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## ANALYSIS OF THE HABITAT OF HENSLOW'S SPARROWS AND GRASSHOPPER SPARROWS COMPARED TO RANDOM GRASSLAND AREAS

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### ABSTRACT

Henslow's Sparrows are endangered prairie birds, and Grasshopper Sparrows are considered rare prairie birds. Both of these birds were abundant in Illinois, but their populations have been declining due to loss of the grasslands. This begins an ongoing study of the birds' habitat so Fermilab can develop a land management plan for the Henslow's and Grasshoppers. The Henslow's were found at ten sites and Grasshoppers at eight sites. Once the birds were located, the vegetation at their sites was studied. Measurements of the maximum plant height, average plant height, and duff height were taken and estimates of the percent of grass, forbs, duff, and bare ground were recorded for each square meter studied. The same measurements were taken at ten random grassland sites on Fermilab property. Several *t*-tests were performed on the data, and it was found that both Henslow's Sparrows and Grasshopper Sparrows preferred areas with a larger percentage of grass than random areas. Henslow's also preferred areas with less bare ground than random areas, while Grasshoppers preferred areas with more bare ground than random areas. In addition, Grasshopper Sparrows preferred a lower percentage of forbs than was found in random areas and a shorter average plant height than the random locations. Two-sample variance tests suggested significantly less variance for both Henslow's Sparrows and Grasshopper Sparrows for maximum plant height in comparison to the random sites. For both birds, the test suggested a significant difference in the variance of the percentage of bare ground compared to random sites, but only the Grasshopper Sparrow showed significance in the variation in the percentage of forbs

### INTRODUCTION

Henslow's Sparrows and Grasshopper Sparrows are grassland birds found in Midwestern prairies during the summer months. Henslow's Sparrows have recently been considered the highest priority for conservation efforts in eastern and Midwestern North America [1]. Grasshopper Sparrows are considered rare and uncommon in the habitat where they have been known to reside [2]. Both of these birds' populations are declining because of diminishing grasslands [1,2].

Henslow's Sparrows were first sighted at Fermilab in the summer of 2000, and they have been increasing in population since then [3]. Grasshopper Sparrows have been seen on the site since the bird population first started being monitored and counted in 1987,

but their populations have been decreasing in recent years [4,5]. The suspected cause of this population decline at Fermilab is the lack of a suitable habitat [1,2]. The birds' habitats were studied so that Fermilab could manage the grounds to optimize the preferred habitats for these declining bird species.

Henslow's Sparrows have a characteristic hiccup sound, and Grasshopper Sparrows make a high-pitched buzz sound. Both birds are small, 12 to 23 centimeters, and both have a flat head. Henslow's have an olive-colored head. They have a dark moustachial line and dark streaking all over their bodies. Grasshoppers are a buff color all over. They have virtually no markings or streaking on their pale breast, but their wings and backs have some dark streaking [6,7].

Both species have been found in prairies and European grasslands on Fermilab grounds [8]. Grasslands are dominated

by introduced European grasses, and prairies include native North American prairie plants. In this study, Henslow's Sparrows were seen in two different European grassland areas and one reconstructed prairie area. Grasshopper Sparrows were seen in two European grassland areas, and one reconstructed prairie area. The random sites were chosen to include either grassland or prairie sites, and did not exclude sites where the birds were sighted.

## MATERIALS AND METHODS

### Overview

Research was done in various prairie and grassland regions around Fermilab. Initial bird identification was by song, and visual identification confirmed the aural identification. A GPS (Global Positioning System) was used to record the position for each bird sighting. This enabled later measurement of the sites. The habitats were surveyed based on these characteristics: maximum plant height, average height of vegetation, amount of duff (dead plant material), and percent of the ground that was covered with grasses, forbs, duff, or left bare. A point-quarter study (see below) of the vegetation was conducted at each of the recorded bird sites. For comparison, a point-quarter study was also done in randomly selected prairie and grassland regions regardless of bird sightings.

To select random points, a 100-meter square grid was superimposed in a north-south, east-west direction on top of an aerial map of Fermilab. The prairie and grassland areas were then separated out from the agricultural lands, bodies of water, roads, and buildings [8]. The grid intersections in prairie or grassland were numbered; there were 963 such intersections. Ten random numbers between 1 and 963 (inclusive) were generated, and the area corresponding to each number was located on the aerial map [9].

The same measurements were taken at random grassland and prairie areas at Fermilab to serve as control areas. The characteristics of the vegetation in the bird areas were compared to control areas, and the data were analyzed for a statistical difference between the habitats where the birds live and the general prairie land.

### Point-Quarter Methodology

Around the initial bird sighting point, an imaginary 10-meter line was drawn in four directions: north, south, east, and west, breaking the bird's territory into four quadrants. Each quadrant was subdivided into 100 one-square-meter quadrats. A list of random numbers, 1 through 100, was generated to select the one-square-meter quadrat for each 10-meter by 10-meter point-quarter quadrant [9]. A randomly selected 1 square meter quadrat of the vegetation around the bird's location could be surveyed in each of the four quadrants: northeast, northwest, southeast, and southwest.

Vegetation data were taken in four quadrats for every bird site and randomly selected site. Henslow's Sparrows were sighted at ten different locations (40 quadrats), Grasshopper Sparrows were sighted at eight different locations (32 quadrats), and there were ten random locations (40 quadrats).

### Vegetation Survey

The maximum plant height was measured using a meter stick. The average plant height was measured by having one person hold the meter stick in the center of the quadrat while the other person stepped about five meters away, thus providing a complete view of the quadrat. The average plant height was estimated visually against the meter stick. Actual duff height was measured from the ground to the top of the vegetation litter in two places — one from the east and one from the west side of the quadrat. The two measurements were averaged together.

The ground cover percentages were taken as a visual estimate. While the quadrat was on the ground, the researchers mentally pictured each type of ground cover as though it was grouped together. Estimations were always performed by the same individual.

### Statistical Analysis

Once the data was collected, the means were graphed with the standard error using Microsoft Excel. Then, *t*-tests were performed using SPSS (Statistical Package for the Social Sciences). The *t*-test was chosen because it is the standard way to statistically compare the means of a limited statistical sample [10]. Microsoft Excel was used for two-sample variance tests to determine if a difference in the variance between the bird sites and the random sites exists regardless of the difference in mean. All hypothesis tests were evaluated at a significance level of  $\alpha = 0.05$ .

## RESULTS

Figure 1 shows the mean vegetation heights with standard error bars for each of the three types of sites: Henslow's, Grasshoppers, and random. Figure 2 shows the percent of ground cover for each of the three site types. Several *t*-tests were performed on this data to determine statistical significance.

The *t*-test suggested that Henslow's Sparrows prefer a significantly larger percent of grass than was found in random areas ( $t(76) = 2.57, p = 0.012$ ). The *t*-test also suggested that Henslow's prefer less bare ground than was found in the random sites ( $t(40)$

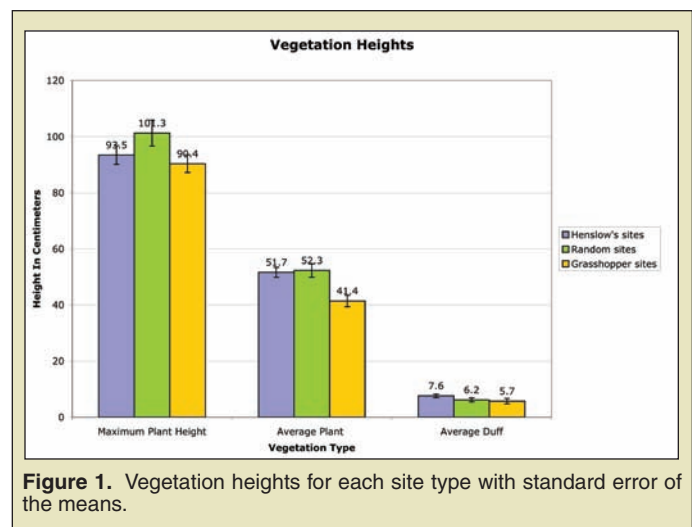
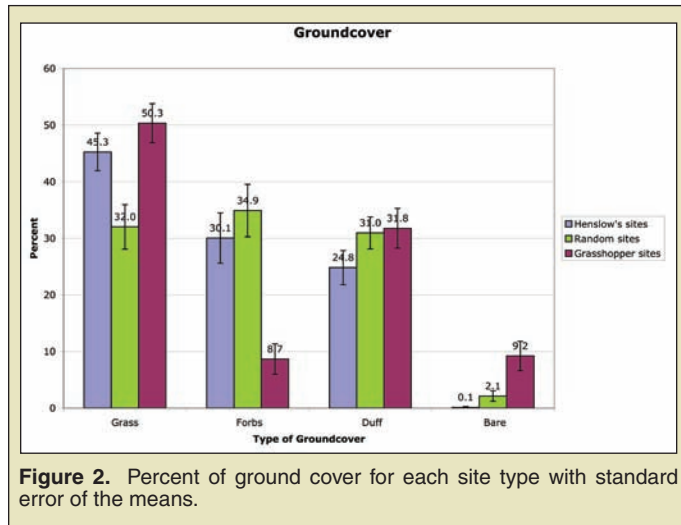


Figure 1. Vegetation heights for each site type with standard error of the means.

= 2.17,  $p = 0.036$ ). The  $t$ -tests did not show significant differences for other variables for the Henslow's Sparrow.

Based on the  $t$ -tests, Grasshoppers appear to prefer a shorter average plant height than what was found in the random areas ( $t(70) = 3.45, p = .001$ ). Further, it was found that Grasshoppers prefer a higher percent of grass than the amount of grass found at the random sites ( $t(70) = 3.51, p = 0.001$ ). Additionally, the  $t$ -test suggested that Grasshopper Sparrows were sighted at places with a



**Figure 2.** Percent of ground cover for each site type with standard error of the means.

significantly lower percentage of forbs than the random plots ( $t(61) = 4.91, p < 0.0005$ ). They also suggested Grasshoppers preferred more bare ground than was found at the random sites ( $t(39) = 2.58, p = 0.014$ ). There were no other statistically significant differences for the Grasshopper Sparrow sites.

Based on the two-sample variance tests, it was found that there was a significant difference in the variance for the percent of bare ground for Henslow's Sparrows compared to the variance of bare ground for the random sites ( $F(39, 39) = 53.4, p < 0.0001$ ). It was also shown that there was significantly less variance for maximum plant height at Henslow's sites than at random sites ( $F(39, 39) = 1.93, p = 0.044$ ).

For the Grasshopper Sparrow, the two-sample variance tests performed using Microsoft Excel showed that their sites have significantly less variance for the percent of bare ground compared to the random areas ( $F(31, 39) = 6.42, p < 0.0001$ ). The test also suggested there was a significant variance difference for the percent of forbs compared to the random areas ( $F(39, 31) = 3.70, p = 0.0003$ ). Further, it was seen that Grasshopper Sparrows have significantly less variance for the maximum plant height compared to random sites ( $F(39, 31) = 2.74, p = 0.0048$ ).

## DISCUSSION AND CONCLUSIONS

Based on the results of the statistical analyses, both Henslow's Sparrows and Grasshopper Sparrows appear to be particular about their habitats. They both prefer areas with more grass than random grasslands. The reason for this is unknown, but it is possible that a

grassy area is more suited to their nest building. Both birds build their nests on the ground at the base of grass clumps [11].

Henslow's seem to prefer less bare ground than random sites, but Grasshoppers seem to prefer sites with more bare ground than random areas. Interestingly, Henslow's and Grasshoppers can live near enough to each other, an observer could hear both of their songs and sight them at the same time. Of course, this is not always the case.

Both sparrows eat insects they find on the ground. It is probable that Grasshoppers prefer more bare ground because they can find their food more easily. Even though Henslow's also eat insects from the ground, they do not appear to prefer bare ground [1]. Grasshopper Sparrows were also shown to prefer sites with a shorter average plant height and a shorter maximum plant height than random sites. The reason for this is unknown.

Henslow's Sparrow sites did not have a statistically significant difference from the random sites in maximum plant height; however, they did have a statistically significant difference in the variance for maximum plant height. This means Henslow's prefer a narrower variation in the plant height than random sites, even though the average height is statistically similar. The reason for the difference in the variance is unknown, and could be an idea for future research.

Grasshoppers seemed to prefer a lesser amount of forbs in their areas than the amount of forbs found in random grasslands. The reason for this is unknown; however, their preferred type of ground cover probably makes nest building and food acquisition more ideal.

Both sparrows are particular as to where they live, and in order to increase their populations, land managers must effectively control the grounds to be suitable for them. It would be advisable to continue studying these birds' habitats so that the land can be suited to their preferences, since they are both rare birds.

The continuation of this study will provide more information about the preferred habitat for the sparrows. Since this is the beginning of an ongoing study, further research and more data collection will increase the accuracy of the characterization of the habitat preference. In the future, the site should be thoroughly investigated for additional Henslow's and Grasshopper sites. For example, there were Henslow's Sparrows heard at three sites that were not characterized because they were found near the end of the study, and time did not permit their inclusion in the study.

Another interesting study would be to observe the behavior of these birds in order to determine their territories. It would be useful to find out how much area they take up for their territories in order to see if they need lots of space, or if a smaller section of the preferred ground would be enough to accommodate several birds.

A third suggested study would be to survey the vegetation heights for each bird in comparison to random areas. There has not been much research on the study of the vegetation heights, and this study found some significance between vegetation heights for Henslow's Sparrow sites, Grasshopper Sparrow sites, and random areas.

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