ASB Partnership for the Tropical Forest Margins

Policybrief 20

Co-existence of people and orangutan in Sumatra

Stabilising gradients for landscape multifunctionality

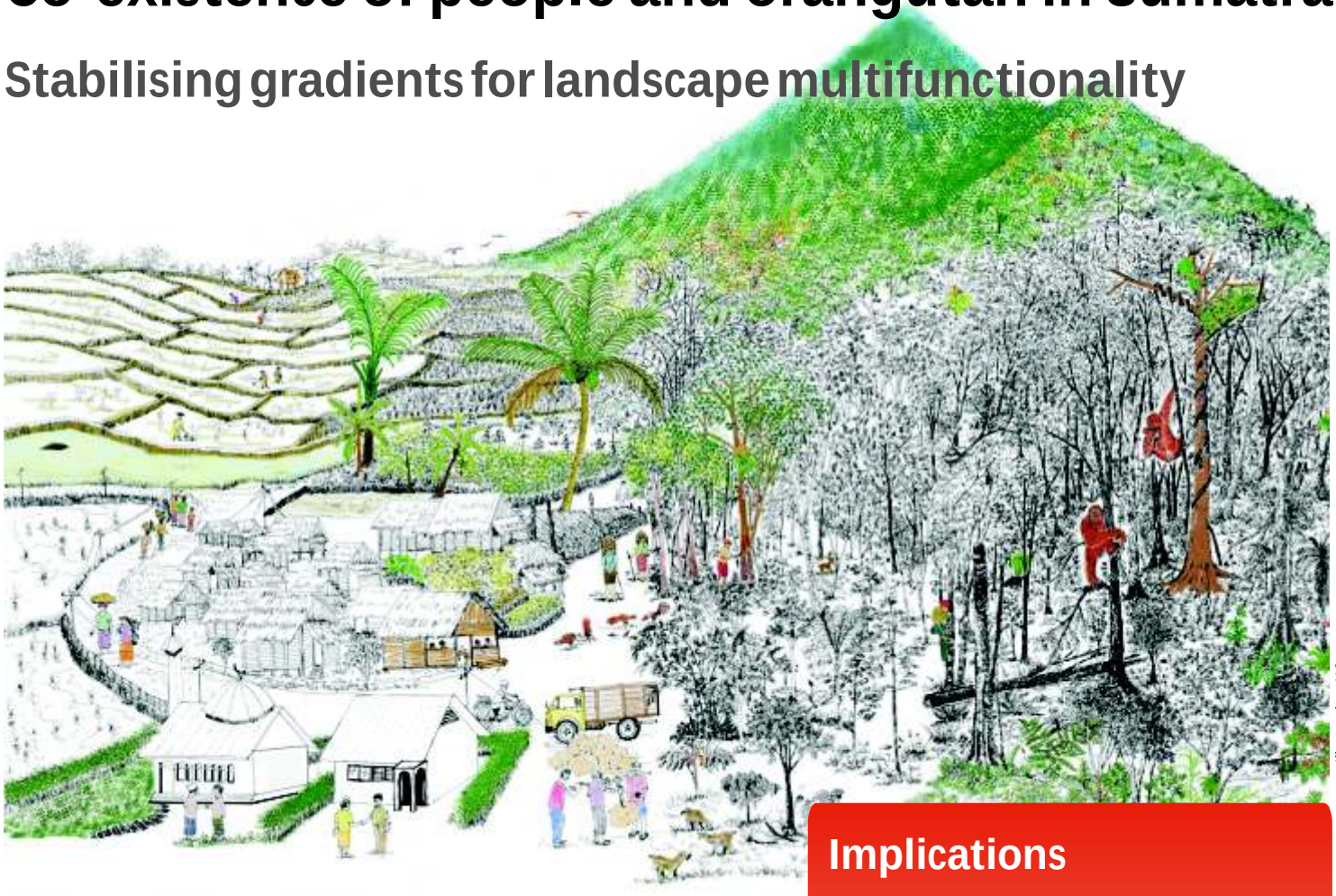

Illustration: Wiyono

Key findings

1. A gradient of forest–agroforest–agricultural landscape survived in Batang Toru because of local recognition on agroforestry systems; the resultant landscape maintains well the provision of different ecosystem services

2. Migration into forest margins, facilitated by logging roads, is a threat to conservation objectives; local stewardship contracts potentially halts this threat

3. Establishing formal 'protected area' status in a multifunctional landscape will lead to conflict and loss of conservation values

4. Economic incentives for maintaining agroforests linked to conservation values are needed to secure a stable gradient

Implications

- Agroforestry as a land-use category needs recognition and appropriate policy support, to be part of zoning concepts
- New agreements are needed between forest authorities and surrounding villages to make forests less vulnerable to conversion, especially where logging roads have provided access
- Indonesia needs, as other countries have, options for protected area status of 'landscapes with people'
- Appreciation for the conservation value of stable village–forest gradients needs to translate to co-investment in a green economy

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Multifunctional landscapes and species-rich agroforests can support biodiversity conservation. Command-and-control conservation approaches tend to create sharp distinctions between protected areas and surrounding agriculture. Can a village–agroforest–forest landscape gradient be stable? Or is it part of a continuous process of forest conversion that in the end will leave hardly any conservation values intact? The landscape of Batang Toru, Sumatra offers a case study. It is home to a genetically unique Sumatran orangutan population and to people of diverse backgrounds. It provides insight into the types of government policy and market-based instruments that are needed to stabilise the existing gradient.

Introduction

The landscape of Sumatra can be seen as a gradient consisting of various land-use types, from forests in the mountains through agroforests in the middle to paddy rice fields and agricultural land downstream. The agroforests represent a halfway point between the two extremes of intensification.

Villages in Sumatra are generally located below the natural forests. From around the houses up to the vicinity of natural forest, gradients of domesticated tree-based systems can be found, starting from homegardens where fruit trees are planted to a zone of agroforest with tree crops for regular income, which consists of trees that provide firewood, timber for local use and non-timber products. There has been at least 2000 years of trade of benzoin resin, known locally as *kemenyan*, to India, harvested from *Styrax sumatrana* and *S. benzoine*, both native trees of Sumatra. There's a long history of cultivating native trees in agroforest, when wild supplies became exhausted. The international trade tradition made it easy for introduced trees to be incorporated in the Colonial era: various coffee species and oil palm from Africa, cacao, para rubber, quinine from Latin America. The agroforests blended local and foreign, old and new, 'agro' and 'forest'. Farmers received income and other benefits while maintaining a regular flow of good-quality water and other ecosystem services that the (agro)forests provide.

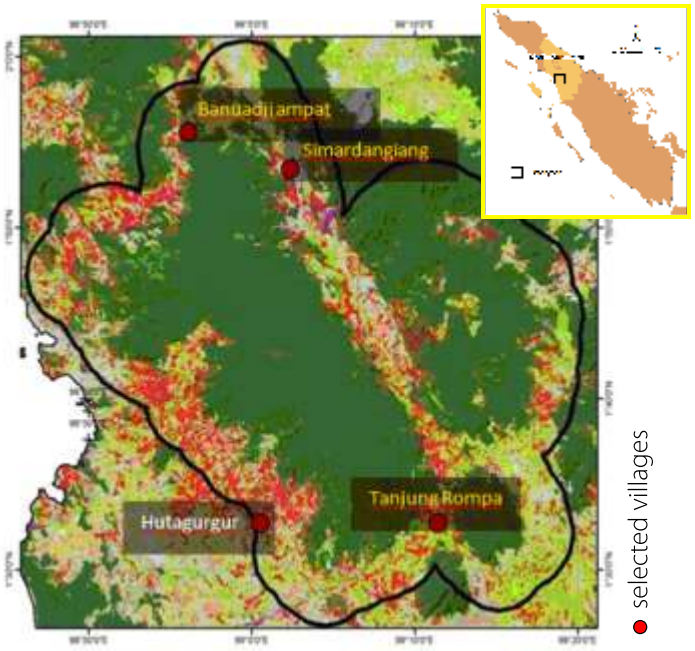

Figure 1. The villages of Banuaji Ampat and Simardangiang in North Tapanuli district represented Group 1; Hutagurgur (Central Tapanuli district) and Tanjung Rompa (South Tapanuli district) represented Group 2. Insert: Sumatra island

The Batang Toru landscape as case study

The Batang Toru landscape close to the old port city of Sibolga, North Sumatra, is the last place south of Lake Toba where the genetically distinct southern populations of the Sumatran orangutan have survived. Conflict between humans and orangutan may arise when orangutan feed on fruit—such as durian, *petai* and mangosteen—that are common in home gardens as well as natural forest. The conservation of critically endangered species such as the Sumatran orangutan is a global priority. However, the Batang Toru habitat exists in the context of a broader landscape and long history of co-habitation with humans.

This study aimed to contribute to basic facts on:

- *what is where* (the types of agroforests and other tree-based land uses that complement natural forests and rice fields in the landscape),
- *who* uses them,
- *how* this has changed over the recent decades, and
- *what are the consequences* for carbon emissions and survival of forest flora and fauna.

Only if such basic facts are understood can we hope to find new ways to reconcile human development and the ecosystem functions on which our species, as well as so many others, depend.

A livelihoods study was conducted in four villages, which were selected based on history of land-use change. Village characteristics are presented in Table 1. Based on an analysis of land-use changes from 1990 to 2005, the Batang Toru area was classified into two groups: (i) Group 1: areas that had a longer history of land conversion. Some conversion was seen in land-cover data from the year 2000; (ii) Group 2: areas with a higher recent conversion rate (see Figure 1).

1. A gradient of forest–agroforest–agricultural landscape survived in Batang Toru because of local recognition on agroforestry systems; the resultant landscape maintains well the provision of different ecosystem services

Deforestation implies a shift from 'forest' to 'non-forest' land status and thus depends on the way 'forest' is defined. Commonly used definitions of forest assume that 'forest' and 'agriculture' are not mutually compatible. Yet, a number of agricultural systems critically depend on trees and when there

are a lot of trees on a piece of land it may mimic the function of forest and be misclassified as forest, leading to restrictions on access by farmers. This tree-based land use is called 'agroforest' which easily meets the internationally accepted definition of forest based on tree cover and tree height, but it is managed by farmers rather than by forest management institutions. It can actually be claimed by both and needs agreement by farmers (or rural communities) and forest authorities to serve both local livelihoods and public ecosystem services. The institutional distinctions between 'forest' and 'non-forest' thus differ from the ecological ones, with the latter referring to a gradient of land use types, rather than a dichotomy. With the current international attention on the rate of deforestation, its consequences and drivers, 'agroforest' as a type of land use must be put on the map. Agroforests must be understood on the basis of their history, management style and current functions for watershed protection and biodiversity conservation. Understanding this can help reduce the conflict between local communities and forest authorities, which may lead to joint management.

The description above fits what exists in Batangtoru landscape. The area comprises different land cover types: undisturbed and disturbed forests, mixed gardens (durian, salak (snakefruit), petai ('stinky bean')), pine plantations and kemenyan agroforests. The existence of mixed tree farms and agroforest serves as a connecting gradient from forest to the agricultural areas. Undoubtedly, undisturbed forests had the largest diversity and richness of species, while disturbed forests and mixed gardens were the second and third largest for diversity and richness of species, respectively. Rubber agroforests ranging 31–40 years-old has the lowest diversity compared with the other three land-use types (Figure 2A). Regarding carbon stock, disturbed forests have slightly less carbon stock compared with undisturbed ones. Carbon stored in mixed gardens is slightly higher than that in disturbed forests and pine plantations (Figure 2B). This evidence shows that agroforests play a significant role in biodiversity conservation and carbon storage.

Recognition by policy makers of the benefits that agroforests provide should be a priority in order to maximise human and ecological benefits.

2. Migration into forest margins, facilitated by logging roads, is a threat to conservation objectives; local stewardship contract potentially halts this threat

The terrain of the Batang Toru landscape was usually hard to access until logging companies established roads in order to extract the valuable timber species that Sumatran forests were renowned for. Government-sanctioned logging concessions became widespread in, and after, the 1960s and led to clearing forests for human settlements and other land uses. Migrants, in particular, placed high demand on forests for their livelihoods, using ex-logging roads for access in

[1]According to the first maps of Indonesia that include agroforests as a category, the area has declined from about 20 million hectare in 1990 (roughly 10% of Indonesia's land area) to 16 million hectare in 2005 (about 8% of Indonesia), while oil palm plantations cover less than 5% of the total area (http://www.worldagroforestrycentre.org/sea/ALLREDDI).

Table 1. Characteristics of the four sites in the Batang Toru area

DISTRICT	North Tapanuli	North Tapanuli	Central Tapanuli	South Tapanuli
SUB-DISTRICT	Pahae Julu	Adiankoting	Sibabangun	Marancar
VILLAGE	Simardangiang	Banuaji Ampat	Hutagurgur	Tanjung Rompa
GROUPING	Group 1	Group 1	Group 2	Group 2
MAIN LAND USE (% OF HOUSEHOLDS)	• Paddy (20%) • Cover crops and perennial crops in **agroforestry**: rubber (10%), *kemenyan* (benzoine) (50%), durian, mangosteen and candlenut (30%)	• Paddy (17%) • **Agroforestry**: coffee (22%), rubber (25%), cocoa (11%), *kemenyan* (31%) • Pines (4%)	• Steep land **agroforestry**: rubber (39%), cocoa (39%) • Flat land in the mountains: *nilam* (patchouli) (11%) • Paddy (13%)	• Paddy (38%) • Irrigated non-technically • **Agroforestry**: *salak* (snakefruit) (21%), cocoa (25%), coffee (8%), rubber (17%)
LANDHOLDING PER HOUSEHOLD (% OF HOUSEHOLDS)	• **Agroforestry** 1–2 ha • Paddy rice 0.5 ha (peanut and chilli intercropped)	• *Kemenyan* **agroforest** 1–2 ha • Paddy rice 0.5 ha (peanut and chilli intercropped)	• **Agroforestry** 1–4 ha • Paddy 0.5 ha • *Nilam* in steep areas 0.5 ha	• **Agroforestry**: cocoa, coffee and rubber 0.5–2 ha • Paddy 0.5 ha, harvested once per year (chilli intercropped)
ETHNICITY	Batak Toba	Toba	Batak Toba and Nias	Batak Toba, Angkola
RELIGION	Christian	Christian	Christian	Muslim and Christian equally

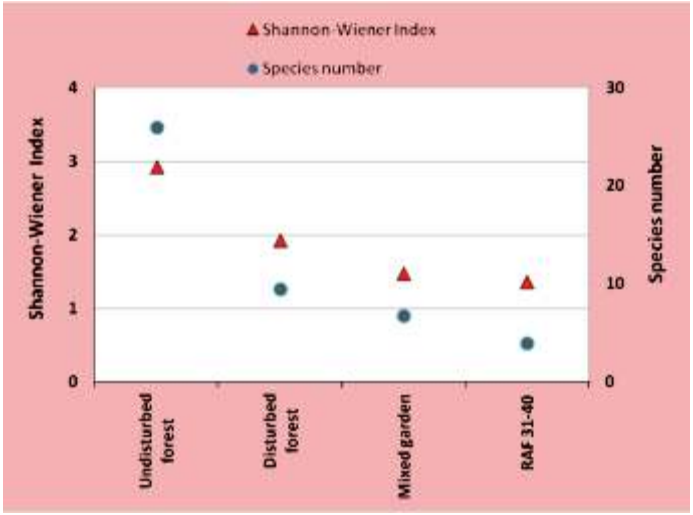

Figure 2a. Diversity index and number of species in different land-use types in Batang Toru

order to clear them for agriculture and housing. In the migrant village of Hutagurgur, households were large (7–8 persons each) compared with other villages (average 4–5 persons per household). The annual population growth in Hutagurgur village was relatively high, at 1.8% per year, and expansion of the village was rapid.For the Batang Toru area as a whole, population density was in the range 26–78 persons per km2, which was around the average for Sumatra. High annual population growth, in particular in Central Tapanuli (3–4% per year), posed a threat to forest use. Rapid population growth has social consequences and usually leads to environmental destruction, such as encroachment on forests for agricultural and industrial purposes, resulting in widespread deforestation.

Local stewardship contracts between forest authorities and surrounding villages, such as agreements like *hutan kemasyarakatan* (community forest) or hutan desa (village forest), is considered potential to halt activities that threaten the conservation values of Batang Toru.

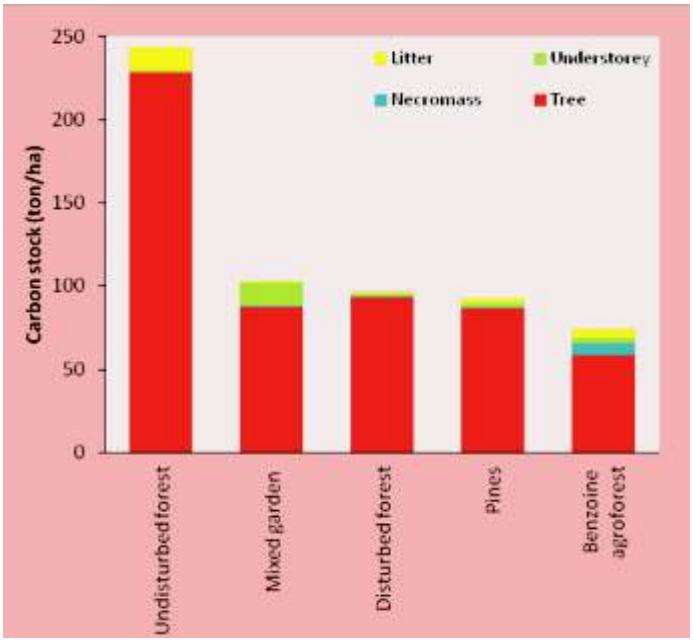

Figure 2b. Carbon stock of trees and necromass in Batang Toru

Figure 3. Ex-logging roads provide family migrants easy access to the remaining forest in Batang Toru, allowing them to clear the land for agriculture and housing

3. Establishing formal 'protected area' status in a multifunctional landscape will lead to conflict and loss of conservation values

Biodiversity conservation has typically been attempted using what has become a 'traditional' approach, for example, national parks and nature reserves. To date, land boundaries have been the basis for policy, land-use planning and institutions to attempt to reduce conflict and manage land for multiple functions. The main objective of protected areas is to minimise anthropogenic impact on biodiversity, however, in reality, land encroachment commonly happens on large parts of protected areas and biodiversity continues to decline.

Nowadays, sustainability of conservation requires consideration of the trade-offs between human uses and biodiversity values (Wiens 2009). The conservation of critically endangered species such as the Sumatran orangutan is a global priority and so the possibility of co-habitation with humans has become a critical issue. The Batang Toru area exists in a broader mosaic of landscape and includes people and their activities. Establishing formal protected area status for conservation in a multifunctional landscape like Batang Toru may lead to conflict and loss of conservation value. On the other hand, a multifunctional approach to conservation allows for land-use *sharing* for agriculture, forests and other functions. This approach demonstrates the potential for co-existence of nature and human activities. Therefore, identifying the links

Table 2. Return to labour and land per land-use system in Batang Toru

Land-use system	Return to land (IDR 000/ha)	Return to labour (IDR 000/ha)	Labour requirement (pd*/ ha/yr)
Coffee agroforest	9309	38 067	87
Mixed kemenyan garden (Styrax spp.)	4586	29 555	146
Rubber agroforest	7327	34 889	121
Irrigated rice paddy	2229	32 433	73

Note: Price are for 2010 as expressed in June in Indonesian rupiah (IDR 9199 = USD 1), nominal interest rate 6.5%/yr.
*pd= person day

between biodiversity and changes in human population structures are urgently needed.

In the landscape of Batang Toru, four main commodities of tree crops contribute to farmers' incomes and the return to labour and return to land are presented in Table 2. Coffee-based agroforestry (60% coffee bush) and rubber-based agroforestry (50% rubber trees) yielded almost similar results in terms of return to land. However, coffee agroforestry performed higher since coffee-based systems have a shorter immature period. Additionally, coffee agroforests also have the highest return to labour, which indicates that these systems would be more attractive to farmers. In addition, profitability of agriculture (paddy) was also relatively low because of low productivity, but return to labour was still higher than the agricultural wage rate. Moreover, farmers also considered this system important for food security.

Agroforestry has been practised in Batang Toru for hundreds of years and will likely continue because agroforests offer many sources of income. Farmers raise weekly income from rubber and sugar palm; monthly income from cacao, coffee, *kemenyan* and *salak*; and annual income from fruit gardens (durian, *petai* and mangosteen). Bearing all of this in mind, it appears that agroforests with appropriate tree species may align with orangutan conservation and human needs. For example, trees that are not part of orangutan diet, such as rubber, candle nut and *Styrax spp.*, but which are already popular with local farmers, can be planted more widely, thereby lessening the chance of human–orangutan conflict and increasing farmers' income security.

4. Economic incentives for maintaining agroforests linked to conservation values are needed to secure a stable gradient

Renewed focus on forest preservation appeared to provide new opportunities for conserving the habitat of the orangutan. As part of the global concerns over carbon emissions and climate change, international efforts to reduce emissions from deforestation and degradation (REDD) received a boost at the Thirteenth Conference of Parties of the International Framework Convention on Climate Change (UNFCCC) in Bali in December 2007. It was argued that economic incentives provided in a REDD framework could be used to shift the balance towards protecting forests (aka carbon stock) and reducing carbon emissions from deforestation. This was likely to have substantial 'co-benefits' for local people as well as for conservation.

Forest dominates the landscape of Batang Toru, covering approximately 151 000 ha (61%) of the entire area in 2009, although agricultural and agroforest activities have been growing rapidly within the last two decades. Forest has been degraded in some areas, amounting to 8000 ha and 9000 ha in 2005 and 2009, respectively. Forest loss from 1994 to 2009 is approximately 11 000 ha (7 % of total forest area), agroforests and mixed gardens tended to be stable, while plantations (timber and oil palm) increased rapidly (Figure4).

The pattern of land-use changes in Batang Toru was relatively slow, with a small but declining fraction in the 'medium carbon and medium profitability' class (such as logging and agroforest) and a small, but slowly increasing, fraction of 'high profitability and low carbon' land uses (for example, oil palm). From 1994 to 2009, 48 % of Batang Toru stayed in the 'high carbon and low profitability' class, that is, forest. The dominant change and the highest contributor to CO2 emissions has been from undisturbed forest to disturbed forest, which reflects logging and other timber extraction activities.

Conserving the habitat of orangutan in places where forest can be converted into profitable land uses, such as oil palm

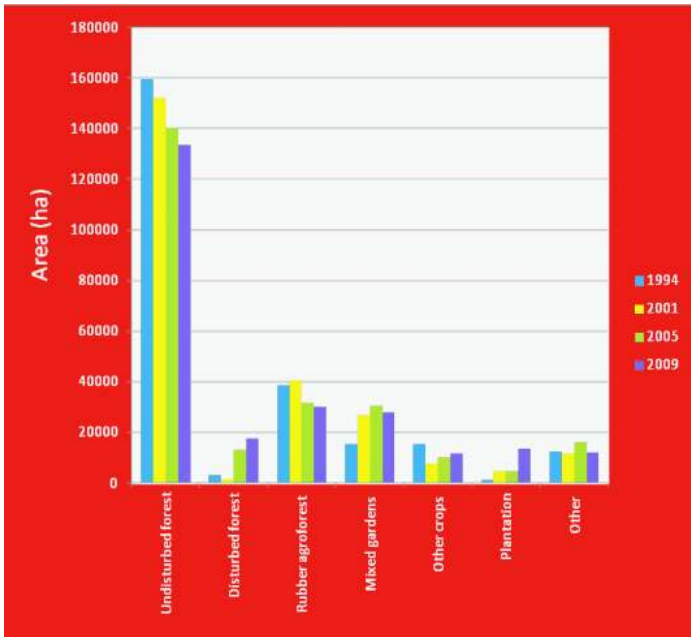

Figure 4. Land-cover changes from 1994 to 2009 in Batang Toru

plantations, entails a relatively high opportunity cost. In such cases, a REDD scheme might provide 'co-benefits' by providing rewards for local people not to convert forest to plantations and thereby protect the forest and the orangutan habitat. Other orangutan forests that are not so rich in carbon (because on mineral soils) could also provide other types of co-benefits. For example, they could be important watersheds, providing many services for downstream communities who could reward upstream residents for protecting forests and, hence, the watershed and water quality. Appreciation for the conservation value of stable village–forest gradients needs to translate into co-investment in a 'green' economy.

Recommendations

1. Mixed gardens and agroforestry systems can be counted as 'forest' according to the current internationally agreed definition. Again, by international standards all emission reduction options discussed in this paper are eligible for inclusion in REDD schemes, even though they involve land outside the 'forest area' (*Kawasan Hutan*). How government translates REDD+ into policy and actions in Indonesia and the way, in particular, that government agencies outside of 'forestry' are to be involved is currently under discussion.

2. The continued in-migration of people may be the most immediate threat to orangutan habitat, given the expansion of mixed farming along the lower elevations of the Batang Toru block (these are the most interesting part of the landscape for orangutan). It is probably also the most difficult to control and deflect, as there is no single government agency that can withdraw permits and stop the process. Other primary threats, such as logging and gold mining, generate substantial income for the local and central governments and offsets of local job opportunities will not be sufficient.

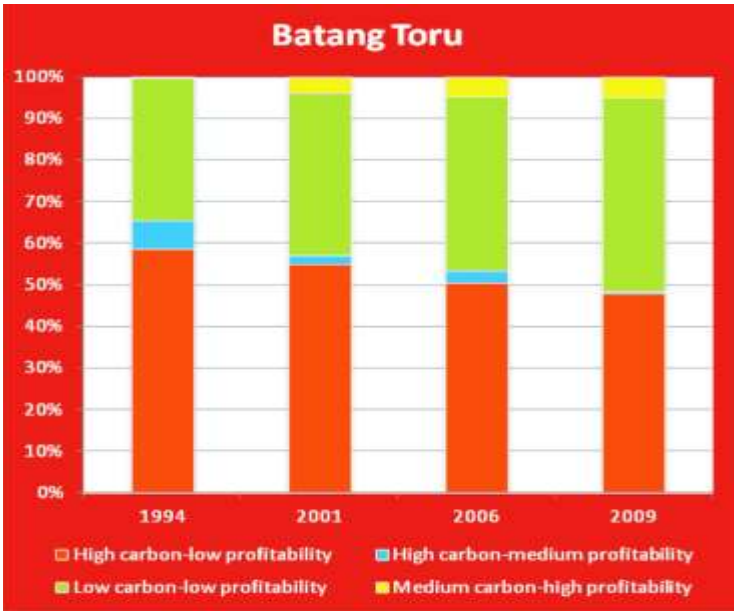

Figure 5. Land-use change patterns over time in Batang Toru in the four groups of land uses, classified by carbon stock and profitability

3. Efforts to reduce emissions can, under certain conditions, coincide with efforts to conserve orangutan. A REDD+ scheme might provide 'co-benefits' by providing rewards for local people not to convert forest to plantations and thereby protect the forest and the orangutan habitat.

4. A multifunctional approach that allows for land-use *sharing* for agriculture, forests and other functions can achieve good results in preserving orangutan and their habitat, reducing greenhouse gas emissions and raising food production levels only if appropriate tree species are planted and appropriate management is adopted.

The ASB Partnership for the Tropical Forest Margins is working to raise productivity and income of rural households in the humid tropics without increasing deforestation or undermining essential environmental services.

ASB is a consortium of over 90 international and national-level partners with an ecoregional focus on the forest-agriculture margins in the humid tropics, with benchmark sites in the western Amazon basin of Brazil and Peru, the Congo Basin forest in Cameroon, southern Philippines, northern Thailand, and the island of Sumatra in Indonesia.

The ASB Policybriefs series aims to deliver relevant, concise reading to key people whose decisions will make a difference to poverty reduction and environmental protection in the humid tropics.

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