

Three-Year Analysis of the Habitat of the Henslow's Sparrow Compared to Randomly Selected Grassland Areas

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ABSTRACT

Three-Year Analysis of the Habitat of the Henslow's Sparrow Compared to Randomly Selected Grassland Areas. VIRAG NANAVATI (University of Illinois at Chicago, Chicago, IL 60607)
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Henslow's Sparrows (*Ammodramus henslowii*) are endangered prairie birds, and Grasshopper Sparrows (*Ammodramus savannarum*) are rare birds in Illinois. Historically, grasslands throughout the state provided these birds with a suitable habitat. However, due to the loss of grasslands, the population of these birds is declining. This longitudinal study is being conducted to improve understanding of the habitat preference of the Henslow's Sparrow and Grasshopper Sparrow. This, in turn, will help the Fermilab land managers to develop a restoration plan. In this study, we found Henslow's Sparrows at twenty-three sites and found Grasshopper Sparrows at two sites. Due to such a small sample, the Grasshopper Sparrow's data was not analyzed. A vegetation survey using the point-quarter study methodology was done at each bird location. The emphasis of the vegetation survey was to characterize the general physical structure of the habitat rather than studying the exact species of plants. Random quadrats near each nesting site were surveyed for maximum plant height and duff height. Visual estimates were also carried out to determine the average vegetation height, percent of grass, forbs, bare ground, and duff. A similar vegetation survey was also carried out at sixteen random sites on the Fermilab campus to serve as a control. Statistical analysis found that Henslow's Sparrows are very particular about their habitat. They prefer an average maximum plant height of 90-100 cm, an average plant height of 40-55 cm and average duff height between 4.5-7.5 cm. The Henslow's Sparrow is also particular about the ground cover in its habitat. It prefers ground cover ranging from 45%-60%, forbs cover from 15%-25%, duff cover that ranges around 25% and minimal bare ground. From

the data during the three years of this study, the Henslow's Sparrow's consistent preference of habitat has become clear.

INTRODUCTION

Fermi National Accelerator Laboratory (Fermilab) founding Director Robert R. Wilson strongly believed in stewardship of the land. Under the direction of Ecological Land Management (ELM) Committee, Fermilab conducts several ecological studies to maintain what Dr. Wilson envisioned. The ELM Committee oversees the land use and land management activities at Fermilab on available land. The primary responsibilities of the ELM Committee are to maintain and build upon the many different habitats present on the Fermilab site [1]. My research was a continuation of a longitudinal study intended to better understand the habitat of the Henslow's Sparrow and the Grasshopper Sparrow. The object of this ongoing research is to gain additional information of the birds' habitats so as to assist Fermilab land managers in their conservation efforts.

The Henslow's Sparrow and the Grasshopper Sparrow are grassland birds, both of which were commonly found in the Midwestern prairies during the summer months. The Henslow's Sparrow is about 4.5 inches in length. It is characterized by a relatively large, flat-topped head with a relatively large bill and a short, pointed tail. Overall, it has a dark complexion with streaks through its breasts and flanks [2]. The most easily distinguished feature of a Henslow's Sparrow is its hiccup song. According to the National Audubon Society website, a Henslow's Sparrow is more often heard than it is seen [3]. According to *Birds of North America*, a Henslow's habitat "can be characterized as relatively large fields consisting of tall, dense grass, a well-developed litter layer, standing dead vegetation and sparse or no woody vegetation." [2] They use grasslands that have "well-developed litter." [4]

The Grasshopper Sparrow is about the same size as a Henslow's Sparrow. Its distinguishing characteristic is its insect-like, high-pitched buzz. It is also a small, flat-headed

sparrow with a deep bill and a rusty streaked back with a short tail [5]. It has an unstreaked, whitish-yellow breast, which distinguishes it physically from the Henslow's Sparrow. The Grasshopper Sparrow prefers grasslands of intermediate height with patches of bare ground [4].

Several studies report that the counts of both of these birds along with other grassland birds have dropped significantly [6]. In fact, twenty different common grassland bird species have seen their populations drop by at least half in the past 40 years [7]. The population of the Henslow's Sparrow and the Grasshopper Sparrow also follows this trend. The Henslow's Sparrows, which used to be abundant throughout the Midwestern states, are now considered endangered in five states including Illinois [2]. The National Audubon Society reports a 65 percent decline in the Grasshopper Sparrow population [7]. For these reasons, studies such as this one become necessary for management recommendations.

Both of these bird species have been found in the Fermilab campus. Prior habitat studies on these birds have shown a rise in the Henslow's Sparrow population and a decline in the Grasshopper Sparrow population [11, 12]. In this study, Henslow's Sparrows were visually confirmed in 25 locations and the Grasshopper Sparrows were located only in two locations. The purpose of this study was to better understand the habitat preference of both the species of birds; however, due to the low population count for the Grasshopper Sparrow, it was not factored into any statistical analysis.

METHODS AND MATERIALS

Overview

The Fermilab campus is approximately 6,800 acres. Therefore, a systematic plan for collecting data was necessary.

In phase I, the objective was to go to different grassland sites throughout Fermilab to sight birds. Sites in which the Henslow's and the Grasshopper Sparrows have been known to reside were visited first. However, the remaining grasslands were visited just as frequently to make sure the data was unbiased. The sparrows are most active in the early morning; therefore, we visited all the sites from 6:30 A.M. to 10:00 A.M. The process of identification was bi-fold; an audio signal, in the form of singing, suggested the presence of the bird, and its identification was confirmed visually with the use of binoculars. Whenever a confirmed sighting of a bird occurred, a GPS (Global Positioning System) was used to record the exact location. The GPS locations were used for phase II of the study.

In phase II, our objective was to survey the vegetation. We used the previously recorded GPS locations to help us navigate to the location where confirmed bird sightings had occurred. Once there, we used the Point-Quarter Methods to survey the vegetation.

In phase III, random locations within the grassland areas that served as control were generated. These areas were located on the field using a GPS, and then a vegetation survey was conducted using the Point-Quarter Method.

Point-Quarter Method

The Point-Quarter Method involves surveying the vegetation in four different quadrants of all locations; locations where Henslow's Sparrows were found as well as the random locations. This method involved going to the GPS location and extending an imaginary 10-meter line in four directions: north, south, east, and west. This resulted in breaking the territory into four quadrants. Each 10-meter by 10-meter quadrant was further subdivided into one hundred one-meter squares as shown in Figure 9. Then, Random.org was used to randomly generate a

number from 1 to 100 for each quadrant [8]. The vegetation survey was then conducted in all four quadrants at each bird location as well as random sites.

Vegetation Survey

The purpose of the vegetation survey was to help us determine what type of vegetation is preferred by the two birds species that we are studying. The emphasis of the vegetation survey was on the physical structure of the habitat preference, and not on the particular type of species. The survey called for measurements of the maximum plant height, duff height, average plant height, and percentage of bare ground, forbs, duff, and grass. A meter stick was used to measure the exact maximum plant height and the duff height. The average plant height was visually estimated against the meter stick. The percent of ground cover was also visually estimated. For consistency, the same individual carried out the actual measurements and visual estimates.

Random Sites

As mentioned earlier, we needed to generate random sites to act as a control. To ensure an equal distribution of the fragmented campus, four strata that were approximately equal in area were selected. In order to balance the data, we selected four random sites within each strata.

We used Google Earth [9] and superimposed an aerial image of the prairie and grassland areas at Fermilab to get latitudes and longitudes. Random.org was used to generate random sites within each stratum [8]. To ensure findings that were relevant to our study, sites were limited to the prairie and grassland areas that avoided bodies of water and the marsh grasslands.

Statistical Analysis

Once the data were collected from all sites, we computed averages for each category using Microsoft Excel. *T*-tests and two-sample variance tests were executed for the heights

because they are standard ways to statistically compare the mean of a limited sample. Mann-Whitney U -tests were performed for the percent cover data.

RESULTS

Figure 1 compares the average vegetation heights for the Henslow's sites and the random sites in 2007. According to the t -test, Henslow's Sparrows prefer a lower maximum plant height in comparison to the random sites ($t = 3.323, p = 0.004$) and lower average plant height ($t = 3.284, p = 0.004$). The t -test also found that the duff height at the Henslow's sites is higher than that at random sites ($t = 4.860, p = 0.0005$).

Figure 2 compares the percent of ground cover for the two sites in 2007. The Mann-Whitney U -test suggests that the Henslow's Sparrows prefer sites with significantly more grass ($U = 84.50, p = 0.004$) and duff ($U = 49.50, p = 0.0005$). The test also suggests that they prefer sites with lower coverage of forbs ($U=82, p=0.003$) and minimal bare ground ($U = 52.50, p = 0.0005$).

Based on the two-sample variance test, it was found that there was significantly less variance in the average maximum plant height for Henslow's Sparrows in comparison to the random sites ($F = 5.78, p = 0.0002$). The test also found that there was significantly less variance in the average plant height of the Henslow's sites when compared to the random sites ($F = 8.16, p < 0.0001$). However, the variance between the two sites was not significantly different when it came to duff height ($F = 1.64, p = 2.788$).

Systematic Errors

Our statistical analysis is based on the data that were collected during fieldwork. However, the method of collecting data for the vegetation survey has some built-in biases. Only maximum plant heights and duff heights are exact measurements taken using a ruler. Average

vegetation height and percent ground cover are visual estimates taken by the participant of the study that year. So, the values of those will be based on the participant's discretion. For any given year, the effect of this potential bias is mitigated by having the same person perform his/her estimations for all the sites. This removes any bias when comparing relative values between the bird sites and the random sites. However, since different people perform the study each year, it could affect the comparisons between the sites. It can also affect the absolute values of the estimates for any given year.

DISCUSSION AND CONCLUSIONS

Based on the statistical analysis of the data, it is evident that the Henslow's Sparrow seems to prefer a particular type of habitat. Figure 1 shows the average maximum plant height, average plant height and average duff height based on the data collected during this season. The graph shows random sites have a higher average maximum plant height and a higher average vegetation height, but lower average duff height in comparison to the Henslow's sites. Figures 3 and 4 show the average maximum plant height and average vegetation height respectively for all three years of the study. Figure 3 is particularly interesting because it demonstrates the consistent preference of Henslow's Sparrows for areas with average maximum plant height that varies between 90-100 cm. Figure 4 shows their preference of average plant height around 40-55 cm. The two-sample variance test found little variance in the average maximum plant height and average plant height in the Henslow's sites.

Several sources have concluded that the Henslow's Sparrows prefer habitats that have a "well-developed litter" layer [2, 4]. Based on our results, Figure 1 shows Henslow's Sparrow's preference for higher duff than random sites. Figure 7 is a graph based on a compilation of data

for all three years of the study. It shows the Henslow's Sparrow's preference of higher duff height, so our findings were consistent with what other researchers have found.

The preference of the Henslow's Sparrow is just as distinguished when it comes to ground cover. Figure 2 demonstrates the Henslow's Sparrow's preference of sites that contain a high percent of grass cover in comparison to the random sites. Figure 6 is a graph that demonstrates percent ground cover in the Henslow's sites and the random sites for the years 2005, 2006, and 2007. It is evident that the percent grass coverage was consistently higher in the Henslow's sites in comparison to random sites. Findings from our study are also in agreement with the findings of the Northern Prairie Wildlife Research Center [4]. Figures 2 and 6 also make it apparent that Henslow's Sparrows prefer sites that have some forbs coverage, but not as much as seen in random sites. Interestingly, such preference is due to the fact that Henslow's sparrows prefer scattered forbs for song perches [4].

The Henslow's Sparrow's preference for minimal bare ground is also evident. Figure 8 is based on the compilation of the data from all three years of this study. It shows the Henslow's Sparrow's continued preference of minimal bare ground in comparison to the random sites. Maier [11] and Nunez [12] both mention similar findings. However, considering that Henslow's Sparrows build their nest on the ground in the shelter of duff [2], their preference for sites with minimal bare ground is logical. The duff coverage is also important to the Henslow's Sparrow. As Figure 6 shows, their preference for duff coverage has been consistent throughout the three years of this study. Based on our results, they prefer 22%-28% duff coverage.

In comparing the data collected from the three years of this study, the results seem fairly consistent. However, duff heights in 2005, maximum plant heights in 2006 and average vegetation heights in 2006 provide insights into natural anomalies. The year 2005 was a drought

year and so a lot of vegetation died [11]. This resulted in higher duff height. On the other hand, 2006 was a year in which the vegetation was unusually high [12]. The spread of sweet yellow clover throughout the campus resulted in a significant spike in the coverage of forbs as well as the average vegetation height. Had the weather patterns not been so different from each other, generalizations about the Henslow's Sparrow's habitat preference might have been made. However, that is not the case, and hence, further studies are required.

The decline of the Grasshopper Sparrow in Fermilab is a cause for concern. Their count went from eight in 2005 [11], six in 2006 [12] to only two this season. According to Jim Herkert, the increase in the Henslow's Sparrow population and decrease in the Grasshopper Sparrow population is a trend that "is consistent with what is happening at a number of locations" that he studies locally [10]. He also found that prairies in early restoration phases tend to have higher Grasshopper Sparrow population and the numbers "drop as the restoration matures." [10] If this is true, then habitat restoration for the Grasshopper Sparrow should precede those for Henslow's Sparrows.

We were unable to collect substantial data this season to formulate any restoration recommendations. However, a study can be done to combine the data for all three years to get a general idea of the Grasshopper Sparrow's habitat preference. Taking a thorough population count of Grasshopper Sparrows instead of studying their habitat can also be studied for next year.

As this year's study comes to a conclusion, no clear answers can be provided to implement restoration efforts for the Grasshopper Sparrows. However, the habitat preference of the Henslow's Sparrow is clearer. We recommend that this study be continued for another year or two to account for unusual weather patterns. That will provide us with substantial data to clearly understand their habitat preferences.

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TABLES AND FIGURES

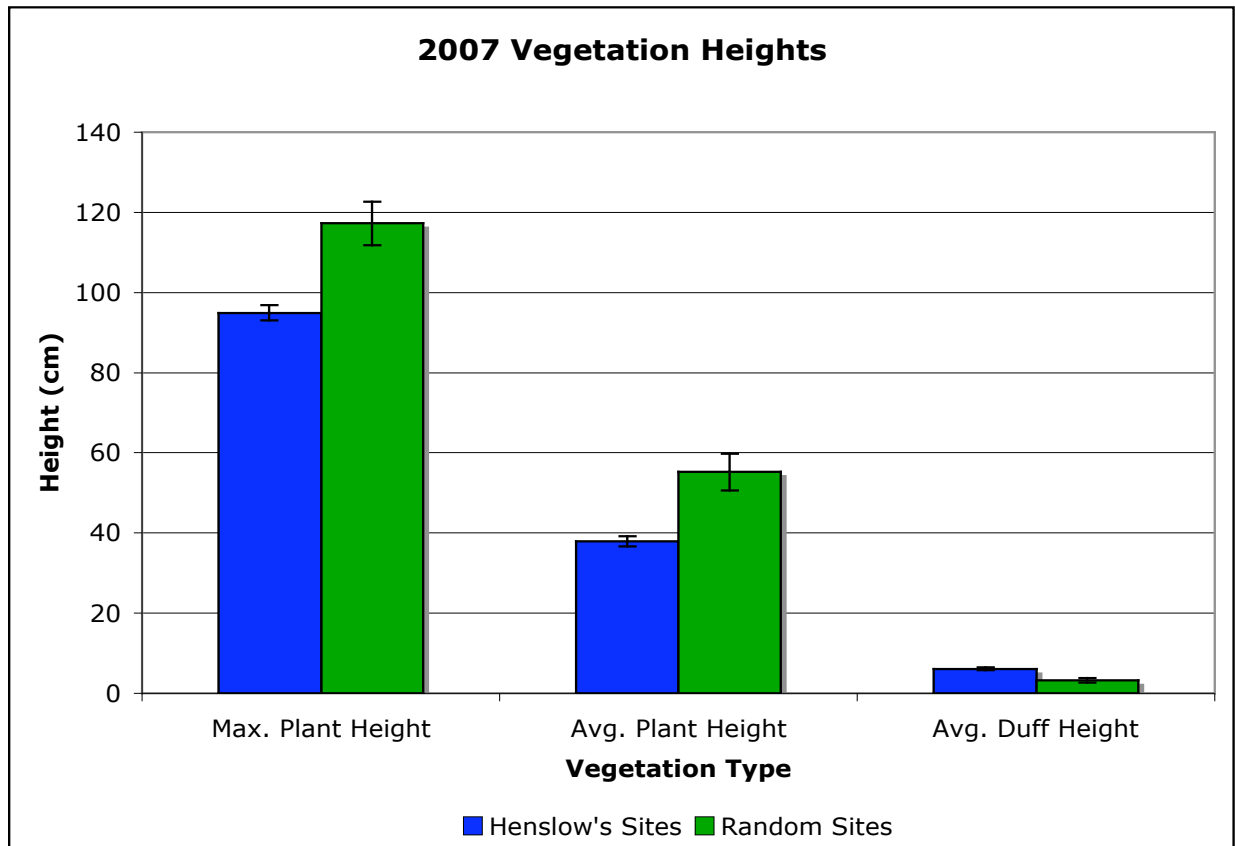


Figure 1: The average vegetation height in Henslow's sites in comparison to random sites.

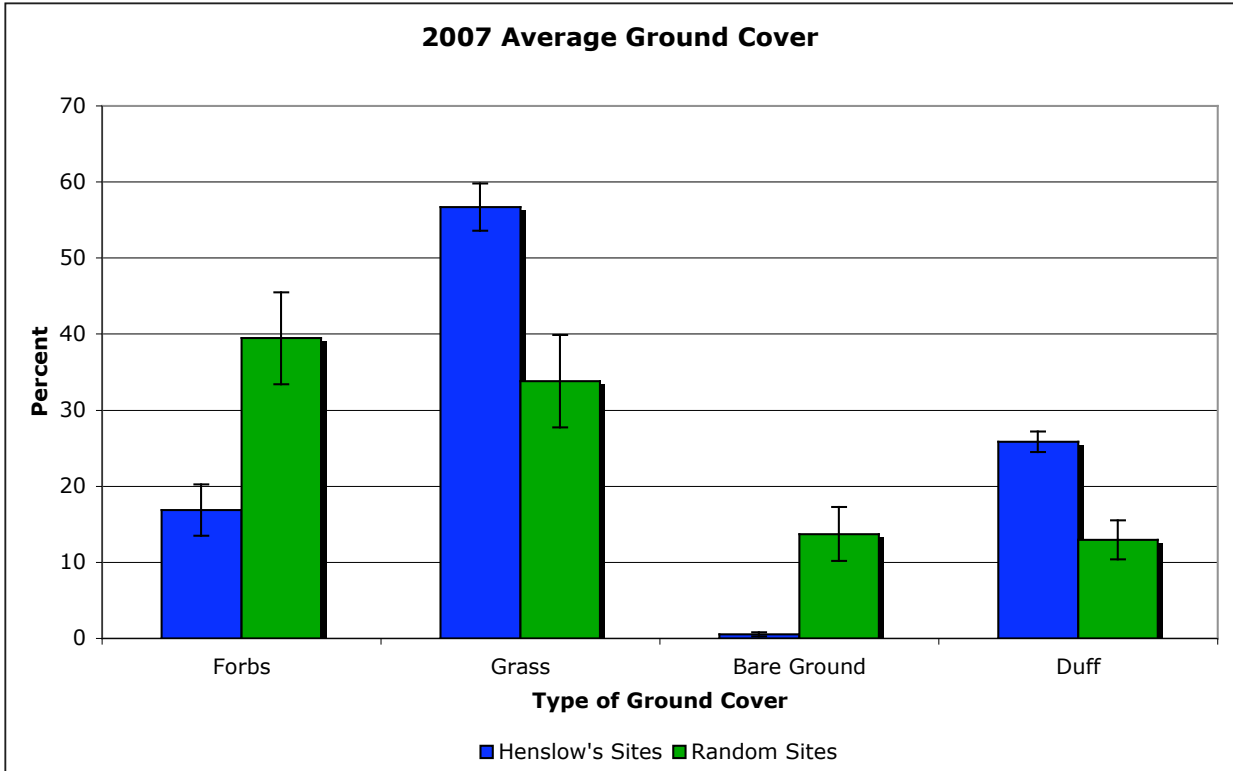


Figure 2: The average ground cover in Henslow's sites in comparison to random sites.

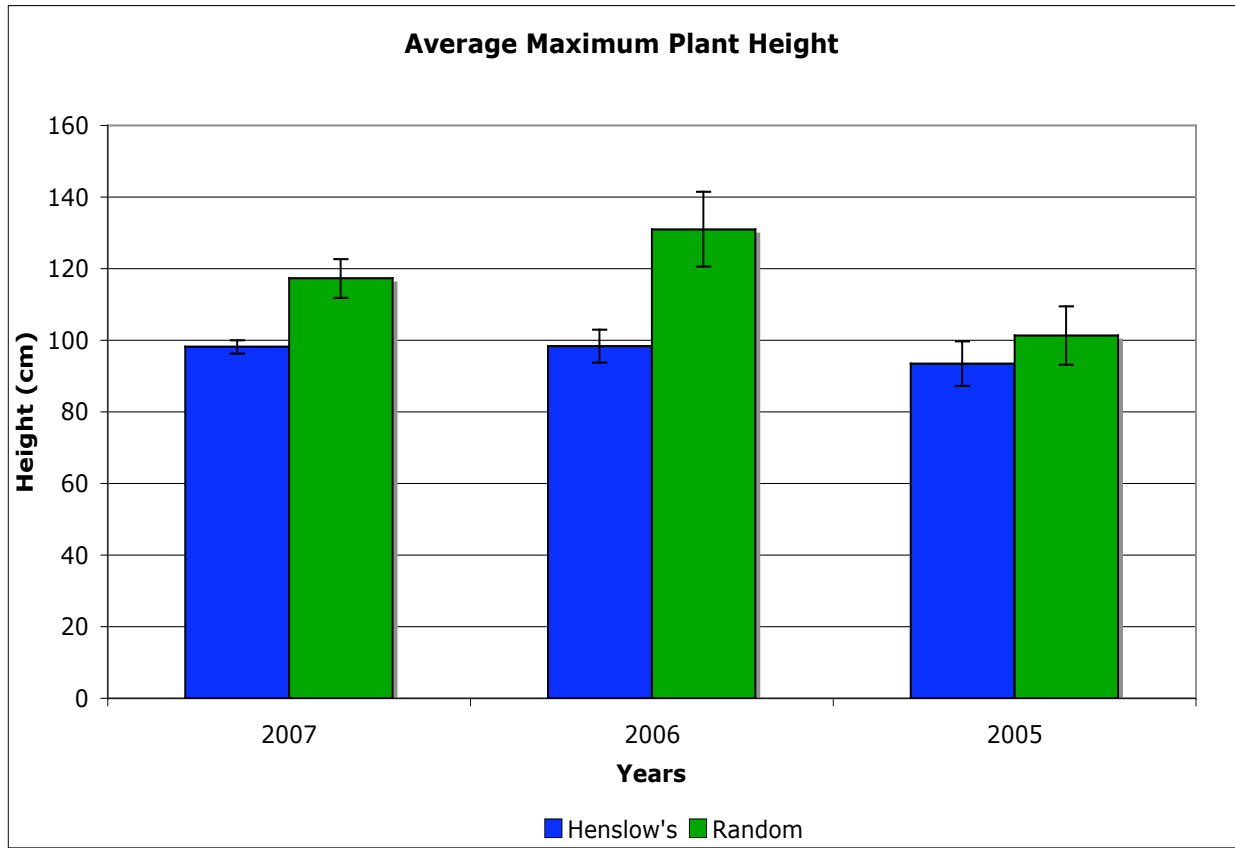


Figure 3: Average maximum plant height for the Henslow's sites and random sites for 2005, 2006, and 2007.

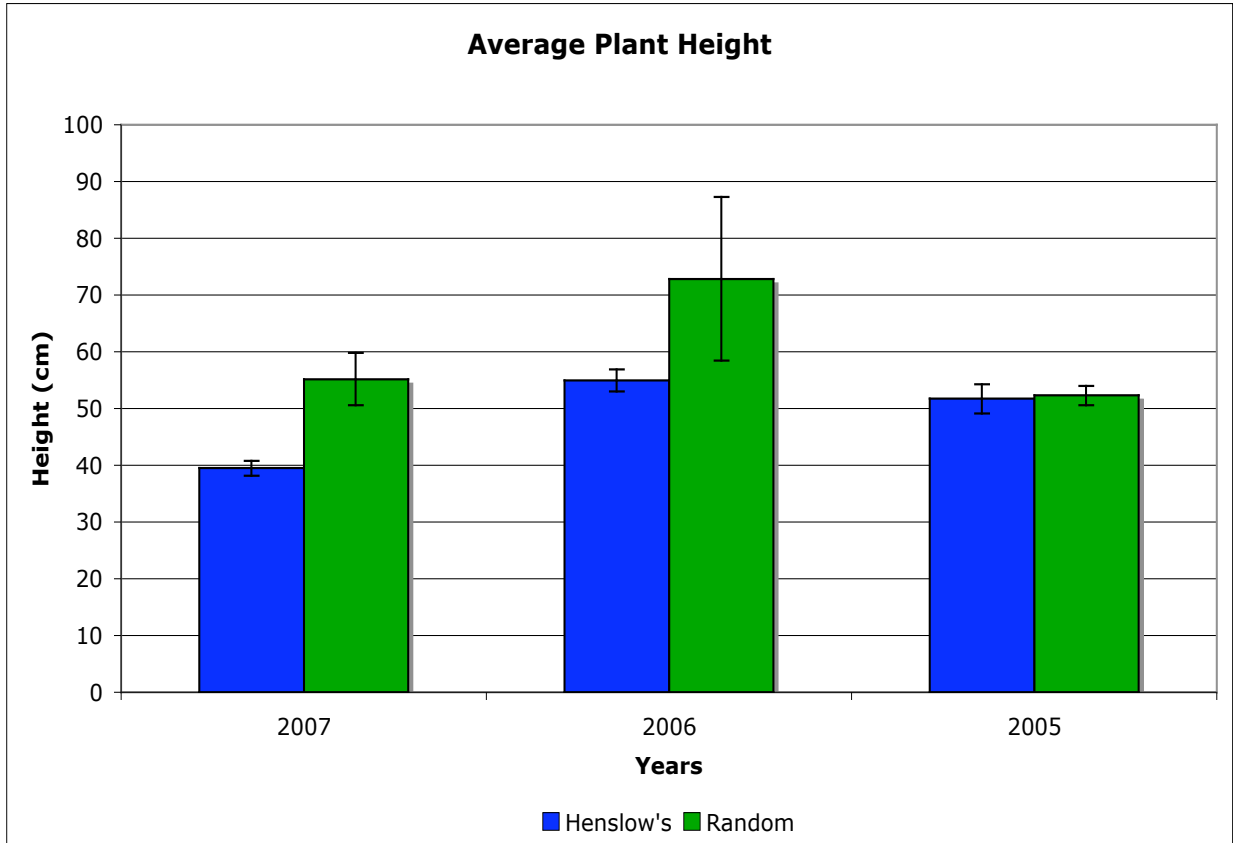


Figure 4: Average vegetation height for the Henslow's sites and random sites for 2005, 2006, and 2007.

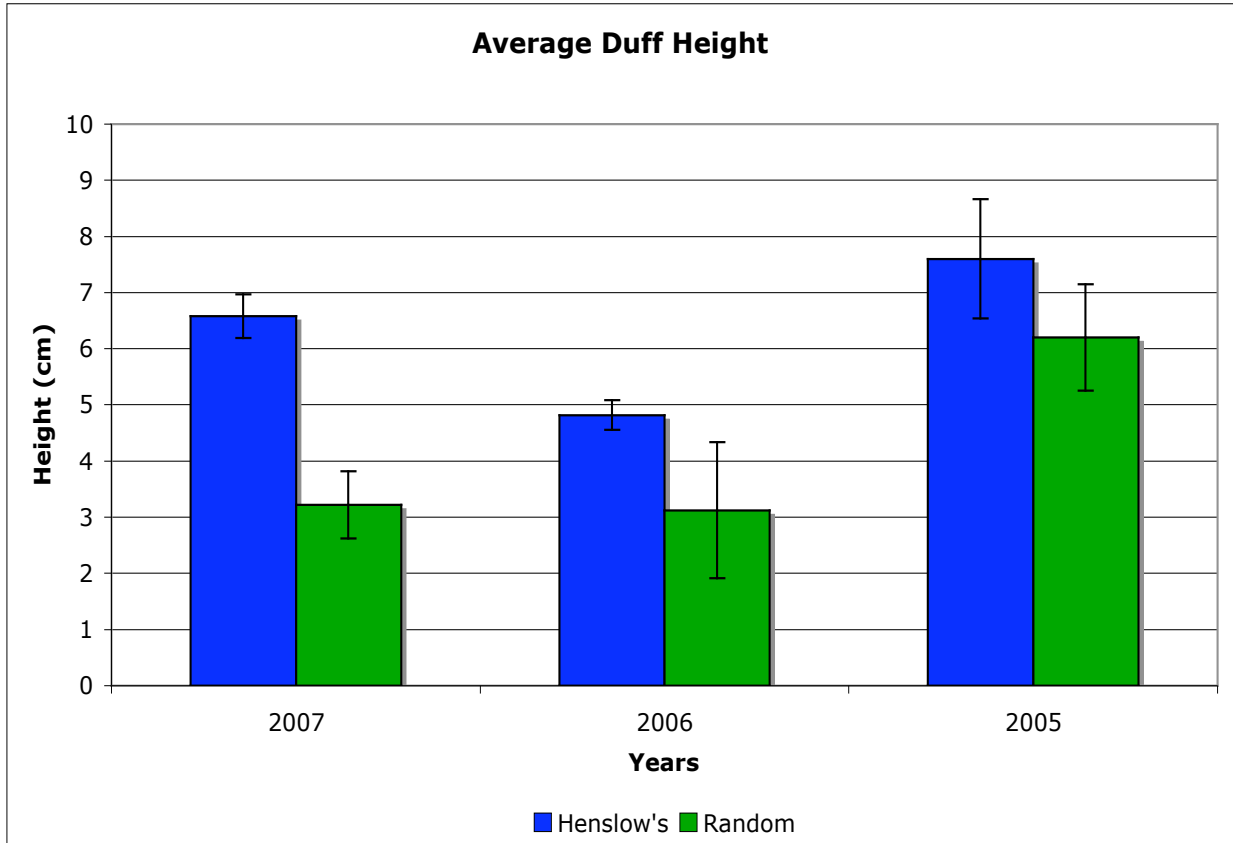


Figure 5: Average duff height for the Henslow's sites and random sites for 2005, 2006, and 2007.

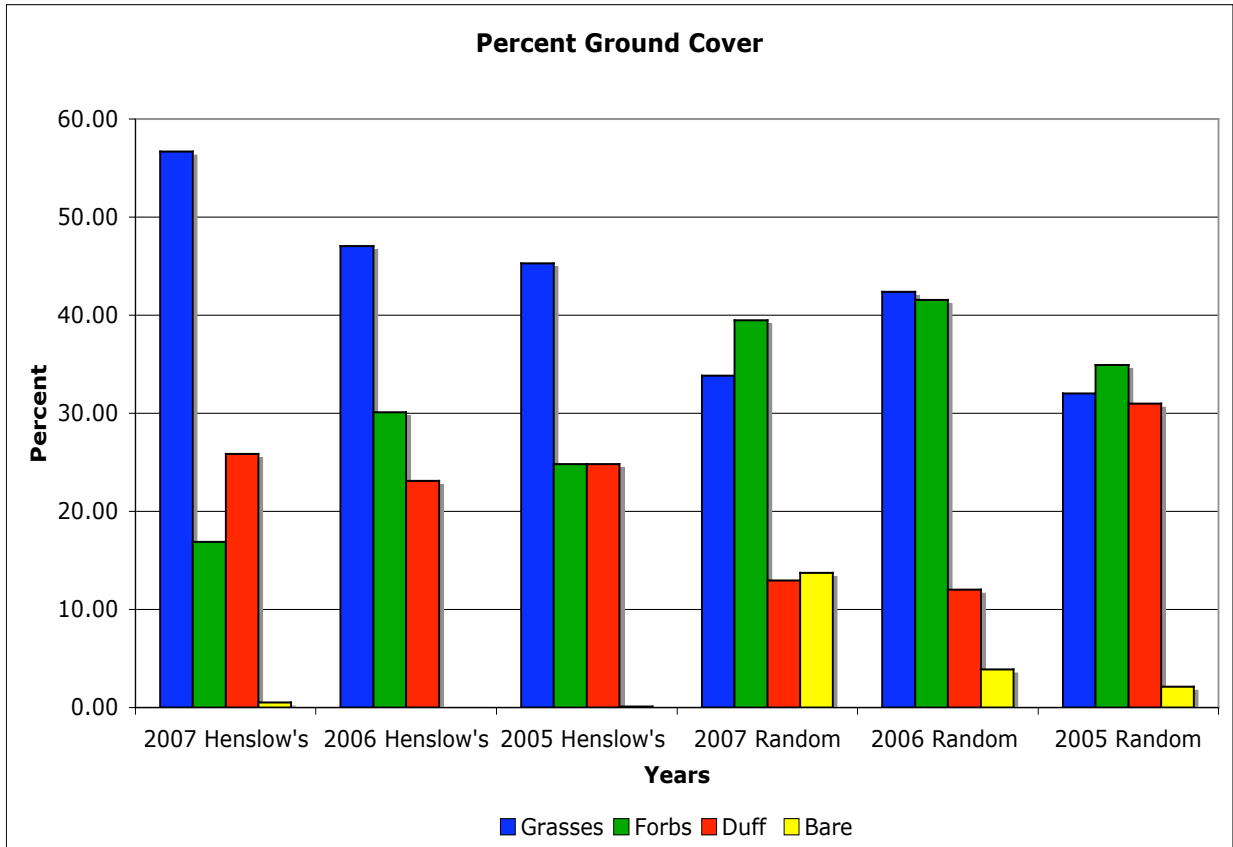


Figure 6: Percent ground cover for Henslow's sites compared to random sites for 2005, 2006, and 2007.

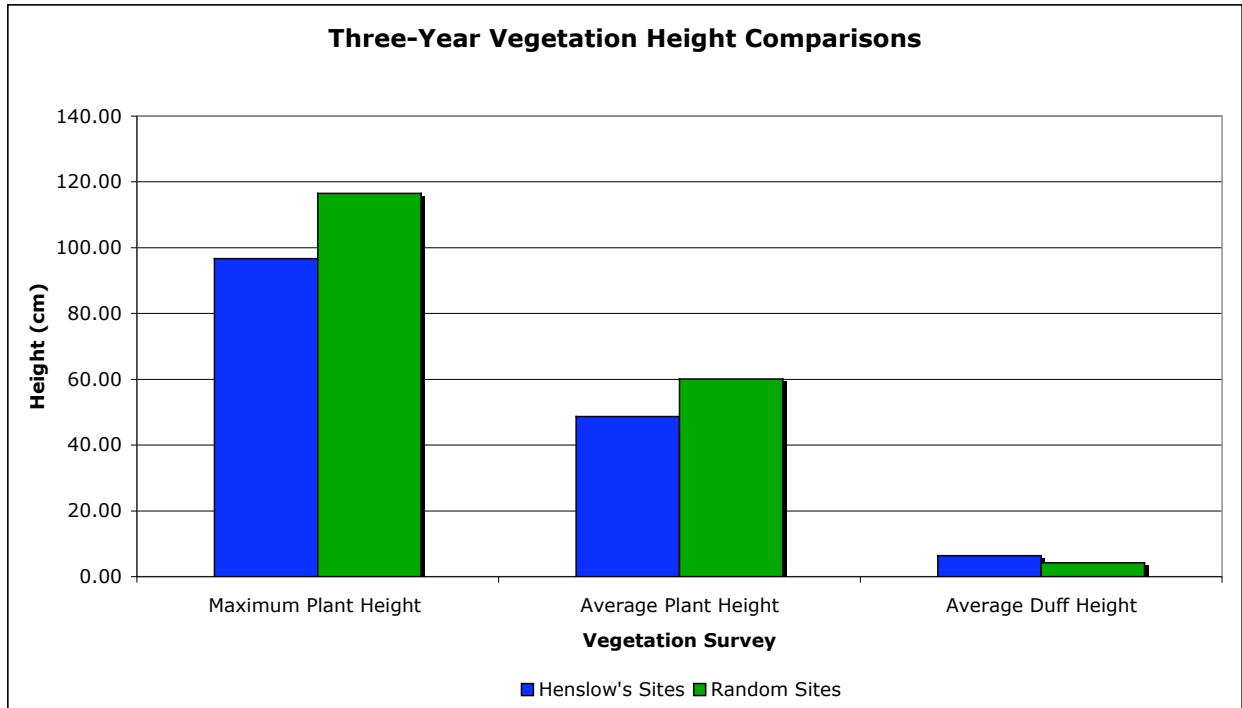


Figure 7: The results when data of the average vegetation heights for all three years of the study for the Henslow's sites were combined.

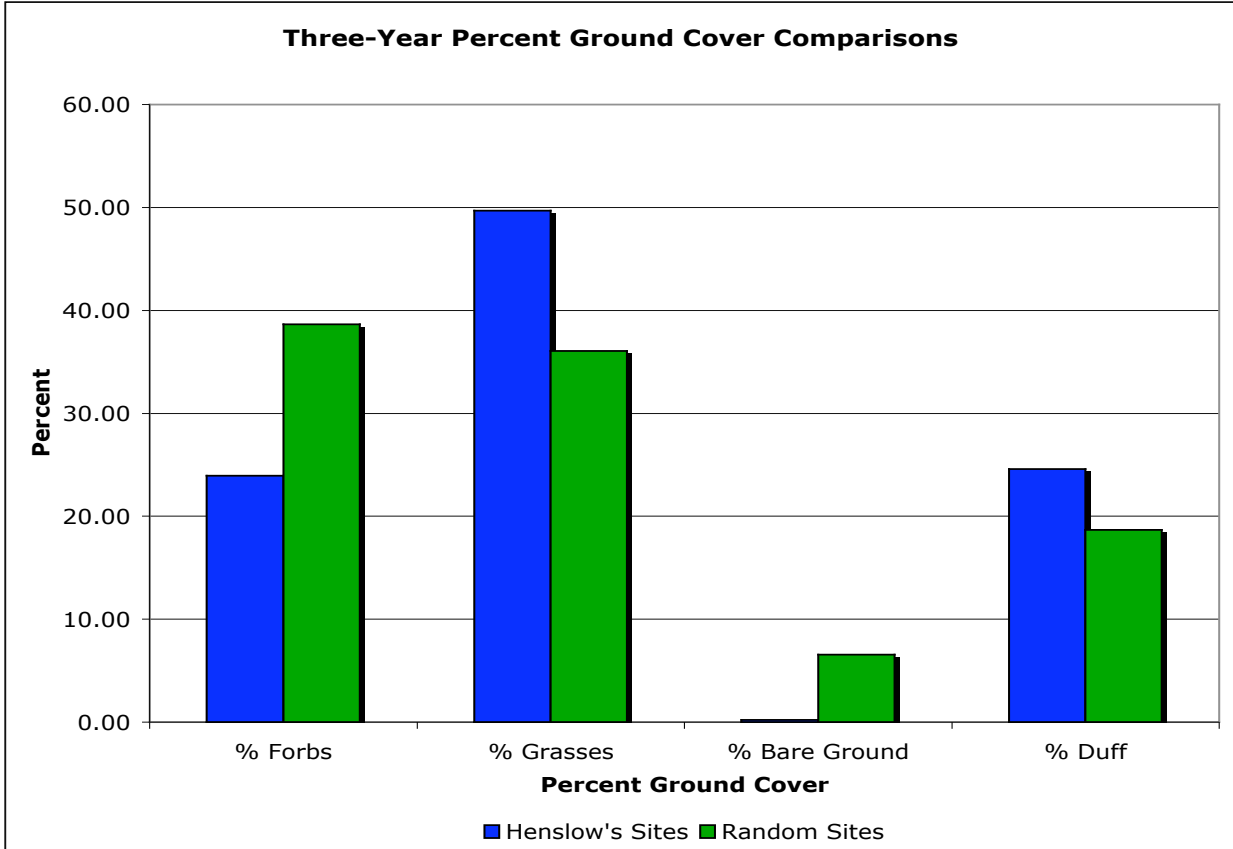


Figure 8: The results when data of the percent ground cover for all three years of the study for the Henslow's sites were combined.