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"Bridging the gap between increasing knowledge and decreasing resources"

Carbon Storage Potential of Rubber Plantations of Different Age and Elevation in Xishuangbanna

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Abstract

Forest transition by economic-orientated rubber plantations is considered as one dominant land use change in Xishuangbanna. In order to conduct sustainable land use management, as well as to meet the international political and economic interests, the public calls for reliable assessment of carbon sequestration potential by rubber tree based systems. However, the evaluation of rubber plantation's carbon stock is difficult due to variations in stand age, clone type, planting density and growth habitats. Different ownership of rubber plantations also influences various management activities, which further affect carbon stock assessments.

This study aims to assess carbon stocks at the tree level and at the plantation level. At tree level, the main locally used clone types were selected and felled with a range of stand ages and elevation gradients. To avoid the influence of plantation ownership, those trees were all selected within smallholders' plantations and with similar management activities. Destructive sampling method was used to separate trees into stems, branches (large, medium and fine), leaves, flowers/seeds, taproot and lateral roots (large, medium and fine). Log-transformed power functions were applied to build allometric relationships between diameter at breast height (DBH) and aboveground, below ground and total carbon stocks (kg C/tree). At plot level (20*25 m), sampling covering different stand ages and elevation gradients were selected. The total tree carbon stock was calculated by allometric equations built at the tree level; moreover, understory vegetation, litter, deadwood and soil organic carbon (0–30 cm) was counted together as plot carbon stock. Linear mixed models were used to evaluate the influence of clone, site, stand age, planting density, and soil conditions on carbon stocks. Adequate assessments of C stocks at plot level were made using experimentally found parameters for rubber tree specific allometric relationships. For same stand age (<20 years), C stock decreased by 13 % and 49 % from low elevation (<750 m) to mid (750–950 m) and high elevation (>950 m) respectively. We showed that expansion of rubber plantation to higher elevation reduces the C sequestration potential in the long run; an important information to design sustainable and climate friendly land use decisions on sloping land.

Keywords: Allometric equation, carbon sequestration, elevation, land use management, rubber, tree age

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