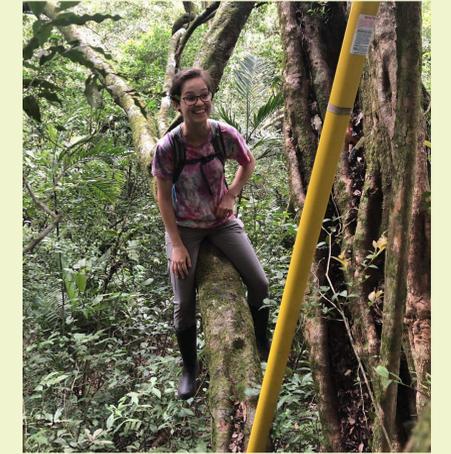


# CARBON STORAGE AND SEQUESTRATION IN SECONDARY FORESTS

Oliwia Krupinska and Vicki Jagdeo  
 Advisor: Don Morris and Alexandra Paniagua  
 Lehigh In Costa Rica 2019  
 Lehigh University, CIEE San Luis



## Background

Greenhouse gas emissions play a significant role in the advancement of global warming, as they change the chemical makeup of our atmosphere and intensify its greenhouse effect. To counter their carbon emissions, many institutions are initializing carbon neutrality programs, in which they preserve forests on premises so that growing trees may sequester carbon as they grow.

The objective of this project was to calculate the carbon stored by trees in the CIEE San Luis campus forest plots and create a baseline for future calculations of carbon sequestration.

## Approach

We visited two permanent forest plots (100m x 100m each). Camino Real and Zapote on the CIEE San Luis campus. In each plot, 10 subplots of size 20m x 20m were chosen for sampling.

In each subplot, DBH measurement was performed on all trees with DBH  $\geq 10$  cm and height of 10% of the trees was taken in line with Standard ND: 03: 2016, the official standard to develop inventories for the Carbon Neutrality Program in Costa Rica.

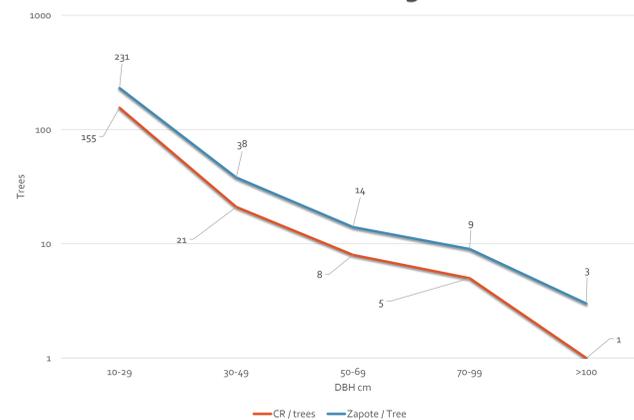
The measurements were used to calculate the basal area of trees in the plots, the volume of tree matter, and ultimately the amount of carbon dioxide collected by the forest growth. These results were ultimately extrapolated over the full forest area to calculate how much carbon is stored in the entire campus forest. We estimate that, to date, there are 18,205.15 Tons of CO<sub>2</sub> stored in the trees of CIEE campus forests from the main population, or 20,819.37 Tons including large outliers.

## CO<sub>2</sub> Storage Calculation

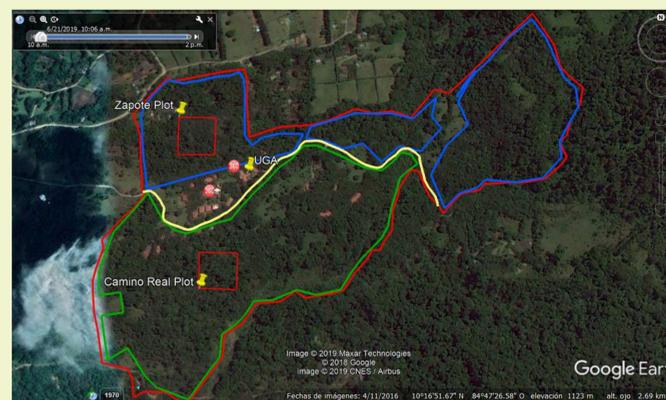
$$CO_2 = DBH^2 * (\pi/4) * h * FF * CF * PEB * FEBA * FEBS * 3,67$$

h = height of the tree  
 FF = form factor (0.7)  
 FC = carbon fraction (0.5)  
 PEB = basic specific weight (0.5)  
 FEBA = aerial biomass expansion factor (1.2)  
 FEBS = expansion factor of underground biomass (1.2)  
 3,67 = carbon to carbon dioxide conversion factor

## Tree Distribution According to Diameter



## Area Map



Camino Real results were expanded over the area with a green perimeter in the Southern part of the campus and the Zapote plot results into the blue perimeter area, which mostly represents the northern half of the campus.

## Calculated CO<sub>2</sub> Stored

	Average tons of CO <sub>2</sub> /ha	Corresponding hectares
Zapote	518.07	22
Camino Real	243.13	28
Total Tons CO <sub>2</sub> in the forest	18,205.15	

## Conclusions

### Carbon Storage in Campus Forest

The numbers calculated for total carbon stored are typical for secondary forests. According to historical records, Camino Real has been more interrupted by human activity than the Zapote plot, which is why it has less trees, less basal area and, ultimately, less stored carbon volume.

The basal area results are supported by the Google Earth images of both plots, where the Zapote plot is clearly denser than Camino Real. There are around 518.066 tons of CO<sub>2</sub> stored in the Zapote plot, 243.058 tons in Camino Real plot so, after extrapolation over the whole campus, we conclude that there are about 20,819.37 tons of CO<sub>2</sub> stored in the forests.

### Further Steps

With an existing baseline for the volume of carbon stored in these permanent plots, future groups can calculate the carbon sequestered by the forest through the same measurement procedures as described in this report and then comparing the initial and final carbon stored.

We hope this work will be used in the future calculations of carbon sequestration in CIEE San Luis campus forests and as a reference for other institutions which also wish to understand carbon sequestration of secondary forests, potentially for their own carbon neutrality endeavors.