CH3 Write up

Introduction

Community level pollinator interactions

Density-dependence and the saturation curve. Shrubs as 3 measures of density.

Networks.

Scale dependence.

Rational and implications.

Network background

There are two major hypotheses that explain network interactions: neutrality, where the pairwise interactions are based on abundances, and biological constraints.

Methods

Pollinator visitation networks are a quantitative method to visualize and analyze the many interactions within a community. Species that have a disproportionate effect on a community can be identified by looking at degrees of the many nodes (Dale and Fortin).To create a pollinator visitation network, I quantified visitation to blooming foundation plants in 10-minute observation sessions. Over a period of 19 days I observed 395 individuals, comprising seven species of shrub and three species of cactus for a total of 66 hours of observation. This approach to creating a pollinator visitation network allows visitation rates to be standardized between individuals, compared with the frequently used method of transect walks.

Visitors were identified on the wing when possible, and as many as possible were caught for later identification. Only individuals that touched the reproductive organs of the plants were included. Melyrid beetles in the subfamily Dasytinae and pollen beetles Carpophilus sp. were excluded because while abundant, they were generally stationary deep within the flowers. All visitors, with the exception of Costa’s hummingbird Calpte costa were insects. Very small pollinators, such as the micro-beeflys (Mythicomyiidae) were observed where possible but excluded in analyses as it was not possible to track their visits to very large shrubs such as L. tridentata.

To contrast the contribution of individual traits and floral neighbourhood density on pollinator visitation, I counted the number of flowers and height of the focal plants. I recorded the quantity and identity of blooming shrubs and cactus in a 3 m radius around the focal plant. 2018 was a drought year and annual bloom density was negligible. It was not feasible to count the blooms of all neighbouring shrubs, so the surrounding shrub density is a proxy for neighbourhood floral bloom density. I also measured the distance to and identity of the focal shrub’s nearest blooming neighbour, as well of the distance to the nearest blooming L. tridentata.

I recorded shrub phenology and estimated blooming shrub density of each species using band transects on most study days. Therefore, there are three scales of floral density measures: individual, neighbourhood and site. I also used pan traps placed in open areas to track pollinator population changes throughout the study period. I quantified the number of ‘large bodied’ pollinators to reflect the sizes of those observed during the experiments (hereafter just ‘pollinators’). I plan to analyze this data using two methods: 1) Using GLMM’s to look for interactions between floral density at the different scales. 2) Using a network approach. I will analyze the plant-pollinator network at a community level. Secondly, I will create an individual-based network (as in Dupont et al, 2014), and calculate network indices for each individual. This makes it possible to use individual attributes to predict network topology using GLM.

Networks are comprised of nodes and links. Nodes are defined by the analyst. In this case nodes are species or individuals. Links, are the connections between nodes, in this case floral visits. Attributes are intrinsic characteristics of the nodes (size, floral number). Network topology are the patterns of relations.

In a quantitative visitation network, each link is weighted or assigned a strength. In a pollinator visitation, this is weighted by the number of visited. In our case, it is the number of foraging bouts and not floral visits per se. This is because insects were sampled mid foraging. Additionally, the number of flowers alters the number of possible visits made. However, anytime a visitor left and came back it was counted as a new visitor. In a qualitative network all observed links are the same strength.

Results

Major findings: Current analyses are focused on interactions between shrubs only, because the visitation network (Figure 3) shows that cacti interact primarily with other cacti. Local shrub density had a positive influence on pollinator visitation (Table 2). There is a significant interaction between individual flower number and site level shrub density. When site level shrub density is high, the slope of this relationship is steeper, suggesting individuals with lower flower number are at a disadvantage when site level shrub density is higher (Figure 5).

Discussion

There are interactions of different scales of density.

This has been found before in these papers:

Individual traits influence network topology.

What do these mean.

Implications for community interactions.

Suggestions for future work based on these results.