

Current Research on Grassland Plantings

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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

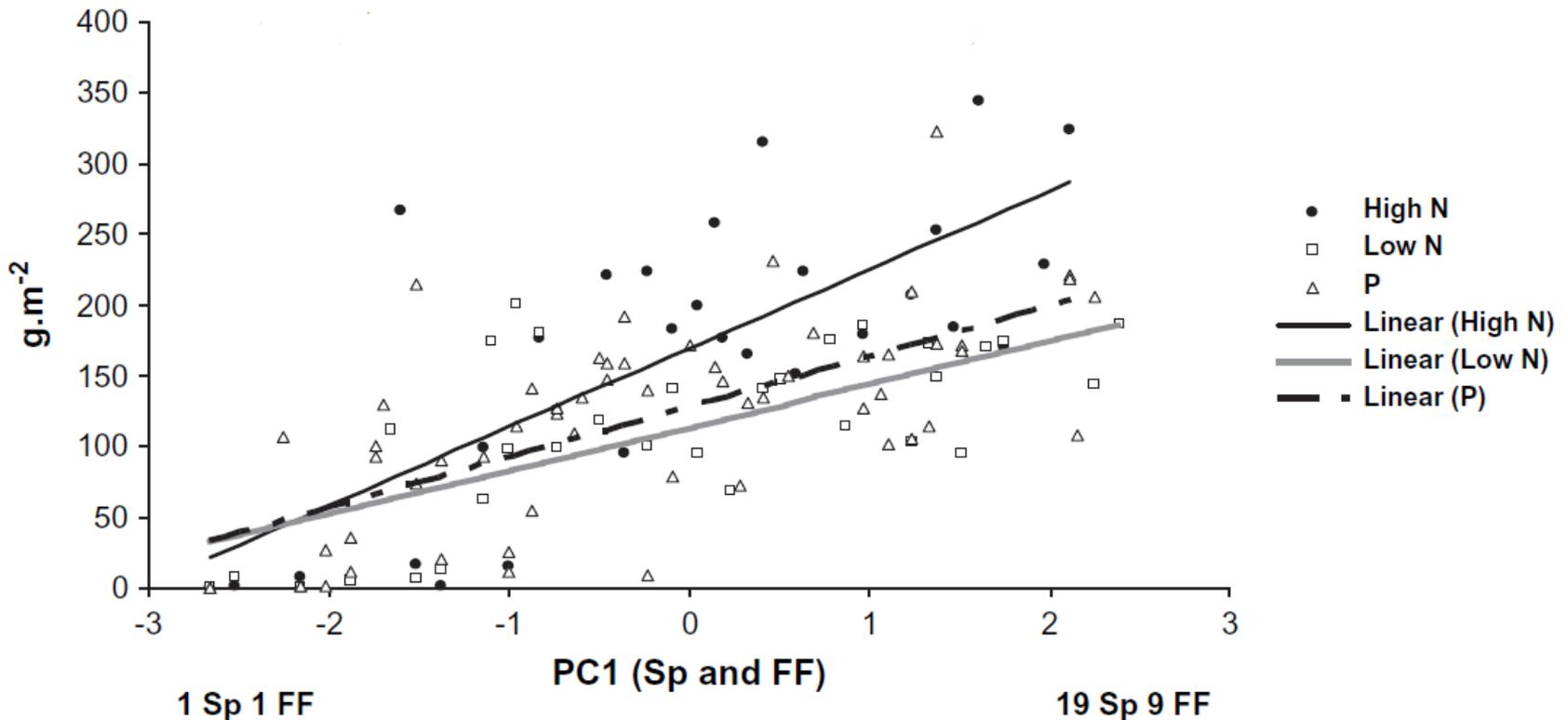
FUNCTIONAL FORMS

- Studies used 9 different characteristics

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

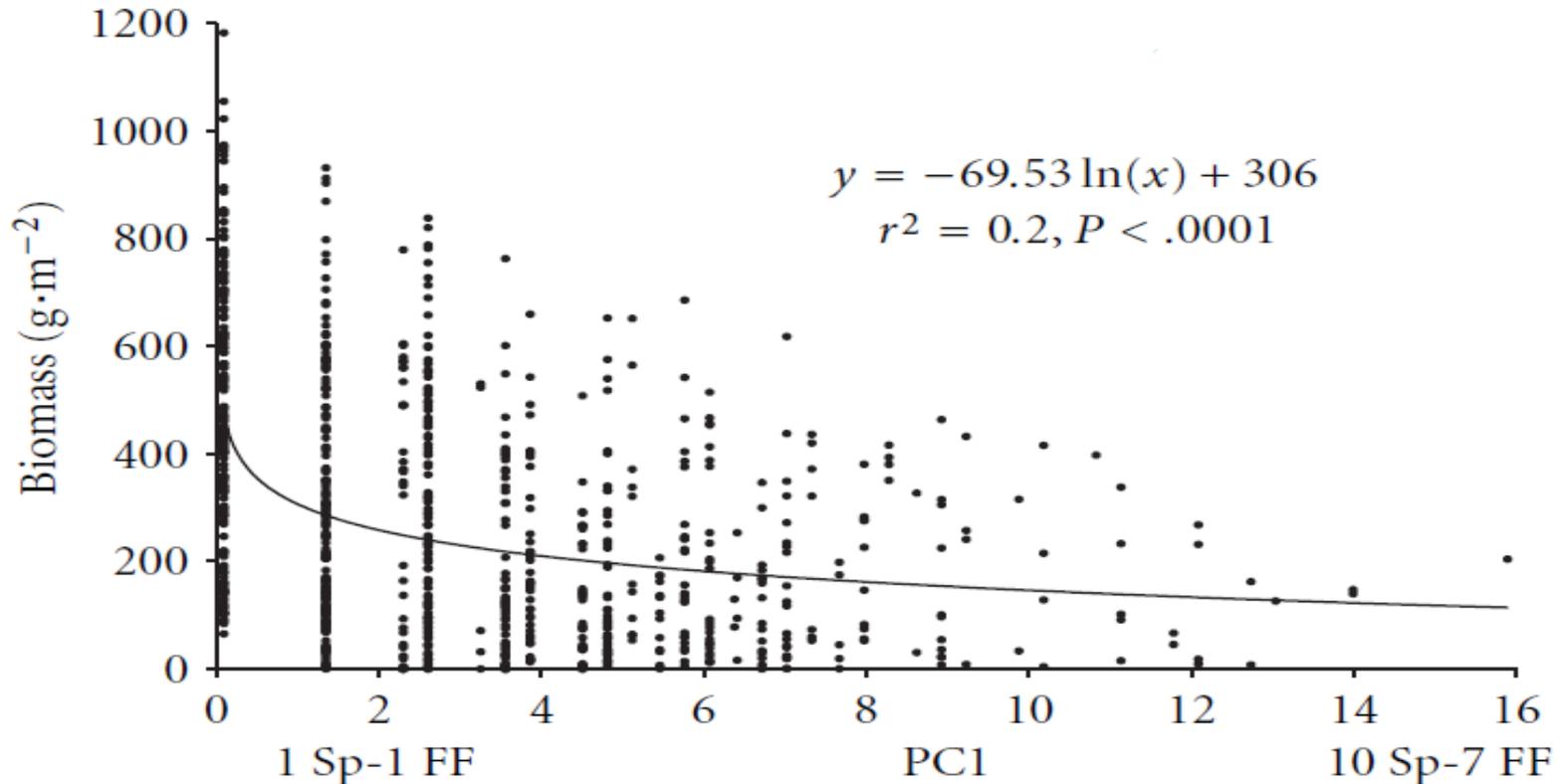
WHAT AND HOW MANY?

- 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**

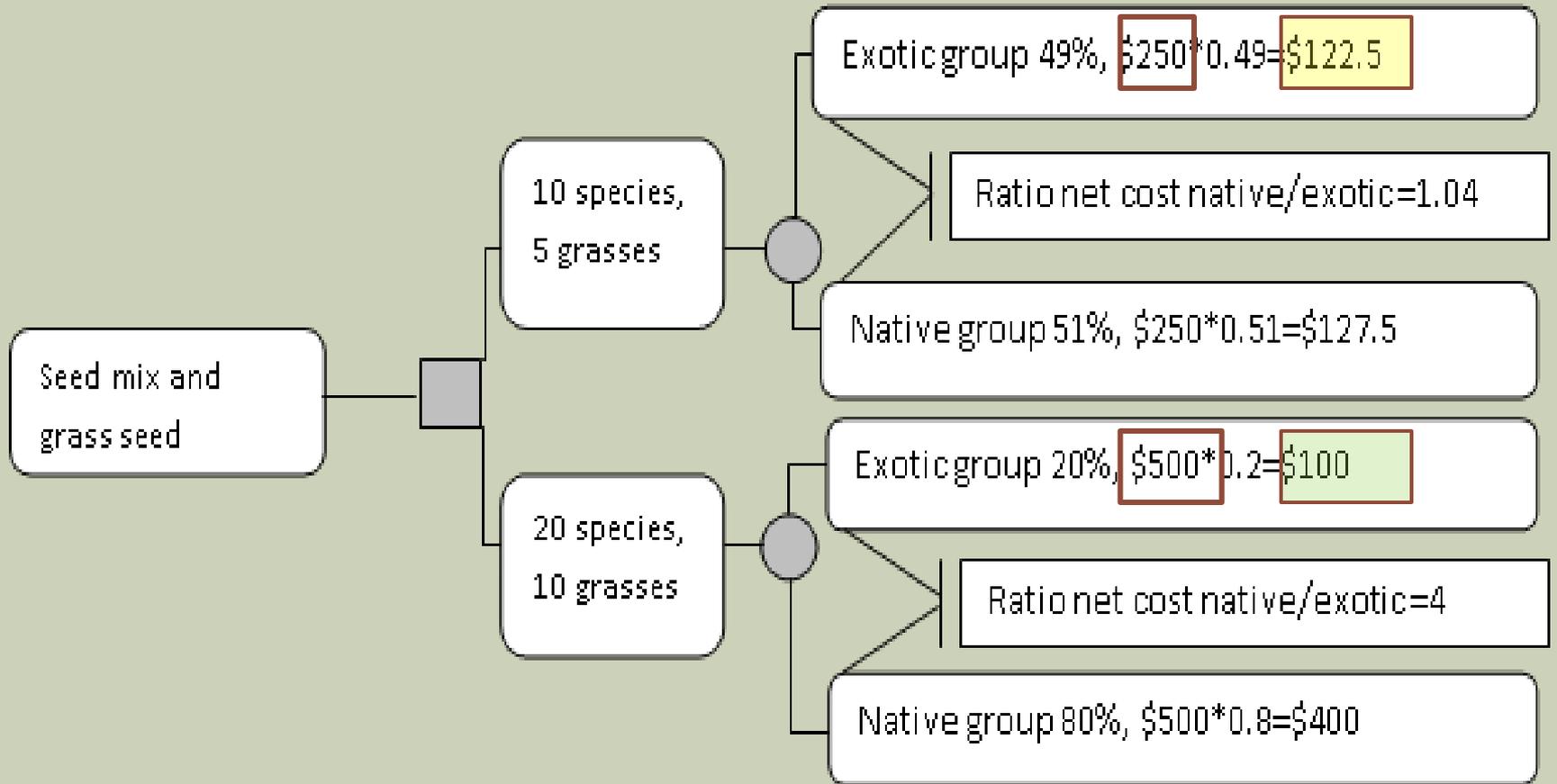
WHAT AND HOW MANY

- 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

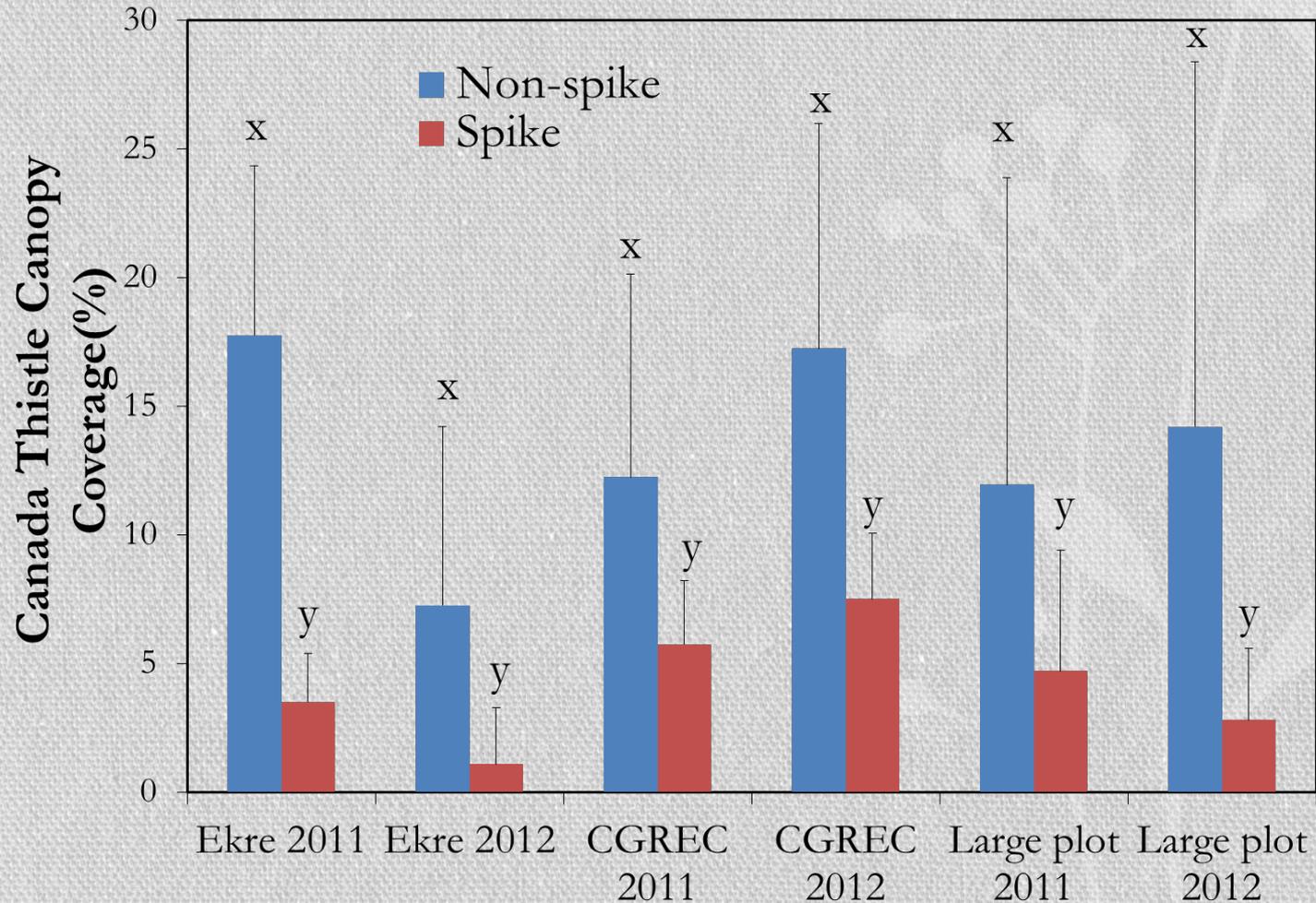


Use functional traits to Target weeds

- 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 /ft² 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 than 10% cover of Canada thistle

Non-spike

Spike

33 % of field had > 10% cover

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