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Variability of Tropical Pollination

Sangeetha Krishna and Satya Mansi

Department of Environmental Science, Govt. Degree College, Bijbehara (J&K), India

(Corresponding author: Sangeetha Krishna)

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EDITORIAL NOTE

The fast decline in biodiversity currently underway has been called the sixth mass extinction. The loss encompasses not only individual species, but also ecological interactions, often at a higher rate. Since many key functional aspects and services important for the maintenance of natural biomes and human subsistence depend on biotic interactions, species interactions should be treated as a major component determining the health of ecosystems. For example, plant-animal mutualistic networks, such as pollination and seed dispersal, sustain terrestrial biodiversity and human food security. However, pollinating insects are declining in many parts of the world because of human disturbances, especially habitat loss, but also landscape simplification, population subdivision, and consequent changes in behavior and in interspecific interactions. The value of ecosystem services provided globally by pollinating insects is estimated to be around 7% of the total of agricultural food production. Around 70% of the 124 main crops consumed by humans depend on animal pollinators, and so do most flowering plant species in the wild, especially in the tropics.

Because no species is an island, effective conservation action must protect not only individual species, but the functioning of the whole ecological community, easily represented by the web of interspecies interactions. This focus on relationships or interactions is at the heart of Ecology as a science, and it is therefore not surprising that network tools and concepts have a long tradition in ecological studies. In fact, network ecology is a large and rapidly growing subfield within the discipline. Studies dealing with species interaction networks often rely on biological survey data, sometimes originally obtained with different goals in mind. These data typically suffer from observation errors, incomplete and biased sampling, particularly when dealing with large geographic extents and species-rich systems. Network inference techniques developed in the domain of Network Science can help in the reconstruction of incomplete data, allowing us to capture patterns at a large scale, gain further insight into ecosystem functioning, and hopefully build better conservation strategies.

In this study, we sought to construct local plant-pollinator networks across a highly impacted tropical rainforest habitat; examine some structural network properties; and explore how network structure relates to natural forest cover and land cover heterogeneity. For this, we used a database on plant-insect flower visitor interactions from the Atlantic Series data papers collection. We hypothesize that the number of species, number of links, sum and evenness of link weights, connectance and modularity will increase with forest cover, while nestedness and centralization will decrease.

There are two cases in which forest-spp and all-spp networks show opposite results, both involving only very weak correlations. First, modularity seems to decrease with forest cover for all-spp and increase for forest-spp networks. We should however keep in mind that, for forest-spp, modularity was more associated with HLC than with forest cover. Secondly, SLW in function of HLC decreases for all-spp, but increases for forest-spp. That is, in homogeneous sites, networks of forest species have weaker links, and networks of all-spp have stronger links. It is interesting to note that most homogeneous sites in the study area are occupied by agriculture rather than forest.