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Wood Waste Caused by Reduced Impact Logging in Indonesian Selective Cutting and Planting System, North Borneo, Indonesia

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Abstract

One of the most efforts possible to secure raw materials national wood processing industry is to increase the value added in forest management activities. Wood waste is measured and observed in logging plots and in landing. Wood waste in the conventional logging and RIL plots was 16.33 m^3/ha 11.06 m^3/ha, respectively. Based on the type of commercial species in conventional logging plots is dominated by commercial dipterocarps species (15.48 m^3/ha). Wood waste in reduced impact logging (RIL) plot is dominated by commercial dipterocarp species (9.78 m^3/ha).

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This resarch indicated that RIL techniques increased timber utilization (9.47%). Value of wood utilization using a proportion of the volume that can be used from a number of potential volume of tree per hectare.

Keywords: Dipterocarps; forest management; logging; wood waste.

1. Introduction

The role of the forest products and wood industries in Indonesia today face tough challenges, related to gaps between the needs of industrial raw materials with sustainable timber production capability. When considering the condition of the natural forest of decreasing mean more rarely wood raw materials, as well as the magnitude of the challenges many aspects, especially in the forestry sector (the environment, eco-labeling, carbon trading) there should be a fundamental change in the policy of forestry development, one of them by promoting the role of technology innovation more aligned to the community especially small industries, improve the efficiency of the processing of forest products and maximizing the use of wood waste.

In addition, the existence and preservation of natural tropical forests is getting increasingly more important and has become an important issue at the international level. Over-exploitation of the forest resources resulted in the deforestation, degradation, and land conversion [3, 5, 8]. Humans have transformed natural forests into agricultural land, settlement areas and managed forests [6, 9]. Studies on the dynamics of forest change are one of the mainstays in land change science.

Currently Indonesia's forest industry is facing various problems. The perceived problems of the most disturbing and must be addressed as soon as possible and find a way out is increasingly rapid depletion of timber resources, as well as the imbalance between demand and supply of timber forest products as a result of forest management policies and the development of timber industry are not synchronized in times past. One important factor that needs to be done is the efficiency of raw material for other than forest resources are increasingly scarce, the price of wood is more expensive, also because of the international pressure that calls for the entire product timber industry resulting from sustainable forest management. One of the most effort possible to secure raw materials national wood processing industry is to increase the value added in forest management activities.

2. Material and Method

How to measure the harvesting waste wood from felled trees are as follows : (a). High-stump measured from the ground to the tip of the stump; (B) Stems which is not excluded; and (c). Rod on top of the first branch diameter ≥ 10 cm. It’s measured the length and diameter.

Volume of forest harvesting waste per sample plot size of 100 m x 100 m or per hectare was calculated by summing the volume all the stems or tree that becomes waste within the sample plot and on landings. Volume of waste timber harvest per hectare is the total volume of waste from the wood (such as stumps, branch, stems from the main stem, and the stem of the branches with a diameter ≥ 10 cm); volume of waste is as a result of damage to remaining trees (due to logging, skidding and manufacturing of skid trails); and the waste that occurs in landings from the cutting and bucking logs.

The percentage of each type of waste is calculated by comparing the volume of each type of wood waste (location and type of tree diameter distribution) of the total volume of waste wood of forest harvesting per hectare. The percentage of waste wood harvesting is the ratio between the volume of forest harvesting waste to the total volume of forest harvesting (stem volume plus the volume of forest harvesting waste) per hectare. The timber arrived at landing counted throught measuring of log length and diameter. Stumps are bottom of the tree that is under notch and back cut. Dimensions were measured diameter and stump height.

3. Results and Discussion

Wood waste is measured and observed in logging plots and in landing. Results of measurement of waste wood harvesting can be seen in Figure 1.

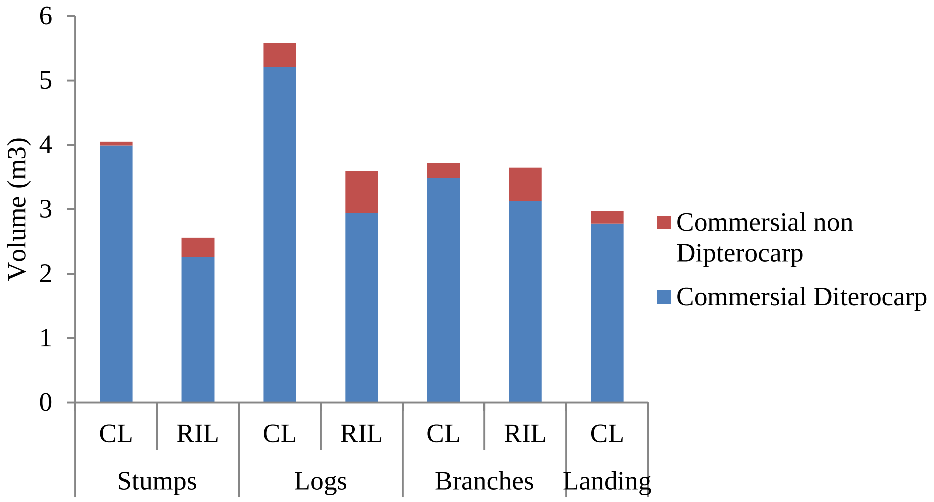

Figure 1: Number of wood waste on conventional logging (CL) and reduced impact logging.

Figure 1 showed that wood waste in the conventional logging was 16.33 m^3/ha, or an average harvest of the trees, wood waste was 3.27 m^3. In RIL plot, wood waste was 11.06 m^3/ha, or an average harvest one tree, wood waste was 2.21 m^3.

Based on the type of commersial forest group in conventional logging plots is dominated by commmersial dipterocarps species (15.48 m^3/ha) or 94.79% of the total waste wood. Wood waste of commercial non dipterocarp was 0.85 m^3/ha (5.21%). Wood waste in RIL plot is dominated by commercial dipterocarp species (9.78 m^3/ha) (82.29%) and non-dipterocarp commercial species was 2.11 m^3/ha (17.71%).

The volume of wood waste in conventional logging plots at the main stem was 5.58 m^3/ha or equivalent to 34.17% of the total waste volume of 16.33 m^3/ha, at the stump 4.05 m^3/ha (24.81%), wood waste at the branches was 3.72 m^3/ha (22.80%) and wood waste in landings was 2.98 m^3/ha (18.22%). In RIL plot, the largest volume of wood waste is at branches (3.65 m^3/ha) or equivalent to 30.69% of the total volume of wood waste that are in the wood harvesting RIL plots was 11.08 m^3/ha that wood waste in the main stem was 3.61 m^3/ha (30.35%), wood waste of stump was 2.57 m^3/ha (21.57%) and wood waste in landing was 2.08 m^3/ha (17.38 %).

Based on paired sample t test showed that average volume of wood west in conventional logging and RIL plot was significantly different at 95% confidence level (Table 1).

Table 1: Paired sample t test of wood waste in conventional logging (CL) and reduced impact logging (RIL) plot.

Wood waste	Volume m^3/ha (CL vs RIL)	P Value
Stump	4.053 vs 2.565	0.137
Stems	5.580 vs 3.608	0.274
Branches	3.724 vs 3.649	0.884
Landing	2.976 vs 2.067	0.013
Total	16.334 vs 11.890	0.006

Table 1. showed that total of wood waste and wood waste in landing of conventional logging is significanly different compared to wood waste in RIL plot. In additon, based on source of wood waste of stump, stems and branhes is unsignificantly effect.

The volume of timber harvested in a conventional logging plots 40.83 m^3/ha and RIL plots was 43.45 m^3/ha. When compared to wood waste that occurs in CL and RIL plots 16.33 m^3/ha and 11.08 m^3/ha, respectively, the percentage of wood waste caused by logging in conventional logging and RIL was 40.01% and 25.50%, respectively.

When linked with the amount of wood that can be used/produced by the total harvest volume (volume + volume of clean wood waste in landings), then the timber can be used for conventional logging by 71.56% and for forest harvesting RIL by 81.03 %.

These results suggest that the RIL is better than conventional logging. Value of wood utilization using a proportion of the volume that can be used from a number of potential volume of tree per hectare.

Figure 2 showed that the highest wood waste volume was in the felling areas. Average of sood waste volume in the felliang areas in convntional logging (CL) and reduced impact logging (RIL) plot was 13.36 m^3/ha and 9.82 m^3/ha. Wood waste in the landing was from some of logs broken while logs are skidding and bucking. Based on the percentage of timber utilization of logging is presented in Table 2.

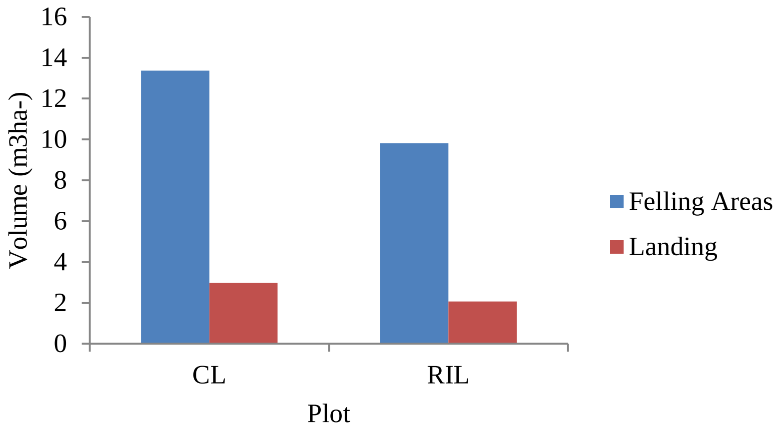

Figure 2: Number of wood waste based on location of wood waste.

Table 2: Percentage of timber utilization.

No.	Plot	Volume of log in block cutting (m^3/ha)	Volume of log in landing (m^3/ha)	Timber utilization (%)
1.	Conventonal Logging	40.83	29.22	71.56
2.	Reduced impact logging (RIL)	43.45	35.21	81.03
Increase of timber utilization by RIL technique				9.47

Table 2 showed that the percentage of timber utilization on conventional logging and RIL was 71.56% and 81.03%, respectively. This resarch indicated that RIL techniques increased timber utilization by 9.47%. If the average production of forest harvesting in PT Inhutani II was 22405.73 m^3/year, the increased utilization of timber was 2121.82 m^3/year.

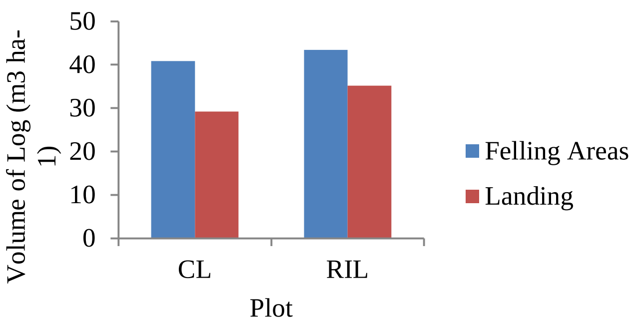

Figure 3: Wood waste on conventional logging (CL) and reduced impat logging (RIL).

Several factors are thought to effect the amount of wood waste caused by logging was the diameter of trees felled, shape of branched crown, number of trees harvested, slope of the field and stand density. The amount of forest harvesting waste is mostly due to technical factors logging method implementation and market demand. The more skilled the operator in cutting, the waste generated will be smaller.

Until now wood waste from branches and twigs are not exploited because of the difficulty in the decision, branching irregular shape and the number of knots and standing stock still a lot of prompting to calculate profit and loss and the lack of marketing of the wood waste. Manufacturing of forest products such as paper pulp, wood working (particle board, hard board) located far away even between the cutting block to logpond >170 km and should take into consideration transportation costs and wage standards making the wood waste.

Unlike in teak, teak is very high value and high demand for wood causes the branches and Twigs of wood under 7 cm in diameter and roots is dig to be utilized. Easily accessibility and more labor, cost and durability of the wood causing economic value is high.

The use of such agricultural waste is called for in other less developed countries demanding an adoption of appropriate technology [7]. Combining technological changes, good operational practices and recycling measures could reduce wood waste by approximately 50% [4]. Reduction of wood waste in the timber sector may also reduce the other environmental impacts in the timber sector. Reference [2] indicated that during processing, 7% up to 40–50% of the annual supply of wooden raw material become residues.

Reference [1] result that compared with conventional stem-only harvest, removing the stem plus the harvesting residues generally increases nutrient outputs thereby leading to reduced amounts of total and available nutrients in soils and soil acidification, particularly when foliage is harvested along with the branches. Losses of available nutrients in soils could also be explained by reduced microbial activity and mineralization fluxes, which in turn, may be affected by changes in organic matter quality and environmental conditions. Whole-tree harvesting has negative impacts on soil properties and trees that may have an impact on the functioning of forest ecosystems.

4. Conclusions

Wood waste in the conventional logging was 16.33 m^3/ha, or an average harvest of the trees, wood waste was 3.27 m^3. In RIL plot, wood waste was 11.06 m^3/ha, or an average harvest one tree, wood waste was 2.21 m^3. Percentage of timber utilization on conventional logging and RIL was 71.56% and 81.03%, respectively. This resarch indicated that RIL techniques increased timber utilization.

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