

# Current Research on Grassland Plantings

Jack Norland, Natural Resource Management  
NDSU

# Current Research

- Research comes from both the eastern and western part of the state
- Research comes from studies done by various NDSU researchers
- Biondini, M. 2007. Plant diversity, production, stability, and susceptibility to invasion in restored Northern Tallgrass Prairies (United States). *Restoration Ecology* 15: 77-87.
- Grygiel, C. E., J. E. Norland, and M. E. Biondini. 2009. Precision prairie reconstruction (PPR): a technique for increasing native forb species richness in an established grass matrix. *Ecological Restoration* 27:459-467.
- Grygiel, C. E., J. E. Norland, and M. E. Biondini. 2010. Can Carbon and Phosphorous Amendments Increase Native Forbs in a Restoration Process? A Case Study in the Northern Tall-grass Prairie (U.S.A.). *Restoration Ecology* 20:122-130.
- Biondini, M.E., J.E. Norland, C.E. Grygiel. 2011. Plant Richness-Biomass Relationships in Restored Northern Great Plains Grasslands (USA). *International Journal of Ecology*. 2011:1-13.
- Norland, J.E., S. Fasching, C. Dixon, K. Askerooth, K. Kelsey, and G. Wang. 2013. Reduced Establishment of Canada Thistle (*Cirsium arvense*) Using Functionally Similar Native Forbs. Accepted. *Ecological Restoration*.
- DiAllesandro, A., B. Paradeis Kobiela, and M. Biondini. 2013. Invasion as a Function of Species Diversity: A Case Study of Two Restored North Dakota Grasslands. Accepted. *Ecological Restoration*.

# Diversity Effects



## QUESTIONS:

- 1. HOW DIVERSE SHOULD A SEED MIX BE?  
HOW MANY AND WHAT KIND?***

# WHAT SPECIES SHOULD BE IN A SEED MIX?

- Grass, forb, shrub, C3, C4
  - Often mixes dominated by grasses — Results in plantings with lower diversity
- Beyond growth form — Functional Forms
  - Physiological and structural characteristics that drive community assembly

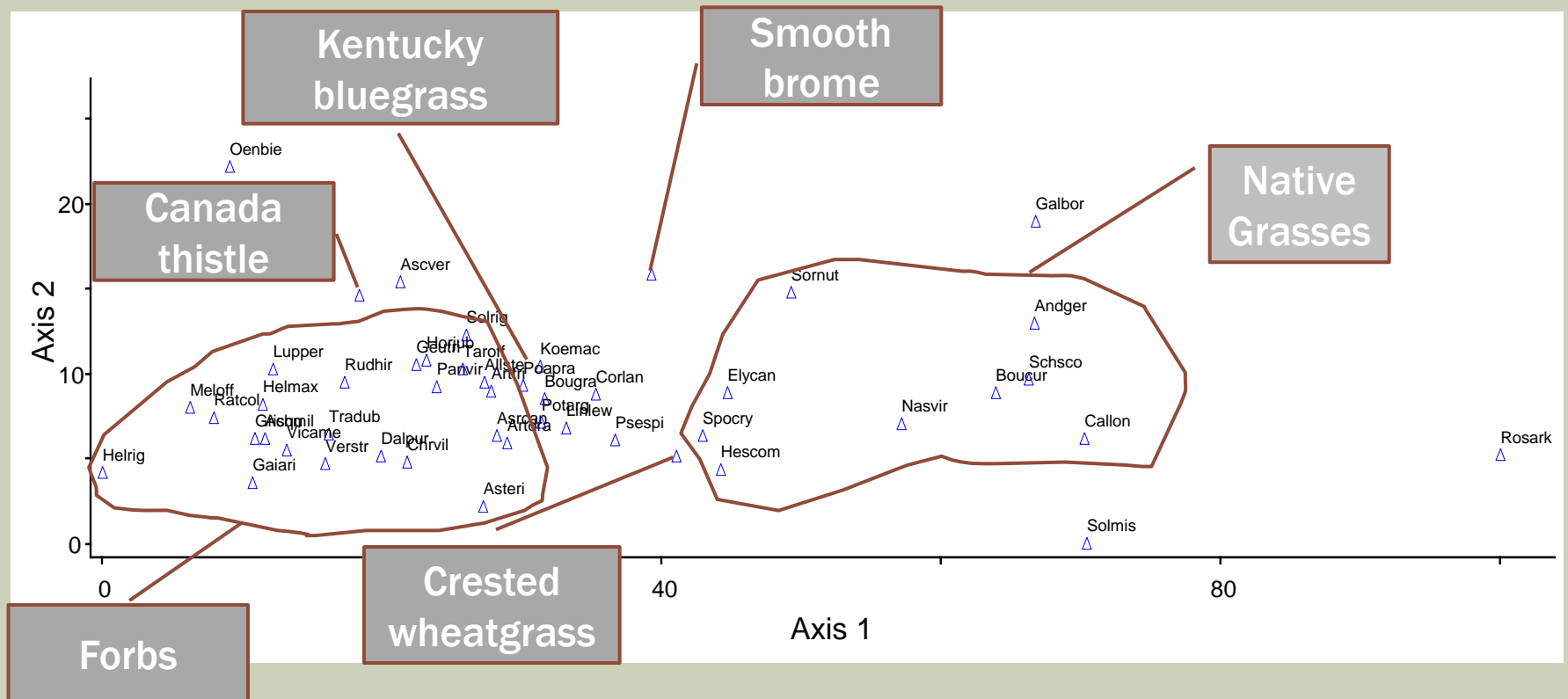
# FUNCTIONAL FORMS

- Studies used 9 different characteristics

<b>Root:Shoot ratio</b>	<b>Relative growth rate</b>
<b>Nitrogen use efficiency</b>	<b>Nitrogen root uptake</b>
<b>Phosphorus use efficiency</b>	<b>Phosphorus root uptake</b>
<b>Root lateral spread</b>	<b>Root surface area</b>
<b>Root plasticity</b>	

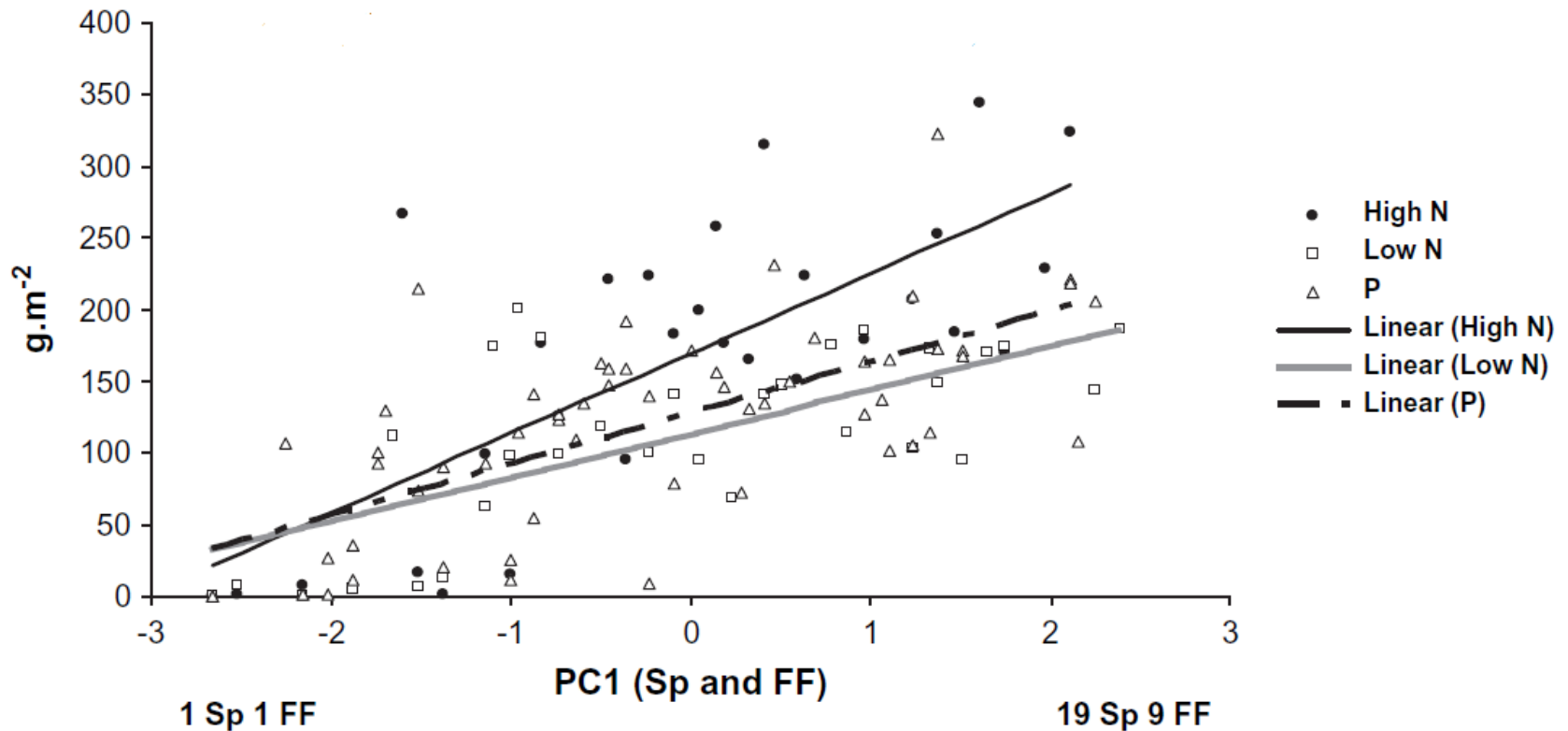
# FUNCTIONAL FORMS

- Ordination of 50 species with the 9 functional form characteristics



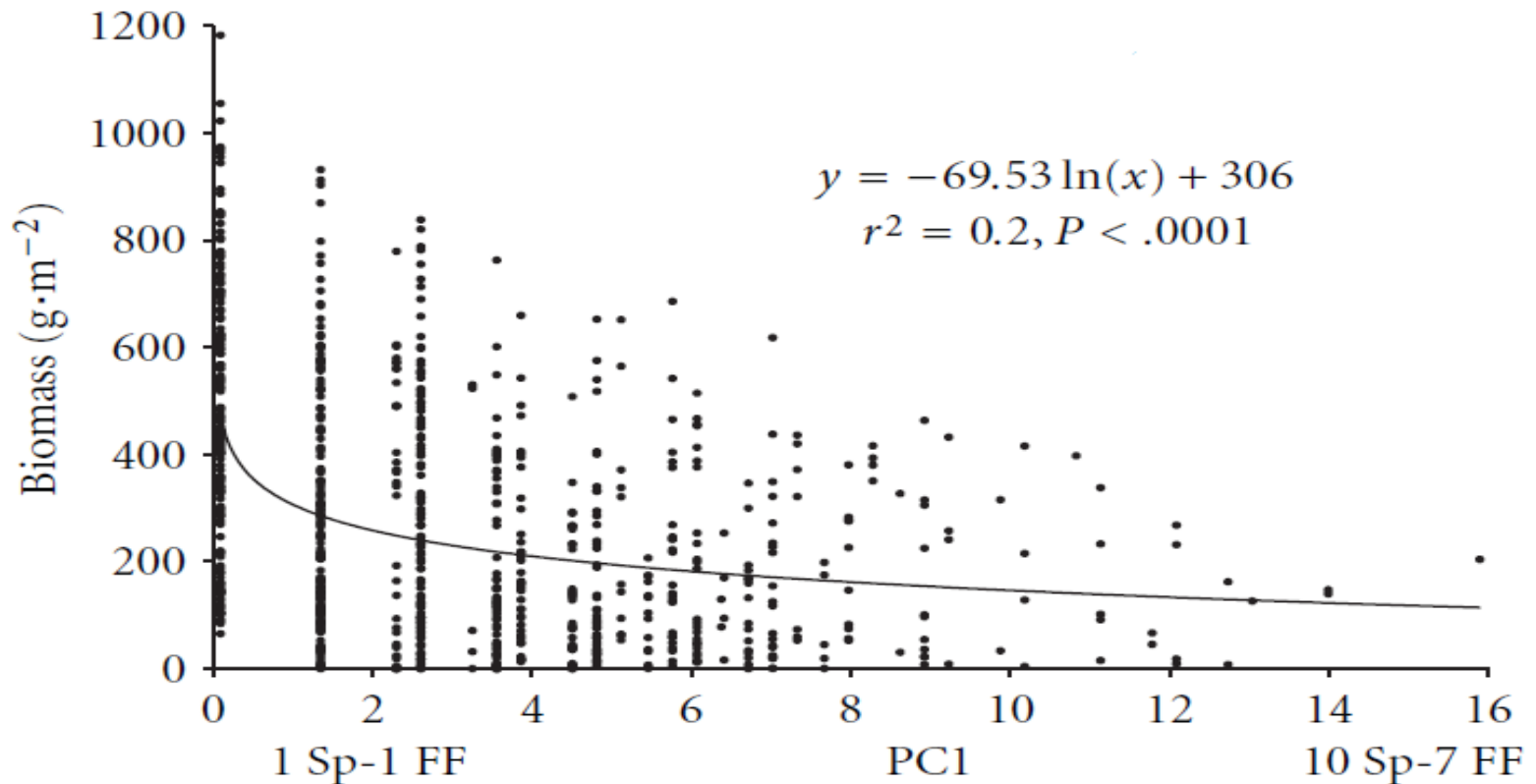
# WHAT AND HOW MANY?

- Relationship between stable biomass and species (SP) and functional forms (FF) — similar response east and west



# WHAT AND HOW MANY

- Biomass of invading species against number of planted species and functional forms





# WHAT AND HOW MANY

- With higher species and functional form diversity:
  - ✓ **Higher stable biomass**
  - ✓ **Resistance to invading species**
    - Crested wheatgrass and smooth brome
  - ✓ **Holds for both east and west**

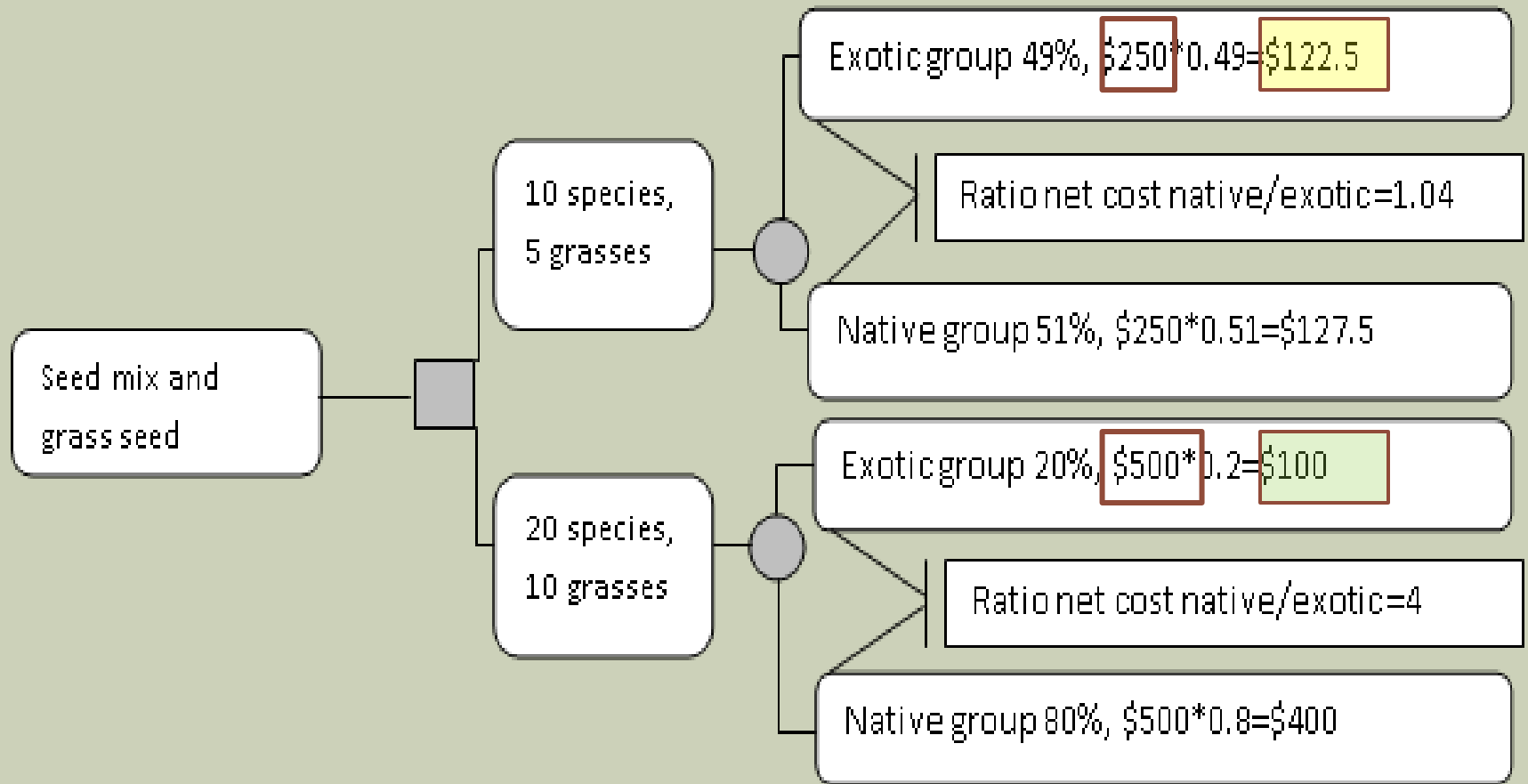
# WHAT AND HOW MANY

- Survey of 120 grassland plantings found that:

10 species with 5 grasses	20 species with 10 grasses
51% dominated by native	80% dominated by native
49% dominated by exotic grasses	20% dominated by exotic grasses

- Higher diversity with 10 grasses increases odds to get desired outcome
- There will always be failures — Is the 20% failure rate the best we can do?

# COST ANALYSIS



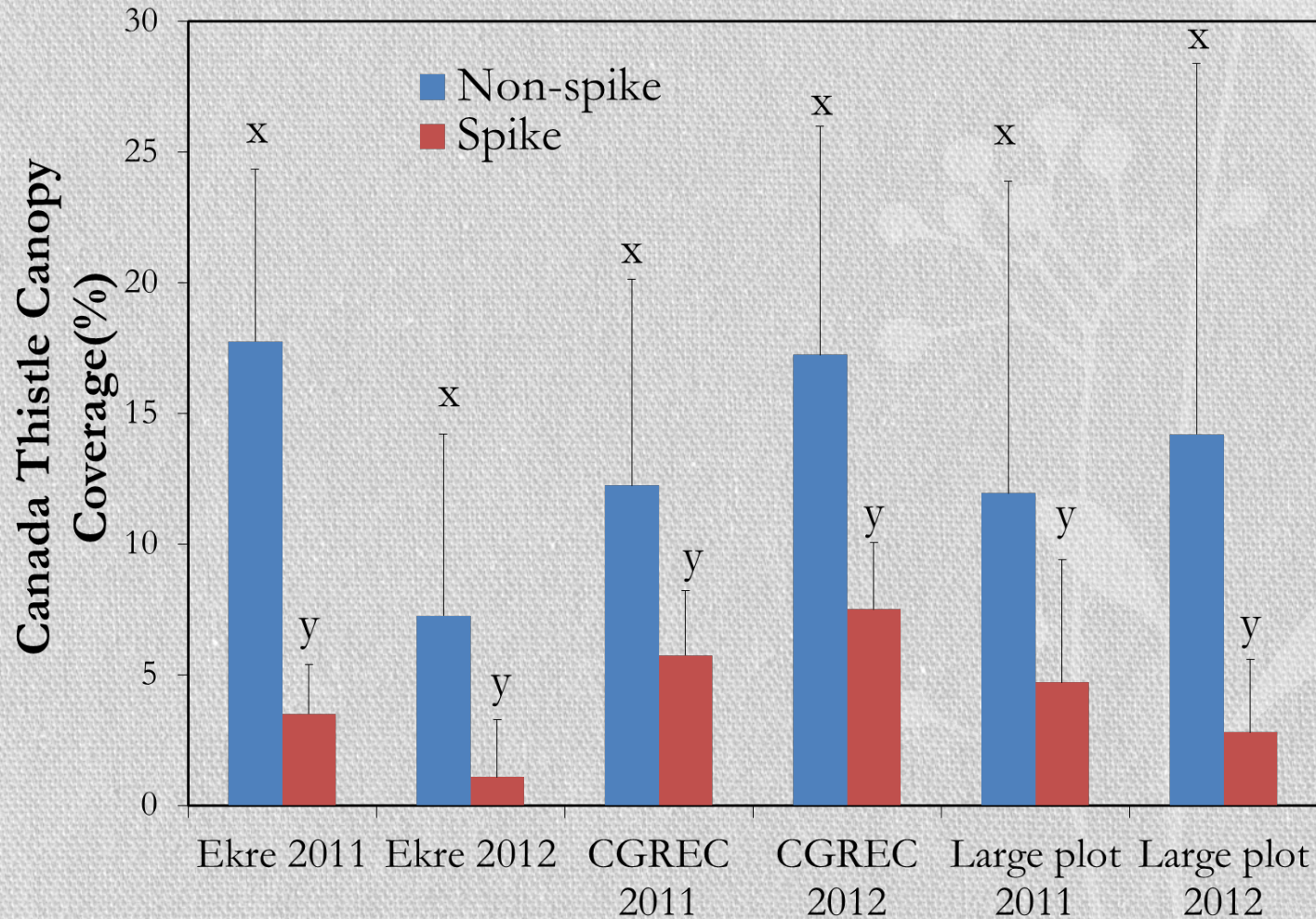
# Use functional traits to Target weeds

- Rationale: By planting species with similar functional characteristics to the weeds — the weeds will be reduced.
- Target species: *Canada thistle*
- Planted 3-4 native forbs similar to Canada thistle
- The forbs were added or **SPIKED** to the chosen seed mix — increased seed density to at least 100 seeds /ft<sup>2</sup> and as high as 300



# Results of targeting weeds

- Spiking seed mix resulted in reduction of Canada thistle establishment in small plots and at field trials





# Field trial results

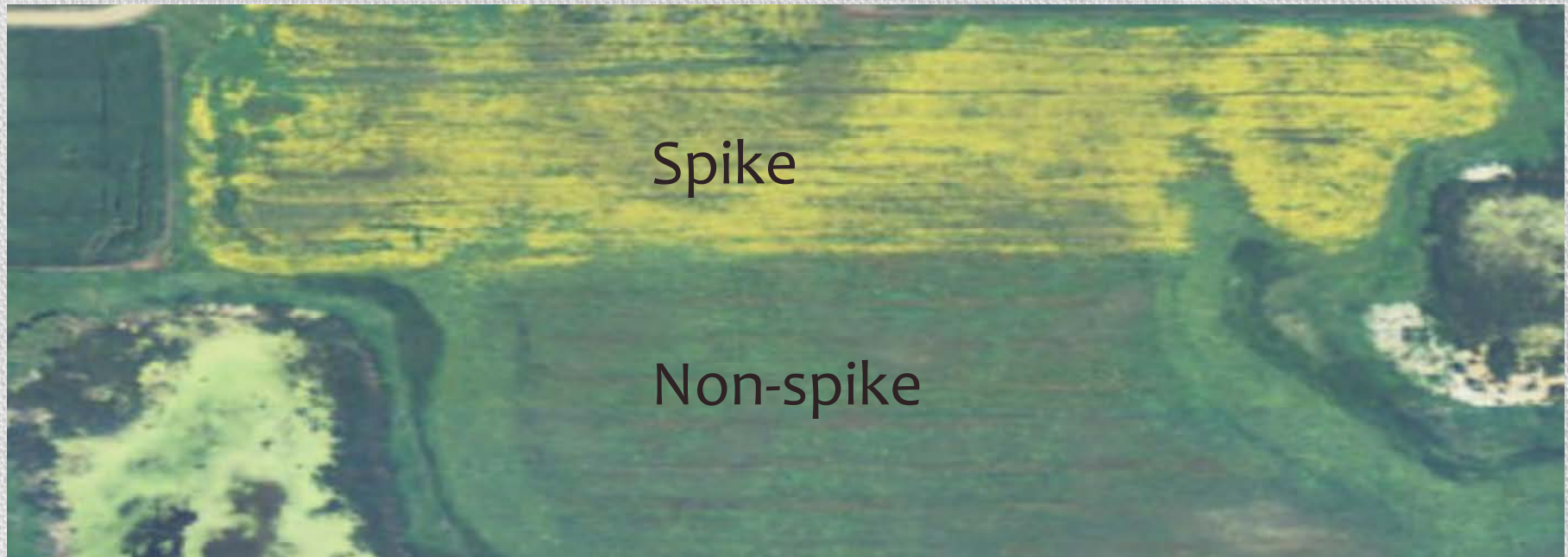
## Field trails with greater that 10% cover of Canada thistle

Non-spike

33 % of field had > 10% cover

Spike

5% of field had >10% cover





# Targeting weeds with the spike

- Can reduce weed establishment from seed bank
- Using functional traits should be tried on other species
- Using native plants that are desired in the final outcome avoids using annuals to accomplish similar objectives
- Monitoring plant communities over time
- Replicating this research in the western part

# Conclusions



- Higher diversity more stable — better able to adapt to changing conditions
- Higher diversity resists invasion
- 20 species and above with 10 grasses increases odds of desirable outcomes
- Higher diversity costs more but less is going to undesired states
- Use functional form information to guide targeting of weeds