Geomys bursarius: Vegetation Variation on Gopher Mounds within a Northern Minnesota Vole Field

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Abstract

The plains pocket gopher (*Geomys bursarius*) lives throughout the southern 2/3rds of Minnesota. The pocket gopher is known for turning up soil and digging extensive tunnels that can aerate soils. Our study site is located near the north entrance of Itasca State Park in Northern Minnesota. The goal of our study was to determine if there were distinct vegetation patches associated with the gopher mounds and if plant diversity increased around and on mounds. We used transects to sample the field for vegetation patches and the locations of old, new, and abandoned gopher mounds. We then ran a series of test to determine whether or not there was any correlation between gopher mounds and plant diversity, and then distinct vegetation patches. We determined that patches of vegetation were most likely associated with gopher mounds, and that species diversity increased on and around mounds.

Introduction

The plains pocket gopher, *Geomys bursarius,* can be found throughout Minnesota, except the northeast coniferous forest portion of the state (Hazard 1982). The pocket gopher resides in prairies and open fields within sparsely wooded areas. They are fossorial mammals, living entirely underground and digging extensive networks of tunnels. The gophers excavate the dirt to the surface, which accumulates to form a mound of soil. Pocket gophers may significantly alter the grassy environments in which

they occur. As the pocket gophers construct their tunnels, they are constantly aerating the soil which changes the amount of moisture that may be retained. The excavated soil also buries vegetation at the site of removal, creating a new area for different plant species to establish. The nutrient level of the soil will be changed by the pockets gopher's urine and feces deposits, leading to higher nutrient levels in some areas of the burrow (Inouye et al 1987).

In this study, we examined the recently abandoned and old pocket gopher mounds in an abandoned agricultural field. Both the long-term and short-term effects of pocket gopher activity on vegetation were evaluated. We hypothesized that pocket gophers will have a significant impact on plant species around gopher mounds and that in the long-term the pocket gopher mounds will revert back to the grasses.

Study Area

The study area is an abandoned agriculture field in Minnesota, just north of Itasca State Park. The study site is surrounded by aspen stands on three sides and a private residence on the forth. The field is typical a meadow suitable for *Microtus pennsylvanicus*, and is home to several other species of rodents. The only large herbivore present is white-tailed deer (*Odocoileus virginianus*).

Methods

Research into the effects of plains pocket gopher activity on vegetation was carried out in an abandoned agricultural field, located just north of Itasca State Park, Minnesota. We collected three sets of data. For the first, twelve students walked separate transects across the field to identify twelve distinct patches of vegetation, either differing in height, density, or types of species. At these twelve distinct patches, the students each

determined if the patch of vegetation was associated with a gopher mound. If the plot was associated with a gopher mound, it was determined if the mound was a new mound, an abandoned mound, or an old mound. New mounds are characterized by recent soil disturbance and a general lack of vegetation. Abandoned mounds are distinct mounds that are typically covered in only sparse vegetation. There is no evidence of recent activity at an abandoned mound. Old mounds are more difficult to recognize, as the general outline of the mound has typically been lost to plant cover. Clusters of gravel are generally the best indicators of an old mound.

After transects were walked and each student had assessed at least twelve distinct patches, we were split into four groups of three. Each group then established ten transect lines and recorded the size of any active, abandoned or old gopher mounds contacting the transect lines. This was done by using a 50 meter tape measurer to mark off a 20 meter transect line. The location of the transect line's end was established by having one student in each group throw a marker over their shoulder. We then laid out the transect line and measured the diameter of any gopher mounds that came into physical contact with the line. This was done for ten transects.

After we walked the transects and measured the diameter of all gopher mounds contacting the line, we then counted the number of distinctly different plant species within 0.5x0.5 meter plots on ten gopher mounds. We compared these counts to ten control 0.5x0.5 meter plots that did not contain any gopher mounds and were within two to three meters of the gopher mound plots.

We then compiled the data from all groups into a single data set and ran two statistical tests, a chi-squared goodness of fit test and a t-test to determine if vegetation was associated with gopher mounds.

Results

Using transects to survey the field we determined 0.2% consisted of new mounds, 2% abandoned mounds, and 12% old mounds. 85.8% of the field remains undisturbed by gopher mounds. A survey of the field for distinct vegetation patches determined that the patches are associated with gopher mounds (Figure 2). Of the 14.2% of the field that is disturbed by gopher mounds, we determined that vegetation associated with mounds showed greater species diversity then that of the control (Figure 1). A t-test showed a statistical difference in the number of species on each mound and control plot (p-value <.0001).

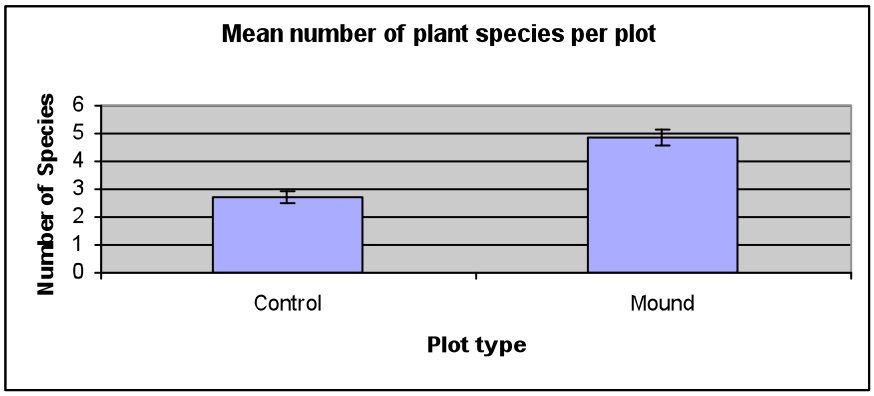

Figure 1- Mean number of plant species associated with each gopher mound and control plot.

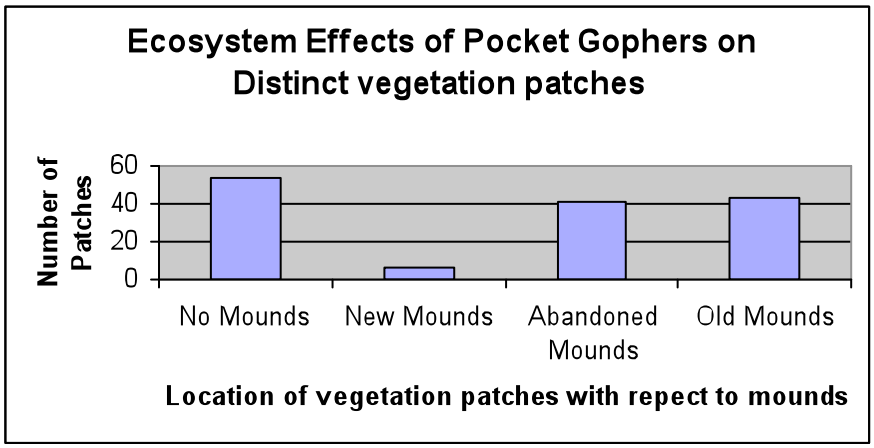

Figure 2- Number of distinct vegetation patches associated with each mound type. A Chi squared test shows a positive relationship with a value of 9, critical value 3.841.

Discussion

In a study of an abandoned agriculture field in Northern Minnesota, our data clearly shows an increase in diversity of plant species in relation to gopher mounds (Figures 1 and 2). This runs counter to other studies (Coggins and Conover 2005) who demonstrate little relationship between gopher mounds and vegetation diversity. Coggins and Conover (2005) suggest that vegetation is most influenced by large herbivores which were present on their study site (*Cervus elaphus, Odocoileus hemionus, Bos taurus*). Our study site lacks large herbivores like elk (*Cervus elaphus*) and cattle (*Bos taurus*). The main source of disturbance is from *Geomys bursarius.* As a result of this, the plant community on our site in might be more responsive to the disturbance caused by gophers in the absence of large herbivores. The response of the plant community that Coggins and Conover (2005) report, may be in turn a result of a difference in selection pressure or disturbance regime. Distinct vegetation patches were also associated with gopher mound sites (Figure 2). These patches exhibit greater species diversity then non-mound associated plots (Figure 1). This is to be expected according to Tilman (1990). Gophers turn up soil and restore the mound area to an early secession stage, which can then be colonized by plant species that would otherwise be overwhelmed by the dominate prairie

species (Tilman 1990, Santor 2001). This will often create small islands of microhabitats within the broader field or prairie (Tilman 1990). This is clearly evident in our study site, where the old mounds show the greatest species diversity containing both the dominate prairie grass species and pioneer species.

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