**Title: Composition and structure of dry forest plants, in altitudinal gradient and correlation with Fauna (birds and landsnails) in fragmented landscape.**

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**State of the art**

The tropical mature dry forest is estimated at only 2% of the total of its spatial configuration area (Janzen, 1988) (Stan and Sanchez, 2019). On the shore of Central America coast, only 0.1 % of the original forest is funded without perturbation (Gonzalez et al, 2006). The dry forest in Central America includes approximately 34 million hectares, which is an equivalent to 0.1% of the original regional forest (Castro, 2005) and the dry forest in Nicaragua was calculated in 2500 km2 moistly around the coast, where live 50% of the populations (Gonzalez et al, 2006).

The forest loss in the Pacific region of Nicaragua is mainly the loss of dry forests. The rural population is highly dependent on natural resources, because the trees are an important form of energy. For this reason, the 74% of the trees are used as firewood. So became today the dry forest to be a rare form of forest in the area (Kolbe, 2008). In fact, gaining connectivity is a huge challenge and it is vitally important to know the vegetation structure of these dry forest mosaics, in order to establish long-term conservation strategies and strengthen ecosystem connectivity.

In the upper side of the Managua hills, and forested areas near to Villa El Carmen, we have a lack of knowledge about the current floristic structure. Also information about the understory roll and its importance for wildlife is very scarce registered in this area of Nicaragua. Alongside the loss of forest stands, is the subsequent loss of faunal biodiversity. Some species are more specific to dry forest area such as the White-bellied Chachalaca, Nicaraguan Grackle, Pacific Green Parakeet, etc., as example of some birds, and these species need healthy landscapes and connectivity. We will know better the vegetation structure of undergrowth in dry forest and to identify strategic alternative to conservation of them.

**Research question, objectives and aim**

* Review of the species composition and structure of the undergrowth in dry forest conservation areas and lowland dry forest to the “Pueblos Blancos” plateau and Managua hills.
* To determinate patches structure and function in mosaics of dry forest.
* To determinate the value of forest patch in the connectivity for forest under protection on the Pacific dry forest, such as Reserva Natura (432 ha) and Wildlife Refuge Quelantaro (70 ha), both in Villa el Carmen and the Sierra de Managua Reserve.
* To know a specific correlation of understory plants structure with birds and landsnails.
* To stablish the diversity along the altitudinal gradient from lowland dry forest to the Pueblos Blancos and Managua hills.

**Study of area and vegetation sampling**

The area of study corresponds to dry forest patches located in the high areas of the region called Managua hills. Our sampling will be carry out from classic dry forest areas in Villa Carmen, going to plateau from El Crucero to Diriamba region.

The study of vegetation will be carried out through a stratified sampling where plots of forest will be located in the forest with point centered quartier method of Cottam and Curtis (1956). Apart from this we are going to sample in the same sites using two methodologies for fauna.

For vertebrates such as birds, we are going to do point counts, trying to cover as much as 40 sampling sites. Methods according to Handbook of fields methods for monitoring landbirds (Ralph et al, 1993).

For invertebrates such as land snails, we are going to do thirty minutes’ intensive research in the same sites where birds point counts where held, and we will collect one square meter of superficial soil, to determinate the micro snails diversity. The method will be according to Marquet (1985).

**Data analysis methods**

**Vegetation**

Identification of plants with herbarium exemplars and keys of the Nicaraguan flora Missouri botanical garden.

For the analysis of vegetation will be use R-Project 3.5.2 package (vegan) for multivariate analysis. Alfa and beta diversity we will determinate, ordination analysis PCA, CCA. Multiple correlation between plant diversity, vertebrates, and invertebrates.

**Birds**

For the analysis of bird’s populations will be based on the strata where the birds are detected, stablishing the detections as follow: 0 –3 m, 4 – 7 m, 7 – 20 m, and more than 20 m. Also R-Project 3.5.2 package Mass, plyer dplyer and Ggplot2.

Alfa and beta diversity we will determinate in each forest patchs and each altitudinal belt.

**Spatial analysis with Arcgis 10.5.**

1. Elaboration of maps
2. Evaluation of landscape networks
3. Patch characteristics and analysis

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