The impact of *Geomys bursarius* on prairie vegetation diversity in Minnesota

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ABSTRACT:

Plains Pocket Gopher (*Geomys bursarius)* has shown significant effects on soil alteration and plant population by the building of mounds. Typically inhabiting grasslands, prairies, and other open areas, this alteration of the soil is thought to alter the natural state of the vegetation where these gophers are present. Data from Itasca State Park, located in Clearwater County, Minnesota, were taken by; determining if distinct patches of vegetation were associated with gopher mounds, making mound classifications of random 20 meter transects, and specifically looking at differences in vegetation between abandoned mounds and control sites. Results using chi-squared and t-testing showed significant differences ($P<.0001$), concluding that gopher mounds play a distinct role in the alteration and diversification of vegetation within grassland habitats.

INTRODUCTION:

Herbivores, such as the Plains Pocket Gopher (*Geomys bursarius),* can change plant populations in many different ways. They can either reduce growth and survival of certain plant species through feeding, or benefit them by means of dispersal (Inouye et al 1987). Other sources have also shown significant effects of mound-building by Pocket Gophers and the alteration of soil composition (Spencer et al 1985). The purpose of this experiment is to examine Plains Pocket Gophers effect on vegetation in its habitat.

The Plains Pocket Gopher has a range in Minnesota that covers all of the state but the northeastern most corner. Its habitat typically includes grasslands, prairies and other open areas (Hazard 1982). The plains pocket gopher typically spends most of its time underground in its tunnels. This activity digs up the soil, creating mounds throughout

their habitats. This alteration of the soil is thought to alter the natural state of the vegetation where these gophers are present.

The question this paper addresses is whether or not the natural activity of the pocket gophers alters the vegetation, both in the long and short run. We hypothesize that gopher activity will be associated with a change in the existing vegetation. We also predict that more vegetative species will be present and that distinct patches will be associated with old or abandoned gopher mounds. Further, we believe that gopher mounds will be very prevalent in the field and can potentially have an effect on the vegetation of not only the mounds themselves, but the entire field.

METHODS:

Itasca State Park is located in Clearwater County, Minnesota, about 25 miles north of Park Rapids, MN. Itasca State Park is located in Clearwater County, Minnesota, about 25 miles north of Park Rapids, MN. It is primarily wooded with both coniferous and mixed hardwood forests, with some open grassland fields as well. In these fields, there is a significant amount of plains pocket gopher activity (Gerrald et al 1993). Approximately one mile north of the north entrance to Itasca State Park off of MN State Highway 200, a plot has been chosen and studied in previous years to measure pocket gopher activity and how it effects the vegetation in the field (Gerum et al 1996).

To begin with, our group spread out to various portions of the field and observed distinct types of vegetation from a distance. We were to identify pieces of vegetation that had some type of distinct characteristics which distinguished it from the vegetation that covered the majority of the field. These areas included patches with varying vegetation, varying density, or altered in height in relation to the rest of the field. Once these areas

were identified, we determined whether that particular distinct patch was associated with any variety of gopher mound.

If determined that the distinct patch was associated with a gopher mound, we then classified as to which type of mound we were observing; new, abandoned, or old mound. First, if it was associated with a new mound, it would include current or fresh digging and it would likely have little or no vegetation. An abandoned mound included a mound that is still very noticeably a mound of dirt, but typically included more vegetation and no fresh digging. The last class of mounds would be the old gopher mound. An old mound was identified by raised soil covered with vegetation with gravel present in the dirt.

Our next step was to try to get an approximate measurement of the number of mounds that are in the field by making mound observations of random 20 meter transects. In this portion of the experiment, both a meter stick and a twenty meter tape measure were needed. In addition, we also used a simple marking flag to attempt to further randomize our data. As a group, we threw the flag in a random direction and paid attention to the direction it was pointing when it landed. From this direction, we stretched out the twenty meter tape to where the flag pointed and made this a transect. . From this direction, we stretched out the twenty meter tape to where the flag pointed and made that a transect. Once the tape measure is stretched out, we were to walk the tape and note each mound that directly intersected with the transect. For each of these mounds, we would again use the above classifications of the mounds and then measure the greatest total width of each mound. We noted the width of each mound and kept the data separate for the new, abandoned and old mounds. As a group, we completed ten

total transects and afterwards we totaled the data for each of the new, abandoned, and old mound categories.

Lastly we specifically looked at the difference in vegetation between abandoned mounds and the native vegetation or control sites. We identified mounds which would fall into the abandoned mound classification. Once at each abandoned mound, we counted the total number of plant species growing directly on the observation mound. For our control sites, we then measured approximately two meters off of the mound and again counted the number of species of vegetation growing in a set .5m x .5m area. This was conducted on and surrounding sixty different abandoned mounds.

RESULTS:

The total number of old mounds observed (82) on distinct patches of vegetation was greater than the number of new mounds (11) and abandoned mounds (77). To test the significance of different mounds found on distinct vegetation patches on the field, a chi-square test was done using 2 degrees of freedom. The test resulted in a critical value of 3.841, stating significance. When we measured mound widths per 20 meter transect, it was also observed that the proportion of land covered by old and abandoned mounds (0.0636, 0.0328 respectively) is greater than the proportion of new mounds (.00167).

Sixty abandoned mounds were identified, as well as 60 controlled areas which were found adjacent to the mounds. The number of plant species found on the abandoned mounds had a greater average (6.7) than the number found in control areas (3.183) (*Figure 1*). Significant results were found using t-test for comparing plant diversity within abandoned mounds and controlled areas as well ($P<.0001$).

DISCUSSION:

Our data supported that our hypothesis. There is a clear difference in the average amount of species seen on the gopher mounds compared to the amount seen off the mounds. Our hypothesis is supported because we have found that our results are statistically significant ($p<.0001$). From this result, we can also make conclusions on the role gopher mounds play in grassland habitats from the other results found. If old gopher mounds produce more specie variety, and more old and abandoned gopher mounds were observed in proportion to the field, then the mounds themselves in the long run will play an important part in specie variety of vegetation throughout grassland fields.

The short-term impact on the field appears to be a relatively short-lived change in the amount of species richness of plant life. While the mounds are inhabited, the vegetation is pulled beneath the surface of the ground to feed the gophers. After the mounds are left, the vegetation begins to re-grow. These vegetative species are early successional species, only present for a short time after the gophers have turned over fresh soil (Inouye et al 1987). Soon after, other grasses out compete these species and the prairie once again has an average 3.183 species, as opposed to the 6.7 average on the abandoned gopher mounds.

The long-term impacts of the gopher mounds on the prairie can be hard to distinguish with our short study. For assistance in analyzing the role of the gopher mounds, we looked to Inouye et al (1987). Inouye found that *Geomys bursarius* mounds helped slow the rate of succession in old fields. The mounds were significantly slowing the displacement rate of the early successional species. Mounds have also been found to play keys roles in impacting water flow and soil nutrients, thus altering heterogeneity

(Eldridge 2004). This also prolongs the amount of biodiversity present in the prairie over a longer period of time.

In the collection of the data, there were some possible causes of inconsistency or error. The most probable error was in the identification of new, abandoned and old gopher mounds. Our inexperience my have led to us missing possible usable mounds or incorrectly aging them. The other inconsistency that may have occurred was our ability to identify different species of prairie plants. As a result, being inexperienced in identifying these species may have misidentified certain plants and miscalculate our data.

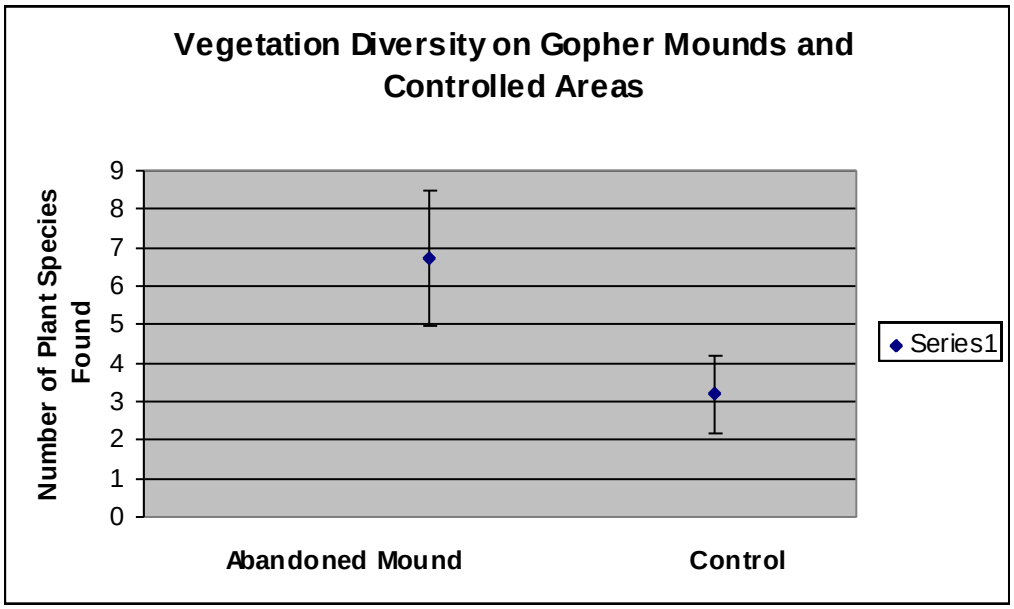

Figure 1: Vegetation Diversity on Gopher Mounds and Controlled Areas

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