Monitoring the Diversity and Speciation of Low Canopy Bees

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Abstract

In order to monitor the impact of the upcoming Long Island Solar Farm (LISF) in the Long Island Pine Barrens within BNL, a sampling of low canopy insects was performed. The specimens were collected through the use of pan traps on one hectare plots, three different colored bowls containing a low surface tension solution. Each hectare plot contains two fifty meter transects with 30 bowls evenly distributed among the two transects. Each plot was chosen in different habitat areas that were scheduled to be redeveloped, such as areas with tall over stories, areas with low over stories, and areas with a mix of both. The traps were placed in the morning and collected in the afternoon. Once the bees were identified, their distribution was compared to that of other sampled insects also obtained through pan traps. Additionally, the bees and vegetation of one area were compared to the bees and vegetation of all other areas to find a correlation between bee and vegetation. A total of five sample plot were established, with about one hundred and fifty bowl collections. We anticipate that the long term results of this base line study will document the growth of the low canopy bee population as a result of low canopy flora no longer having to compete with high canopy vegetation for resources because the high canopy will be replaced with the solar arrays. Should the implementation of solar panels show a positive effect on the bee population, it could be an added benefit of renewable energy projects by stabilizing declining bee populations.

Introduction

In an effort to transition to green energy, areas of the Long Island Pine Barrens surrounding BNL have been selected for redevelopment for the construction of the Long Island Solar Farm. As a result redevelopment of the LISF, all the high canopy vegetation will be removed. The focus of this project was to create a base line study on low canopy bees, in order to monitor the effects the removal of high canopy vegetation. Due to the lack of available information regarding the insects that reside within the Long Island Pine Barrens. The information collected in this study is intended to be submitted to the national bee database in efforts to help monitor bee populations across the country.

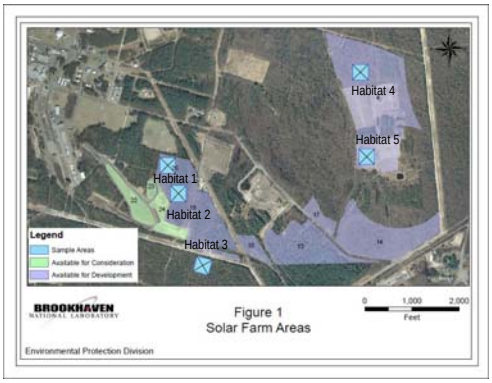


Figure 1
Solar Farm Areas

Figure 2
Habitat Areas chosen for Plots

Materials and Methods

Five different habitat types were chosen for sampling, within the chosen areas a one hectare plot (100 meter by 100 meter square) was set up in order to obtain a representative sample of the bee population. To improve efficiency, hectare plots were set up ahead of time using a geographic information system (GIS), from which longitudinal and latitudinal coordinates were gathered. The five points of the hectare plot (corner points and center) were then traveled to with the aid of a global positioning system (GPS) unit. Pictures were then taken from the corners of the hectare plot towards the center and four pictures were taken from the center to the corners. The long term purpose of the pictures is to serve as a means of comparison for future changes in the vegetation when the solar arrays are established. Using the coordinates for the center of the plot, two fifty meter transects were then set from the center of the plot pointed towards the corners of the plot forming an x-like shape.

Bowl traps were then placed in the morning prior to 9 AM. In each transect five white colored bowls, five yellow colored bowls, and five blue colored bowls were randomly distributed. Each bowl was filled with a soap water solution; the solution was made by adding two tablespoons of dawn blue soap/gallon of water. After the traps were set, the time, temperature, wind direction, and max wind speed were recorded. The five sampled plots were chosen to represent different vegetation types in order to get a diverse sampling of the bees present. The sampled areas were; area 26, area 19, the upper and lower part of area 4 and the area south of 19. Although the area south of 19 is not chosen for redevelopment, it will serve as a control for future comparisons.

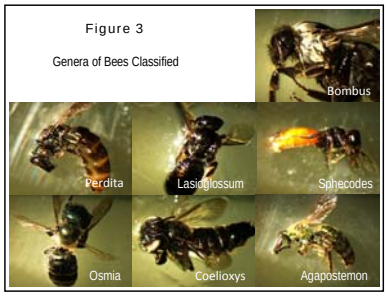


Figure 3
Genera of Bees Classified

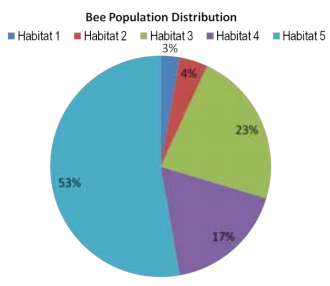
The traps were collected after three pm. To collect the bees, a tea strainer was used to gather the insects and then move them into a large centrifuge tube, each sample was then labeled by plot number, transect number, bowl number, and bowl color. Once the samples were collected the temperature would then be recorded again and the samples were taken to the lab to be stored in 70% ethanol. Once in the lab, the samples were then washed by removing the specimens from the centrifuge tube into the tea strainer, rinsing out the tube, then adding a small drop of soap with water into the tube, then add the insect and shake the tube for 30 seconds. The samples where then dried by pouring the samples into the strainer and then putting them between a folded piece of paper towel to dry. Once the samples were dried they were then stored in glass vials with 70% ethanol, each vial labeled according to plot, transect, bowl number and bowl color. The samples were then separated according to insect species, when unable to discern from which species they belonged to, they separated by color shape and size and stored in separate glass vials. In addition to being labeled by plot, transect, bowl number, and bowl color, they were also labeled by what species they were or what type of insect they were thought to be, if it was unknown as to what type of insect they were, then they were classified as unknown.

Each bee specimen was identified for key features with the aid of a microscope and online taxonomic keys. Bees were identified for key physical features, such as if they had a second or third submarginal vein on their forewings, or if they had a straight or very bent basal vein. Body color was also used in bee identification, if their head was dark or had yellow or white marking, the color of the thorax or abdomen was also used in identification. The bees were then checked for scopa, modified hairs used for the harvesting of pollen, if it was present on the tibia and femur of their hind leg or if it was located on their abdomen. They were also checked if padding was present between their tarsal claws. Using the keys the genus and species of the specimens were identified, due to the diversity of some of the genera some specimens were only identified down to genera.

Results

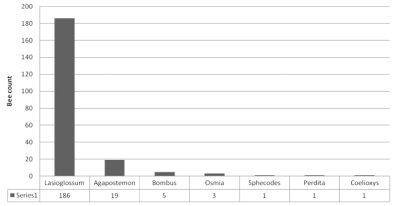
From the five sampled plots there were a total of 216 collected bees. In plot one there was a total of 6 bees collected, in plot two 9 bees were collected, in plot three there were 49 bees collected in plot four there were 38 bees collected and in plot five there were 114 bees collected. As seen in figure 4 the amount of bees caught in plot 1 makes up 3% of bees caught, plot 2 makes up 4% of bees caught, plot 3 makes up 23% of the population, plot 4 makes up 17% of bees caught, and the bees caught in plot 5 make up 53% of the bees caught.

Figure 4

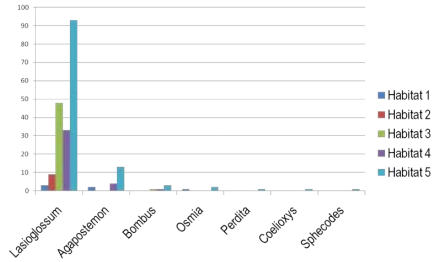


There was a total of 7 bee genera that were obtained from the sample; *Lasioglossum*, *Agapostemon*, *Bombus*, *Osmia*, *Sphecodes*, *Perdita*, and *Coelioxys*. From all the 216 collected bees, 186 belong to the *Lasioglossum* genus, 19 belong to the *Agapostemon* genus, 5 belong to the *Bombus* genus, 3 belong to the *Osmia* genus, 1 belong to the *Sphecodes* genus, and 1 belongs to the *Coelioxys* genus. This information can be seen in figure 5.

Figure 5 Diversity in Genera of Bees Caught



Bees were separate by genera per plot in order to observe the diversity in the genera of the bees caught. In Plot 1 there were 3 bees that belonged to the genus of *Lasioglossum*, 2 that were of *Agapostemon*, and 1 that was of *Osmia*. In plot 2 there were 9 bees were of the *Lasioglossum* genus. In plot 3 there were 48 bees that belonged to the genus of *Lasioglossum*, 1 that belong to the genus of *Bombus*. In plot 4 there were 33 bees that belong to the *Lasioglossum* genus, 4 that belong to the *Agapostemon* genus, and 1 that belonged to the *Bombus* genus. In plot 5 there were 93 bees that belonged to the *Lasioglossum* genus, 13 bees that belonged to the *Agapostemon* genus, 3 that was of the *Bombus* genus, 2 of the *Osmia* genus, 1 of the *Perdita* genus, 1 of the *Coelioxys* genus, and 1 of the *Sphecodes* genus.



Conclusion

It is anticipated that the differences in the amount of bees caught in the plots are a result of the differences in vegetation. Plot 1 was comprised of tall overstory of white oak and pitch pines, the under story of this area was primary scattered shrubbery. The over story of plot 2 was densely covered in pine and spruces; there was barely any understory present. The overstory of plot 3 was very similar to that of 1 but it was densely covered with understory shrubbery. Plot 4 was similar to plot 1 it had white oak but the understory contained scattered vegetation . Plot5 had no over story and was densely covered in low canopy grassy vegetation. It can be said with the higher increase in low canopy vegetation there was a higher increase in be population.
From the results it was shown that 186 of the bees caught were of the genus of *Lasioglossum*, these bees were found through all the plots sampled. Perhaps this may be due to a certain type of low canopy vegetation present in all the plots or a multitude of other factors.
This research was only a baseline study and as part of the protocol it is suggested that the bees be sampled from March to October, due to the time constraint this was not an option. If more sampling was possible there may have been variations throughout the season. It is a possibility that the implementation of the solar panels may result in larger population yields due to the opportunity for low canopy flora to grow without competing against high canopy vegetation.

References

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