Grass and Drought in 3 Dimensions

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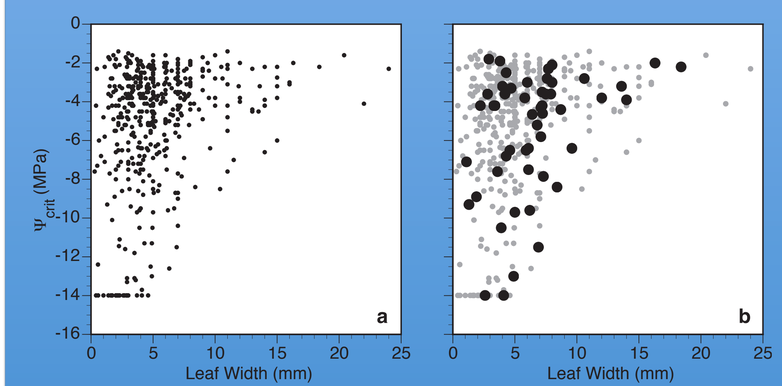
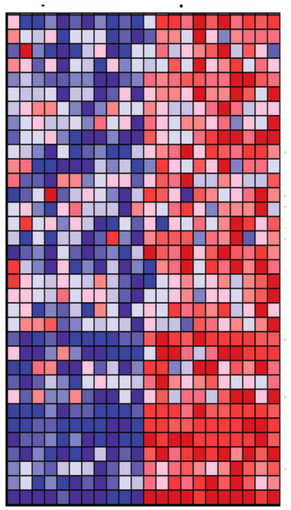
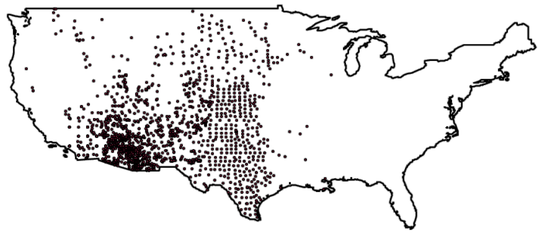
GD3D
Grass and Drought in Three Dimensions

The goal of the proposed research is to examine the interplay among grass genetics, phylogeny, and functional traits in order to understand the evolution of drought tolerance in grasses and its consequences for determining the biogeography of grasses and continental-scale grassland productivity. At the core of the research, it is proposed to determine physiological drought tolerance and associated anatomical and physiological traits for >1000 species of grass distributed across eight major clades and broad geographic and environmental ranges. The scale of the investigation will be matched by new phylogenetic reconstructions of grasses based on whole chloroplast genome sequencing. Complementing physiological drought tolerance, we will develop the first *model species set* to examine how drought tolerance relates to root and leaf anatomy and morphology, stomatal density, and leaf gas exchange. To better understand the genetics of grasses, gene expression with transcriptomes on control and droughted plants for each species will be examined. For each species, environmental niche spaces will be generated from extant databases on global geographic distribution of species and newly available climatic and remote sensing datasets. Through this novel combination of genetic, taxonomic, and functional data, two core questions will be tested: 1) **how drought-tolerance has evolved in different grass clades**, and 2) **whether there is congruence among clades in gene expression in response to drought**. The proposed datasets also will be used to parameterize models of global productivity in the face of drought in a biogeographic and phylogenetically structured manner, coupling data on drought tolerance with gas exchange and environmental data, which will be critical in modeling responses of vegetation to future climate change.

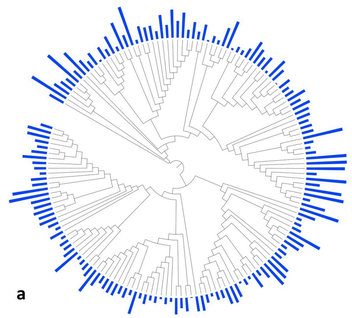




Transcriptomics



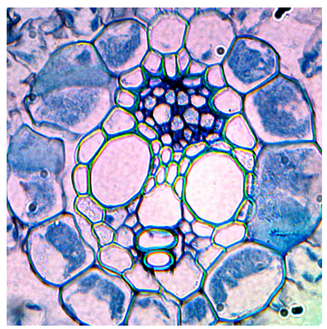
Biogeography



Phylogenetics

Functional Traits

Global C fluxes



Anatomy