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Environmental benefits and sustainable land-use options in the Jambi transect, Sumatra

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Abstract. Loss of environmental services provided by forests is a non-linear process in Jambi Province, Sumatra, Indonesia. Intermediate-intensity land-use types in the form of complex agroforests have maintained global environmental benefits under a sustainable and profitable land use regime. Conversion to tree crop monocultures, however, poses a challenge to the environmental stakeholders and an opportunity from to stakeholders in the private economy. We quantified environmental indicators, as well as profitability and sustainability of a range of existing and possible production systems. Criteria and indicators were used at plot to landscape scales, taking into account local, national and global perspectives. Agronomic sustainability and profitability were assessed at plot level as they are of primarily local concern, while environmental services of forests, such as plant species and functional type richness, carbon stocks, greenhouse gas emissions, and trans-boundary haze, which are of national and global concern, were assessed at landscape level. Quantitative trade-offs and complementarities were analysed between global environmental benefits and local profitability. The current trend towards simplification of the complex agro-ecosystems and inherent loss of environmental services of forests is driven by profitability. The sequence in which environmental services of forests are lost is: standing carbon stocks, biodiversity, and low or negative greenhouse gas emissions.

Keywords: Agronomic sustainability; Biodiversity; Carbon stock; Emission; Greenhouse gas; Trade-off analysis

Abbreviations: ASB = Alternatives to Slash-and-Burn; NTFP = Non-timber forest product.

Introduction

Global concerns about deforestation often are expressed as if a binary classification ('forest' versus 'non-forest') is sufficiently informative regardless of the land-use type that follows forest conversion, or the consequences to forest health under low-intensity use. The Jambi transect in Sumatra was set up to explore the consequences of a gradual loss of environmental services of forests under intensifying land-use rather than 'black-or-white' deforestation.

Characterization of land-use change in Jambi was first carried out by multi-disciplinary research teams that took part in the global Alternatives to Slash-and-Burn (ASB) project, followed by a comprehensive comparison of land-use options (Van Noordwijk et al. 1995, 1998a; Tomich et al. 1998a, b, 2001). In this overview, Jambi is placed within the context of a transect for global land-use change research, that was established by a consortium of national and international research organizations. The transect offers a 'laboratory' for understanding the ongoing land-use change. It also offers an opportunity to study agroforests as a land-use system that is distinctive in the degree to which allows for a 'cohabitation' of biodiversity and directly productive trees. The term 'agroforest', as defined by de Foresta & Michon (1996) captures the mixed heritage of the 'wild' and the 'domesticated' aspect of these systems, and highlights an intermediate stage between natural forest and agricultural plantations.

We (1) describe the biophysical and socio-economic setting of the Jambi transect, and (2) evaluate land-use options on the basis of (2a) local and national criteria and indicators, such as, agronomic sustainability and profitability, and (2b) global environmental perspectives, such as biodiversity loss, carbon stocks, greenhouse gas emissions, and trans-boundary haze pollution.