



Tropentag, September 16-18, 2026, hybrid conference

“Towards multi-functional agro-ecosystems
promoting climate resilient futures”

Carbon accumulated after 11 years with two native species in an agricultural area in Colombia

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Abstract

The lowlands of the Andean Mountains in Colombia have acidic, low-fertility soils, necessitating conservation practices to mitigate natural degradation. This study evaluated carbon stocks in above-ground biomass (AGB) and soil in land used for pasture, sugarcane, and cocoa for 60 years. In September 2014, three monoculture plots (each 30 × 30 m) were established with *Cariniana pyriformis* (abarco) and *Schizolobium parahyba* (paricá) in the Santander department, Colombia. The planting spacing was 5 m × 5 m. After 11 years, soil samples (0–10 cm deep) and tree measurements (DBH, height, and survival) were collected in each plot.

A nearby secondary forest without human intervention for about 40 years was also evaluated with three plots. AGB was estimated using allometric equations developed locally for abarco and paricá, while the equation of Chave et al (2014) was used for the secondary forest. AGB was converted to stock carbon using a factor of 0.5. Soil carbon stock at 10 cm depth was determined from carbon concentration (Walkley-Black method) and bulk density. The mean values for soil carbon, AGB, and forest system (soil + AGB) were analysed using ANOVA and Tukey's test ($p < 0.05$). The paricá plantation (55.4 Mg ha⁻¹) accumulated significantly more carbon in the soil than the secondary forest and the abarco plantation (mean = 37.1 Mg ha⁻¹). There were no differences between the native species in any component. However, carbon in the AGB (mean = 31.1 Mg ha⁻¹) and forest system (mean = 78 Mg ha⁻¹) for both native species was 5.7 and 2.8 times lower than in the secondary forest, respectively. The results show that both species could be viable options for soil restoration in these degraded areas. However, in terms of AGB, this process remains slower than in the reference secondary forest.

Keywords: Aboveground biomass, *Cariniana pyriformis*, forest restoration, tropical ecosystems