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Landuse Dynamics and their Socio-Environmental Impacts: Results from Simulation Studies with the Site Modelling Framework

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Abstract

Land use and land cover change, especially in tropical regions, have received much attention in recent years. Land use dynamics are usually caused by a combination of large scale drivers of change such as global markets or climate, but also region-specific forces like demographic change and regional/local policies. During recent years we developed SITE, an integrated land use model, as a tool to study both socio-economic and environmental impacts of land use and land cover change, as well as the feedbacks of altered environmental conditions on future land use decisions. In the case study from Indonesia presented here, large areas of forest were replaced by cocoa agroforestry plots during the last two to three decades. These processes are intimately linked with agricultural intensification and ongoing population growth and rural immigration. Simultaneously, the food crop paddy rice, but also coffee agroforestry were losing importance in the regional agricultural production systems. In this paper we used the SITE model to study the dynamics of major land-use and land cover types and quantify selected indicators of change. Focusing on the socio-environmental impacts of the agricultural transition process, we analysed environmental impacts in terms of (i) forest conversion e.g. to open secondary forest, agroforestry plots etc as well as (ii) the impact on profit margins of different crops. Additionally, we developed a policy scenario to study the potential impacts of rural immigration. Our simulation results revealed that — as expected - in the ‘no immigration’ scenario forest conversion was reduced. However, the average household income in the ‘no immigration’ scenario was reduced as well, due to the fact that the gross margins for traditional food crops grown by local farmers were lower than the ones for cocoa, a crop mainly introduced and grown by immigrants. While the rural population, living mostly close to or below the poverty line, obviously profited from the recent regional ‘cocoa boom’, the negative impacts of the ongoing threat of natural resources have not yet been quantified.

Keywords: Cash crop, Indonesia, land-use modelling, socio-environmental systems, subsistence crop, Sulawesi, tropical agriculture, tropical rainforest

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