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“Bridging the gap between increasing knowledge and decreasing resources”

Carbon Storage on Unmanaged Bamboo Plantations in Costa Rica

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Abstract

Perennial systems have a strong interest as contributors to climate change mitigation through carbon storage. This study evaluated the carbon removals of unmanaged bamboo plantations which were established in 1993 on the perimeter of the Arenal's reservoir (Costa Rica). We analysed the above and below-ground carbon fixing capacity by harvesting 95 culms of *Dendrocalamus latiflorus*, *Guadua angustifolia* and *Guadua aculeata* and sampling herbaceous vegetation, necromass and soils at 30 cm depth. Using the basal area as independent variable, allometric models were fitted by the ordinary method of least squares, obtaining a R^2 value of 0.815 for total carbon. In *Dendrocalamus latiflorus* plots we estimated a density of 10793 culms ha^{-1} with 186.6 tons ha^{-1} of carbon stored. Culm components accumulated approximately 59% (111.2 tons ha^{-1}), whereas soil represented 38% (70.11 tons ha^{-1}) and necromass/herbaceous vegetation accounted 3% (5.28 tons ha^{-1}). In the case of mixed plantations of *Guadua angustifolia* and *Guadua aculeata*, the density was 6146 culms ha^{-1} with 118.61 tons ha^{-1} of carbon in the system. Soil represented 60% (71 tons ha^{-1}) while culms components and necromass/herbaceous vegetation contributed to 35% (41.94 tons ha^{-1}) and 5% (5.67 tons ha^{-1}) respectively. The carbon fraction ranged from 43.2% to 47.2% among the different components on the same axle (leaves, branches, stems, roots and rhizomes), from 36.4% to 46.7% in the necromass/herbaceous vegetation, and had a value of 2.45% in soil. We observed high rates of death culms in both systems, 17% in *Dendrocalamus latiflorus* and 25% in *Guadua angustifolia*/*Guadua aculeata*, which could be due to internal competition. By interpreting the results of carbon content in each pool, the study suggests that high rates of death culms may be reducing the potential of bamboo plots as a carbon sink. In this sense, could some interventions (e.g. thinning) increment the carbon storage of bamboo plantations?

Keywords: Above/below-ground carbon, allometric models, basal area, carbon sink, carbon storage, culm components, unmanaged bamboo plantations