Comparison of Total Amounts of Plant Cover in Black Grama Grassland and Honey Mesquite Shrubland

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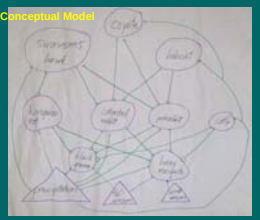
Introduction

Desertification is a problem in many ecosystems. In the Jornada Experiment Range (JER), desertification manifests itself on the transition from native black grama grassland to honey mesquite shrubland. In both communities the lack of plant cover can contribute to the desertification process. The question we attempt answer in this protocol deals with local desertification. Is there a decrease in the total amount of plant cover when black grama grassland is replaced by honey mesquite shrubland? Although there is an obvious difference in the plants that are found in both of these ecosystems, it is less obvious as to whether a difference in the amount of total plant cover exists between the two types of ecosystems.

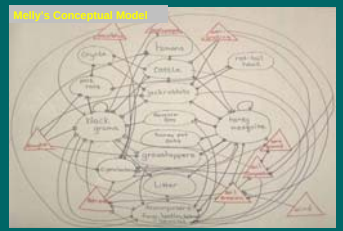
Hypothesis: There will be more total plant cover in the black grama communities than in the mesquite shrub communities when measured by line transect plots.

Conceptual models

John's Conceptual Model



Melly's Conceptual Model



Materials and methods

Materials: rebar, pin flags, measuring tape (at least 20 m long), half cm diameter dowel

Procedures: We used five line transects in two plots in each of the grass and shrub areas. Plots had already been marked off by Asombro Institute scientists. Line transects were 4 m apart and 20 m long. Data was recorded every 20 cm. Species of plant was recorded if any of the plant touched the dowel at the designated marks on the tape. No plant (NP) was recorded when there was not a plant touching the dowel.

Results

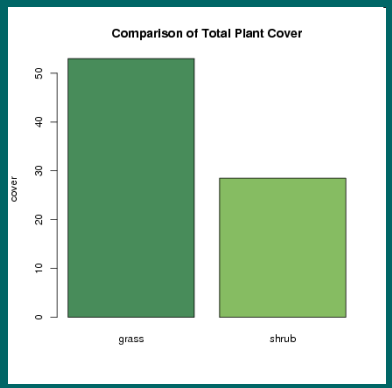


Figure 1. Comparison of median values of total plant cover based on 10 line transects per plant community type.

The median plant cover for the grassland was 52%. The median plant cover for the shrubland was 28% (Figure 1). There were bare areas at the end of all the transects in the first grassland plot due to the presence of a large pack rat mound. Without the pack rat mound, the differences between the median plant cover between grassland and shrubland would have been even greater. All 4 plots had harvester ant mounds that contributed to the amount of areas that lacked plant cover.

Since the data was not normally distributed, a Wilcoxon rank sum test was run. The test statistic was W = 100 and the p-value was <0.0001.

Species richness was 6 in the grass community and 5 in the shrub community. These were the species that were touching the line transects, however other species were noted within the total area of the plots (Table 1).

	Grassland	Shrubland
	Black grama	Honey mesquite
	Cyanobacteria	Snakeweed
	Yucca	Burro grass
	Snakeweed	Purple aster
	Fluff grass	Russian thistle
	Desert marigold	
Total species richness	6	5

Table 1. Species richness in grass and shrub communities

Mesquite shrub plots

The above photos are from the shrub community plots. Note the clumping of vegetation around the mesquite, and the lack of cyanobacteria on the soil surface in the bare ground areas (Green arrows). Pictures were taken July 7 and 8, 2008 at the JER, after rainfall.

Black grama grass plots

The above photos were taken on July 7and 8, 2008 at the black grama grassland plots on the JER. Black grama is the dominant plant species. The green arrows point to green areas of cyanobacteria on the soil surface. These were only observed in the grassland plots.

Conclusions

In this study, total plant cover decreased significantly from the black grama plots to the mesquite plots. On average, the black grama grass plots contain nearly twice as much plant cover as the mesquite shrub plots. Another way of looking at this is to say that the shrublands have more bare ground than the grasslands. This is an important finding in terms of the recent interest in the levels of CO_2 in the atmosphere. As slightly acidic rain hits the bare ground (which has a high level of $CaCO_3$), CO_2 is released into the atmosphere. The increased amount of bare ground in the shrubland leads to increased CO_2 levels in the atmosphere. Soil texture is an important factor of maintaining plant cover. Soil erosion from wind and water increase as plant cover decreases. Overgrazing disrupts the soil surface and also contributes to loss of plant cover and soil erosion. The presence of cyanobacteria on the surface of the soil helps prevent soil erosion in bare areas. We found it only in the grass plots. While species richness was approximately the same in each type of community, not all species present in the plots occurred in the data because they did not appear on the line transect.

Plan for classroom implementation

John: I could use this protocol in several different ways. My district does not have a separate Biology course; instead, all our science courses are divided into several integrated units. In the first level, I could use this protocol as a theoretical introduction to ecosystems and ecoplexity. I could also use this protocol in the second level where the students work in groups to learn more about their local ecosystem using it as a guide.

Melly: I would use this protocol to compare a small area of creosote shrubland that is adjacent to Sierra MS with a more natural area at the Chihuahuan Desert Nature Park. I would hope to increase student awareness of the desertification process and the impact of natural and human factors on that process. The conceptual model would help students consider possible connections and interactions in an ecosystem.

Acknowledgments

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