

RIL for biodiversity and carbon conservation

Deramakot forest shows positive conservation impacts of reduced impact logging

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Reduced impact: Wild elephants roam around Deramakot. *Photo: H. Matsubayashi*

FOREST CERTIFICATION assures green consumers that the wood products that they wish to purchase are produced from a well-managed forest (Leslie *et al.* 2002). Forest certification also gives producers an eco-friendly label so that they obtain better market access and (in some cases) greater income to compensate for the higher cost of management incurred during the certification process (often including the application of reduced-impact logging—RIL). By linking green consumers and certified timber producers, forest certification is expected to ultimately drive unsustainably produced timber from the markets. Forest certification is expected to give economic incentives to timber producers and economic/ecological value for green consumers.

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Green consumers who are willing to pay a premium for certified timber are actually valuing the reduced level of environmental impacts on forest lands, including habitats for wildlife and biodiversity, during harvesting. Green consumers assume that the forest certification scheme correctly evaluates the additive positive effects of the management practices in the forest from which the wood products originate. However, the additive positive effects that need to be labeled by forest certification are not always scientifically well evaluated. This is especially so in the case of biodiversity. Biodiversity is among ITTO's

criteria for sustainable forestry and is included in almost all auditing schemes for forest certification. However, such biodiversity indicators are at a rudimentary stage in terms of testing on the ground and have not yet been proven for wide applicability. Moreover, the additive effects of reduced-impact logging (RIL) have not been tested systematically for many taxonomic groups. This paper briefly reports the results of a recent Malaysia-Japan collaborative project in Deramakot forest (a model site for RIL) in Sabah, Malaysia, which concludes that reduced-impact logging is effective in maintaining a level of biodiversity equivalent to a pristine rain forest, and in stocking a greater amount of carbon than that of nearby conventionally logged rain forest.

Deramakot forest

The Sabah Forestry Department, with technical support from the German Aid Agency for Technical Cooperation, began developing a management system in Deramakot Forest (which consists mostly of a lowland tropical rain forest of mixed dipterocarp trees) in 1989. The intent was to ultimately manage all commercial forest reserves in Sabah in a way that mimics natural processes for sustainable production of low volume, high quality, high priced timber products. A Forest Management Plan (FMP) was developed and about 55 149 ha of the entire Deramakot area was set aside for log production with 4 000 ha of protected area established for conservation. This FMP is the blueprint for operational work and biodiversity conservation in Deramakot up to today. Deramakot is divided into 135 compartments of varying sizes and the annual harvest is planned on a compartment basis. The annual allowable cut

is not more than 20 000 m³. A strict protection area is set aside for biodiversity conservation within the reserve. RIL has been employed for harvesting with minimal impacts on the physical environment. Deramakot Forest Reserve was certified as 'well managed' by the Forest Stewardship Council (FSC) in 1997 and was the first natural forest reserve in Southeast Asia so recognized as being managed in accordance with sustainable forestry principles.

In March 2003, a collaborative research project was initiated between the Sabah Government and several Japanese universities to investigate the recovery processes of tropical rain forests after RIL. Additive effects of RIL were evaluated by comparing Deramakot with surrounding areas where conventional logging was continued until recently (see Lee *et al.* 2006). Fieldwork was conducted in the two sites where RIL took place three years and eight years prior to the time of the fieldwork.

The richness of species and families of canopy trees per small plot was significantly greater in the RIL forest than in the conventionally-logged forest. The richness of species and families in the RIL forest was not different from that in the nearby pristine forest.

Carbon stocking

The amount of carbon stocked in the above-ground vegetation was estimated based on a specially developed algorithm using satellite data. The mean amount of carbon in above-ground vegetation is estimated to be 156±18 ton/ha in Deramakot where RIL is being practiced, while it is 123±11 ton/ha in the conventionally-logged forest. The difference of 33 tons of carbon per ha is statistically significant and is considered as the mean, positive effect added by RIL. Extrapolating for the entire area, RIL brought a net addition of about 1.8 million tons of carbon for 55,149 ha.

Biodiversity

Researchers compared the additive effects of RIL for the community composition and richness of tree species, macro soil fauna, flying insects, and large mammals by comparing Deramakot with the surrounding conventionally-logged forests.

Tree species: The richness of species and families of canopy trees per small plot was significantly greater in the RIL forest than in the conventionally-logged forest. The richness of species and families in the RIL forest was not different from that in the nearby pristine forest. Logging can increase the number of tree species by favoring fast-growing pioneer species and one might suspect that the greater richness in the RIL forests is due to the addition of the pioneer species that are favored by logging. However, the composition of the canopy tree community in the RIL forest was more similar to that of the nearby pristine forest. From this research, it can be concluded that RIL can maintain the richness and composition of the canopy tree community at a level equivalent to the pristine forest.

Macro soil fauna: Macro soil fauna consists of various organisms such as earthworms, termites, ants and insects found in the litter and surface soil horizons. The density and the richness of taxonomic groups at order or equivalent taxonomic level (not species in this case) were not different among the RIL, conventionally-logged, and pristine forests. However, the composition of the soil macro-fauna community was modified greatly by conventional logging, but less so by the RIL operation. Therefore, RIL could maintain the richness, density and composition of soil macro fauna reasonably well at least at broader taxonomic units. Macro soil fauna includes the important decomposers that function in nutrient cycling and sustain tree growth. They are relatively immobile compared with those living above the ground, and can be relatively easily sampled. It is thus suggested that the composition of soil macro fauna is a good indicator for assessing impacts on biodiversity.

Flying insects: Seven families that were trapped with baits, including fruit flies, bees, sap beetles and others, indicated a general pattern that the populations in the understorey were more sensitive to logging than in the canopy layer. The number of trapped insects decreased with increased logging intensity for some families. In this case, RIL did not maintain the population abundance of the flying insects at a level equivalent to the pristine forest, but maintained a higher abundance than conventional logging.

Medium to large sized mammals: A limited survey using camera traps indicated that the number of photographed mammal species was greater in the RIL forest than in the conventionally logged forest. A few mammal species demonstrated a higher frequency of appearance in the RIL forest than in pristine forest. Large mammals are often hunted for bush meat unless the access of hunters is physically limited. The greater species variety and population abundance in the RIL forest may just reflect the protection from hunting, because the access to the RIL forest is limited by locked gates. However, another independent census on the orangutan population from a helicopter also indicated a significantly higher nest density in the RIL forest than in the surrounding forests.

Conclusions

These results are still incomplete because other important organisms such as amphibians, reptiles and birds are not included. However, this study shows that there are direct benefits from improved forest management in Deramakot on biodiversity. RIL is certainly effective for sequestering a greater amount of carbon in the above-ground vegetation. The degree of the benefits appears to vary depending on taxonomic groups, but canopy tree species generally maintain a level of richness and composition comparable to the nearby pristine forest. Soil fauna is also likely effectively protected by the improved management. Highly mobile

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Mapping Mbalmayo Forest

Remote sensing helps with the management of Cameroonian forest reserve

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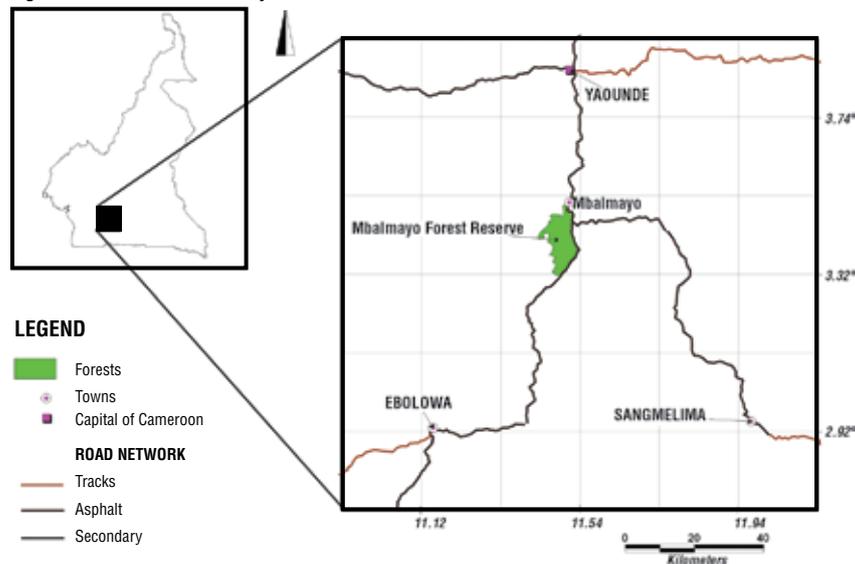
ESTABLISHED IN 1947 by the French colonial administration, the Mbalmayo Forest Reserve (MFR) ranks among the oldest protected areas of Cameroon. The majority of Cameroon's forests, including the reserves, are now threatened by degradation and advancing fragmentation due to the steady increase in local populations (Whitemore 1997, Lawrence and Bierregaard 1997, Simberloff 1986).

Previous studies undertaken in the MFR (Yonta, 1994; Owona, 2006; Temgoua, 2007) show that this area is utilized and inhabited by local communities. The activities of such populations, combined with other natural causes lead to changes in vegetation, biodiversity and landscape, to an extent which is not well recognized.

The resulting landscape units are made up of a mosaic of agricultural plots associated with disconnected wooded areas of varied size and shape (Galochet *et al.*, 2002). A land use study was undertaken in the MFR in order to produce a spatialized database. Starting from three high resolution Landsat satellite images and field validation surveys, this study mapped the current land use status in the MFR. The thematic mapping of landscape units thus produced could be used as a reference in future analyses of the Reserve's dynamics.

Where

Figure 1: Location of Mbalmayo Reserve



LEGEND

- Forests
- Towns
- Capital of Cameroon
- ROAD NETWORK
- Tracks
- Asphalt
- Secondary

The study aims at contributing to the generation of information for decision-makers in charge of the environmental policy and management of this protected area, including for local communities since forest policy in Cameroon is increasingly focused on transfer of forest management responsibilities to communities.

Mbalmayo Forest Reserve

The MFR is located about fifty kilometres from Yaoundé, the administrative capital of Cameroon, in the department of Nyong and So'O of the central province. It is bounded to the East by the asphalted Yaoundé-Ebolowa road, to the North and the West by the Nyong river and to the South by the So'O river (Figure 1).

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organisms such as flying insects and mammals need further research; however, these also appear to be protected to some extent. Strict compliance with the international principles, criteria and indicators of SFM maintains the abundance of keystone fruit species, standing dead snags, large stems, foliage and litter on which animals depend for food and habitat, and appears to maintain plant and animal diversity relatively intact. Lowered harvest volume and minimal impacts from skid trails help to keep the microclimate nearly intact. However, this does not mean that all certified tropical forests maintain biodiversity equally well because principles, standards and auditing systems can vary depending on the certifying body and location.

The island of Borneo where Deramakot is located has lost a vast area of tropical rain forests in recent years due to forest fire and land conversion. The area of strictly protected natural parks comprises only several percent of the total land area. Production forests function as the habitat for biodiversity in the current degraded landscape of Borneo, especially for large wildlife which has wide home ranges. Well-managed production forests, as described here, are expected to play a major role in the conservation of values like biodiversity and carbon stocking. The adoption rate of RIL and forest certification is,

however, marginal because most producers cannot secure adequate revenue. Unless additional financial values are attributed to well-managed forests and the revenue available to forest managers thereby supplemented, the present situation of marginal adoption rate will not improve. It seems clear that the timber-related revenue from well-managed forests needs to be supplemented by the payment for other ecosystem services of global importance. Biodiversity and carbon storage are two ecosystem services of global importance that a tropical rain forest can provide, and adequate financial remuneration based on the additionality of conserving biodiversity and carbon storage potential in improved forest management will give producers a better economic incentive to undertake it.

References

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