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Analyse The Waste Potential of Felling Community Forest In Cendana District of Enrekang Region

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Abstract. This study aimed to determine the volume of felling waste, the waste utilization prospects and the factors that influence the amount of felling waste in community forests. This study was conducted in December 2017 through February 2018 in the community forests in Pinang village, Cendana District of Enrekang Region. The method used in this research was descriptive and quantitative analysis. The descriptive analysis aimed to describe and explain teak logging activities while quantitative analysis carried was undertaken for the diameter measurement and calculate of waste volume generally observed in this study are community forest enforce be felled within the study site. The results of this study showed that the total volume of waste was 0.128 m³ with the percentage of 18.492% derived from stump waste, waste of main stem, branch and above the bole waste. Prospects of utilization of felling waste especially waste branch at Bangka Trading Business can be created as a furniture raw material and firewood. Factors that influence the amount of felling waste were labor and industrial demand factor.

1. Introduction

There Waste harvesting is a part of the tree that should be exploited, but for various reasons have to be abandoned in the forest [1]. Meanwhile, according to Puspitasari [2], timber harvesting waste is part of the felled trees that are not utilized because of defects and damaged in small diameter and length are not eligible for certain use purposes, including the part of the tree on the stand that is damaged due to logging activities, alignment, and forest road construction.

The teak forests of the people in Enrekang Regency are managed independently by the community either in the form of one species plant pattern or with mixed crop pattern. The teak tree of the people has been decades old, so it has a high selling value. The harvesting of new forests is directed against the wood of certain types and sizes sold in the market. While timber that is not sold in the market and can not be exported left behind in the forest in the form of untapped logging wastes. Potential of people forest in District Cendana that is equal to 270 ha. One of the potential stands that can be seen clearly in *Kecamatan Candana* is the availability of sufficient raw materials for an industry that is the potential of the teak stand (*Tectona grandis*). Most people harvest timber from community forests that act as labor to supplement their income. However, trained and experienced labor is needed to improve work productivity [3] [4].

Seeing the value and potential of teak utilization is increasingly it is necessary attention to the techniques of teak logging that can reduce and utilize waste logging is left. Attention to the potential of



felling wastes in the teak forests of the people of Pinang Village, Cendana District, Enrekang Regency needs to be analyzed to reduce the problem of optimal utilization of wood raw materials and to increase the income of timber entrepreneurs. Therefore, research is needed to analyze the potential waste due to the emission of teak forest in Enrekang.

2. Material and Method

This research was conducted in December 2017 until February 2018. The research location was in Pinang Village, Cendana Sub-district, Enrekang Regency, South Sulawesi Province. The materials used in this research are teak stands ready to be felled. The tools used in this research are roll meters (50 m) and tape meters each to measure the length and circumference of logs, and good diameters that can be utilized or in the form of logging wastes, calculators, stationery, tally sheets, and Haga meters. This research is conducted with the following stages.

2.1. Population and Sample Research

The population of this research is related parties such as the operator and the foreman, where the harvest and utilize the teak wood of the teak forests while the determination of the sample is done by purposive sampling by choosing as many as 30 teak trees ready for cut.

2.2 Data Collection Technique

The data collection technique consists of the primary data source that is collecting data by measuring the circumference and length of each piece of wood waste stem, both on the stump, main stem, branch and above free branches at each stage of harvesting activities, including the circumference and length of logs. And secondary data sources are data obtained from institutions or related agencies, books, research reports and other sources that are related to this research.

2.3 Data Analysis

A descriptive analysis covering timber industry raw materials, waste utilization and description of factors and causes of waste which include labor factors, wage system, and industrial demand while quantitative analysis includes characteristic abiotic data which includes diameter measurement and waste volume calculation.

3. Results and discussion

3.1 Waste Stamp

The average diameter of stump wastes is 0.276 m, the height of stump is 0.316 m, the average volume is 0.019 m³ with the percentage of waste is 2,242%. The highest number of trees is in the height of the stumps ranging from 0.28 to 0.30 m ie as many as 15 trees, while the height of the stump with the least number of trees ranging from 0.37 to 0.39 m. This indicates that the chainsaw operator is logging with a mean height of ≤ 50 cm in weight. The determination of the height of the crop only considers the ease of the technical faller and the security of the trub. Trubusan becomes one of the considerations because the community does not plant after logging but expects a growing tubular on the grounds that it grows faster and is not attacked by pests such as in teak plants with newly planted seedlings, so for the sake of sustainable management of teak forests these three factors should be considered [5].

Table 1 .Length, Diameter and Volume of Waste Disposal at Felling of Teak Forest in Pinang Village, Cendana Sub-district, Enrekang Regency

Height stump (m)	Diameter (m)	Volume (m ³)/position	Percentage (%)	Number of
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				Tree s
0,28- 0,30	0,23- 0,24	0,012- 0,014	1,911- 2,128	15
0,31- 0,33	0,25- 0,26	0,015- 0,017	2,129- 2,346	10
0,34- 0,36	0,27- 0,28	0,018- 0,020	2,347- 2,564	3
0,37- 0,39	0,29- 0,0	0,021- 0,023	2,565- 2,782	0
0,50- 0,43		0,024- 0,026	>2,783	2
0,316	0,276	0,019	2,242	30

The largest volumes of waste arrears are 0.026 m³ with the percentage of 2.851%, while the smallest volume of trees is 0.012 m³ with the percentage of 1.974%. Thus the percentage of waste stump averaged 2.242% of the total volume of trees that should be utilized. The occurrence of the waste stump is largely determined by the operator's ability and understanding of the maximum utilization of wood. The size of the waste is very dependent on: The loggers do not understand the making of the notch and the notch that can cause waste. Loggers do logging without considering the small size of the waste, but based on logging positions that facilitate logging activities. Lumberjacks pay more attention to meeting the targets of cutting, so do not pay attention to the height of the stump in logging.

3.2 Main Trunk Waste

The diameter and average length of the main stem to be waste respectively 1.472 m, and 0.165 m, the average volume of 0.032 m³ / tree, with the percentage of waste 3.868%. The size of the main stem waste logging activity is due to the large diameter of the main stem waste and the length of the waste. However, in general, the amount of waste depends on the total volume of wood that can be utilized for the untapped timber.

Table 2. Length, Diameter, and Volume of Main Stem Waste on Felling of Teak Forest in Desa Pinang Kecamatan Cendana Kabupaten Enrekang

Length of Waste (m)	Diameter (m)	Volume (m ³)	Percentage (%)	Number of Trees
1,36- 1,42	0,15	0,023- 0,025	2.331- 3.014	1
1,43- 1,46		0,026- 0,028	3,015- 3,698	5
1,47- 1,53	0,17	0,029- 0,031	3,699- 4,382	9
1,54- 1,60		0,032- 0,034	4,383- 5,066	8
1,61- 1,67	0,18	0,035- 0,037	5,067- 5,750	5
		0,038- 0,040	5,751- 6,432	2
1,472	0,165	0.032	3.868	30

The largest volume of stem waste is 0.040 m³ with a percentage of 6.432% while the smallest volume is 0.023m³ with a percentage of 2.331%. This is in accordance with the statement of [6] which

states that the major stem waste from logging activities is due to the large diameter of stem waste and the length of the waste. Another factor causing the high percentage of waste in addition to diameter and length of wood is how much the volume of wood is not utilized compared to the total volume of trees so that the diameter and length of wood have not determined the percentage of waste.

3.3 Branch Waste

The mean diameter and length of the branches to be waste respectively 1.461 m and 0.111 m with an average volume of branch waste of 0.014 m³. The highest percentage of waste is 2,043 - 2,614% with the number of the stem as many as 20 stems. A waste branch occurs because in branch cleaning activities not all branches meet the size requirements demanded by the industry and the length requested, so it is not sent to Java, eventually left in the forest to be waste. Then the waste is then utilized by local industry into the raw material of furniture

Table 3. Length, Diameter and Volume of Branch Waste on Felling of Young People's Forest in Pinang Village, Cendana Sub-district, Enrekang Regency

Length of Waste (m)	Diameter (m)	Volume (m ³)/portion	Percentage (%)	Number of Trees
0,65-0,85	0,09	0,006 - 0,008	0,899 – 1,470	2
0,86–1,06	0,10	0,009–0,011	1,471 – 2,042	6
1,07–1,27	0,11	0,012–0,014	2,043 – 2,614	20
1,28–1,48	0,12	0,015–0,017	2,615 – 3,186	12
1,49–1,69	0,13	0,018–0,020	3,187 – 3,758	6
1,70–1,90		>0,021	3,759 – 4,333	3
1,461	0,111	0,014	1,787	49

The average percentage of branch waste is 1.787% of the total wood volume that should be utilized. The occurrence of such waste is due to the felled trees generally have branches with sizes that do not meet any size such as diameter and length. Thus, the branch cleaning activity is taken because it is considered to have a small diameter, although the branch has a diameter of > 9.25 cm. This is consistent with the [2] statement which states that timber harvesting waste is part of the felled trees that are not utilized because of defects and damaged in small diameter as well as lengths not eligible for a particular purpose.

3.4 Waste above Free Branch

The diameter and the mean length of the stems above the tree branches became a waste of 1.956 m and 10.112 m respectively with an average waste volume of 0.021 m³. The highest waste volume is 0.005 - 0.012 m³ with the number of stems as many as 23 stems because the waste is so much that the logging operator also cut the tip of the tree into several parts with a long size. The occurrence of waste above the free branch due to the trees felled in general have many shoots/tip. But it has a small diameter of 0.07 - 0.08 m diameter so that may become waste because the size is not eligible to be sent to Java, eat local industry take it and made as a raw material of furniture. This indicates that the value of the above-mentioned free-branch waste from logging activities is strongly influenced by the above-free waste

diameter and the length of the waste. But basically waste depends on the amount of total wood volume that can be utilized for the untapped timber.

Table 4. Length, Diameter and Volume of Waste above Branch Free at Felling of Teak Forest in Pinang Village, Cendana Sub-district, Enrekang Regency

Length of Waste (m)	Diameter (m)	Volume (m ³)/pohon	Percentage (%)	Number of Trees
1,10–1,74	0,07–0,08	0.005–0.012	0.224–0.714	23
1,75–2,39	0,09–0,10	0.013–0.020	0.715–1.205	19
2,40–3,04	0,11–0,12	0.021–0.028	1.206–1.696	17
3,05–3,69	0,13–0,14	0.029–0.036	1.697–2.187	12
3,70–4,34	0,15	0.037–0.044	2.188–2.678	4
4,35–4,99		0.045–0.053	2.679–3.169	1
5,00		> 0.053	> 3.170	2
1,956	0,112	0.021	1.505	78

3.5 Recapitulation of Wood Waste Volume

The results of species identification and diameter and length measurement of teak logging waste can be obtained recapitulation of average volume composition and percentage of four types of waste as shown in Table 5.

Table 5. Recapitulation of Average Volume and Percentage of Waste on Felling of Jati Rakjat in Desa Pinang Kecamatan Cendana Enrekang Regency

Kind of Waste	Average (Volume/tree m ³)	Percentage %
Waste Stump	0,019	22,093
Main Trunk Waste	0,032	37,209
Branch Waste	0,014	16,279
Waste above branch	0,021	24,491
Total	0,086	100,000

In Table 5 it can be seen that the average volume/tree for each type of waste is for caudal waste of 0,019 m³ with a percentage of 22.093%, the main stem waste equal to 0,032 m³ with percentage 37,209%, branch waste equal to 0,014 m³ with percentage 16,279%, waste above free of branch equal to 0,021 m³ with percentage 24,419%. Percentage of waste can be seen in Figure 1.

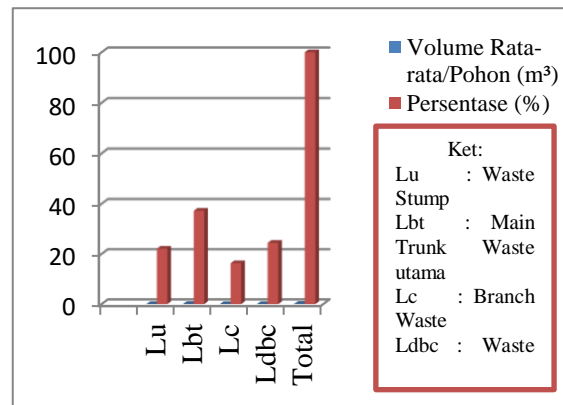


Figure 1. Recapitulation of Mean Waste Volume in Pinang Village, Cendana Sub-district, Enrekang District

In Figure 1 it is seen that the type of waste that most produces waste is the main stem waste. This is seen from the percentage generated amounted to 38.095% and the smaller percentage is found in the branch waste of 16.667%. Based on the results obtained, it is known that the largest waste comes from the main stem waste. Waste can be suppressed through improved bearing-making techniques. The smallest waste source is derived from branch waste, where the limited number of eligible branches is a minimum length of 1 m and a diameter of at least 8 cm. This is consistent with the [1] statement, which states that timber harvesting waste is part of unused harvestable trees because small diameter and length are not eligible for a particular use purpose.

3.6 Potential of Logging Waste

Based on the measurement data in the field, it is known that the type and potential of waste contained in the logging site as shown in table 6

Table 6 Potential of Logging Waste of Jati Rakjat in Pinang Village, Cendana Sub-district, Enrekang Regency

Kind of Waste	Average Volume of Waste (m³)	Number of Trees	Total Average Waste Volume (m³)
Waste Stump	0,019		
Main Trunk Waste	0,032		
Branch Waste	0,014	1.500	129
Waste above branch	0,021		
Total	0,086		

Based on Table 6 it can be seen that cow waste has an average volume of 0.019 m³ / tree, main stem waste 0.032 m³ / tree, waste branch 0.014 m³ / tree and free waste above 0.021 m³ / tree from 1,500 number of trees in the village Pinang Kecamatan Cendana Kabupaten Erekan with a total of 0.086 m³ with a total average volume of waste of 129 m³. This means a large potential waste generated

from logging activities in the community's teak forests of 129 m³ for 1,500 trees. The largest waste potential is obtained from primary stem waste. The major potential of stem waste is caused by the activity of making a sortimen that changes the shape of the main stem from the initial form into a bearing shape. This activity causes many parts of the main stem to become waste.

3.6 Prospect for Utilization of Logging Waste

The description of the size of wooden samples utilized by the wood processing industry in Pinang Village, Cendana District, Enrekang Regency is described in Table 7

Table 7. Description of Wood Sortimen Size Utilized by Wood Processing Industry in Pinang Village, Cendana Sub-district, Enrekang Regency

	Size of Wood Sorted			Raw Material
	Length (cm)	Width (cm)	Thickness (cm)	
Parties Utilizing UD.	200	25	23	Sawmills
Bangka	60-80	5-6	2-3	Meubel

The teak wood used by local industry (UD Bangka) to be used as the wood of sportsmen / bearing has size with length 200 cm, width 25 cm and 23 cm thick sent to Java made as furniture. Teak wood waste utilized by industry (UD.Bangka) is a log that has a diameter ranging from 10 cm to 20 cm, which is converted into blocks of length 60 cm in width and thickness (5 cm x 2 cm), (5 cm x 3 cm), (6 cm x 3 cm), (5 cm x 5 cm), which is used for the manufacture of chairs and table legs. Research conducted by Ahmad, 2011 suggests that the size of the teak wood delivered to Java has a wide and thick (15 x 15), (20 x 20), (25 x 25), (30 x 30) of varying lengths ranging from 80 cm up to 300 cm.

The size of the utilized waste comes from branch waste. Branch waste criteria utilized ie waste with size below 60 cm. Form of utilization of existing waste that is made as raw material legs of tables and chairs. Size of existing waste potential to be used as various forms of utilization one of them can be used as a source of fuel energy (charcoal).

3.7 Factors Affecting Waste

Factors affecting the magnitude of the potential waste that is, (1) Labor factor where the factor of labor intended in this case comes from the chainsaw operator itself. Chainsaw operators with experience and knowledge The basic thing done by logging is the cause of waste in logging plantation in Pinang Village, Cendana Sub-district, Enrekang Regency due to: a. Chainsaw operators are cutting too high to leave a huge waste of stumps. b. Notch making techniques. (2) Industrial Factors where other factors that cause the occurrence of waste in the field that most industries only make the raw materials of small diameter. This is due to certain conditions demanded by the market that will affect the extent of the exploitation factor. In teak sawmilling industry with the raw material product for furniture, it is said that wood with small diameter 10 cm to 20 cm will be utilized by UD furniture industry. Bangka with the length of 60 cm with width and thickness (5 cm x 2 cm), (5 cm x 3 cm), 6 cm x 3 cm) and (5 cm x 5 cm), which is used for making chair and table legs.

The occurrence of waste can also be suppressed by utilizing waste wood, where the utilization of wood waste is directed at industries that manage the wood regardless of the shape and size of wood so

that it can be processed into useful items and the utilization of wood can be more optimal, whether that comes from waste wood logging and waste from the wood processing industry, such as the utilization of waste in the form of wood powder into a useful product.

4. Conclusion

From this study, it can be concluded that the total volume of logging waste of the whole is 0.128 m³ / tree with the percentage of 18.492% coming from cow waste, stem waste, branch waste and waste above free branch. The prospect of utilization of logging waste, especially branch waste at logging in Pinang Village, Cendana Sub-district, Enrekang Regency is at UD. Bangka can be made as a raw material of furniture and firewood. And the factors that influence the occurrence of logging waste are the labor factor and industrial demand factor.

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