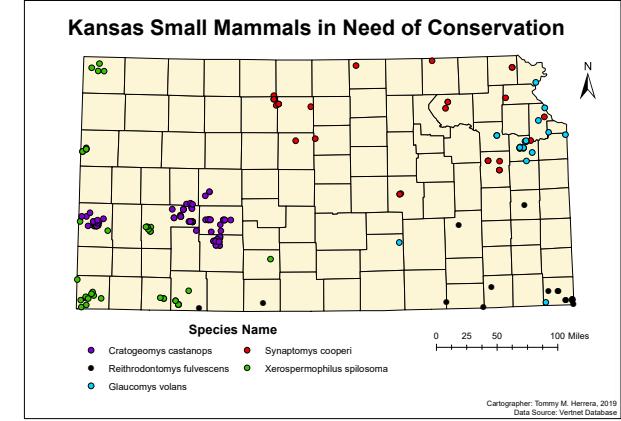
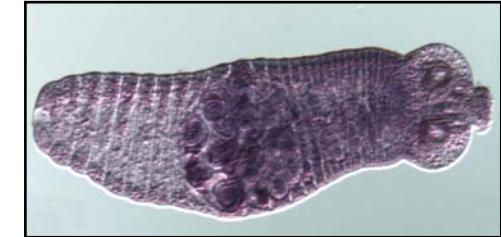
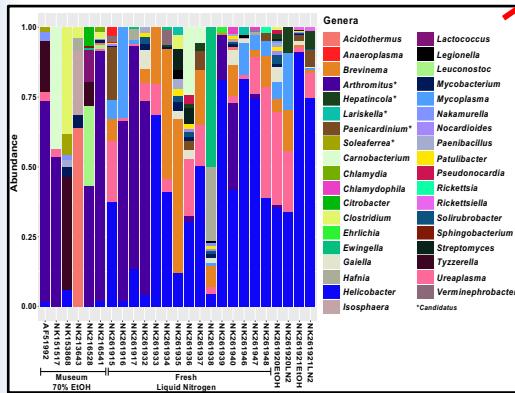


# Mission of NSF Long Term Ecological Research Network

- “*...to provide the scientific community, policy makers, and society with the knowledge and predictive understanding necessary to conserve, protect, and manage the nation’s ecosystems, their biodiversity, and the services they provide.*”
- Goals include building legacies: “*...of well-designed and documented long-term observations, experiments, and archives of samples and specimens for future generations.*”



# Long-term specimen archives

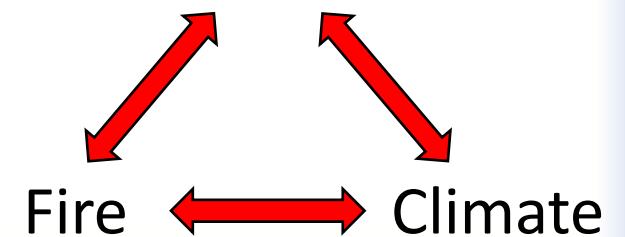


# Konza LTER Tallgrass Prairie



Ecosystem Drivers:

Consumers



# Small mammal sampling 2016-2020 – Konza LTER

- 8 experimental burn treatments
- 2 transects per treatment
  - 1 capture-mark-release
  - 1 specimen removal
- 160 trap nights per transect per year
- All specimens fully processed via published guidelines (Galbreath et al. 2019)
- Ecto-parasites
- Endo-parasites



Specimen data downloaded from Arctos database ([arctos.database.museum](http://arctos.database.museum))  
Red = removal; Blue = catch-and-release

# Stable Isotope Trophic Ecology

- Fur and liver
- Analyze dietary nutrient composition
- Trophic niche defines dietary breadth
- Test for diet variability:
  - By species
  - By year
  - By habitat
  - By season

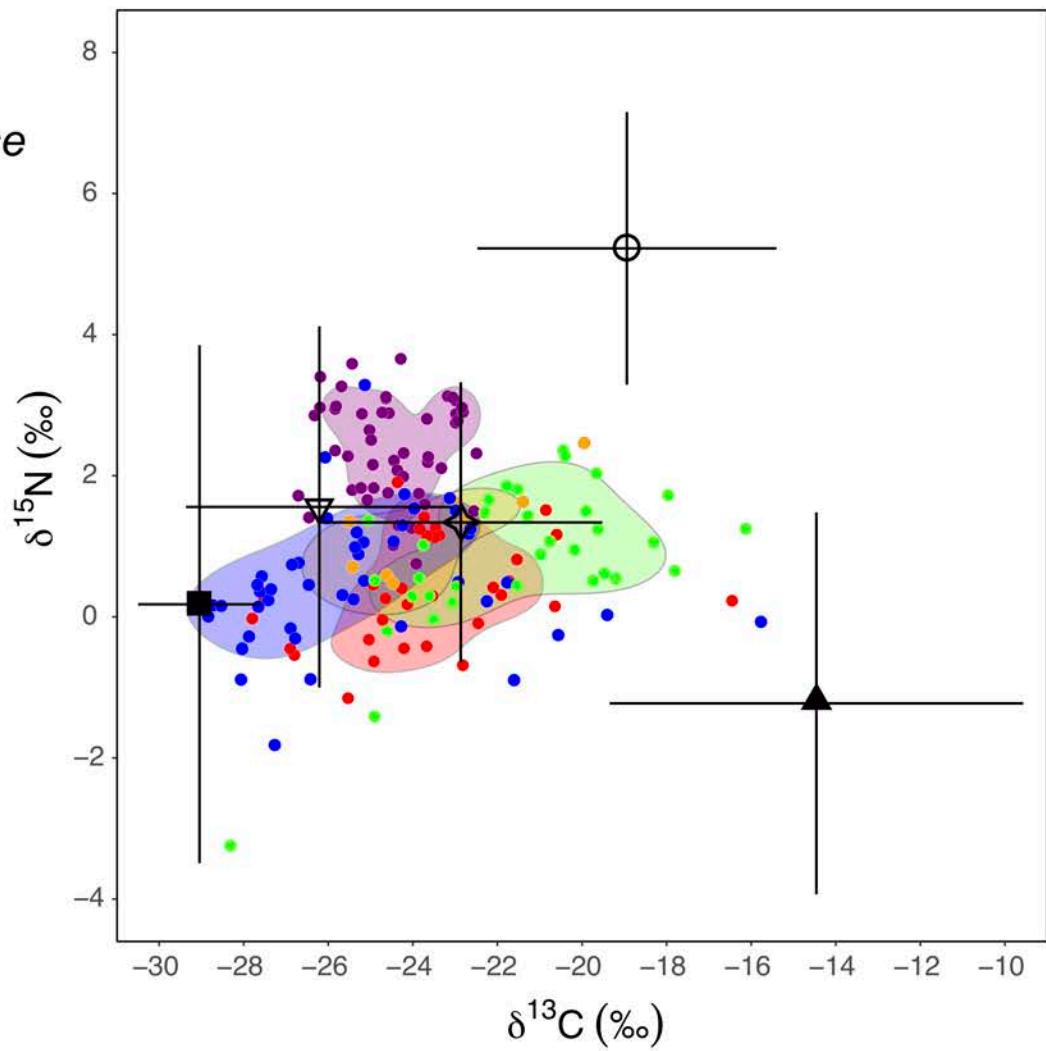


Bia Gragg – K-State UG, 2018.  
Manuscript *In Prep* for Journal of Animal Ecology

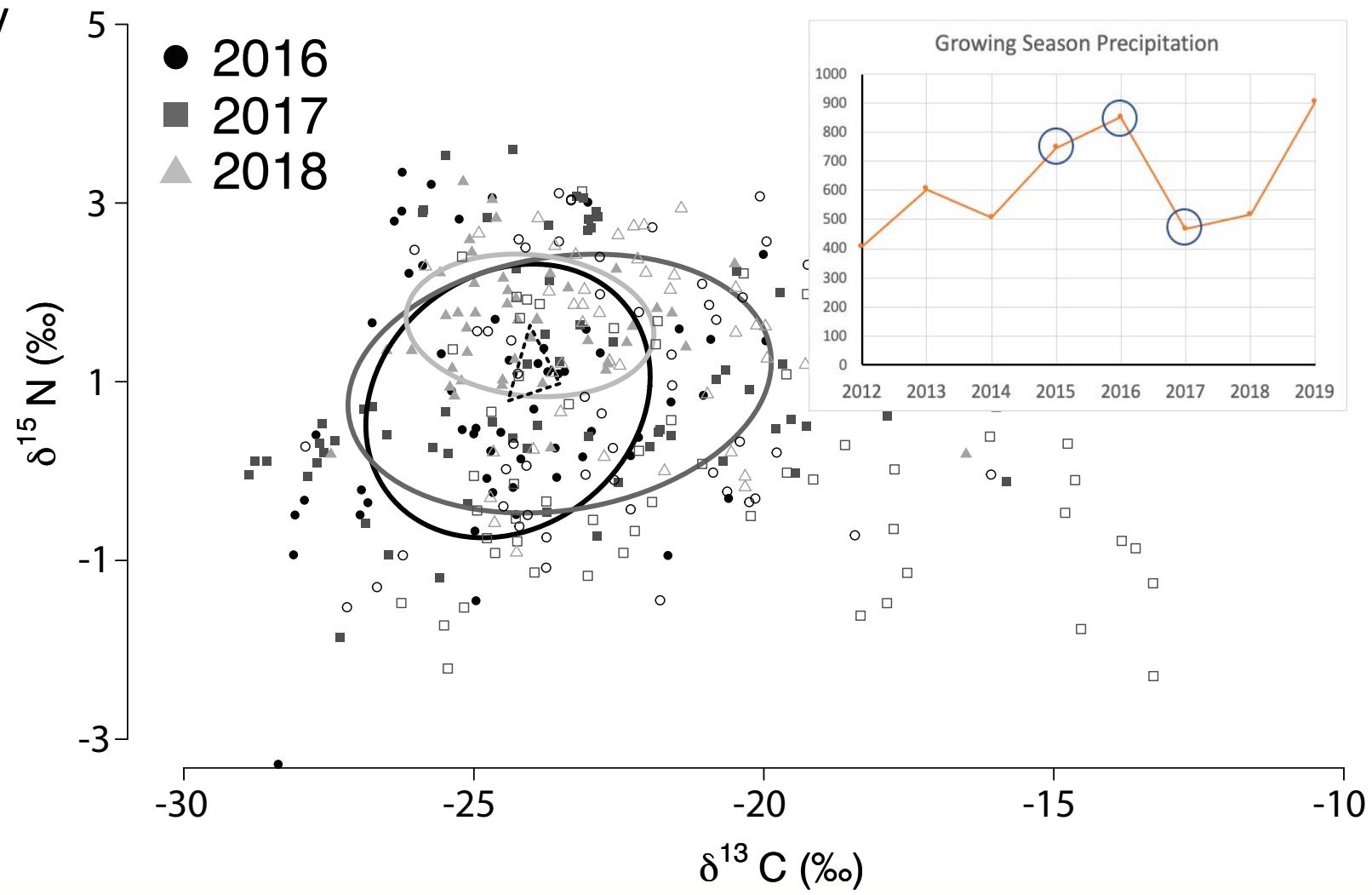
Community  
Data:  
By species

- *Prairie vole*
- *White-footed mouse*
- *Deer mouse*
- *Harvest mouse*
- *Hispid cotton rat*

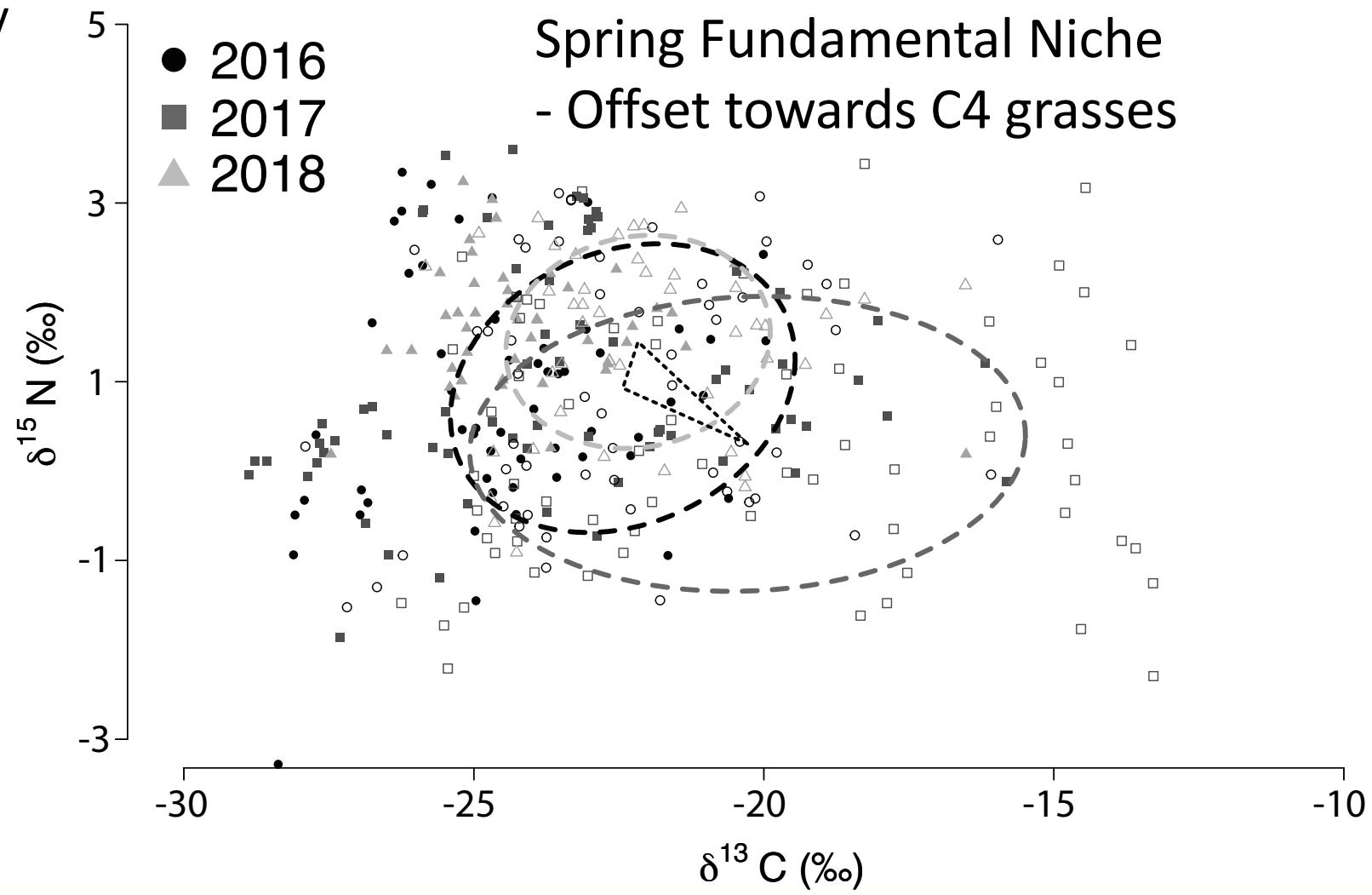
- ▲ C4 plant
- C3 woody
- ▽ C3 herb
- ◇ Invert - herbivore
- Invert - predator



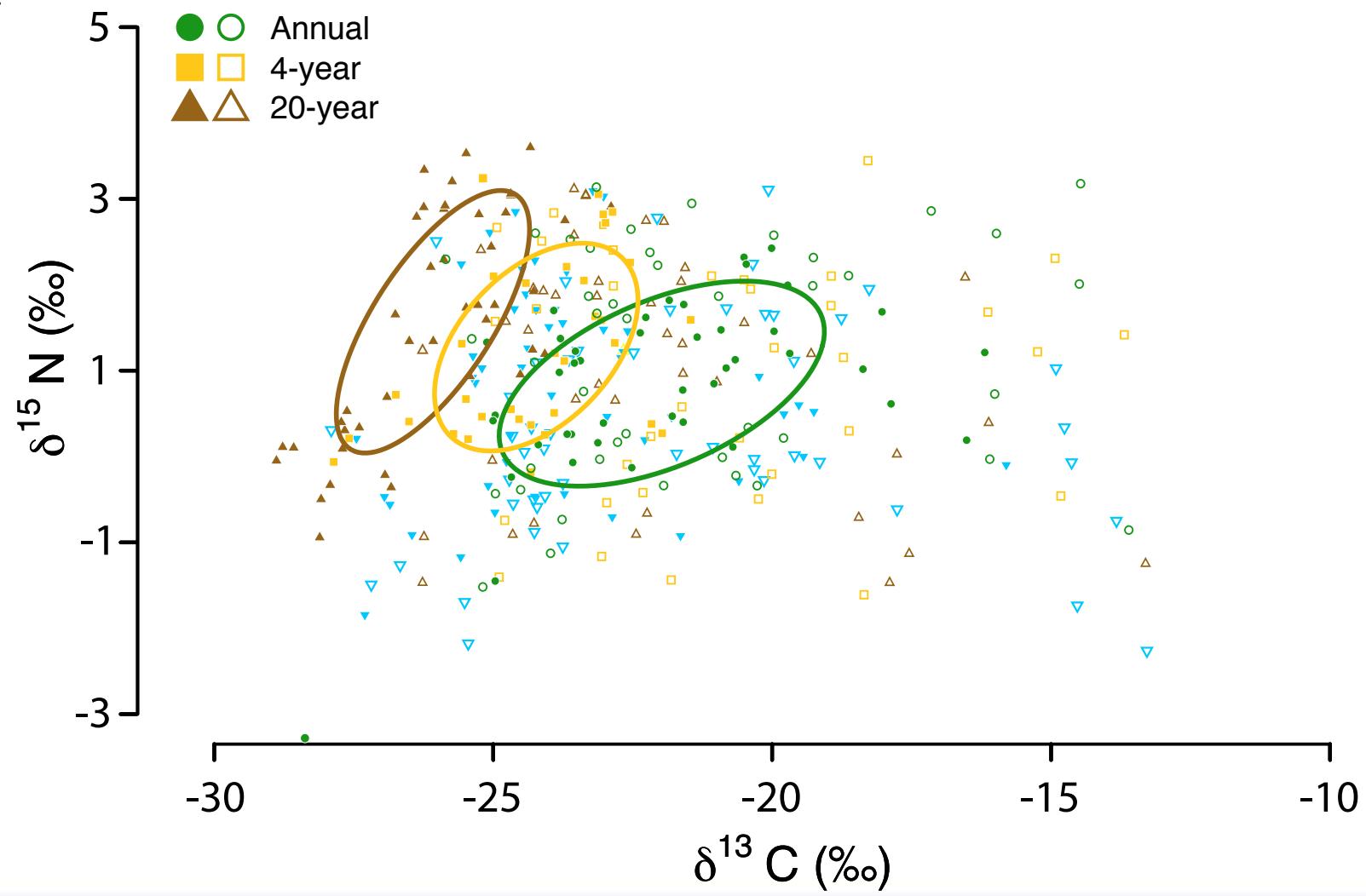
Community  
Data:  
All species  
By year



Community  
Data:  
All species  
By season



Community  
Data:  
All species  
By burn  
treatment



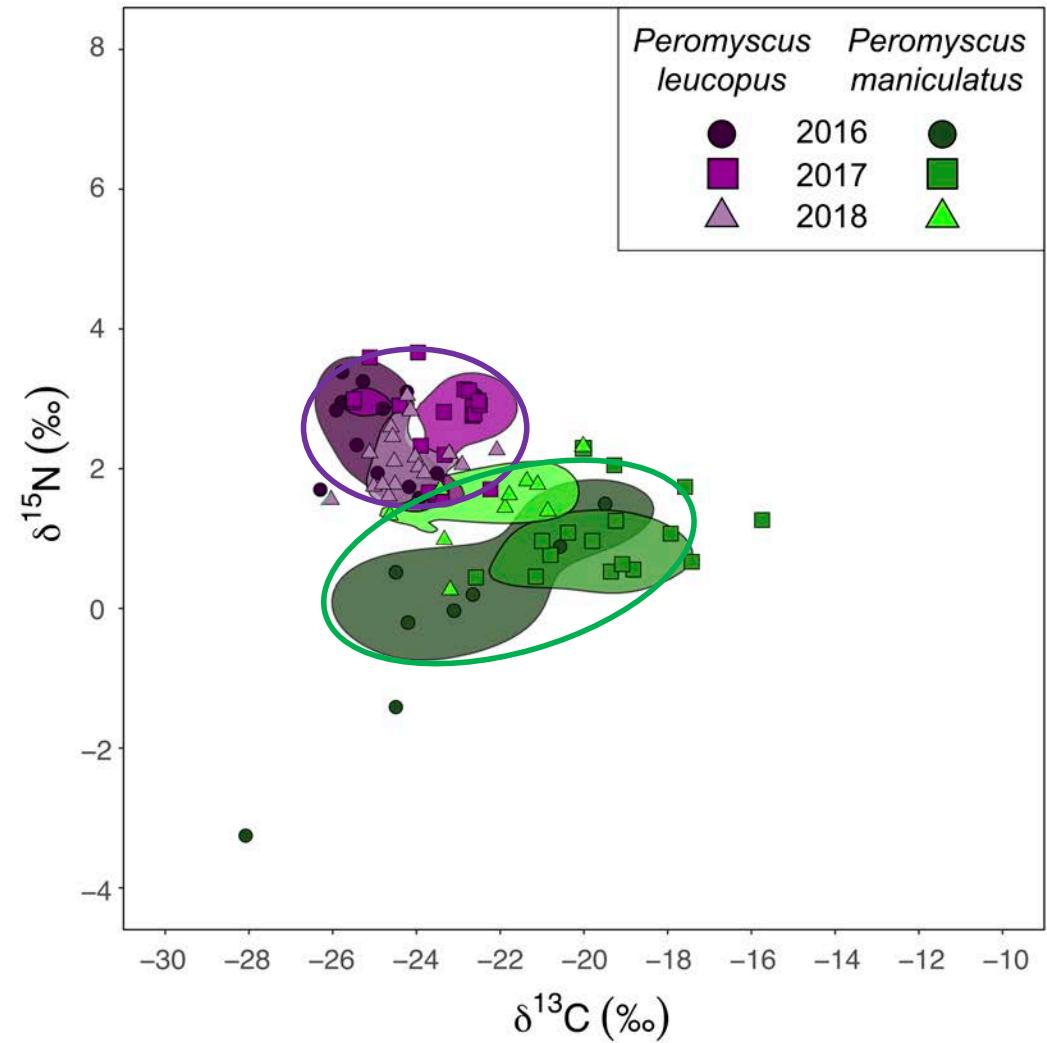
## Dominant Species Turnover



White-footed  
mouse  
Woodland



Deer mouse  
Grassland

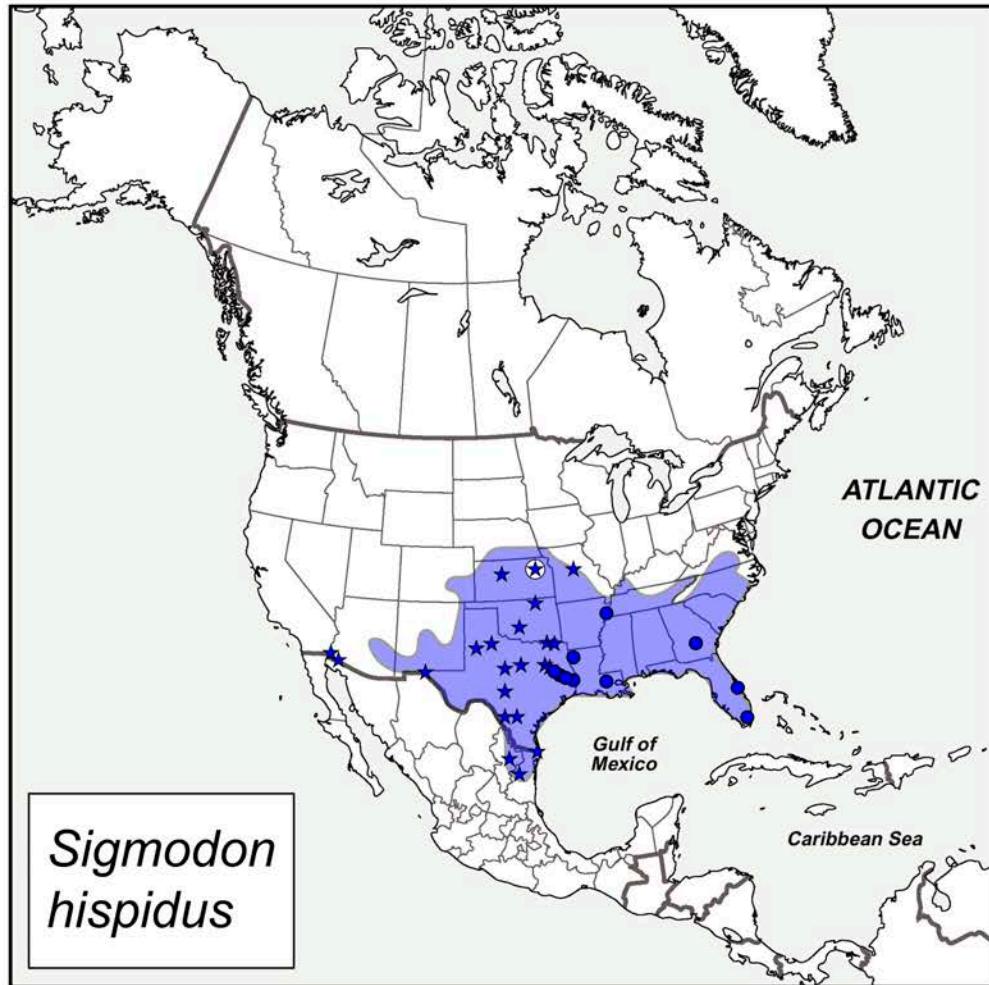


# Trophic Ecology Summary

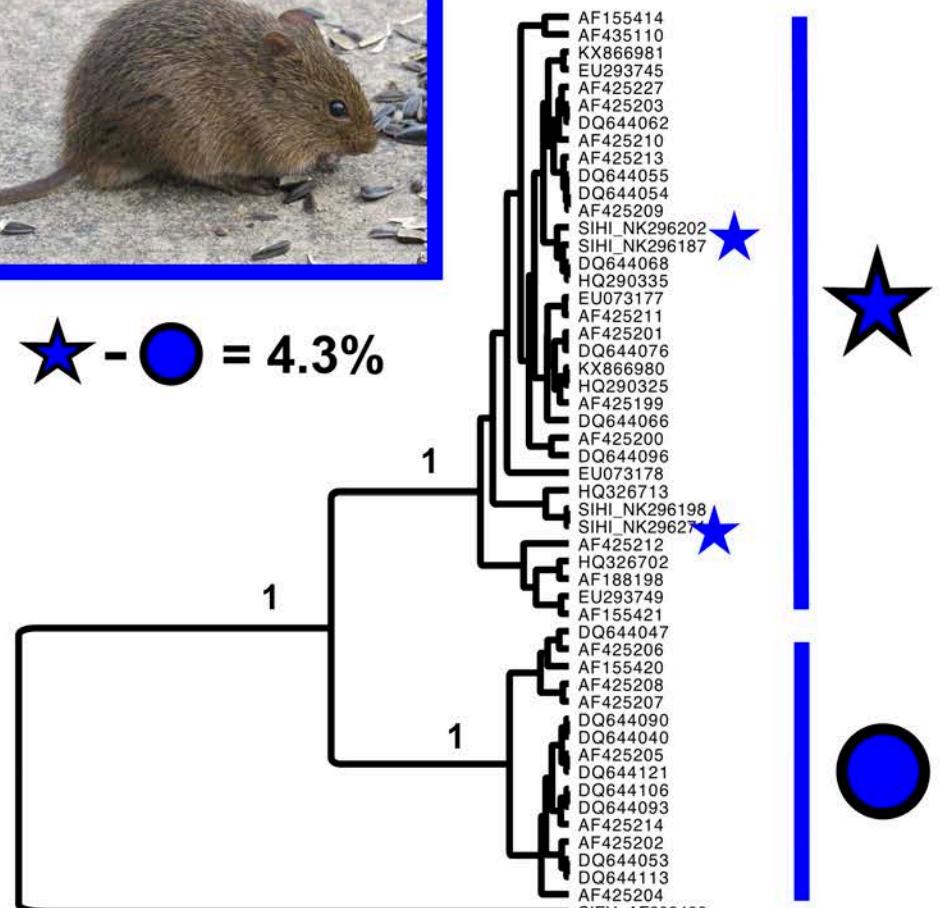
- Predictable dietary variability by species and by habitat
- Predictable change in trophic breadth by year and by season
- Significant displacement of consumer resource use as prairies experience woody encroachment
  - Reflects community turnover
  - Implications for prairie regeneration and fire management

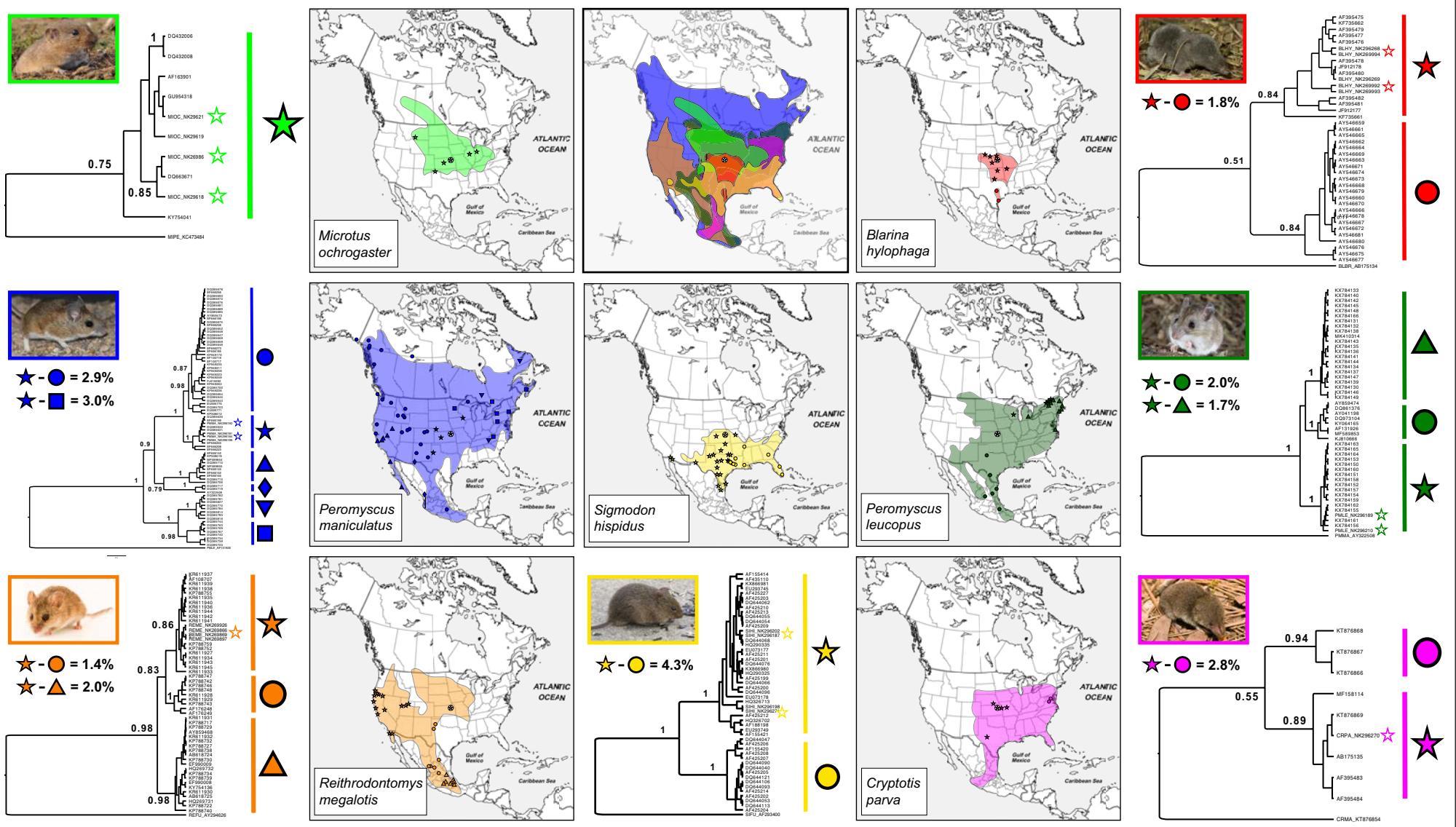


# Evolutionary Ecology – tissue samples for genetics resolve community assembly

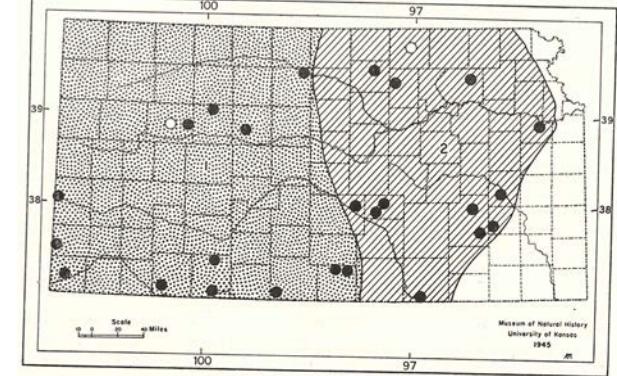
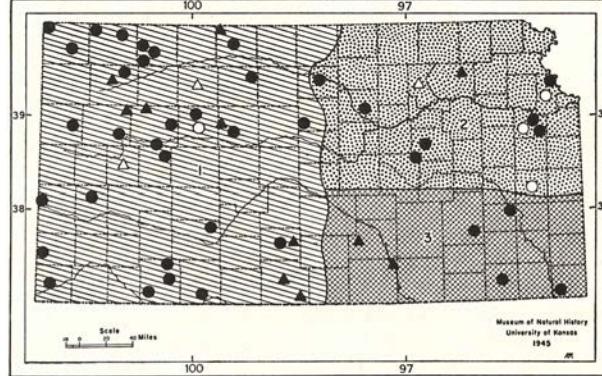
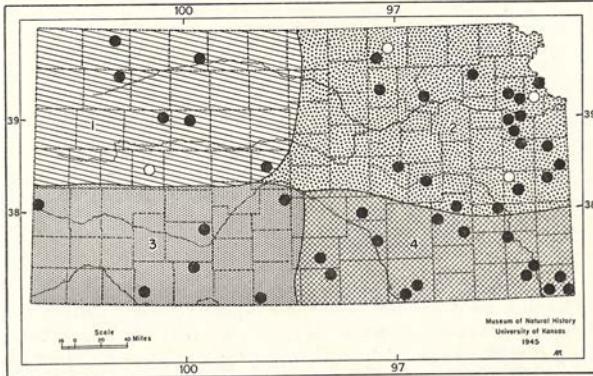


$$\star - \bullet = 4.3\%$$





# Community Ecology – Statewide community turnover



Eastern cottontail

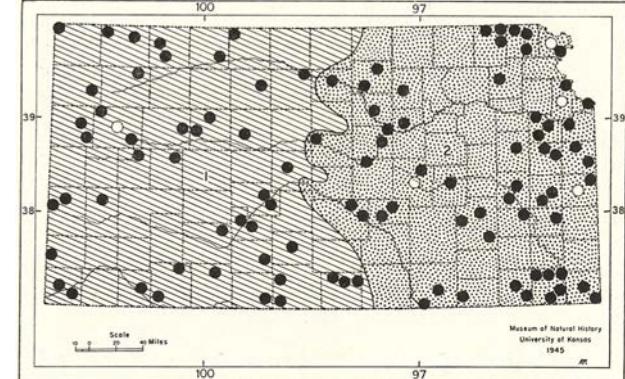
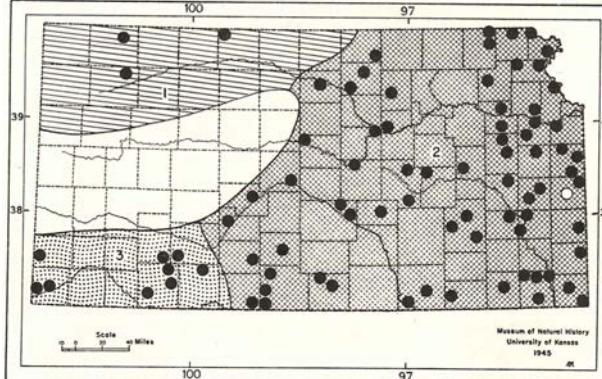
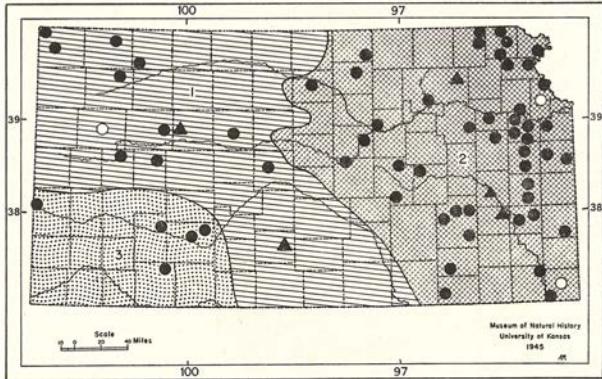


Thirteen-lined ground squirrel



Plains harvest mouse

# Community Ecology – Continued...



Prairie vole



White-footed mouse

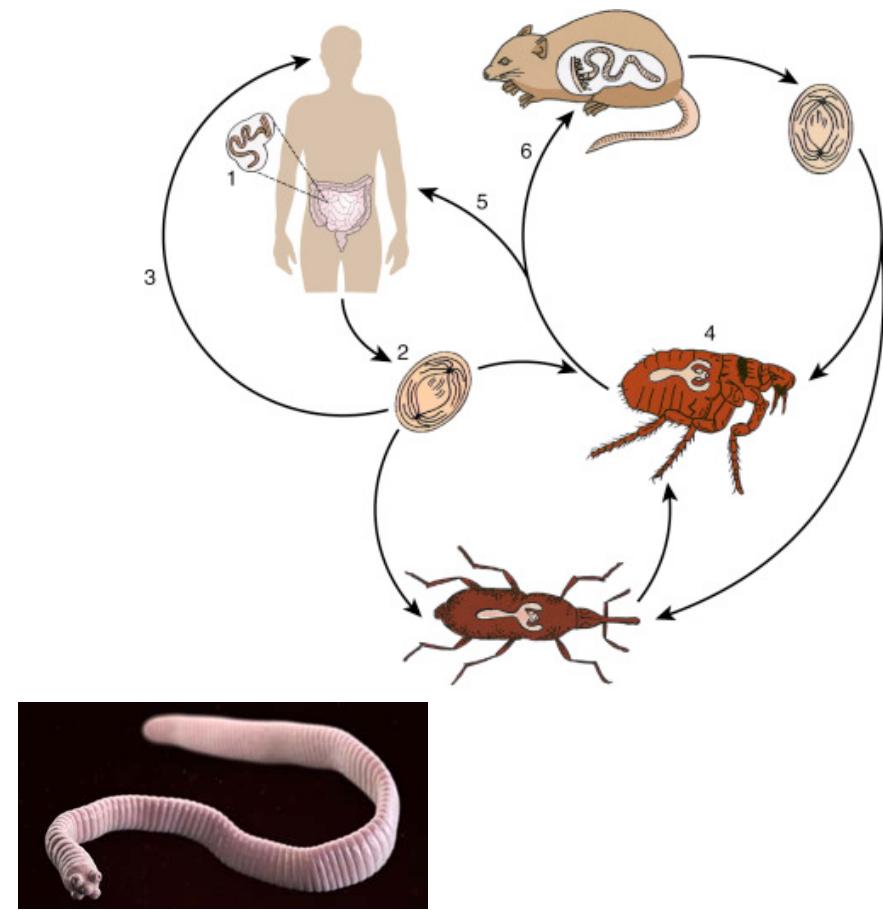


Deer mouse

# Mammals, parasites, other hosts are inter-connected

“...parasites are known to play major roles in the dynamics and persistence of populations as well as the structure and stability of communities and ecosystems...”  
(Gehman *et al.* 2019)

- Effective biodiversity management requires a knowledge of existing biodiversity
- Mammalian parasites are vastly underexplored
- **This is not possible without whole fresh host specimens**



## Endo-parasites (gut helminths)

- Many cestode and nematode species (3+ species per host specimen)
- Nematode *Vexillata armandae* – first described from **Sevilleta LTER**
- New nematode species (Genus: *Syphacia*) from *Peromyscus*
- New cestode species (Genus: *Hymenolepis*) from *Sigmodon hispidus*
  - Zoonotic



*Vexillata armandae*

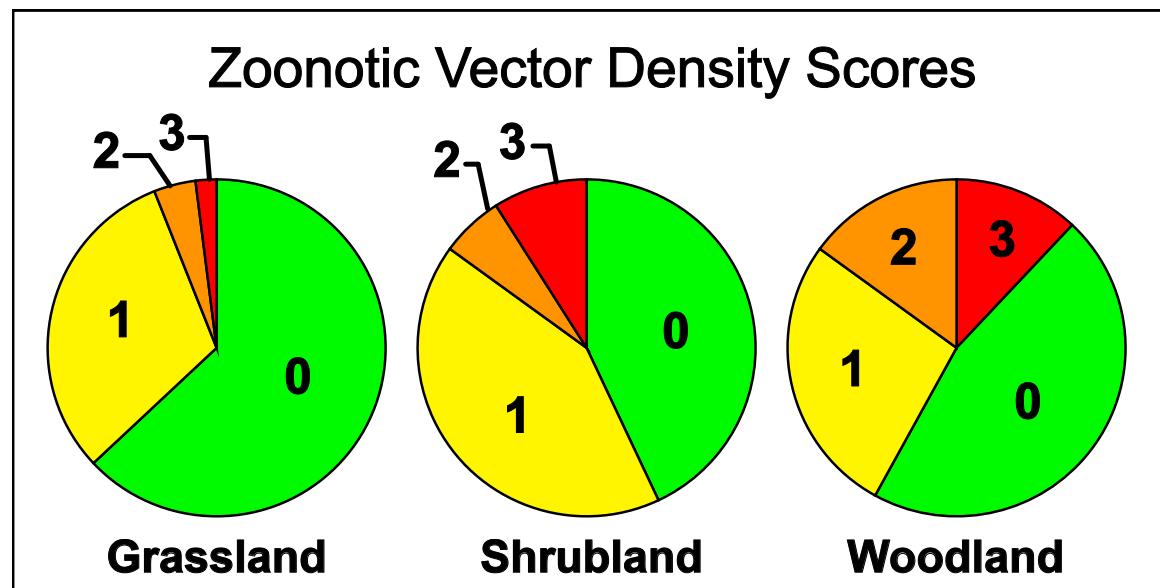


*Hymenolepis ackerti* sp.n.



## Ecto-parasite Disease Ecology (fleas, ticks)

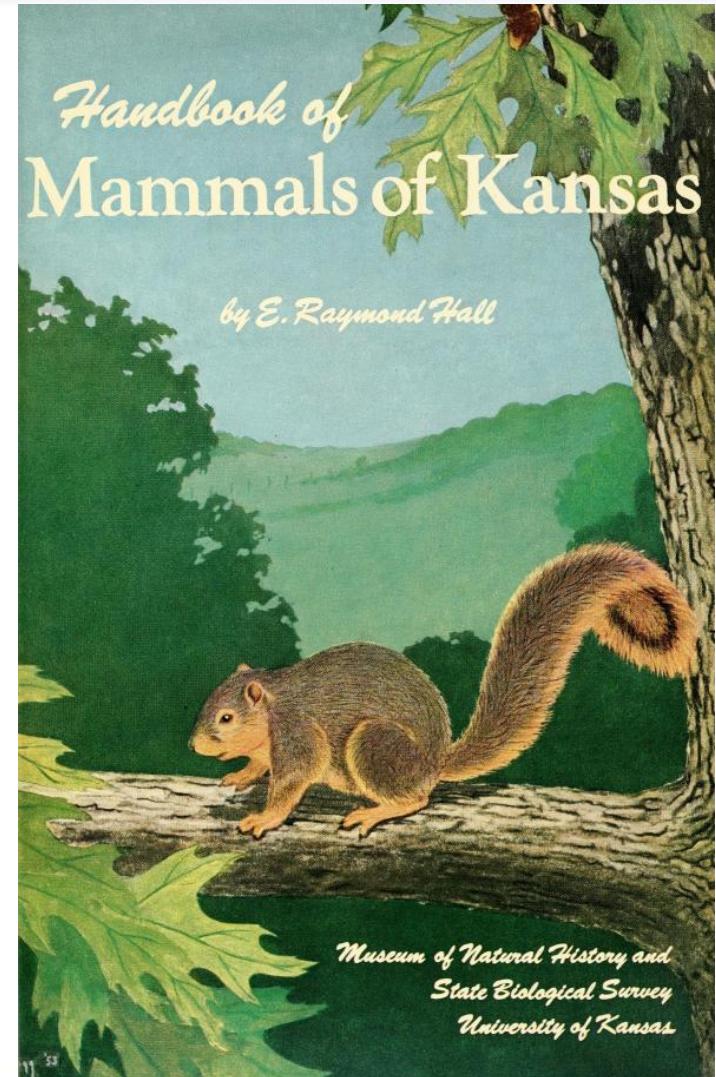
- Unknown diversity
- Unknown host specificity
- Zoonotic potential highest in woody areas
- Future pathogen testing
- **Maintenance of native prairie offers an ecosystem service.**



Kailey Meacham, K-State UG 2021

# Summary

- Now have new data from Kansas small mammals to reflect:
  - Trophic Ecology
  - Evolutionary history
  - Community assembly and change
  - Parasite diversity and prevalence
- Major take home:
  - Comprehensive museum specimens can enable an integrated research program!
  - Loss of native prairies leads to cascading biodiversity change





2019



2018



2017



2016



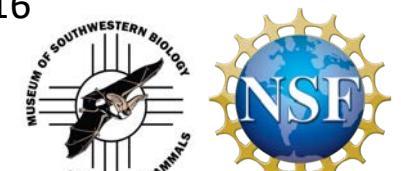
Bia Gragg – stable isotopes



Kailey Meacham – Ecto's



Mary Schmidt  
Mammal lineages



#### Colleagues in Prairie Conservation:

Dr. Fraser Combe (KSU)

Dr. Agustin Jimenez-Ruiz (SIU)

Dr. Vasyl Tkach (UND)

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Thanks!