Tree species diversity relative to human land uses in tropical rain forest margins in Central Sulawesi

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Summary

The large-scale exploitation and conversion of tropical forests causes growing concern about the continued existence of the rich biodiversity of these forests. In the framework of the interdisciplinary STORMA project in Lore Lindu National Park area in Central Sulawesi, we studied tree diversity in six different land use types in the margins of submontane rain forest: undisturbed forest, forest with rattan extraction, selectively logged forest, cacao forest gardens, cacao plantations with mixed canopy of planted trees, and cacao plantations with a monospecific canopy. By analyzing such a finely subdivided use gradient it was attempted to answer the question how human usage and biodiversity conservation in the study area may be reconciled. Tree species (dbh > 10 cm) were sampled in 24 plots of 0.25 ha in all six land use types (4 replicates each). In total, 251 tree species (143 genera, 59 families) were recorded. Number of tree species per 0.25 ha was 51-63 in primary forest and gradually decreased towards the studied cacao systems. However, when native and cultivated tree species were considered separately, significant differences were detected among plantation types in terms of tree diversity. Tree endemism in forest plots totalled ca. 15% and was in good accordance with endemism in woody plants of Sulawesi. The number of endemic species was strongly reduced in cacao systems, although percentage endemism did not decline significantly in cacao forest gardens. Roughly one third of tree species in the forest plots were of economic importance as commercial timber trees; timber diversity was little affected by moderate human use of the forest but was significantly reduced in

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cacao forest gardens and dropped to near zero in other plantation types. The mean basal area of 57 m^2 (36-80 m^2) per ha in natural forest was lower than the previously recorded value from the study area but is still almost double as high as the mean value typical for tropical lowland forests in Southeast Asia.

The results of this study support the notion that tree diversity in the submontane forests of Central Sulawesi is unusually high and rich in large-sized timber trees, although tree size varies locally. Moderate human use of the forest ecosystems does not significantly affect tree diversity. We conclude that conservation of tropical tree diversity is compatible with human exploitation of tropical forest as long as a canopy of native trees is maintained. Future conservation policies in rain forest margin areas should therefore focus on developing measures aimed at sustainable use of the natural resources. Promotion of such activities may help to stabilize tropical rain forest margins in Central Sulawesi.

Keywords: endemism, human impact, land use changes, Indonesia, species richness, Sulawesi, sustainable use, timber diversity, tree diversity, tropical rain forest margins

1 Introduction

Throughout the tropics natural forests are increasingly exploited and converted into pastures or cropland. The large-scale forest conversion causes growing concern about the continued existence of the rich biodiversity of these forests. At the same time, the number of studies focusing on the effect of tropical forest conversion on biodiversity is increasing. The majority of these studies show that forest modification and clearance have negative impacts on biodiversity, leading to reduction of species richness and diversity (e.g. Bawa and Seidler 1998, Beck et al. 2002, Krömer and Gradstein 2004, Lawton et al. 1998, Parthasarathy 1999, Schulze et al. 2004, Turner et al. 1997). In some taxa, however, species richness increases in secondary forests and open habitats (Fujisaka et al. 1998, Gradstein 1992, Kappelle et al. 1995, Klein et al. 2002, Nöske 2005). Secondary forests and agroforestry systems may help to maintain a certain portion of species diversity but not of all taxonomic groups (Schulze et al. 2004). In particular, species richness of trees seems to be suffering seriously from forest modification (Kessler et al. 2005, Turner et al. 1997).

In the framework of the interdisciplinary research project STORMA of the German Research Foundation, set up to study the biological and ecological degradation of rainforest margin areas and to develop strategies to stabilize these margins (Gerold et al. 2004), we have analyzed tree diversity in different land use types in the region of Lore Lindu National Park, Central Sulawesi, Indonesia. Lying between Wallace's and Weber's biogeographic lines and taking a central position in Malesia, Sulawesi has been isolated from the mainland