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Analysis of simulated functional diversity in tropical forests: Differences between cultivated and naturally grown secondary forests in Cambodia

Accelerated deforestation represents a major global environmental concern. Over the last decades Cambodia has experienced a drastic decrease in forest cover and measures to halt deforestation have not been as effective as planned. In order to support reforestation, as well as appropriate sustainable forest management practices, two aspects need to be taken into account: (a) the ecosystem functioning of the forest, thus its ability to promote productivity and resist disturbances, and (b) the influence of harvest measures on the forest dynamics.

For this study the dynamic vegetation model LPJ-GUESS was applied to simulate specific scenarios of the forests in four study sites in Cambodia, representing evergreen, semi-evergreen and deciduous forest covers. The functional diversity, expressed by the community-weighted mean of the analyzed plant functional traits, represents a suitable indicator to describe the performance of plant growth and the dynamics between the species within a forest ecosystem. Based on this model analysis, a difference in functional diversity between the old-growth, cultivated and naturally regrown forest ecosystems could be detected. In relation to the establishment and composition of the modelled group-specific plant functional types, the results suggest an overall dominance of shade tolerant and evergreen trees, emphasizing the advantage of longer leaf life-spans in hot and humid conditions. It is assumed that in three study sites (Koh Kong, Mondulkiri, and Takeo) the secondary forests show an overall higher ability to resist disturbances than the forests in Siem Reap. The extent of impacts of logging practices on biomass production depend on the interval and harvest intensity. Thinning processes of 10% conducted every 20 years tend to increase the forests' overall carbon stock, indicating a positive effect of minor disturbances on the forest's productivity. However, comparisons with self-derived measurements suggest an overestimation of the simulated plant growth, which requires further research to allow for specific recommendations on forest management practices.

Keywords: *Physical geography and ecosystem analysis, functional diversity, plant functional traits, ecosystem modelling, secondary forest ecosystems, sustainable forest management, LPJ-GUESS*

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