Effects of Livestock Use on Wetland Communities

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Study Area
Calculating Livestock Use Intensity

• Used principal components analysis to calculate a univariate disturbance measure

\[ LU = \text{first principal component of pca(} \sim \log[\text{bare ground}] + \text{soil bulk density}) \]
Questions:

1. Does the overall abundance and composition of wetland species vary with increased livestock use?

2. Are these changes associated with the structure, diversity and functional status of the vegetation community?
Does livestock use affect overall community composition?
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Does livestock use affect vegetation structure, diversity and functionality?

Maximal model:
\[ e[Y] = \text{Zone} + \text{LU} + \text{Zone} \times \text{LU} \]

- Total, exotic, and native richness
  \[ Y \sim \text{Poisson with log link function; term for wetland size added to maximal model} \]
- Tall emergent frequency
  \[ Y \sim \text{binomial with logit link function} \]
- Aboveground biomass, Shannon diversity
  \[ Y \sim \text{Normal with identity link function} \]

Models fit with quasi-likelihood and an estimated dispersion parameter
Does livestock use affect total species richness and diversity?

**Total Species Richness**

- \( D_{adj}^2 = 0.52, \ P < 0.0001 \)

**Shannon Diversity**

- \( R_{adj}^2 = 0.49, \ P < 0.0001 \)
Does livestock use affect richness of exotic and native species?

- Exotic Richness
  - $D^2_{adj} = 0.63, P < 0.0001$

- Native Richness
  - $D^2_{adj} = 0.30, P = 0.0004$
Does livestock use affect frequency of tall emergent species?

Tall emergent species:

- *Schoenoplectus acutus*
- *Bolboschoenus maritimus*
- *Carex atherodes*
- *Phalaris arundinacea*
- *Typha latifolia*
- *Carex utriculata*

![Graph showing frequency of tall emergent species against livestock use.](image)

\[ D^2_{adj} = 0.63, \quad P < 0.0001 \]
Does livestock use affect aboveground biomass?

$R^2_{adj} = 0.60, P < 0.0001$
Indirect effects of grazing on breeding waterfowl

**Dabbling Ducks**

\[ D^2_{adj} = 0.17, \ P = 0.0507 \]

**Diving Ducks**

\[ D^2_{adj} = 0.63, \ P < 0.0001 \]
Does livestock use affect wetland vegetation (and ducks)?

- Plant community composition strongly associated with cattle use of wetlands
- Community diversity and “quality” also associated with cattle use
- Some breeding waterfowl also seem to respond to changes in vegetation structure
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