Effects of plant distribution on the foraging behavior of pollinators

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Personal background

- My name is Evangelina Bahu and I have been working in Dr. Suni's lab since the summer of 2019. I took a Pollination Biology course in the spring with Dr. Suni and instantly fell in love with pollinators, specifically bees. One of the course's main focuses was on the recent declines in pollinator populations and the plants on which they forage. Being newly educated about the severity of this issue, I was eager to join Dr. Suni's team to work towards pollinator population recovery. I was fortunate enough to get a position working in Dr. Suni's lab to study plant and pollinator persistence in urban and natural sites around San Francisco. We aimed to determine how urbanization in San Francisco alters pollinators' foraging behavior.

Introduction

- Understanding how pollinators move among plants of different species is important for predicting whether those plants will be able to make seeds. Floral constancy or pollinator constancy is defined as the tendency of a pollinator to primarily visit one plant species in a foraging trip. Pollinators that show higher levels of floral constancy are more likely to transfer conspecific pollen. Pollen is deemed conspecific when the pollen on the pollinator and the pollen found on the flower last visited by the pollinator belong to the same species. Lower levels of floral constancy suggest that pollinators are carrying more heterospecific pollen, pollen from the pollinator that does not belong to the same species as the pollen of the plant last visited.

- Last year, we aimed to study the effects of urbanization on plant-pollinator interactions. We found a pattern that showed that pollinators carry a higher proportion of conspecific pollen than heterospecific pollen in urban sites than in natural sites (Figure 1). The study was able to establish that plant species richness, defined as the number of plant species, does not differ among site types and is not a factor contributing to this pattern. Although we did do transects during our study last year, we did not accurately assess nearest neighbors between plant species.

- Therefore, in this study, I set out to investigate if the distribution of plants could be the driving force of this pattern by asking the questions; **Are plants more clumped in urban or natural areas? If so, how does that affect species foraging behavior?**

- We hypothesize that because the proportion of conspecific pollen has shown to be higher in urban sites, we would expect plants to be more clumped in urban areas than in natural areas.

Methods

- Due to COVID-19, we were unable to begin our study. However, we plan to conduct transects of 13 individual sites to assess nearest neighbors within San Francisco County. The transects will consist of 6 urban and 6 natural sites. Each transect will be done between 1:30 and 3:30 in the afternoon when there is predicted to be a maximum amount of sun and flowers appear to be in anthesis.

- The transects will be done using transect tape that is 30 M long in its entirety. For each site, we will sample the length of three transect tapes, 90 M. The transect tape will be placed randomly throughout the plot of land assessed to mimic the foraging behavior of pollinators.

- We will determine if plants are more clumped in urban sites than natural sites by estimating the proportion of plants whose nearest neighbor was their same species and comparing between site types, urban and natural.

- We plan to use a linear mixed model with the proportion as the dependent variable, site type as the independent variable, and site as a random factor.

Expected Results and Conclusions

- Our hypothesis is based on the Optimal Foraging Theory developed by Robert MacArthur. The Optimal Foraging Theory is the notion that animals will maximize energy gain while minimizing energy expenditure. Based on this theory, we would expect plants to be more clumped in urban areas than in natural areas.

- We anticipate that if our results support our hypothesis, we can assume that pollinators are foraging between closely clumped plant species. However, if our results do not align with our hypothesis, further investigation is necessary to understand why pollinators carried more conspecific pollen in urban areas.