Graminoids in the Tallgrass Prairies of Illinois

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Introduction

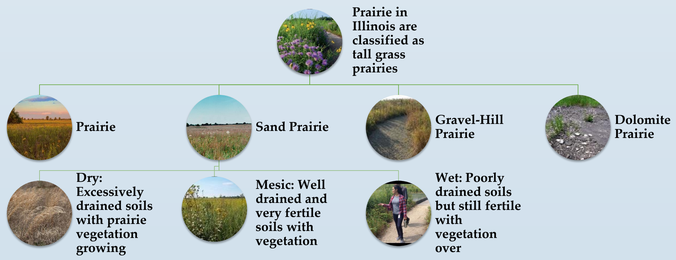
Prairies, grasslands containing herbaceous plant species, harbor and showcase an array of plants and animal species. Prairie communities vary by types such as sand, gravel-hill, and dolomite. Furthermore, they also vary by soil moisture types such as dry, mesic, or wet. Nonetheless, all prairie types contain grasses. The predominance of grasses is a testament to the diversity in forms and traits. Interestingly, grass species you will find will vary depending on prairie community. Some species can be found in multiple prairie types (dry, mesic, or wet), indicating an ability to adapt to different conditions, and some are exclusive to one community type. The species which predominates will depend on the species traits that allow them to survive in different dry and xeric conditions.

Grime's CSR Triangle classifies species by where the species falls in terms of competition (C), stress-toleration (S), and ruderal (R). If a species falls as a competitor that means it dominates under low disturbance and low stress, if a species is stress-tolerant is dominates under low disturbance and high stress, and if a species is a ruderal is dominates under high disturbance and low stress. Grime's CSR Theory could be used to predict which grass species would predominate in each different prairie community. Within these conditions, the traits they have gained allow grasses to contribute a vast amount to the environment both aboveground and underground.

Objectives

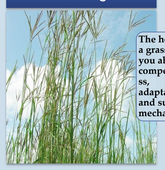
My objective is to make connections between what significant traits grasses have that allow them to sustain and survive in the prairie community types.

Illinois Prairie Divisions Map



Grass species traits

Plant Height

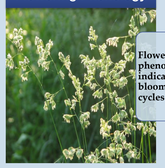


The height of a grass can tell you about its competitiveness, adaptability, and survival mechanisms

Seed Weight

Seed size indicates the healthiness and productivity in the environment

Flowering Phenology



Flowering phenology indicates the blooming cycles

Methods

Site Data:

The project's scope entails utilizing plant community surveys from Illinois that range from the 1900s to the early 2000s. These publications, compiled by Jeremie Fant and Kris Bonefont, are works that have been completed on prairies.

This included data from Marlin Bowles who surveyed a number of prairies in Illinois, and measured presence of species in 20 quadrats. He also classified all the prairies as dry, mesic, or wet. Using this data we worked out relative frequencies of species by prairie type. Grass species were then assigned a prairie preferences, if they occurred at single site type they were assigned that prairie type immediately, while grass species that existed in multiple site types, their relative frequency was calculated in each prairie type and a species was assigned depending on which prairie they were more prevalent.

Species Traits:

Using numerous publications, we recorded different life history traits for every grass species; including average seed weight, minimum and maximum plant height, life history, phenology, conservation status, and photosynthesis (C3/C4).

Using the list of species traits and prairie plant surveys we can make connections and conclusions about which species survive in these prairie communities and which traits do these species have that allow them survive and thrive in different dry communities in the Midwest.

Results

Table 1: Grass species used in study classified by prairie preference which they were the most common

	Prairie Preference			
	Dry	Dry-Mesic	Mesic	Wet-Mesic
Species Full	Andropogon scoparius	Bromus pubescens	Agropyron repens	Calamagrostis canadensis
	Bouteloua curtipendula	Carex bicknellii	Agropyron trachycaulum	Carex buxbaumii
	Bouteloua hirsuta	Dactylis glomerata	Agrostis alba	Carex pellita
	Calamovilfa longifolia	Hierochloe odorata	Agrostis hyemalis	Cladium mariscoides
	Cyperus schweinitzii	Juncus balticus	Andropogon gerardii	Deschampsia caespitosa
	Koeleria cristata	Juncus torreyi	Andropogon virginicus	Eleocharis compressa
	Lolium perenne	Luzula multiflora	Bromus inermis	Eleocharis elliptica
	Panicum oligosanthes	Muhlenbergia mexicana	Bromus kalmii	Glyceria striata
	Panicum villosissimus	Panicum leibergii	Echinochloa crusgalli	Juncus acuminatus
	Poa compressa	Phalaris arundinacea	Eleocharis tenuis	Juncus brachycephalus
	Sorghastrum nutans	Poa pratensis	Elymus canadensis	Juncus canadensis
	Sporobolus heterolepis	Sporobolus asper	Festuca elatior	Juncus dudleyi
	Vulpia octoflora	Sporobolus cryptandrus	Juncus biflorus	Muhlenbergia frondosa
		Stipa spartea	Juncus greenei	Muhlenbergia glomerata
			Juncus interior	Panicum clandestinum
			Juncus tenuis	Panicum flexile
			Leersia oryzoides	Phleum pratense
			Panicum boreale	Phragmites australis
			Panicum precocious	Rhynchospora alba
			Panicum virgatum	Scirpus acutus
			Scleria triglomerata	Spartina pectinata
			Setaria faberi	Typha latifolia

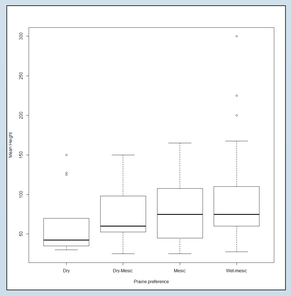


Figure 1. Mean height of the species classified by prairie type which they were most common

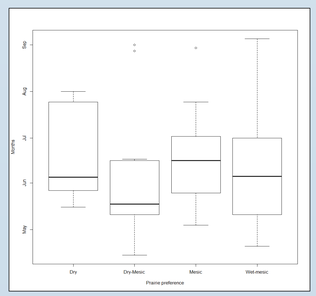


Figure 2. Duration of the flowering period for each species classified by prairie type which they were most common

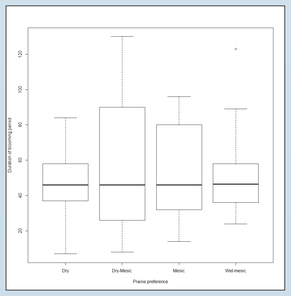


Figure 3. Period of bloom for each species classified by prairie type which they were most common

Conclusion

Of all the traits I looked at, none of the traits showed significant relationships when analyzed, but there are some trends that with a larger data set might show significance.

Figure 1 shows a trend of shorter height in drier prairies, although not significant.

Figure 2 shows that the length of the blooming period is less variable in the two most extreme prairie types.

Figure 3 shows that although there is no significant difference in the initial bloom date amongst prairie types, the species preferring wet-mesic prairies are more variable in their flowering initiation.

These four prairie types show visible differences and the graminoid species play an important role in that structure. Although the study found that there are no significant trait differences, this may be a result of limited data and the fact that the traits were not measured under uniform conditions. Some of the more important traits for soil characteristics can be root traits, for which there is also limited data.

Further work should address acquiring more uniform trait data so that stronger relationships can be inferred through data analysis.

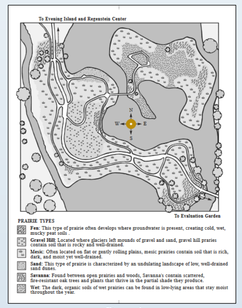


Figure 4

Figure 5

Figures 4 and 5 are pictures of the Dixon Prairie at the Chicago Botanic Garden. Figure 1 is a map of the community types at the Dixon Prairie and Figure 2 is a picture of the gravel-hill prairie

References

Bowles, M., & Jones, M. (2007, March 01). The Prairie-Wetland Vegetation Continuum in the Chicago Region of Northeastern Illinois. *Ecological Restoration, 25*(1), 29-42. doi:10.3368/er.25.1.29

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