Towards Sustainable Forest Management by Implementation of Reduced-Impact Logging (RIL) Techniques in Indonesia with References in Kalimantan

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INTRODUCTION

Logging in the tropics, as conventionally practiced, depletes timber stocks and causes severe ecological damage to residual forests. In general, conventional forest logging may cause detectable changes on environmental variables, depending on the intensity of disturbance and the extent of forest cover removed. By the same token, forest clearance and forest conversion to other land uses cause greater impacts on hydrology and soil erosion processes. With the progress towards sustainable forest management, an improved harvesting techniques (i.e. RIL) is being implemented and promoted in various regions. The aim of this technique is to reduce damage on residual trees, soil disturbance, and impacts on wildlife (Sist et al., 1998, 2003; Elias et al., 2001).

In Indonesia, RIL technique has been integrated within a longer-term research strategy to develop sustainable forest management strategies. Research on the immediate and long term impact of timber harvesting from both environmental and economic perspectives was carried out, comparing both conventional and RIL logging techniques. The overall objective was to promote the environmental and economic benefit of RIL to promote its integration into logging operations at the concession scale.

The current problem

The Indonesian selective logging and planting system (called TPTI: Tebang Pilih Tanam Indonesia) is the currently accepted silvicultural system in Indonesia. It stipulates that all dipterocarps (i.e timber trees in family Dipterocarpaceae) with a diameter of > 50cm dbh (diameter at breast height) can be harvested with a polycyclic felling rotation of 35 years. As such, the harvesting intensity in Indonesian dipterocarp forest exceeds 100 m$^3$/ha, or more than 10 trees/ha. Unfortunately, conventional logging (CL) generally damages more than 50% of the original stand. Several experiments in mixed dipterocarp forest have demonstrated that RIL techniques can reduce damage by at least 30-50% compared with conventional logging and can probably shorten the logging cycle due to better post-harvest regeneration (Putz, 1994).

METHODS

Study site

The study area related with ecological impact of logging treatments (RIL Vs CL) was located in the Indonesian Province of East Kalimantan, on the island of Borneo, within a 50,000 ha forest concession managed by Inhutani II, a state-owned logging company of Malinau. The climate is equatorial with an annual rainfall in the concession of 2,265 mm for 1998. The topography is characterized by a moderate relief with elevations ranging from 200 to 600 m. above sea level.

The adoption study regarding the possible uptake of RIL techniques in 18 concession holders was conducted in East Kalimantan, Central Kalimantan and West Kalimantan. The objectives were to determine how far RIL is implemented in the selected companies, to assess the manager's perception in implementing RIL and analyze the internal and external factors influencing RIL's implementation.

RIL versus Conventional Logging (CL)
In conventional logging, harvesting operations were not planned and the loggers worked without supervision. In the RIL block, all the operators were trained to apply the RIL technical guidelines published in Sist et al., (1998). As part of RIL, the pre-harvesting inventory in block 27 led to the production of an operational map at 1:2,000 scale, showing 5m contour lines and the position of harvestable timber trees. To help the tree fellers select the best felling direction, skid trails were opened prior to felling, following the skid trail network planned and drawn on the operational map.

In both conventional logging and RIL blocks, logging damage was assessed eight months after logging. In the plots, all trees (dbh ≥ 20 cm) measured prior to logging were recorded as untouched, injured or dead.

RESULTS AND DISCUSSION

Felling and skidding
Felling and skidding are two dependent activities. RIL increased felling and skidding productivity by 28% and 25% respectively in comparison with CL (conventional logging). Directional felling in RIL was primarily intended to facilitate skidding in order to avoid residual stand damage. Further improved practice in the felling might improve further skidding productivity although it might reduce feller’s productivity. The benefits of directional felling were clearly seen in Kalimantan. For example, with regard to waste reduction, the volume of logs falling into ravine in the RIL blocks was lower than in CL i.e 4.20 m³ (1 log) vs 49.4 m³ (5 logs). These accounted for 6.4% of the total logs left in RIL and 8.5% in CL or 0.12% of total extracted volume in RIL and 0.9% in CL respectively. The costs of skidding were also reduced by 27% in RIL.

Logging damage assessment
Logging damage is directly correlated to the felling intensity applied. In this study, felling intensities vary among treatments given. In CL plots, the average felling intensity was 7.3 trees /ha (equivalent to 83 m³/ha or 10.5 m³/tree). Meanwhile, in the RIL plots the felling intensity was 6.8 trees/ha on average (equivalent to 60 m³/ha or 9 m³/tree). The total basal area removed in CL was significantly higher than that of RIL with 5.4 m²/ha and 3.8 m²/ha, respectively.

When compared with conventional harvesting practices, RIL also reduced the number of trees damaged by 40%. However, the proportion of trees damaged was similar in both techniques, particularly in the higher intensity logged areas, suggesting that RIL is only effective under low-medium logging intensities. These findings concur with those of Sist et al., (1998) in Berau, also in East Kalimantan. In this study, it was demonstrated that damage caused by felling is different from that caused by skidding. Felling primarily injured trees 30-50 cm in dbh whereas skidding caused substantial mortality of small trees, 10-20 cm dbh. The main benefit of RIL was to reduce skidding damage from 25% of the original stand in CL to only 9.5%. As skidding operations are the major causes of mortality of the residual stand, the low proportion of trees killed or damaged in RIL appears to result from improved skidding.

RIL and its adoption
From the adoption study, it shows that there are three (3) companies that have implemented RIL in their operations (100% implemented) according to company manager. Most companies have only implemented 25% of RIL techniques (6), at least according to company’s owner.

Clear disincentive factors on the RIL implementation were also observed, although the majority of the disincentives were caused by external factors. As shown in figure 1, based on the responses, the eleven factors we listed are as follows: land uncertainty (71), land claim by community (30), illegal logging (27), conflict over land use (26), management is not supportive (26), further training is required (15), lack of staff capacity (10), additional cost of implementation is too high (10). Meanwhile, two disincentive factors that received only a small score were: the need to invest in improved technology (4) and that RIL is not required by the government (2).
In the case of Indonesia, we observe that only few timber companies implement RIL in their concessions. This is due to a number of factors both internal and external, which include the lack of government policy or guidance on the subject, lack of capacity of staff, both technical and managerial and a perception that RIL costs more to implement than conventional logging. The lack of awareness and appreciation of the benefits of RIL is particularly true at the important decision-making levels in governments and the private sector (Priyadi et al. 2007). Without strong leadership from above, progressive mid-level managers and field workers and supervisors have little incentive to change the status quo, although there are exceptions to the rule.

Illegal logging and unplanned forest conversion represent major deterrents to the implementation of RIL (Smith and Applegate, 2001). The lack of trained and experienced personnel is the most critical requirement for the successful application of RIL on a wide scale particularly the availability of skilled logging personnel (Dykstra, 2001). Most countries in Asia and the Pacific have adequate laws governing forest harvesting and management. What are lacking are not laws and regulations, but rather effective enforcement and incentives for compliance.

CONCLUSIONS AND RECOMMENDATIONS

In the mixed dipterocarp forests of Indonesia where the density of harvestable trees exceeds 10 trees/ha, the minimum diameter rule often results in excessive felling and results in excessive damage to the remaining forest. RIL techniques have shown to reduce this deleterious impact on the residual stand and wider biodiversity, but only if the logging intensity is moderate (a maximum of 8 trees/ha). A reduced felling intensity would have benefits, not only for the regeneration and growth of the residual stand, but also for the long-term ecological sustainability of the forest. New silvicultural prescriptions need to be developed in order to improve harvesting operations.

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REFERENCES


