Creating a new rainforest: Tree growth and survival in reforestation in Costa Rica

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INTRODUCTION:

Deforestation and forest degradation have created large expanses of degraded lands in tropical regions. Reforestation is an essential effort to reverse this trend and to restore ecosystem services. To successfully plant a highly diverse rainforest, understanding the performance and requirements of individual tree species is important.

The objectives of the present study were therefore to identify environmental conditions that affect performance and differences among tree species and to determine the carbon capture of the new forest

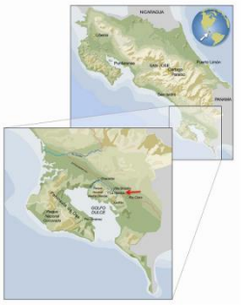

Figure 2: The study area, located in La Gamba (arrow) in the Golfo Dulce region of Costa Rica.

APPROACH:

Nearly 5,000 seedlings of 81 local forest species were planted on an abandoned pasture (Finca La Bolsa, Fig. 1) in 2010/11. The area is located in the Golfo Dulce region in southern Costa Rica (Fig. 2) with an average temperature of 28.5° C and precipitation c. 5,800mm/ year. Two inventories, in 2012 and 2016, measured size (diameter at 50 and 130 cm) and assessed tree quality, slope, light availability and herbivory.

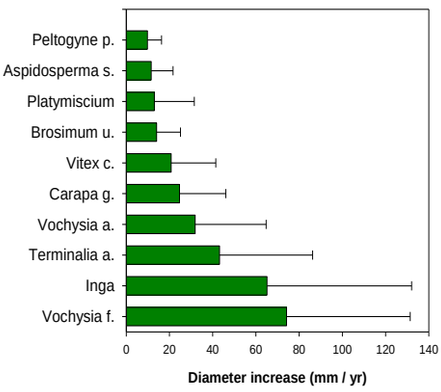

Figure 3. Diameter growth of the eight most abundant tree species.

RESULTS:

In 2012, the overall mortality was 16%, ranging between 5% and 42% for individual species. The annual growth rates varied substantially among species (Fig. 3). In some, but not all species, growth was significantly affected by slope, sun exposure or herbivory, and species tend to respond differently to these factors (Fig. 4). Rates of herbivory were mostly low. Interestingly, while herbivory negatively affected most species, *Inga*, often heavily affected, had higher growth rates at moderate to high rates of herbivory, pointing to a possible trade-off between investment in growth or defence.

Figure 1: Planting trees on Finca La Bolsa in 2010 (top) and the new rainforest in 2016 (bottom)

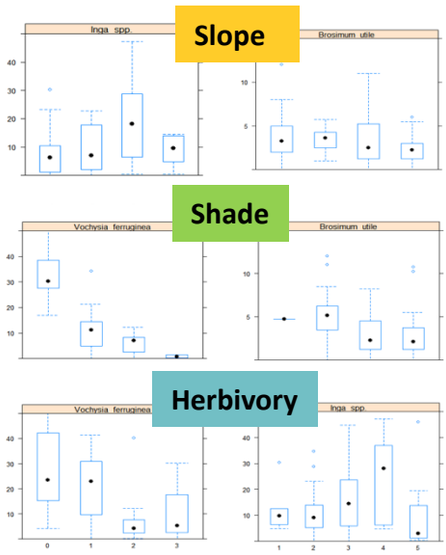

Figure 4: Effect of inclination (1 : flat to 4: very steep), shade (1: full sun to 4: full shade) and herbivory (1: none to 5 :very heavy) on growth rate of selected species.

CONCLUSIONS AND OUTLOOK:

- Species differed hugely in their growth and thus carbon sequestration rate. Further data analysis is required in order to investigate the influence of additional ambient conditions, in particular soil type, topography, slope, and light on growth, and potentially on wood density.
- The results can be used to improve tree selection and the management of future reforestation projects and to compare growth strategies among tree species.
- We will use allometric relationships to calculate the biomass and carbon content of the new forest.
- This carbon sequestration will serve as an ecosystem service parameter to promote future reforestation projects, as CO_2 emittors are increasingly expected to compensate their emissions.