Title

Estimating above and below-ground biomass and carbon storage in Coffea arabica agroforestry systems in the Sierra Madre of Guatemala Under Different Management Schemes: Implications for Sustainability

Authors

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Abstract

Recent land use changes associated with climatic suitability loss in some Coffea arabica growing regions in Guatemala have promoted an accelerated assessment of ecosystem services provided by shade coffee plantations. Yet, the different management schemes operating this heterogeneous landscape limit our ability to extrapolate these findings. In addition to climate suitability loss, economical constrains and pests and infestations have promoted an overall loss of ecosystem services associated to these agroforestry systems, some of which have not yet been accounted for. Among these ecosystem services, carbon stored in shade coffee plantations has not been estimated for most of the coffee growing regions in Guatemala at a site-specific level nor have specific allometric equations being developed to include the stumps left behind after coffee has been pruned, resulting in an underestimation of carbon content in these systems. In this study, we estimated carbon content in living biomass above and below-ground in 36 different coffee farms along the Sierra Madre of Guatemala. We developed allometric equations for each dominant shade tree species and one for coffee plants (Coffea arabica). Remaining plant biomass and carbon stock was estimated using previously published equations. On average, the agroforestry plots contained 80.5 ± 5.2 t C / ha. In these plots, shade trees accounted for most of the carbon content (45%) followed by soil (40%). Coffee plants represented 9% of the carbon in the system, indicating that a coffee system with little or no shade has very low potential for carbon allocation. Coffee farms under a sustainability certification scheme were not statistically different than the non-certified farms. However, the effect of certification on the carbon content should continue to be explored in future research.