Driving Forces of Tropical Deforestation at the Forest Frontiers of Central Sulawesi
An Institutional and Demographic Perspective

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The forests of Central Sulawesi include core ecosystems of the global Wallacea biodiversity 'hotspot' (Myers et al. 2000). Progressive forest conversion is widespread, mainly due to expansion of cacao agroforestry. Previous work around Lore Lindu National Park (LLNP) suggested investigating the influence of institutional and demographic factors on forest conversion. Incidentally, such analyses turned out to be highly scarce for Southeast Asia in spite of extremely high deforestation rates.

Introduction

Few, if any, environmental issues have received as much attention as 'tropical deforestation' in the international debate since the 1970s. Today, with climate change as one of the major concerns in world politics, deforestation – accounting for up to 20% of all anthropogenic greenhouse gas emissions (IPCC 2007: 36) – plays a decisive role not only as a threat to biodiversity but also in the the process of climate change. In spite of more than three decades of scientific discussion, the driving forces of tropical rainforest conversion continue to be a matter of debate (Geist & Lambin 2001).

Rural smallholders are neither necessarily the primary drivers nor the ultimate agents of landscape change and deforestation. Industrial agriculture, commercial lumbering or oil and gas operations are regarded as the most obvious driving forces of deforestation more recently (Butler & Laurance 2008). However, smallholders play a decisive role in forest conversion and land use change, particularly in remote forest frontiers (FWI/GFW 2002: 24) such as the mountainous forests of Central Sulawesi (Maertens et al. 2006). The presence of smallholders in agriculturally marginal but highly biodiverse environments is often a result of unequal tenure regimes and international policies strongly biased against the rural poor (De Sherbinin et al. 2008). For example, deregulation often supports large-scale industrial farmers to expend their agricultural land and displaces the poor, who are not able to participate due to low financial capital and their dependency on subsistence agriculture.

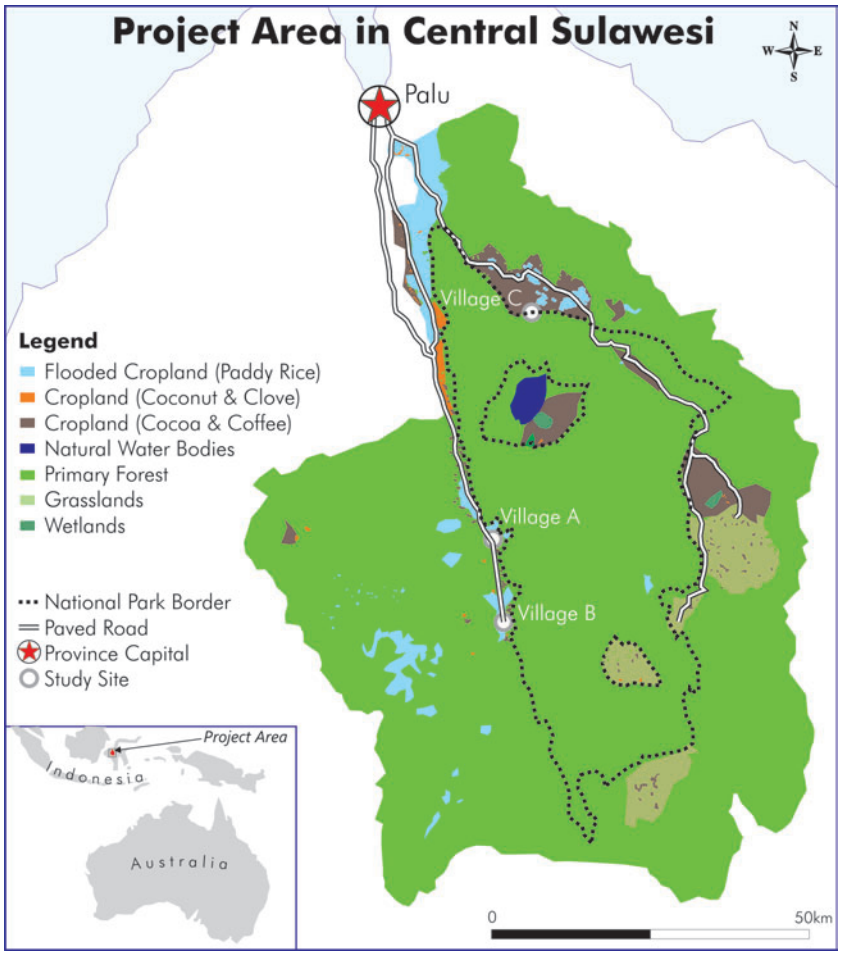

Fig. 1: Project Area and Land Use in the Lore Lindu Area

Deforestation in Indonesia

After Brazil and the Democratic Republic of Congo, Indonesia possesses the world's third largest expanse of tropical rainforests (FAO 2006: 16). Its forests declined from approximately 116.7 million hectares in 1990 to 88.5 million hectares in 2005 with an annual rate of 1.7% between 1990 and 2000, and 2.0% between 2000 and 2005. Nearly 1.9 million hectares of forest are cleared annually without signs of deceleration; this is two thirds of the total loss of South- and Southeast Asia.

In Indonesia, where 68% of the total population of 228.9 million inhabitants (EIU 2007: 17) still live in rural areas and depend crucially on forest resources for their livelihoods, small-scale agriculture has traditionally had a substantial role in forest clearance. Smallholders clear forested land either to grow subsistence food crops for family needs, plant tree crops as an income supplement or establish small-scale plantations of cash-

Table 1: Social and resource conservation aspects as influenced by village institutions

	Village A	Village B	Village C
Resource Conservation Aspects	Enforced common pool resources; Local institutions preserve natural resources in LLNP	Partly enforced common pool resources: Local institutions prevent migrants from conversion of community forest outside LLNP	Factual open access resources: Neither official legal nor local traditional institutions protect LLNP forests
Power and Equity Aspects	Feudal, traditional power relationships	Traditional power structures in transition	Economic power structures
	effective discrimination in forest access and land purchase against migrants	discrimination in forest access but ineffective in land purchase against migrants	progressing socio-economic exclusion of poor locals after land sell-off

Source: own compilation based on original data

crops such as cacao, coffee, rubber, and coconuts for international markets.

Study Area

Located in the humid tropics of Indonesia's Central Sulawesi province, Lore Lindu National Park (LLNP) covers some 2,290 square kilometres of tropical rainforest with an altitude range from ~200 to 2,610 meters a.s.l. (see Fig. 1). First established as an UNESCO Man & Biosphere reserve in 1978, it was declared as National Park by the Ministry of Agriculture in 1982. However, it was not recognized until 1993, and its permanent borders were not fixed until the end of the 1990s. Approximately 136,000 citizens – mainly agricultural smallholders – live in 119 villages in the study area around LLNP. The main land use is characterized by the production of the international commodity cacao at the forest frontier – especially since the cacao boom entered Central Sulawesi in the 1980s – and paddy rice production at the valley bottoms.

Data & Methods

A combination of qualitative and quantitative methodology was applied in order to investigate institutional as well as demographic impacts on forest conversion. Qualitative data on formal and informal institutions governing access to natural resources were obtained using semi-structured in-depth interviews with key informants from leading autochthonous and migrant households (n=30) in three contrasting villages adjacent to LLNP (cf. Koch et al. 2008 for details). The villages represent a gradient of migration intensity and, consequently, ethnic composition (Weber & Faust. 2006). Village A displays low immigration and a high share of autochthonous residents (88%). Village C is characterised by a high influx of migrants, mostly Buginese (44%) from South Sulawesi. Village B represents an intermediate type (35% migrants). Quantitative data stem from a previous census (n=898) conducted in these contrasting villages in 2004. This data set is used in order to examine the intensity of household demographic factors on forest conversion applying a linear ordinary least squares (OLS) regression model (cf. Koch et al. submitted for details).

Forest Conversion inside LLNP

Results

Data on land acquisition show that 29% of all agricultural plots are bought in village A, whereas 55% are inherited, and 6% are cleared from primary forest inside LLNP. In village C, in contrast, 56% are bought, only 18% are inherited and 13% are cleared from forests inside LLNP. In village B, 35% are bought, 41% are inherited and 14% of the plots are cleared from community forest close to but outside LLNP (see Fig. 2). High levels of forest conversion (villages B, C) are related to the sale of land by locals to Buginese migrants ($p < 0.01$).

Differences in migration history and

Photos by Sebastian Koch, 2007

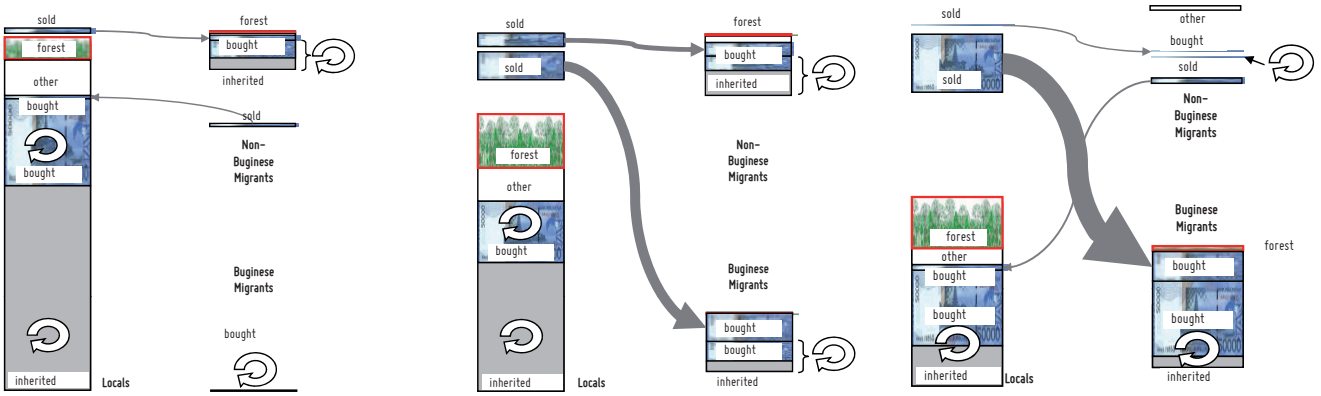

Fig. 2: Land acquisition and circulation in three contrasting villages

deforestation between villages were apparent from the censuses that could not be explained quantitatively. In all villages, power gradients were observed. In village A, a nearly 'feudal' group of autochthonous "first settlers" dominates all formal and informal institutions enforcing strict limitations of land conversion. Migrants from non-autochthonous ethnics are discriminated against in terms of land access and citizen participation in village matters.

In contrast, no effective institutions limit forest conversion in village C. Here, all traditional power relationships appear replaced by economic power based on petty capitalist-type production of agricultural commodities (cacao). While migrant households could convert forest land inside mountainous LLNP, the economically highly successful migrants purchase land outside LLNP for which land titles can be issued.

Village B represents a transitional type. Traditional, ethnically discriminating institutions and power structures are still in place. Because land transfer to economically potent migrants is allowed, forest conversion is high, however. Autochthonous households that sold out their land are the main immediate agents of deforestation as in village C. With the rise of a group of agriculturally successful migrants, either social conflict or an end to discrimination against the migrants appears likely. A summary of the findings including a Theory of Commons perspective is presented in Table 1.

Of the sample, 103 households reported to have converted local forests; 77 of them have children. The census data analysis corroborates the finding, that autochthonous smallholders are the immediate agents of deforestation (>95% of deforesting households). OLS regressions (adj. R^2=0.24) show that demographic variables (worker/consumer ratio: P<0.1; children/adult ratio: P<0.01;

age of children: P<0.001) have a stronger impact on the amount of deforested land per household than farm structural factors and education – or as poverty measured by a relative poverty index. The signs of the coefficients point at consumptive demand, not at labor scarcity, as the most influential underlying household demographic characteristic.

Conclusion

In conclusion, the combination of qualitative research methods concerning village institutions governing access to natural resources and quantitative analysis of household demographic factors provides a profound understanding of tropical deforestation at the forest frontiers of Central Sulawesi. The high prices for the cash crop cacao as well as relative land abundance at Central Sulawesi's rainforest margin can be regarded as ultimate driving forces of deforestation.

From a conceptual point of view, the qualitative results strengthen the idea that an effective self-governance of natural resources is possible at the local level as the Ostrom (cf. 1990) school postulates – however, at the expense of political inequality and discrimination against non-local migrants. Those autochthonous households allowed to and willing to deforest plots in- and outside of LLNP, are themselves poorer than the average. Timing and extent of deforestation depends highly on the consumptive demand of their growing families. Without dependable income alternatives for poor local households and a more legalistic handling of land access, it appears hardly possible to design just, socially responsible and more effective biodiversity conservation measures.

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Village A and Community Forest inside LLNP