



Upper Andean Forest Monitoring Network

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Juan M. Posada, Natalia Norden, Nicola Clerici





BACKGROUND

- ▶ Andean forests are a biodiversity hotspot with some of the highest endemism in the world
- ▶ They are also heavily impacted by human activities
- ▶ In Colombia only ca. 22% of the Andes are still forested



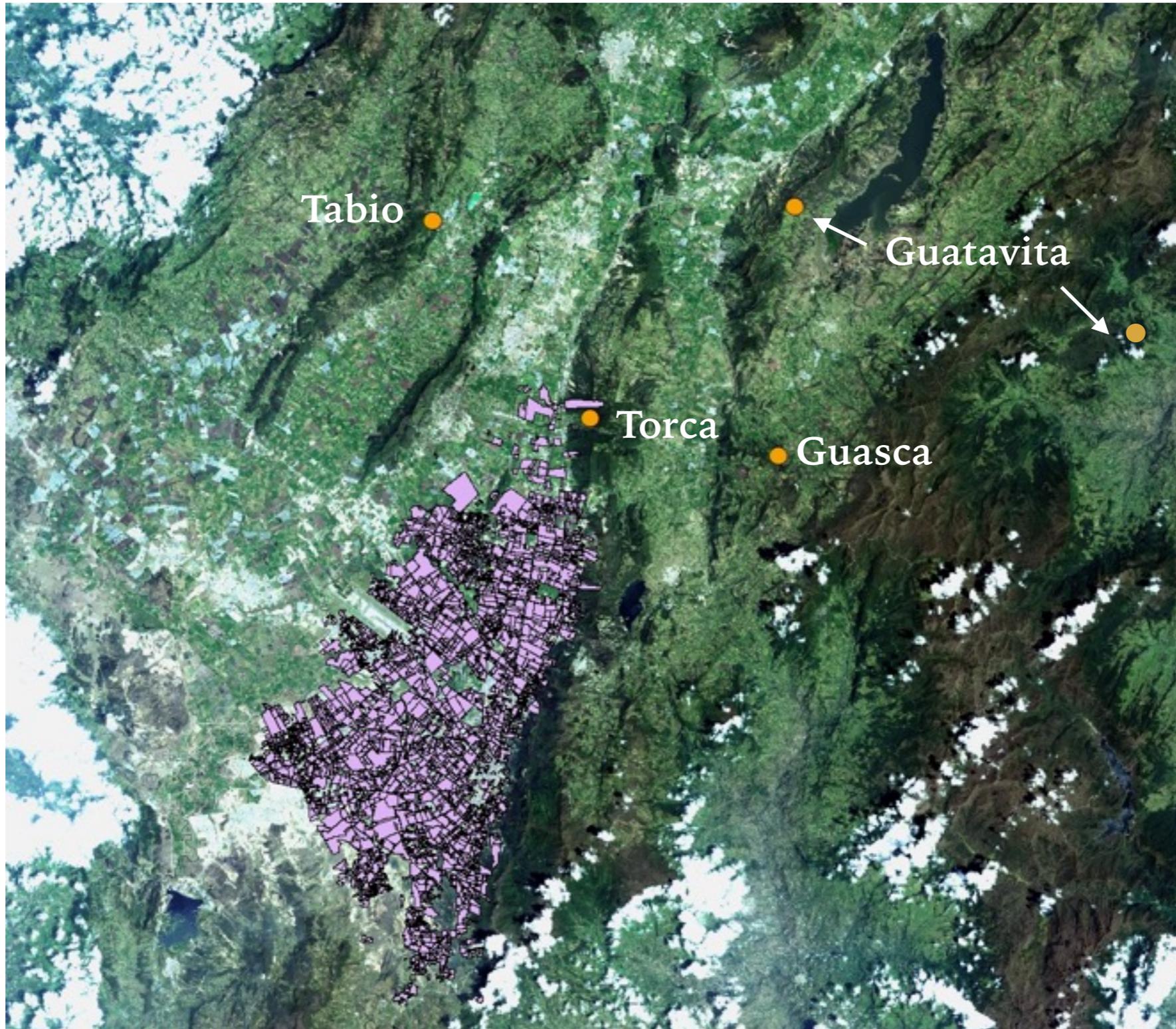
BACKGROUND

- Most Upper Andean forests around Bogotá (ca. 2600-3200 m) have been cut, some for centuries.
- The socio-ecological landscape is a complex mixture of pastures, crops, urban areas, early secondary forests and a few mature forests
- Yet, these forests remain very poorly studied

OBJETIVES

- The Upper Andean Forest Monitoring Network (UAFMN) was developed to study biodiversity and ecosystem processes in secondary and mature forest that are strongly influenced by socio-ecological dynamics
- We are also interested in studying the history of disturbance and determine how forests are going to change in the future
- The UAFMN is open to collaborations from local and international researchers!

LOCATIONS



EARLY SUCCESSIONAL FORESTS



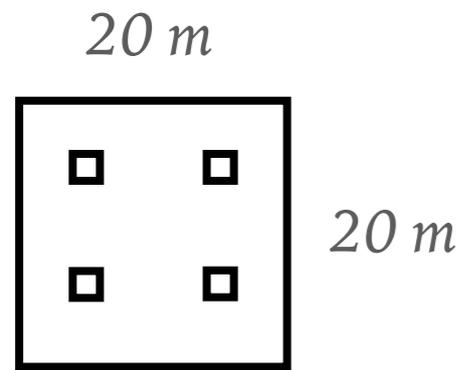
LATE SECONDARY / MATURE FORESTS



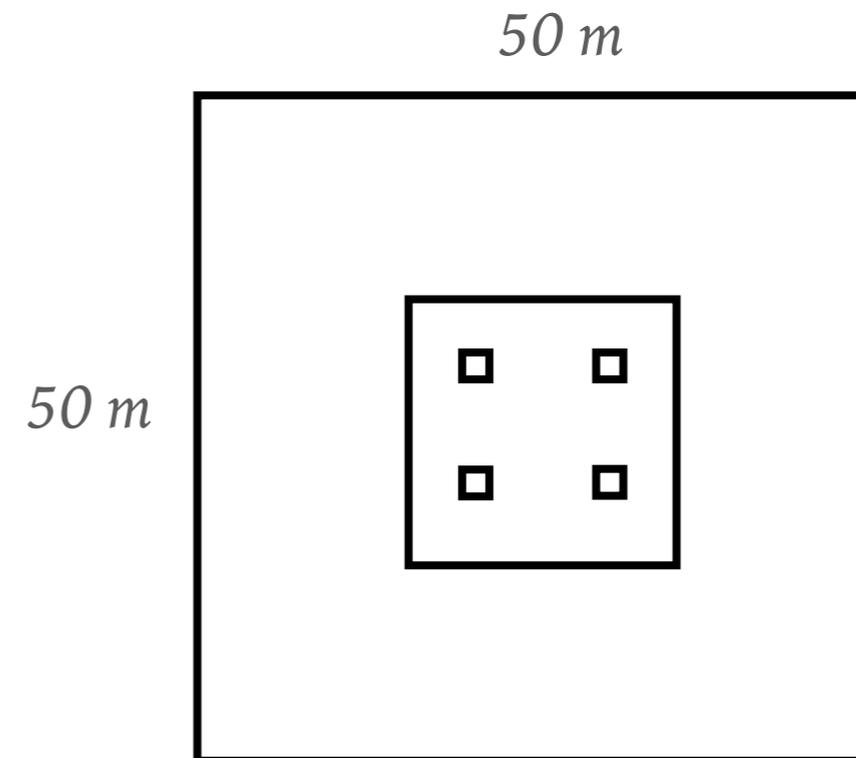
LATE SECONDARY / MATURE FORESTS



PLOT DESCRIPTION



- $n=20$ plots
- Basal diameter > 5 cm
- $n=4$ seedling plots per plot
- Seedlings: everything above 5 cm in height; < 1 cm BD = seedling; 1-5 cm BD = saplings
- All individuals are tagged and identified



- $n=2$ plots (growing to 8)
- $DBH > 10$ cm
- Individuals are tagged and identified

BIODIVERSITY

*High richness: 85 woody species
(many endemics, just 1 exotic)*

*Ageratina
asclepiadea*



*Critoniopsis
bogotana*



*Xylosma
spiculifera*



*Hesperomeles
goudotiana*



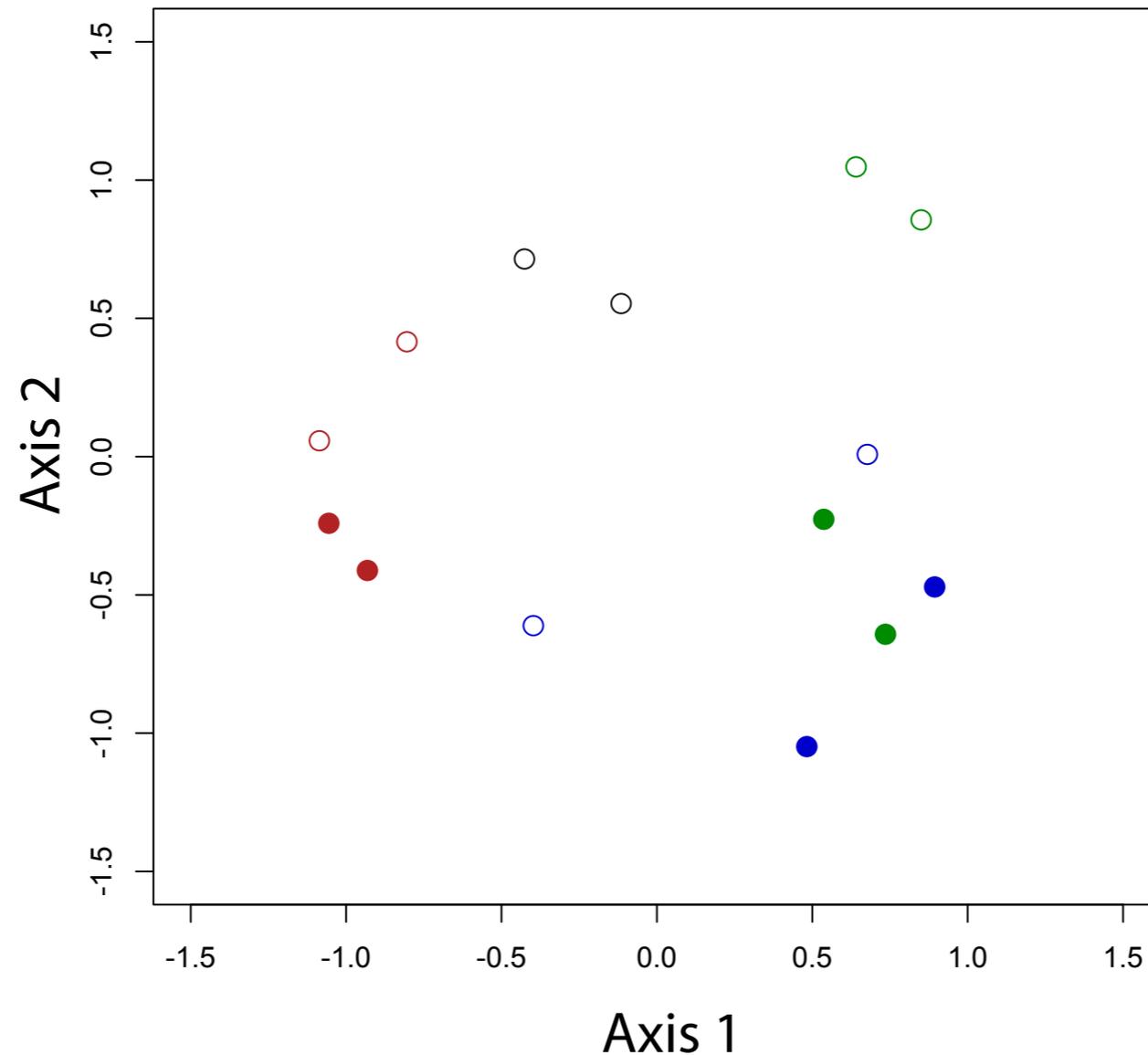
*Rhamnus
goudotiana*



*Miconia
squamulosa*

NON-METRIC MULTIDIMENSIONAL SCALING (NMDS)

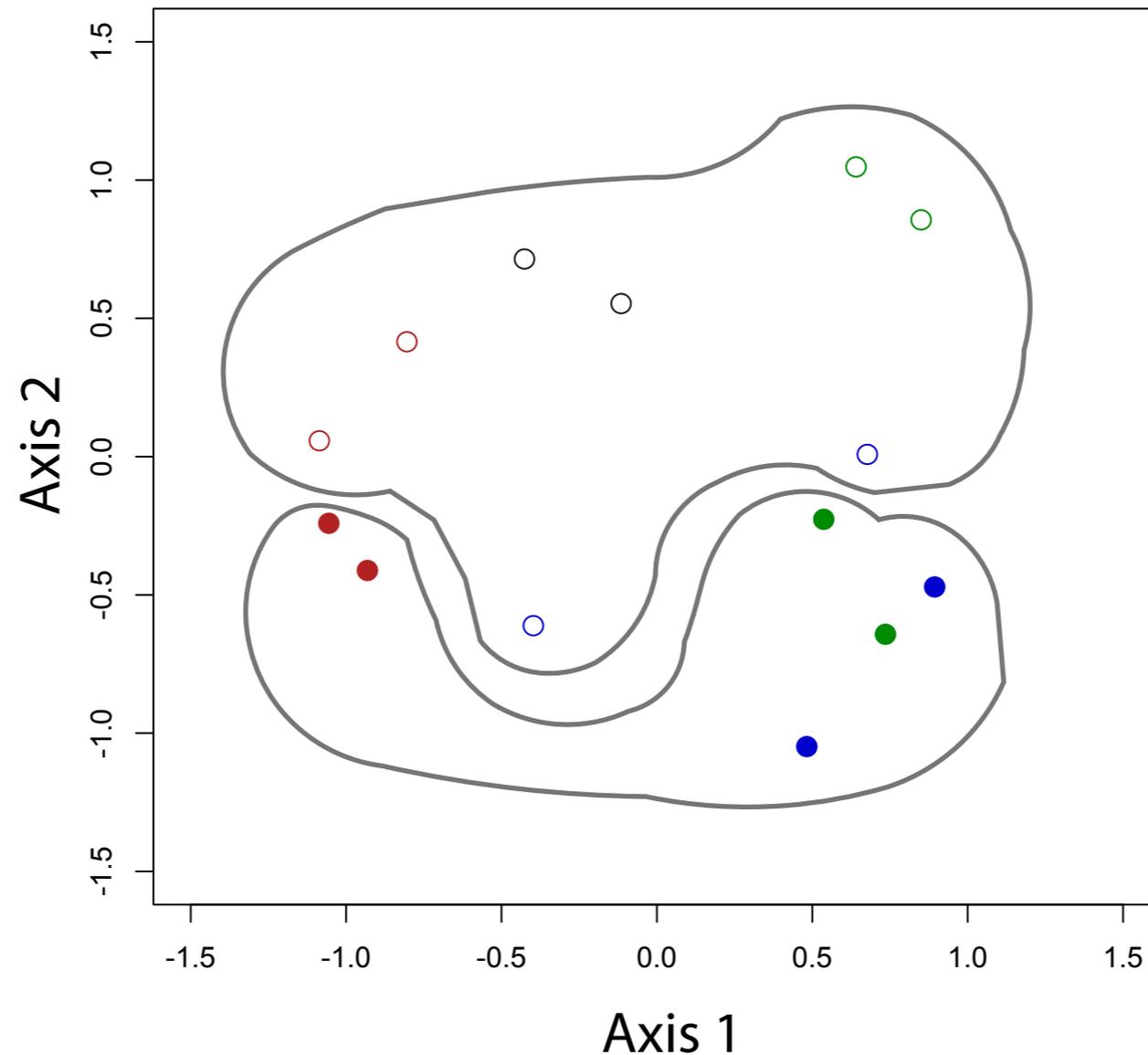
Black- Guatavita
Green-Encenillo
Red-Tabio
Blue-Torca



Early successional forests tend to separate from late secondary forests along axis 2

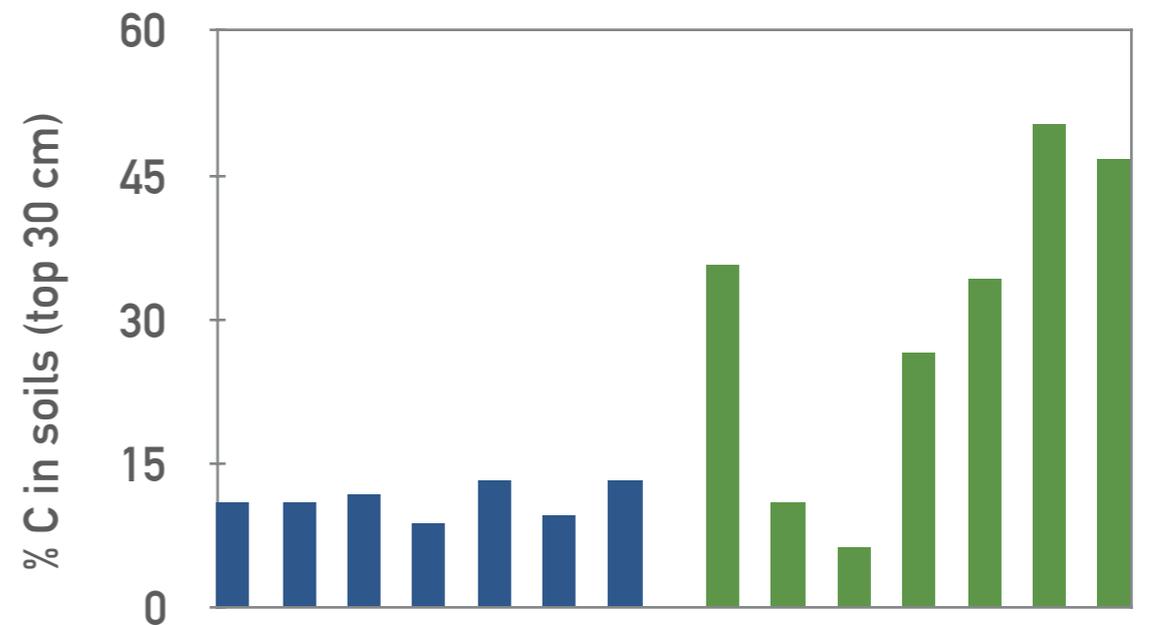
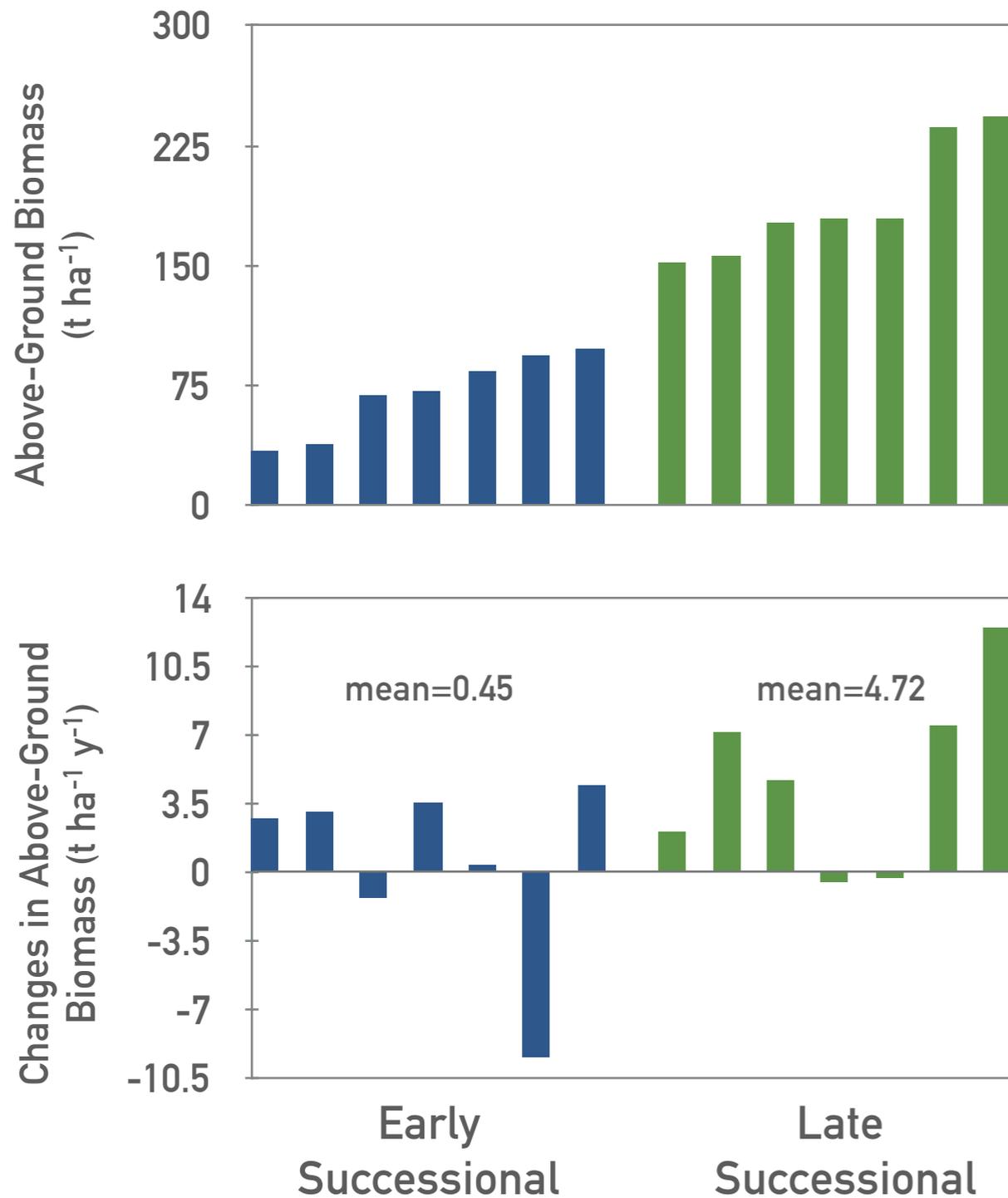
NON-METRIC MULTIDIMENSIONAL SCALING (NMDS)

Black- Guatavita
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Early successional forests tend to separate from late secondary forests along axis 2

CARBON CYCLE

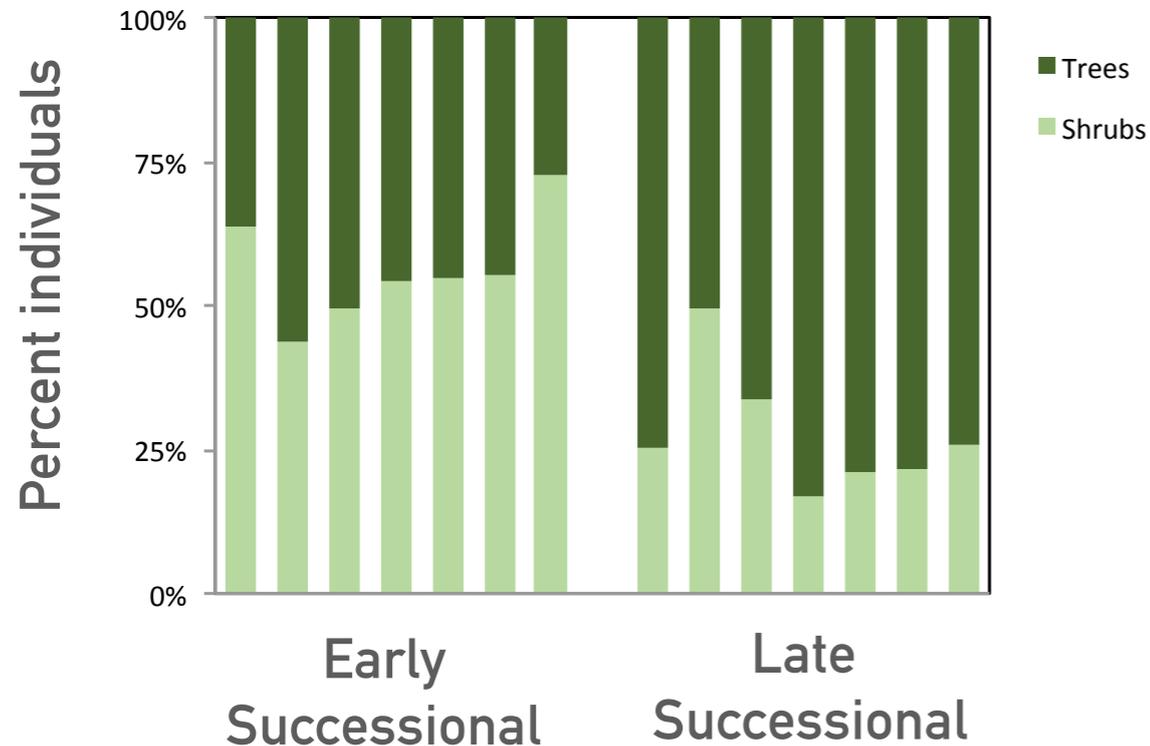


Other measurements:

- Litter production: 0.5 m² traps (x10) per plot => NPP
- => we will soon have estimates of above-ground NPP for 14 plots
- Leaf and ecosystem light use efficiency
- Wood decomposition

FUNCTIONAL GROUPS & TRAITS

Functional groups

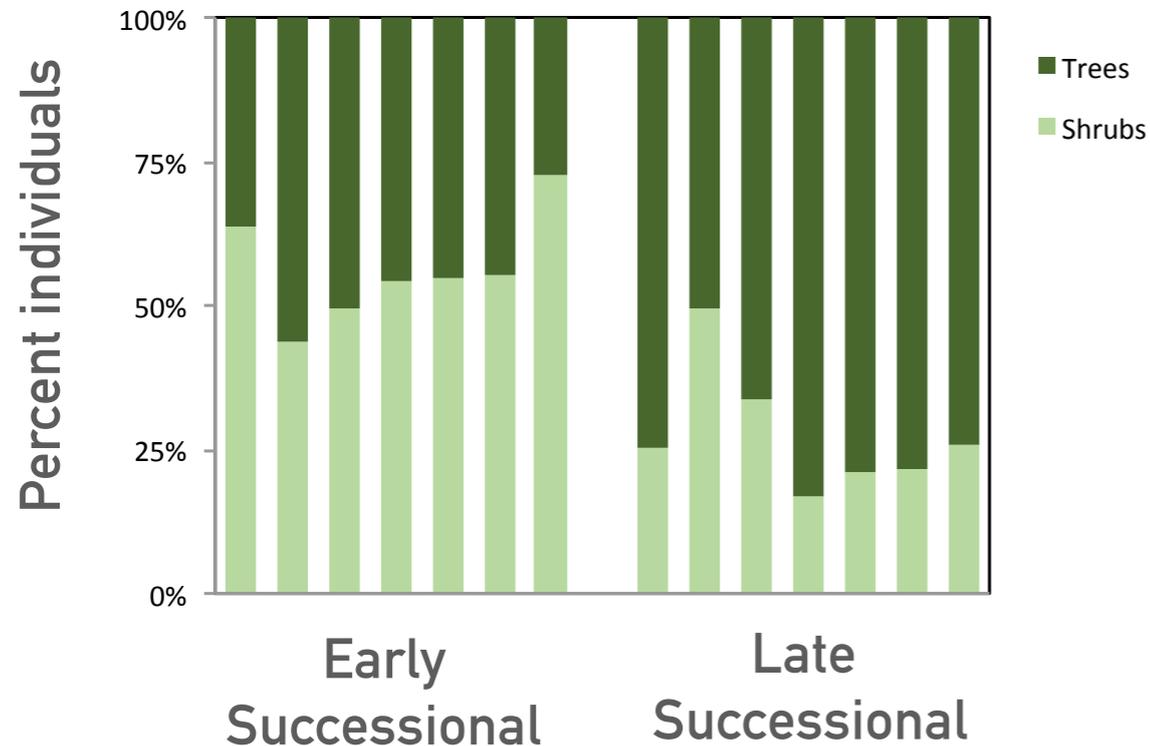


Functional traits

- Leaf A_{max}
- Leaf g_s
- SLA (LMA)
- Leaf Thickness
- Leaf Density
- LDMC
- Wood density
- H_{max}
- Volatile organic compounds

FUNCTIONAL GROUPS & TRAITS

Functional groups



Used to calculate community weighted mean of traits and functional diversity indexes

Functional traits

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- SLA (LMA)
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- Wood density
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- Volatile organic compounds

SOILS & CLIMATE

Anion PRS Probe

NO_3^- , H_2PO_4^- ,
 SO_4^{2-} , Fe, Cu,
Zn, B, Mn, Pb



Cation PRS Probe

NH_4^+ , K^+ , Ca^{2+} ,
 Mg^{2+} , Al, Cd



- 576 Plant Root Simulator (PRS) probes
- Installed in 16 plots and two abandoned cattle pastures
- Other soil measurements:
 - Bulk density
 - d^{15}N
 - d^{13}C
 - Soil %N
- Fine root biomass (2017)
- Soil respiration (2017)

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Climatic measurements

- Air temperature
- Air relative humidity
- Precipitation
- PAR (2017)

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- Installed in 16 plots and two abandoned cattle pastures
- Other soil measurements:
 - Bulk density
 - $\delta^{15}\text{N}$
 - $\delta^{13}\text{C}$
 - Soil %N
- Fine root biomass (2017)
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REMOTE SENSING



forests

Forests 2016, 7, 138; doi:10.3390/f7070138



Article

Estimating Aboveground Biomass and Carbon Stocks in Periurban Andean Secondary Forests Using Very High Resolution Imagery

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GeoEye-1 and Pleiades-1A images;
Ratio Vegetation Index (RVI)

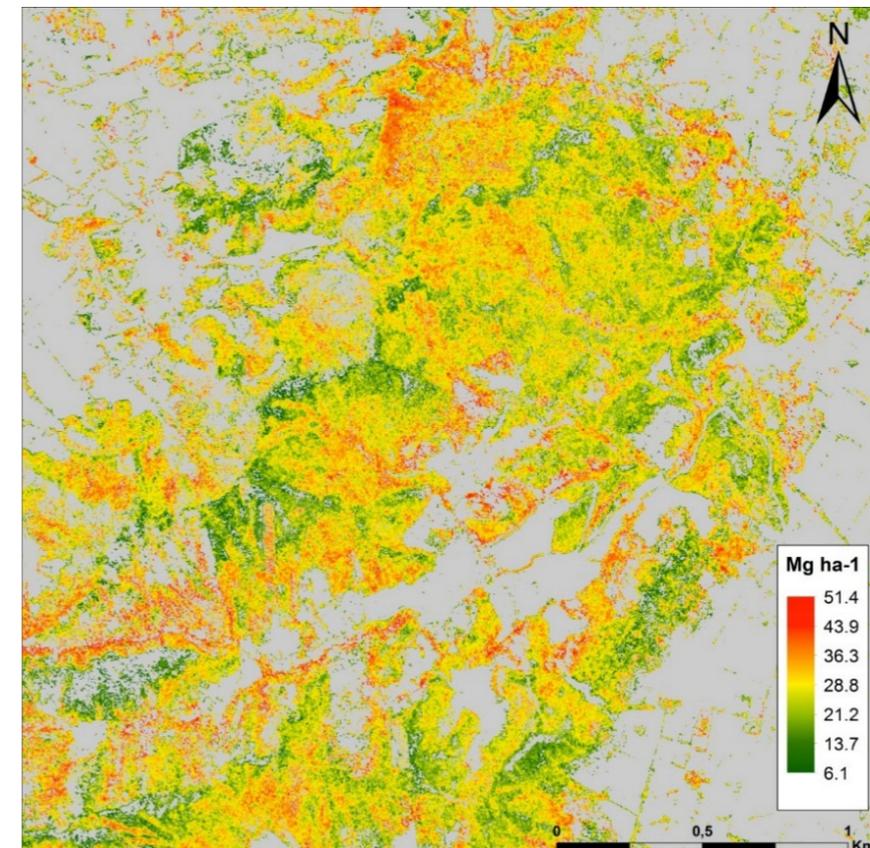


Figure 4. Aboveground carbon stock distribution map for secondary Andean in the Tabio test area near Bogotá, Colombia in $\text{Mg} \cdot \text{ha}^{-1}$ (based on Pleiades-1A imagery).



Links between satellite images
and one cm resolution drone
images (2017)



STUDENTS

- **Ana Belén Hurtado.** Ph.D. Candidate. Ecological processes that determine successional trajectories at local and landscape scales.
- **Luis Gabriel López.** M.Sc. Functional diversity along a successional gradient.
- **Diego Alexander González.** M.Sc. Student. Functional diversity and carbon storage.
- **Juan Sebastián Páez.** Undergraduate students. Changes in functional traits along the lifecycle of trees.
- **Javier Marín Salazar.** Undergraduate student. Changes in tree and shrubs species composition along different ontogenetic stages
- **Javier Marín Salazar.** Young Researcher. Phenology and Dispersion

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Ana Belén Hurtado
Andrea Acuña

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