Ecotypic variation and functional genetic responses of an ecologically dominant grass under natural and reduced precipitation: genes to ecosystem response

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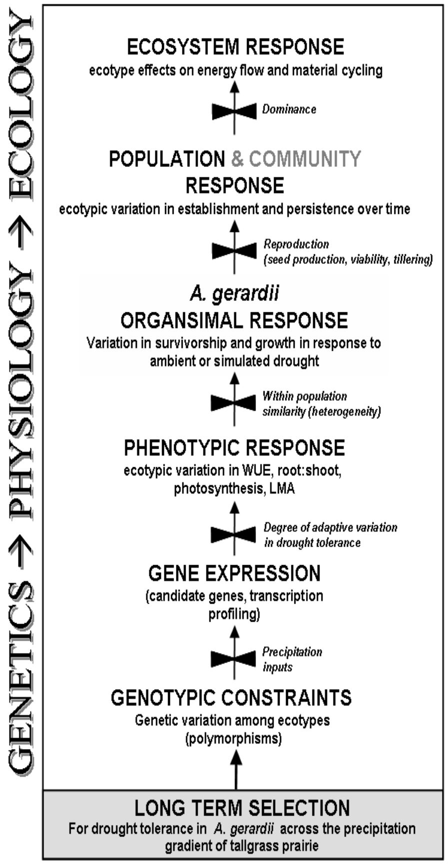

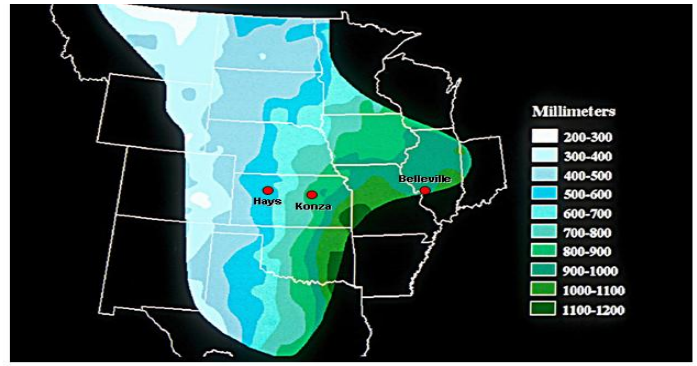

Figure 1. Distribution of the central grassland in North America and corresponding mean annual precipitation (mm) (courtesy of I. C. Burke, Colorado State University). Red dots indicate locations of the reciprocal transplant common garden field experiment of the focal dominant species (*Andropogon gerardii*). Seeds of the focal species will be collected from multiple populations within 50 miles of each of the three sites.

Andropogon gerardii **(big bluestem) is the ecologically dominant grass of the Great Plains. It occurs across a sharp precipitation gradient from 400 mm/yr in western Kansas to >1200 mm/yr in eastern Illinois.**

Goal: **Provide an integrative and mechanistic understanding (spanning from genetics to plant physiology to ecosystem function) of the response of *Andropogon gerardii* to natural and experimentally reduced precipitation.**

Objectives: **Test whether ecotypes are locally or broadly adapted to climate, identify the extent of genetic diversity and functional genetic variation accounting for these putatively drought adapted phenotypes, and whethe**

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are needed to see this picture.

Approach and Experimental Design

- **Common garden of reciprocally transplanted single and multiple source genotypes of *A. gerardii* established under ambient and reduced rainfall across the precipitation gradient (western KS (Hays), Konza, Belleville,Illinois)**
- **Characterize phenotypes and functional genetic variation using cDNA-AFLP and microarrays, quantify ecosystem consequences of genotypic diversity**

Reciprocal common garden design

A similar type of rainfall manipulation is planned for the ecotype project

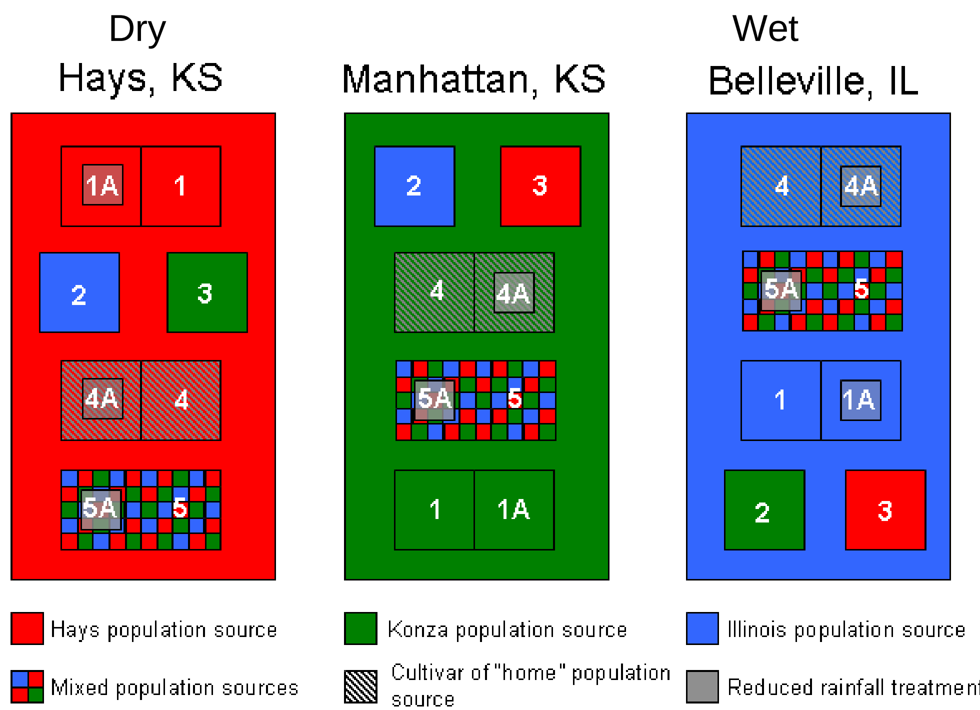
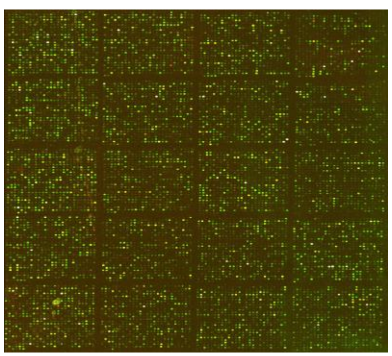
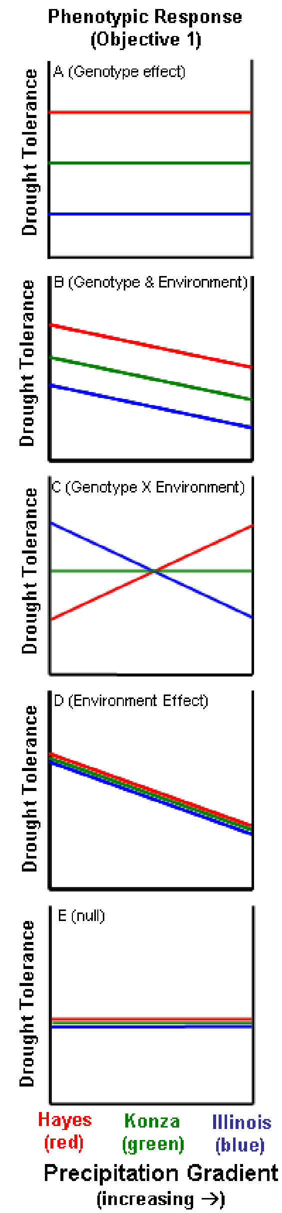


Figure 5. Experimental design for a representative block in each region for the reciprocal common garden experiment conducted in three regions across the precipitation gradient of the tallgrass prairie. Five plots will be established in each block using *A. gerardii* genotypes collected from each of the three regions (Plots 1-3), cultivars (Plot 4), and an equal mixture of genotype from all regions (Plot 5). Plots of single source local genotypes from each home environment, cultivars, and mixed genotypes will be twice as large, with a subplot subjected to a 50% reduction in ambient precipitation at each site (1A, 4A, and 5A). All treatments will be assigned to plots according to a randomized complete block design (n=4 blocks).





Significance and Conservation Implications:

- How will different ecotypes respond to future precipitation changes?
- How can this research inform land managers about how to restore tall grass prairie and to re-assemble CRP prairies?
- Which ecotypes to plant where in the face of climate change?
- Will planting multiple genotypes buffer the system against change?
- How will different ecotypes affect prairie function?