Department of Biological Sciences

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Dear Ms. Parrack:

Below you will find a report summarizing our field efforts that were supported, in part, by the "IDNR Special Wildlife Funds Grant Small Grant". As you can see, the initial study site had to be changed due to vandalism. However, we generated substantial numbers of rodent captures and summarize habitat use of biofuel crops in the area. Please contact me with any questions or concerns. I have also attached a PowerPoint file with slides that were used to present these data at the Midwest Fish and Wildlife Conference (2012). Please feel free to use these slides at you discretion. We very much appreciate the funding as it supported **2** master's projects.

Best regards,

Dr. Karen F. Gaines
Professor and Chair

IDNR Special Wildlife Funds Grant Small Grant Final Report:

The Effects of Microhabitats on Population Structures of Forest Floor Small Mammals

Michael Blackowicz, Jennifer Alberts, Karen F. Gaines, James M. Novak, Jill Deppe

Introduction: The initial purpose of this study was to explore spatiotemporal patterns of rodent activity in a central Illinois hardwood forest are random. Specifically, the objectives of this study were: to determine if rodent activity significantly deviates from complete spatial randomness and to determine if there is a relationship between rodent spatial / temporal activity patterns and microhabitat. Rodents were trapped in Sherman live traps placed 10m apart in an 18 x 19 trap grid. Descriptive microhabitat variables were to be measured at each location to correspond to temporal and spatial scales appropriate for model development. Based on the variables measured, a dynamic model was to be explored with the objective of determining the probability of finding a particular rodent species in any area of a forest. However, after preliminary observations of microhabitats and understanding of local hunting activity, prior to microhabitat data collection, it was determined that the Tarble field station initially chosen for this project was unsatisfactory for a number of reasons.

The first and most influential reason for determination of the field site to be unsatisfactory was the realization that the property was dominated by exotic vegetation, namely bush honeysuckle and autumn olive. Additionally, native species present at the site were indicative of a highly disturbed poor quality habitat. This was supported both by the low diversity of forest floor small mammals captured during preliminary trapping as well as historical land use data. The second influence for moving this research was destruction of traps. On several occasions, traps were found destroyed and later consolidated into piles, likely for scrap metal. Fortunately, the traps were found and removed immediately by research staff before they were stolen. If is for these reasons that the project was moved and split into four separate field stations.

Methods and Results: The four field stations are located throughout Douglass and southern Champaign counties on agricultural and Conservation Reserve Program (CRP) land. The purpose of trapping on agricultural land as opposed to native forests is to explore spatiotemporal spatio-

temporal patterns of small mammals in various types of sustainable energy crops in comparison with annual food crops and land dedicated to CRP. Specifically, this research focused on exploration of small mammal use of *Miscanthus giganteus* stands as refuges in agriculturally dominated areas. *Miscanthus* has already proven to be a valuable sustainable energy crop since it is perennial, fast growing, and among the highest producers of biomass per year. Additionally, the crop is unable to reproduce and persists for 15-20 years. The crop could also be a potentially valuable refuge for wildlife in agricultural areas dominated by poor quality annual food crop habitat.

Traps were set transecting stands of mature *Miscanthus*, 1st year *Miscanthus*, corn, soy, hay, and CRP. Traps were placed 15 meters apart along transects that were trapped for 3 nights every 3 weeks for a total of 9 sessions between May 2011 and October 2011. Over the trapping sessions, 5 species were captured totaling 653 individuals. The five species were the house mouse (*Mus musculus*), white-footed mouse (*Peromyscus leucopus*), deer mice (*Perymyscus maniculatus*), prairie vole (*Microtus ochrogaster*), and the northern short-tailed shrew (*Blarina brevicauda*). The northern short-tailed shrew was discounted from the study since none were captured in *Miscanthus* or traditional food crop stands.

General linear models were run to determine the effect of the number of individuals of each species per 10 trap nights in trap groups located within the same transect and the same vegetation type. A second general linear model was run to determine if there was an effect of vegetation type, site, and trapping session on trapping frequency of each species. The results of the models showed that for all species, there are patterns in habitat selectivity between different crops. All species were found, to some degree, in *Miscanthus* stands, except for the northern short-tailed shrew. However, all species were found most often in CRP over *Miscanthus* when CRP was available. The house mouse significantly preferred CRP land over all other types and was not often captured in other types of vegetation even when CRP was not available. In contrast, the deer mouse showed a preference for CRP, when available, but showed high variation in vegetation type preferences when CRP was not available. This can be associated with the species' history of being a habitat generalist. The white-footed mouse, while very closely related to the deer mouse, differed from the deer mouse in their avoidance of hay stands.

The prairie vole was closely tied to CRP land. This species was not often found in other habitat types except when CRP was not available. In one site with CRP, the prairie vole was found exclusively within the CRP land, while in another site without CRP, the prairie vole was not found at all.

Discussion: While investigating the effects of time on use of *Miscanthus* by small mammals, it was found that the use of *Miscanthus* increases tremendously in late October after harvest of annual food crops. This shift in habitat usage toward *Miscanthus* suggests that small mammals may be using *Miscanthus* stands as refuges after harvest of annual crops. If this is the case, *Miscanthus* may not only be a valuable biomass crop for sustainable energy; it may also be very important in maintaining biodiversity by providing refuge to wildlife in areas dominated by annual harvest agriculture. Although there were no simple and obvious trends across all sites equally, the data does suggest spatio-temporal effects of vegetation use by small mammals in agricultural landscapes. Future work will continue in additionally investigating effects such as time of day, edge effects, larger landscape effects, and covariance in vegetation features.

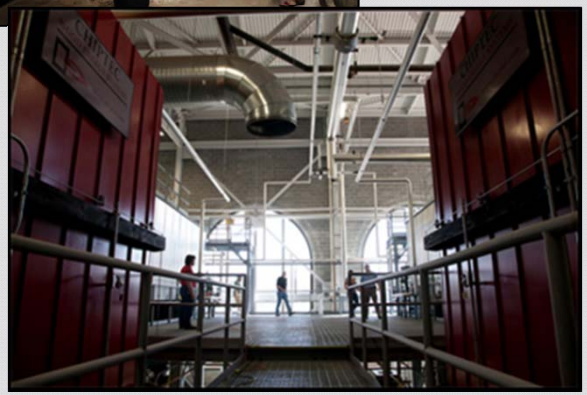
Pilot Study: Pesticide Comparison in Miscanthus trap sites versus croplands. We collected soil samples to determine if pesticide loads differed in soil samples in the Miscanthus versus other cropland areas. 25 soil samples were collected in the Miscanthus area and 25 soil samples were collected in adjacent farmland to determine if there was pesticide drift. After processing samples with a methanol based extraction for an Enzyme Linked Immunossay, no pesticides could be quantified presumably due to drought conditions that altered pesticide application rates in the area.

Please see attached powerpoint for slides that support the above narrative that were presented at the Midwest Fish and Wildlife Conference (2012).

Miscanthus x giganteus

- Dedicated biomass production species
- Non-native sterile hybrid grass species
- *M. sinensis* and *M. sacchariflorus* used as ornamental grasses; invasive
- Mature plants can grow 2.5 – 3.5m tall
- Growing season from late April to October
- Harvested in spring
- Persist 15 – 20 years

Importance of Miscanthus

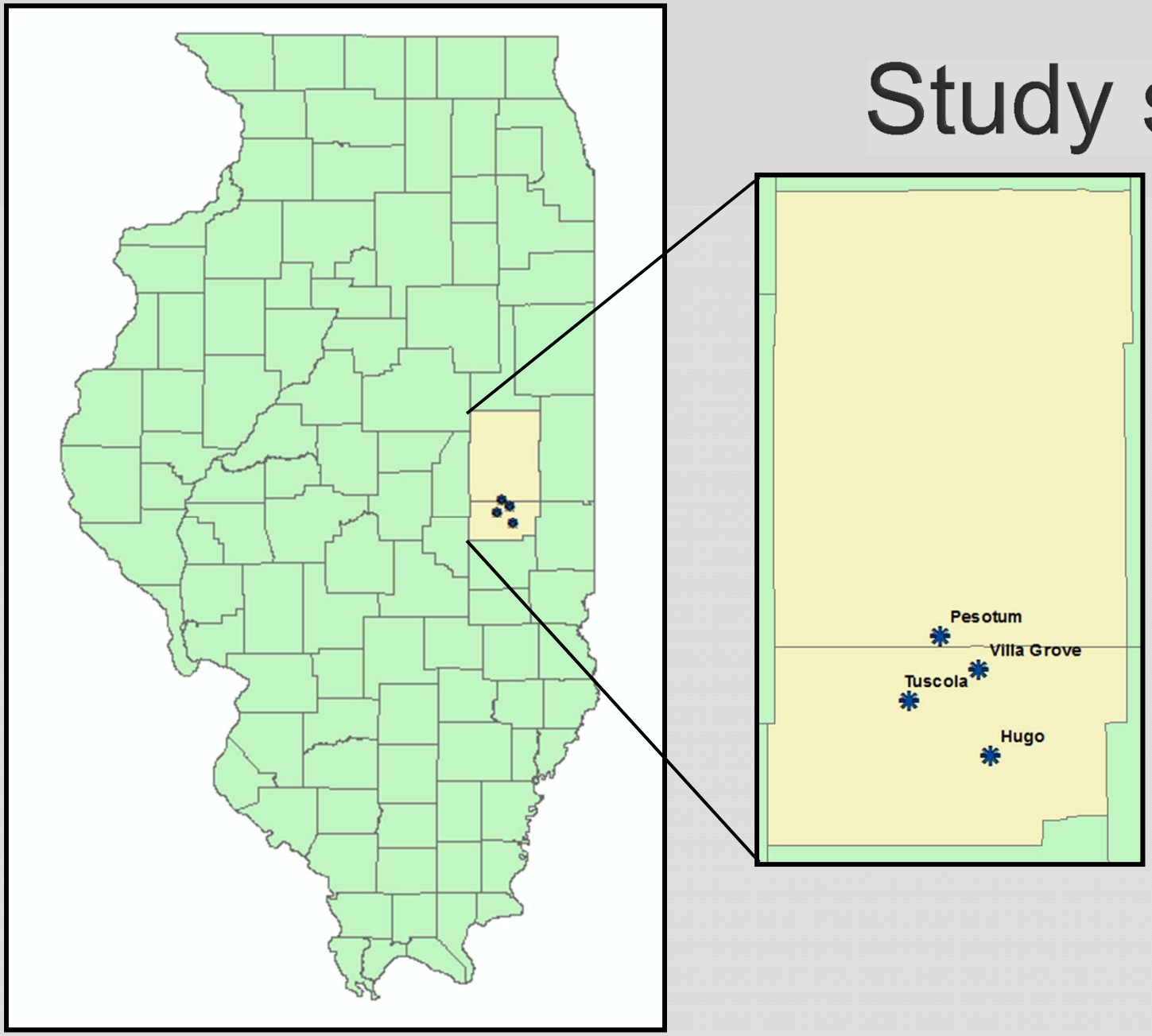


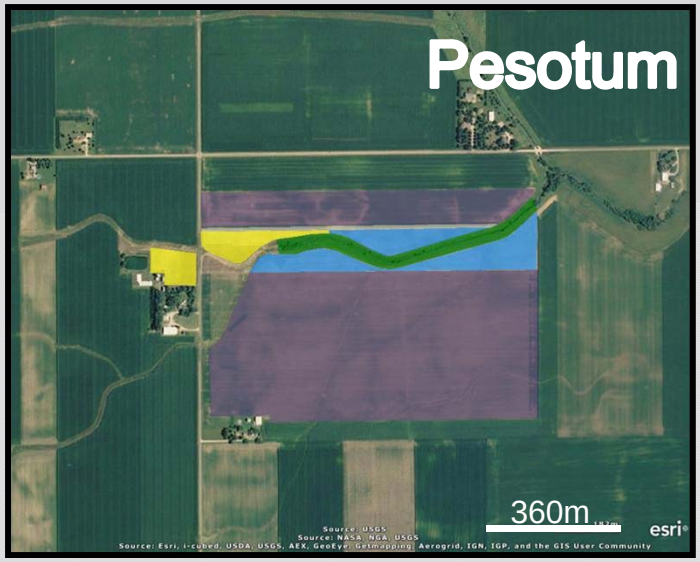
- Use in EIU Renewable Energy Center and other renewable energy facilities
- Impacts of bioenergy development on wildlife
  - Need to understand specific shifts in land cover
    - Traditional crops → Miscanthus
    - CRP & grassy buffers → Miscanthus

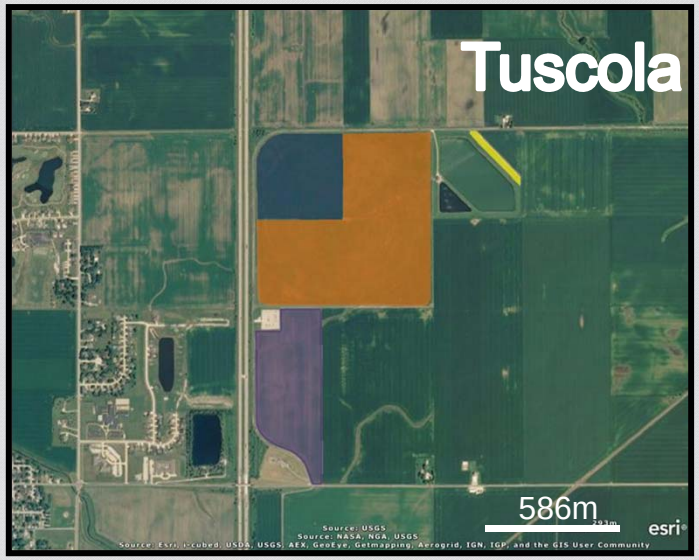
Objectives

Assess the effects of Giant Miscanthus on small mammal assemblages

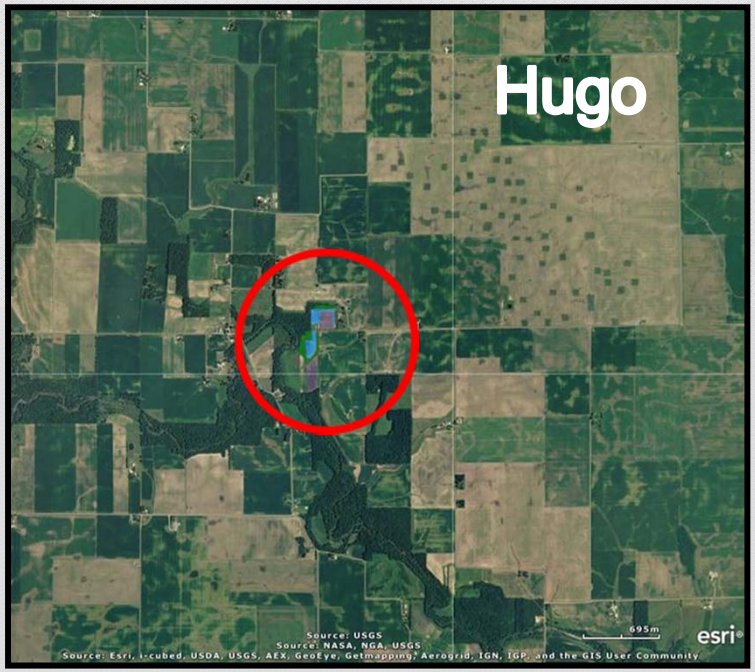
Study sites







- Pure Mxg
- Mxg yr 1
- Mxg/Corn
- CRP
- Hay
- Soy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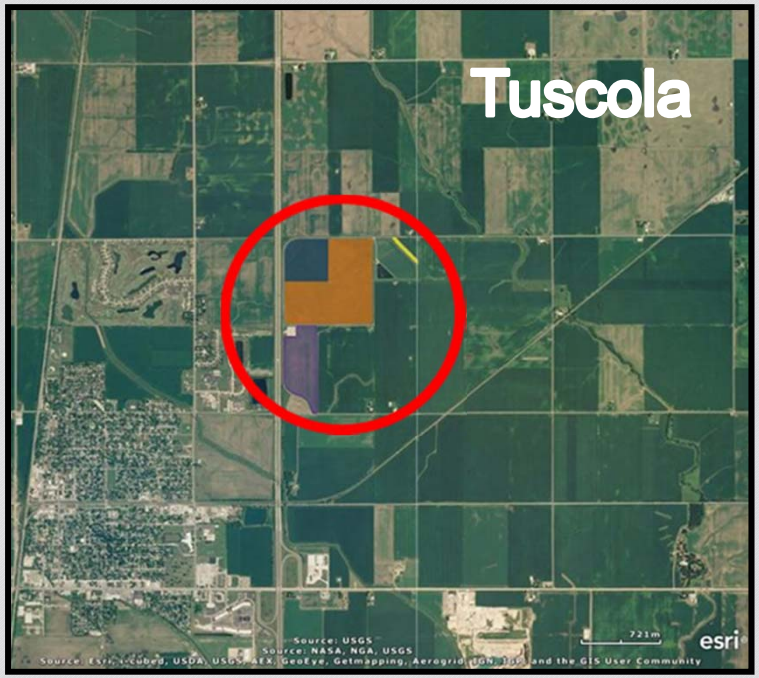
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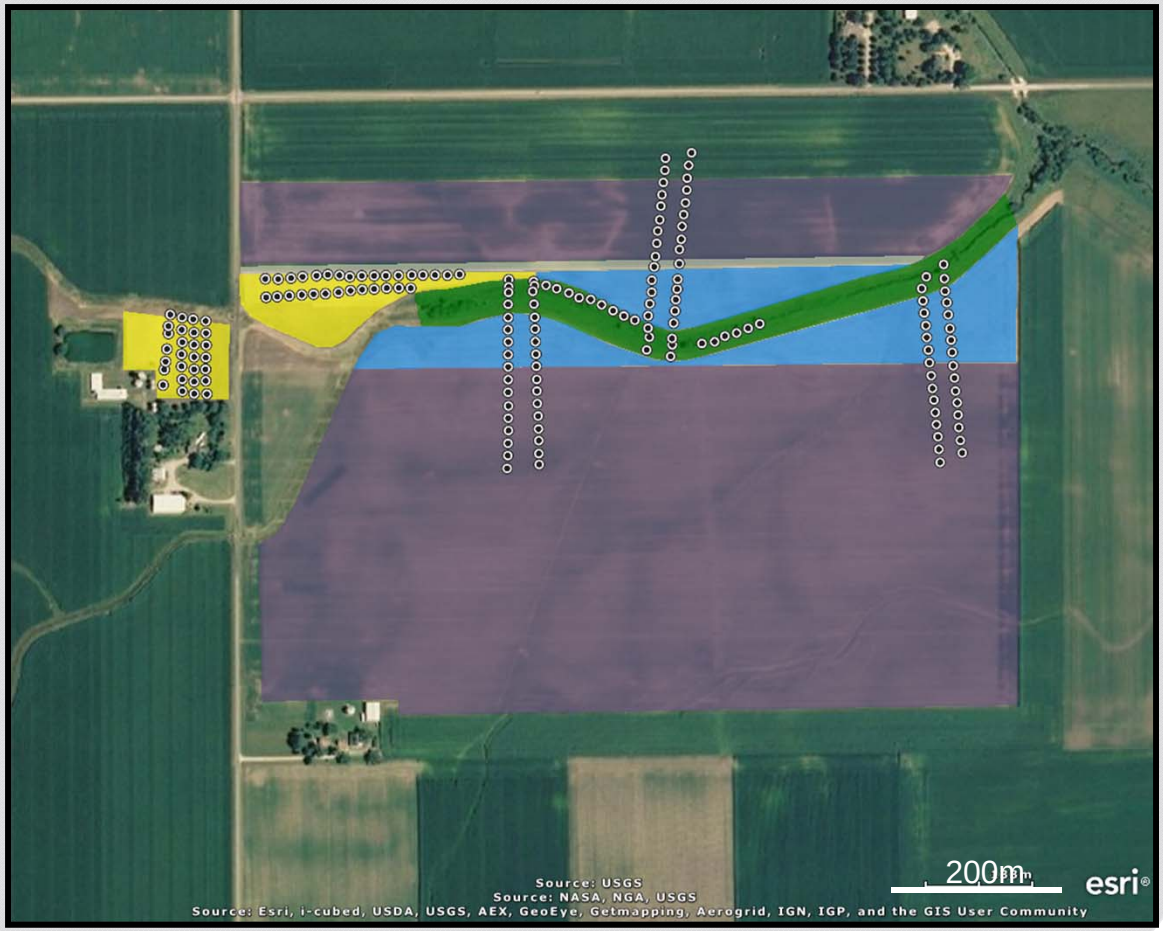
Villa Grove
Source: USGS
Source: NASA, NGA, USGS
Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Co

Methods

- Paired transects
- Sherman traps 15m apart
- 3 trap nights every 3 weeks
- 9 total sessions
- May – late October



Data analysis

- Calculated # individuals/10 trap nights for groups of traps located within same trap line in same veg type
- General linear models
  - DV = # individuals/10 trap nights
  - IV = Vegetation, site & session (random effects)

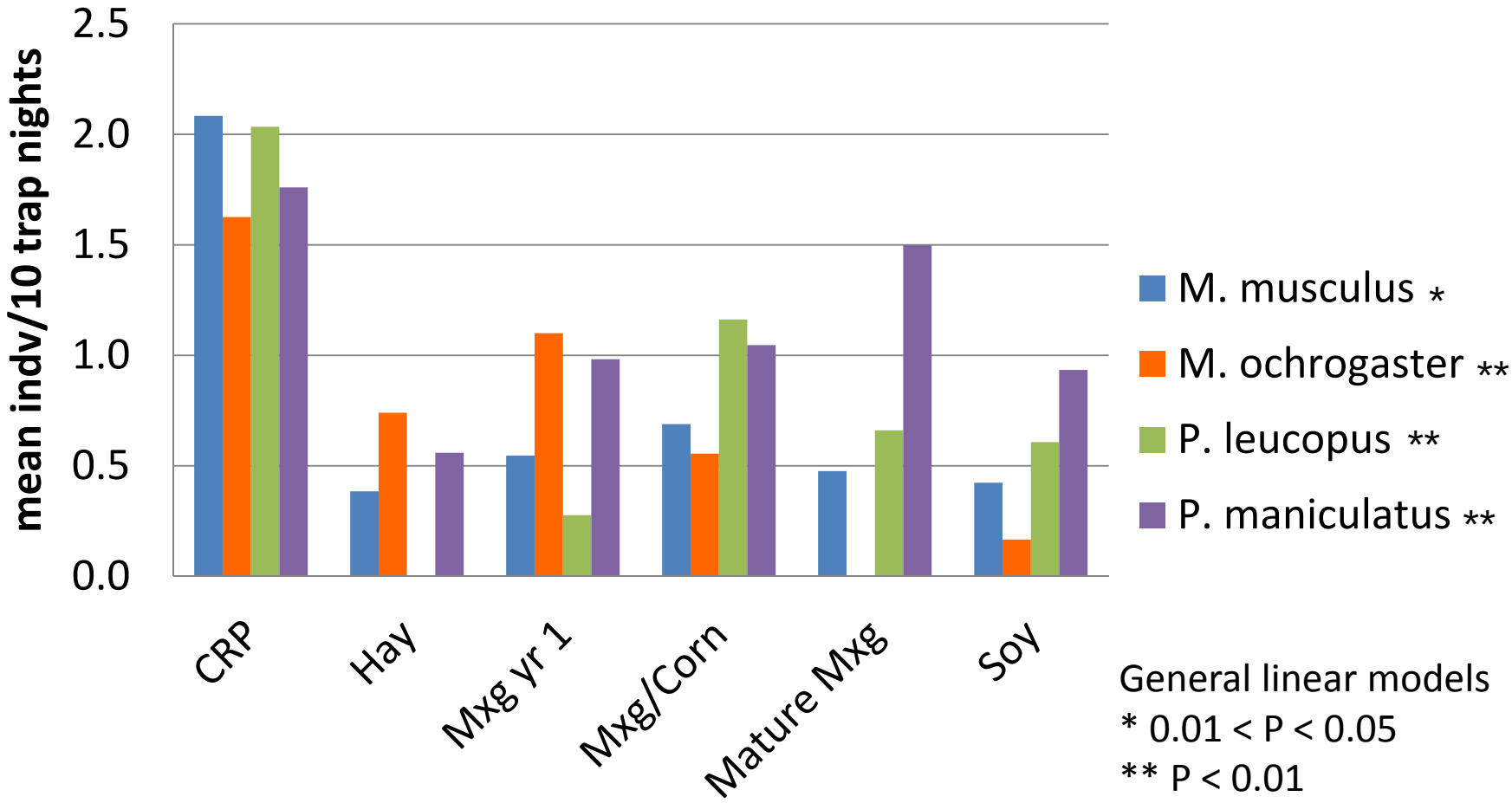
Results

5 small mammal species:

- *Blarina brevicauda*
- *Mus musculus*
- *Microtus ochrogaster*
- *Peromyscus maniculatus*
- *Peromyscus leucopus*

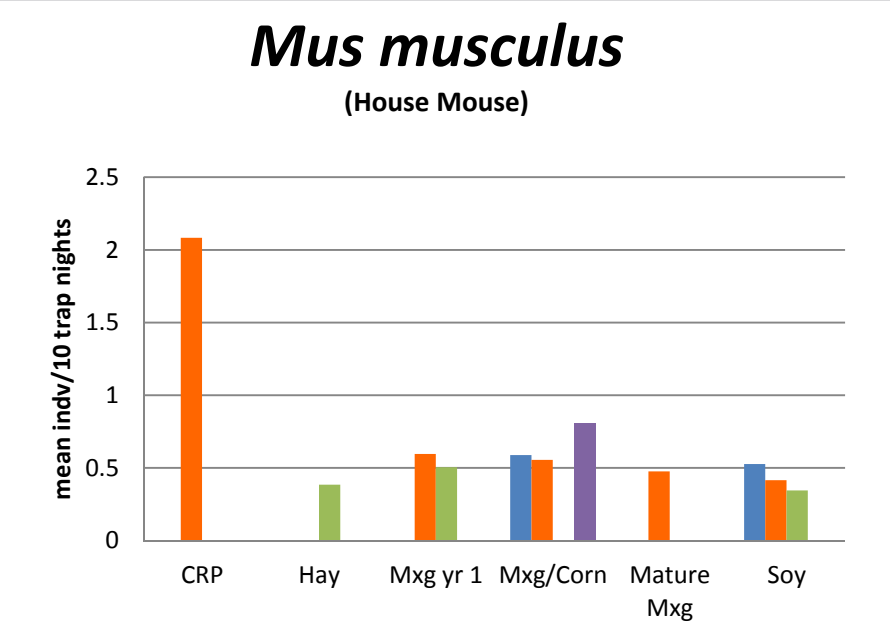
653 individuals

Vegetation

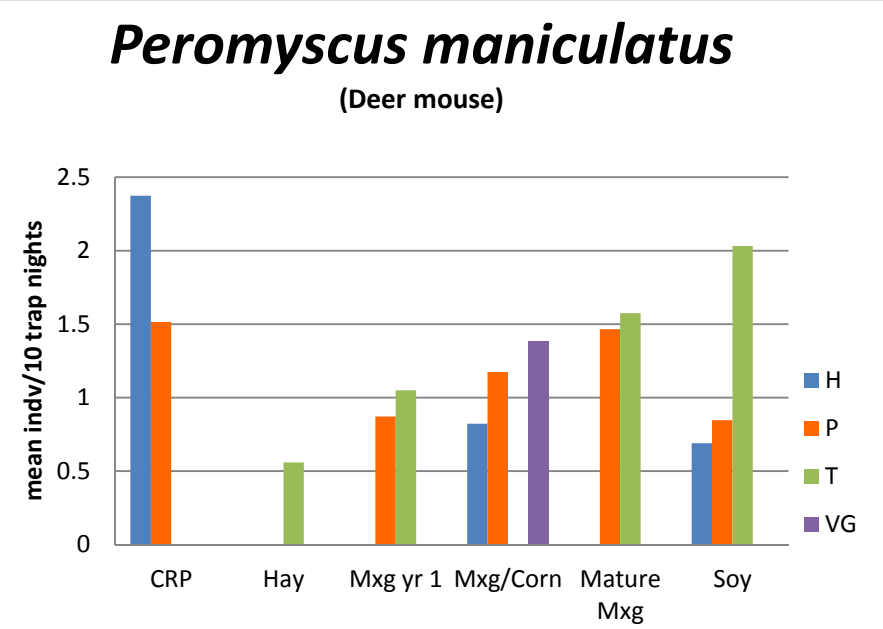


- *Microtus ochrogaster* not found in mature Giant Miscanthus
- All species found in various stages of Miscanthus except MO
- All species found more often in CRP than Miscanthus

Vegetation x site



GLM – sig. veg effect; no site effects or interactions



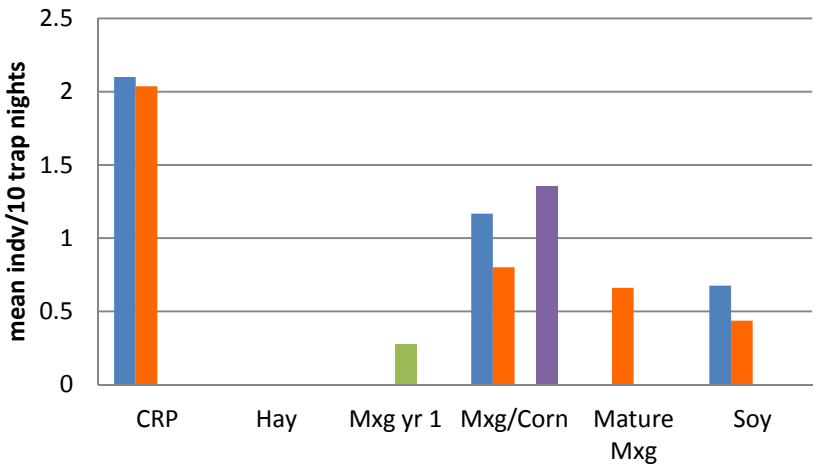
GLM – sig. effects of veg and site

- *Peromyscus maniculatus* most plastic in relation to vegetation type

Vegetation x site

Peromyscus leucopus

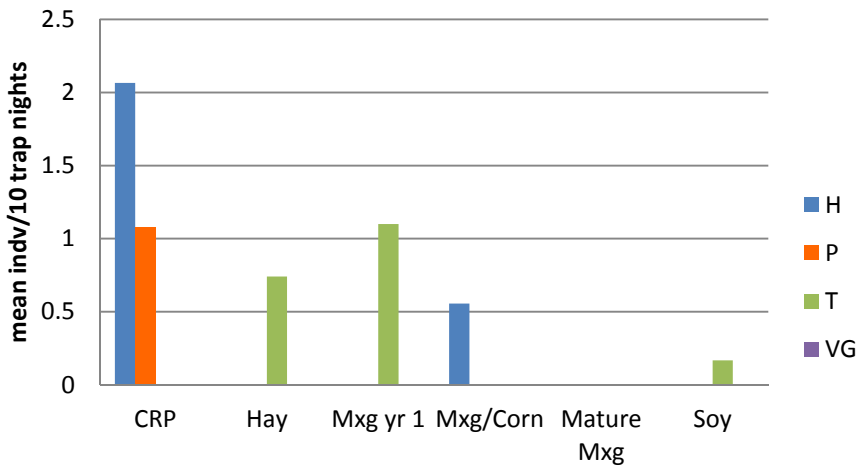
(White-footed mouse)



GLM – sig. effects of veg and site

Microtus ochrogaster

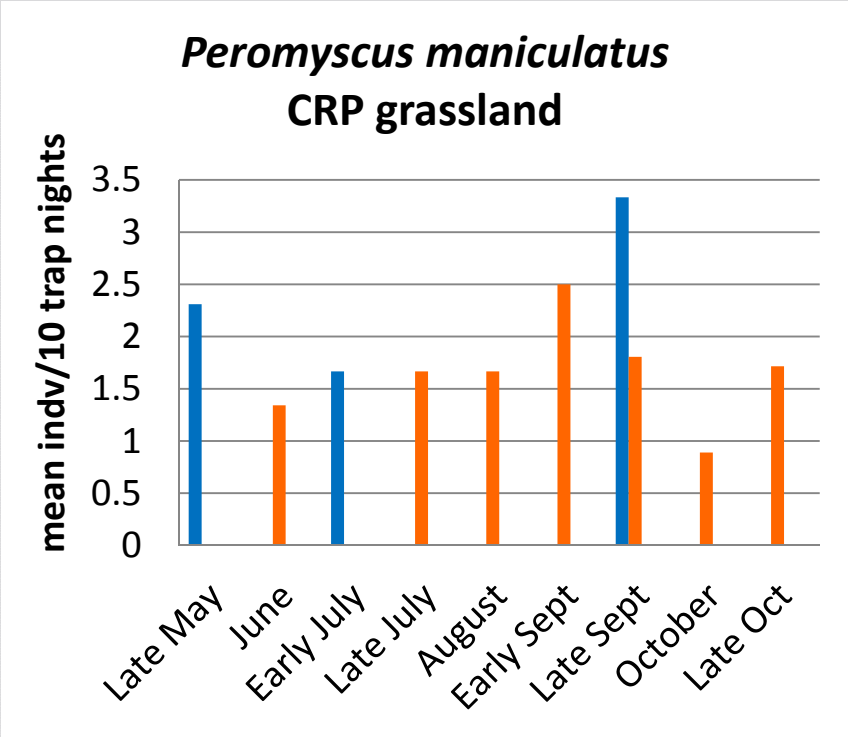
(Prairie Vole)

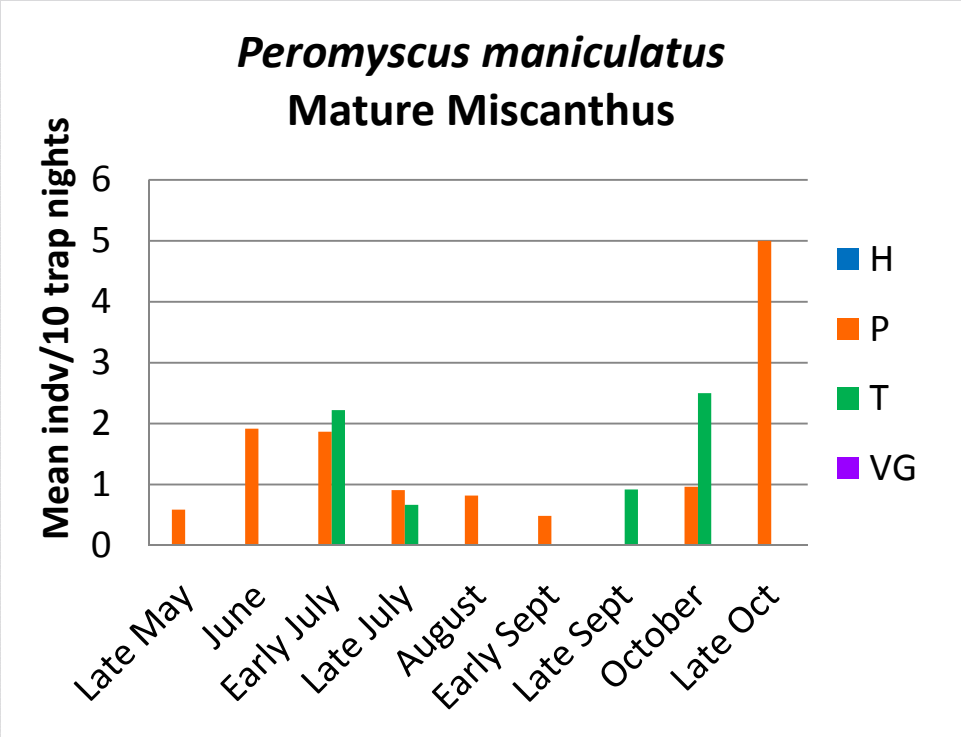


GLM – sig. veg*site interaction

- *Microtus ochrogaster* tied to CRP when available
- *Peromyscus leucopus* not found in hay

Vegetation x time x site

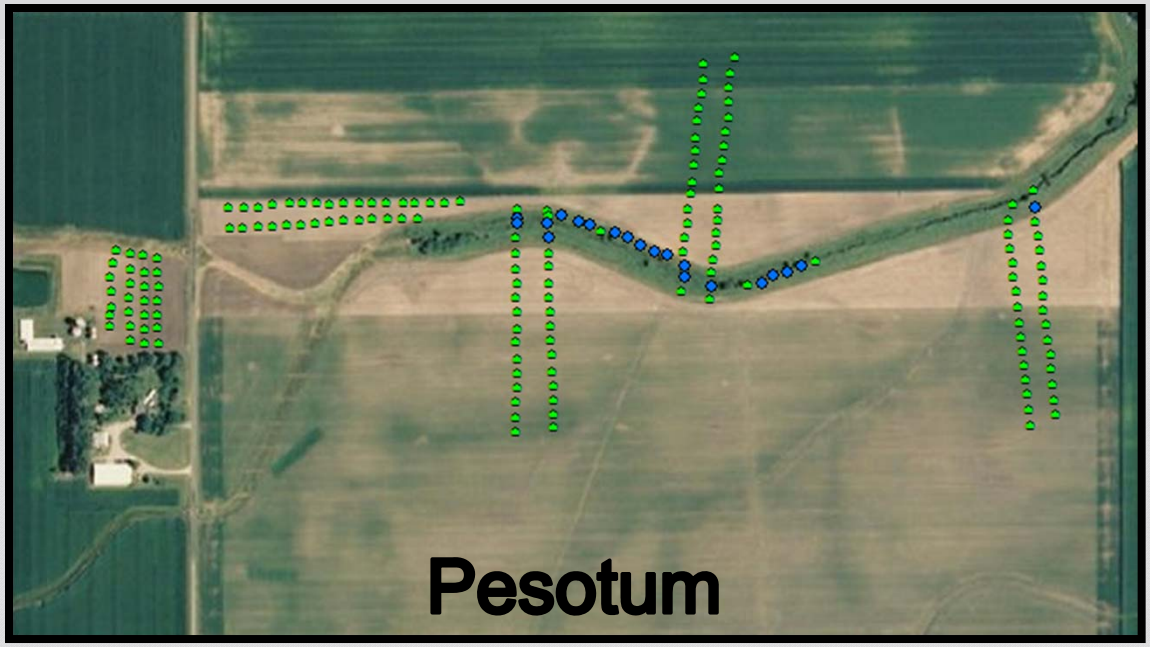




GLM – sig. veg*site*time interaction

- Mean abundance in Giant Miscanthus fields increase after harvest of traditional crops
- Site-specific temporal variation – landscape effects

Blarina brevicauda



- Shrews were not captured in any Miscanthus fields or traditional crops
- Restricted entirely to CRP

Conclusions

- There are no simple trends across all sites
  - Landscape effects
  - Variation in soil or plant communities
- Species do show preferences for field types
  - *Blarina brevicauda* is strongly tied to CRP grasslands and does not use Miscanthus or traditional crops
  - *Microtus ochrogaster* tied to grassland habitat types when available although will use Miscanthus in establishment year and hay

EIU faculty members receive IDNR grants

CHARLESTON — The Illinois Department of Natural Resources has awarded Karen Gaines and Stephen Mullin, faculty members in Eastern Illinois University's Department of Biological Sciences, Wildlife Preservation Fund Grants of nearly $2,000 each.

WPF # 12-014W

Gaines will use her $1,938 to study "The Effects of Microhabitats on the Population Structures of Forest Floor Small Mammals," a project focusing on isolated habitats in central Illinois.

Gaines said, "Since most of the land-use in central Illinois is agricultural, wildlife are challenged in finding viable habitats to seek shelter, forage and mate. 'Microhabitat' structures, that is, the small features of the habitat, are what drive survival of these species. This study uses small mammals (such as) wild mice, wild rats, shrews, voles, etc., to investigate such questions."

She added that the study is also focused on a newly emerging land-use of bioenergy crops for fuel.

"Specifically, we look at the similarities and differences between species that utilize bioenergy crops, conventional crops and woodlands within the central Illinois landscape mosaic," she said.

WPF # 11-008W

Mullin, who specializes in herpetology, serves as the principal investigator for a project titled "The Community Ecology Associated with Hog-nosed Snakes." He received $1,960 for this project.

He said, "Studies of animal behavior in captivity are limited in their ability to explain the influence of a natural environment on behavioral ecology. Defensive behaviors vary among individual animals, between sexes and with age, as well as with other lesser-known factors.

"The toxin-rich diet of many toad-eating snakes might enable or cause their terminal defensive behavior of death-feigning. We videotaped death-feigning behavior in wild Plains Hog-Nosed Snakes subjected to standardized harassment and described the diet of these individuals. Both diet and behavior differed between sexes and age classes. Male H. nasicus death-feigned for longer than females, but initiated death-feigning later.

"Hog-nosed snakes had broader diets than other snake species observed at the study site. Female H. nasicus had more specialized diets than males; adults of both sexes consumed mostly turtle eggs during the study period, while juvenile snakes fed on Six-lined Racerunners and their eggs.

"In spite of the added detail and quantity of information about the diet and anti-predatory behaviors in Plains Hog-nosed Snakes, the physiological mechanism that produces death-feigning behavior in this species is still uncertain, as is its efficacy in deterring attacks from potential predators."

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