Tree Species Identification, Abundance, and Distribution at Cloudbridge

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Project Goals

The goal of this study is to establish the range of tree species at Cloudbridge, to estimate their abundance, and to learn how the different species are distributed within the forest.

To begin to understand the original composition of the forests we will take an inventory of the trees in several small areas distributed around Cloudbridge South and North. To achieve this we will record tree species, size, and location thereby establishing the relative abundance of each species and how that species is distributed. This inventory will be carried out both in primary forest and also in secondary forest to help us understand how the cloud forest tends to restructure itself after human intervention. The results of this inventory will help guide our efforts, and similar efforts elsewhere, to restore the forest.

Background

Forest in Cloudbridge NorthIn a now classic paper published in 1979, Stephen Hubbell showed that the then commonly held notion that tropical tree species are uniformly distributed at low densities was wrong; at least in the tropical dry forest of Guanacaste Province, Costa Rica. His study covered an area of 13.4 hectares and included about 16,000 trees with diameters greater than 2 cm (6000 greater than 5 cm) that were separated into 135 species. He plotted the distribution of both the juvenile and adult trees of each species. He found that for the 30 most common species the average adult is clearly found aggregated with other adults and juveniles. In the rarest species the aggregation was even more pronounced. In the other common species the distribution was random.

In a larger study at six different tropical sites covering dry deciduous to wet evergreen forest on two continents, Condit et al (2000) showed that nearly all of the 1768 tree species were more aggregated than a random distribution with the rare species being more aggregated than the common species. Pitman et al (2001) in a study of two widely separated Amazonian tropical forests, found that most species were rare (<1 tree/hectare) and that a few of the most common species dominated the forests and were locally aggregated. Furthermore, they found that a third of the most common species were found in both habitats separated by 1400 km; the similarities of the two sites were greater than expected. They noted that this kind of tree distribution is qualitatively what one finds in temperate forests, only the tropical forests have more species.

With our proposed inventory of the Cloudbridge forest we will establish which tree species are present and whether or not the members of each species appear to be relatively aggregated as found by Hubbell and Condit

et al, and whether or not most of the species are relatively rare as Pitman et al found. In addition, it will be interesting to see if two widely separated cloud forests, such as Cloudbridge and Monteverde (see Haber et al, 2000), share some of the most common species (as Pitman et al found in the Amazon). These results are important in deciding what species to plant and how they should be distributed in the reforestation of formerly agricultural land at reforestation projects such as Cloudbridge.

One additional point is that Hubbell concluded from his study that the forest was in a relatively nonequilibrium state. This conclusion was challenged in a study by Terborgh et al (1996), in which he found to the contrary that tropical forests tend to return rapidly to an equilibrium state. While our study cannot address this issue, we can make observations from our comparison of primary and secondary forest, and by replications of this study over time.

Methods

Overall, the plan is to establish the range and distribution of tree species at Cloudbridge.

Cloudbridge and Cerro UranIn the first stage of this project we will identify every adult tree with dbh (diameter at breast height) > 5 cm by species and note its location within a sample quadrat of 20m x 20m located in the primary forest of Cloudbridge North. This will be repeated in several areas in Cloudbridge North and Cloudbridge South. Distinguishing the tree species may prove difficult. In cases of doubt, we may take photographs or samples to one of three possible organizations for help: the Instituto Nacional de Biodiversidad or the Museo Nacional de Costa Rica both in San Jose, or the Instituto Tecnologico in Cartago.

If possible, this data collection will be extended to 1 hectare quadrats (100mx100m).

Ultimately we should extend this to 10 or 20 hectares with the intent of capturing the range of diversity across the preserve. Also, if eventually needed for our study, we could identify all trees with dbh > 2 cm (i.e., including juveniles), but this will increase the tree count by almost a factor of three!

Along with species identification we will measure the dbh, estimate the height, and note the condition of the tree.

The results will be compiled and plotted graphically using ArcGIS software. This will enable us to see any species aggregation, as well as the relative rarity of each species. Using a GPS unit we can record the coordinates of the corner of the first quadrat. Then since the quadrats will be laid out quite accurately relative to each other, the entire sampled area can be displayed on an ArcGIS map.

In an effort to understand the factors leading to diversity, we will carry out soil samples for each quadrant. That is, the soil will be classified at various depths and the N2, P, K, pH, and moisture content will be measured. These measurements will be fairly rough, but will hopefully show a range of values across the sample areas.

The first stage of the study should take one to two months or significantly longer if tree species identification turns out to be quite difficult. The results of this first stage will guide our efforts in the next more ambitious stage.

References

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