



Analysis The Degree of Community Participation Possibility on Restoration Planning for Lowland Forest Landscape of Lengan Watershed - Langkat District

Nurhayani Hasibuan¹, Samsuri^{2*}, Alfan Gunawan Ahmad³

¹ Faculty of Forestry, Universitas Sumatera Utara, Padang Bulan, Medan, 20155, Indonesia

Abstract. Watershed performance can become one of forest condition indicators. Lengan watershed belongs to main priority category in North Sumatra encompassed the forest landscape has a poor condition. It has to be restored for getting the better forest landscape. This activity needs community support and proper plant species for restoring the forest. Therefore, the research is important to determine the degree of community participation possibility in the planning of restoration activities that will be done in Lengan watershed and to find suitable plant species. This research used the descriptive statistical analysis method. The result showed that the degree of community participation possibility on forest landscape restoration activity was high. The selection of the suitability of the plant species used was determined from sum of the proportion of weight based on community perception and the analysis of natural forest vegetation were meranti (*Shorea* sp), bayur (*Pterospermum javanicum*), karet (*Hevea brasiliensis*), durian (*Durio zibethinus*), benoang (*Octomeles sumatrana*), matoa (*Pometia pinnata*), marak (*Macaranga indica*), jengkol (*Pithecellobium jiringa*), pulai (*Alstonia scholaris*), dan meranti batu (*Shorea parvifolia*).

Keyword: Community Participation, Forest Landscape, Restoration, Suitability of Plant Species

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1 Introduction

One hundred years ago Indonesia had abundant forests with trees covered 80 to 95 percent of the total land area. Total forest cover was estimated at around 170 million ha. Currently forest cover is around 98 million hectares, and at least half of the area is believed to have been degraded due to human activities. The degree of deforestation is increasing and Indonesia lost about 17 percent of its forest in the 1985 and 1997 periods. On average, Indonesia lost about one million hectares of forest each year in the 1980s and around 1.7 million ha per year in the 1990s. Since 1996, deforestation seemed to have increased again to around 2 million ha per year. At this level, it seems that all Indonesia's lowland forests that are rich in biodiversity and various timber sources will disappear in the coming

*Corresponding author at: Faculty of Forestry, Universitas Sumatera Utara, Padang Bulan, Medan, 20155, Indonesia
E-mail address: gsamsuri@gmail.com

decades (Holmes, 2000 cited in [1]). The proper and enough forest cover can support watershed performance. Unfortunately, many watersheds have degraded forest cover and deforestation.

North Sumatra Province, especially Langkat Regency, has several watersheds, one of which is the Lengan watershed. Lengan watershed is categorized into the 1st priority watershed in North Sumatra. This means that it has high management priorities due to its critical or unhealthy biophysical and socio-economic conditions and problems. Research [2] revealed that forest land cover in 2015 was 28.1% of the total area, less than minimum standards set by the government in Law No.41 of 1999 (30% of the total watershed area). It indicates that Lengan watershed was not in good condition.

Lengan watershed condition can be improved by restoring forest landscapes as close to previous natural conditions as possible. However, in order to successfully restore the landscape, we need support from community in and around the forest such as their participation from planning to evaluate the restoration. The success of restoration also determined by plant type selection, pioneer types or income-source plants. It is important to know community participation degree and suitable plant type because both are significant factors to determine the success of forest landscape restoration [3]. This research aimed to obtain the degree of community participation possibility in the Lengan watershed in Langkat Regency in forest landscape restoration activities and to discover the suitable type of plant for forest landscape restoration activities in the Lengan watershed in Langkat Regency.

2 Materials and Methods

2.1 Tools and Materials

The tools and materials used in this study were GPS, writing instruments, cameras, and questionnaires.

2.2 Methods

The data collection method used in this study was a semi-structured interview and survey. Semi-structured interviews (conversations) involve the individuals or groups for a purpose and carried out using the question guide list. The respondents were given open questions, which answers were not yes or no.

Respondents were selected by purposive sampling method: the technique of determining samples with certain considerations. Samples were respondents who had work or activities and resided in the Lengan watershed in Langkat district.

The research used primary and secondary data. Primary data obtained by field observation included field documentation, field marking, and respondent responses from the questionnaires. Secondary data was supporting data obtained indirectly from previous studies or agencies providing the related data.

2.3 Data Analysis

This study used descriptive statistical analysis studies. Data processing results of questionnaires were carried out using a rating scale. The rating scale is a statement followed by columns indicating degrees, for example was from strongly agree to strongly disagree. This is so that the respondent can provide an assessment according to their criteria based on the choices available. Each respondent's choice of answers was given a score according to the scale of the answer choices available. Each answer A through E had a degree starting from the most positive and given the highest value as shown in Table 1 and Table 2.

Table 1 Interval rating scale with three options of answers

Options	Score	Interval Rating Scale	Category
A	3	201 – 300	Acknowledge/has joined/join
B	2	101 – 200	Doubtful/doubtful/doubtful
C	1	0 – 100	Not knowing/never/not join

Table 2 Interval rating scale with five options of answers

Option	Score	Interval Rating Scale	Statement
A	5	401 – 500	Strongly agree/very good
B	4	301 – 400	Agree/good
C	3	201 – 300	Doubtful/unchanged
D	2	101 - 200	Disagree/damaged
E	1	0 – 100	Strongly disagree/very damaged

The degree of community participation possibility in planning restoration activities in Lengan watershed in Langkat Regency was measured using the formula (Kadir, 2007) which modified by [4]:

$$CP = \frac{\sum_{i,j}^n x_{ij}}{AV} \times 100\% \quad (1)$$

Note :

CP = community participation measurement

X_{ij} = the value number of “yes” answer on the ‘i’ question and the ‘j’ respondent

AV = the actual or supposed value of the respondent's answer

The CP then valued using the category approach developed by (Babbie 1991 cited in [4]) which had been modified as follows:

CP value > 66.68 % : High participation

CP value 33.34% - 66.67% : Moderate participation

CP value < 33.33 % : Low participation

The assessment used to find out the types of plants used in restoration planning activities was assessed based on two criteria. The assessment and calculation of tree species that were suitable for restoration activities were a classification modification according to [5]. Type of plants according to the community's opinions and natural forest vegetation analysis obtained from secondary data were used as assessment criteria.

In principle, the determination of tree species is expected to be the same as the tree species found in natural forest ecosystems near the restoration area. However, the restoration implementation had to prioritize the key types for the formation of ecosystems, nests, and animal feed. Vegetated landscapes that were recommended were at least 30% of the total natural forest ecosystem close to the restoration area [6]. The values on each criterion were presented as follow:

B ₁	Type of plants according to the community's opinion	40%
B ₂	Type of plants according to natural forest vegetation analysis	60%

$$B_1 + B_2 = 100\%$$

$$\text{Suitable type of plants} = [(B_1 \times K_1) + (B_2 \times K_2)]$$

Note :

B₁, B₂ : the value of each type of selection criteria

K₁, K₂ : score of each plant type

3 Results and Discussion

3.1 Community Characteristics

Community characteristics are things that indirectly influence public perceptions of restoration activities on forest landscapes. The characteristics used in this study were the lengths of stay, education, employment, and community income. The number of respondents chosen was 100 people taken from four villages selected as the villages where the research was located in the Lengan watershed in Langkat Regency.

A. Length of Stay

Table 3 shows that the respondents have lived in the area for 6 to 77 years. The lengths of stay of the respondents were divided into eight categories, starting from 6 years to 77 years. The average lengths of stay were 27 years.

Table 3 The characteristic of the community in Lengan watershed based on lengths of stay

No	Lengths of stay (Years)	Number (person)	Percentage (%)
1	6-14	8	8
2	15-23	38	38
3	24-32	30	30
4	33-41	8	8
5	42-50	11	11
6	51-59	3	3
7	60-68	1	1
8	69-77	1	1

B. Education

Data presented in Table 4 indicates that 3% of respondents were uneducated and 97% educated in the range of elementary school to a diploma. In general, elementary school level was dominating with a percentage of 49%. Low education level will be an obstacle in transferring information and technology to the public.

Table 4 The characteristic of the community in Lengan watershed based on education

No	Education	Number (person)	Percentage (%)
1	Uneducated	3	3
2	Elementary School	49	49
3	Middle School	16	16
4	High School	31	31
5	Diploma	1	1

C. Occupation

As the listed data in Table 5, the dominated occupation of the community in the study area was farmer, laborer, and housewife. These occupations were related and able to support of forest ecosystem restoration.

Table 5 The characteristic of the community in Lengan watershed based on occupation

No	Occupation	Number (person)	Percentage (%)
1	Farmer	40	40
2	Laborer	22	22
3	Housewife	17	17
4	Government employee	6	6
5	Teacher	4	4
6	Trader	3	3
7	Entrepreneur	3	3
8	Fisherman	2	2
9	Unemployed	3	3

D. Income

The general income on the community was at a range of IDR 1,000,000,- to 3,000,000,- at the percentage of 41%. The dominated income was IDR 2,000,000,-. Housewives were categorized as residents with no income and can be involved in forest restoration as workers.

Table 6 The characteristic of the community in Lengan watershed based on income

No	Income (IDR/month)	Number (person)	Percentage (%)
1	IDR 0,-	18	18
2	IDR 1,000,000,-	3	3
3	IDR 1,500,000,-	7	7
4	IDR 2,000,000,-	41	41
5	IDR 2,500,000,-	16	16
6	IDR 3,000,000,-	15	15

3.2 The Public Perception

Public perception is needed to obtain an overview of the conditions that occur in the research area and conduct an assessment of the community's knowledge of restoration. Sociology's expert stated that perception is the process of evaluating a person or group of people towards an object, event, or stimulus by involving experiences related to that object, through a technical process and affection to form the object [8]. The mostly community disagree on the forest function restoration, indicated by the total score of 386. People feel worried and threatened not to be able to carry out agricultural and plantation activities. The public perceptions of restoring forest functions are presented in Table 7.

Table 7 The public perception of forest function restoration

Question	Scale of answer	Number	Scale answer x value
If forest functions are restored			
a. Strongly agree	5	0	0
b. Agree	4	4	8
c. Doubtful	3	5	14
d. Disagree	2	91	364
e. Strongly disagree	1	0	0
Total			386

According to Table 8, total score of respondent's knowledge and restoration implementation is 277. This means the community acknowledged of restoration activities and it will make easier to socialize if restoration was carried out.

Table 8 Knowledge about restoration activities

Question	Scale of answer	Number	Scale answer x value
Do you know about forest restoration activities?			
a. Know	3	79	237
b. Doubtful	2	19	38
c. Not know	1	2	2
Total			277

Table 9 shows the information that there has never been restoration activity in the research location it was proved by the total score of 100. Therefore, restoration activity involving the local community is important and necessary.

Table 9 The restoration activity implementation

Question	Scale of answer	Number	Scale answer x value
Have forest restoration activities been carried out?			
a. Ever	3	0	0
b. Doubtful	2	0	0
c. Never	1	100	100
Total			100

Out of 100 respondents obtained a total score of 407 (category A). This means the community agrees to approve rehabilitation and restoration activities which will be carried out (Table 10).

Table 10 The perception of conducting forest restoration activities

Question	Scale of answer	Number	Scale answer x value
What is your opinion if forest restoration activities carried out in this location?			
a. Strongly agree	5	28	140
b. Agree	4	59	236
c. Doubtful	3	5	15
d. Disagree	2	8	16
e. Strongly disagree	1	0	0
Total			407

3.3 The Degree of Community Participation Possibility

Community participation is one of the things that can help the success of restoration activities. Therefore, activities can run smoothly and get the result as expected. One of the principles that can be used in efforts to carry out restoration is by using the principle of community empowerment and institutional capacity and participatory approaches. This is in accordance with [3], who stated that the degree of possibility of community participation is an important factor in determining the success of forest landscape restoration.

3.4 Degree of community participation possibility in restoration planning

The distribution of the degree of community participation possibility in restoration activity planning is presented in Figure 1.

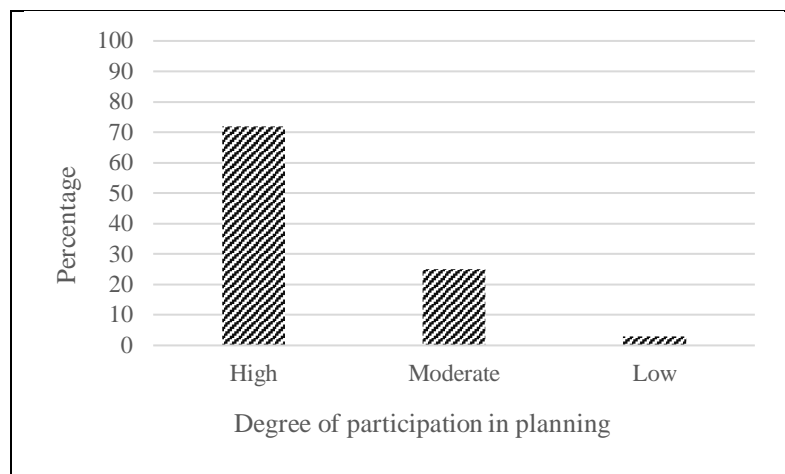


Figure 1 The distribution of community participation possibility in the activity of restoration planning

Community participation in restoration planning was categorized by high category, medium category, and low category with a proportion of 72%, 25%, and 3%, respectively. Communities on high category had a greater proportion of people compared to moderate or low category. This indicates the high passion and enthusiasm, showing the community is willing to be involved from the beginning of the planning.

3.5 Degree of community participation possibility in the implementation of restoration

The degree of community participation possibility in the implementation of restoration activities can be seen in Figure 2.

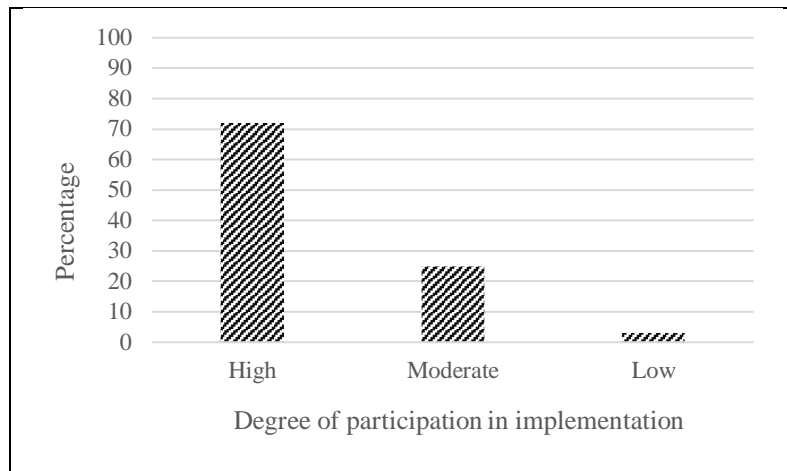


Figure 2 Degree of community participation possibility in the implementation of restoration activities

Figure 2 showed that the people who had a high degree of possible participation in the implementation of restoration activities (72%) and those with a moderate and low category had a smaller proportion of 25% and 3%. A high degree of participation is an important capital for the success of the restoration.

3.6 Degree of community participation possibility in the maintenance of restoration

The degree of community participation possibility in maintenance that included in the stages of restoration activities is shown in figure 3.

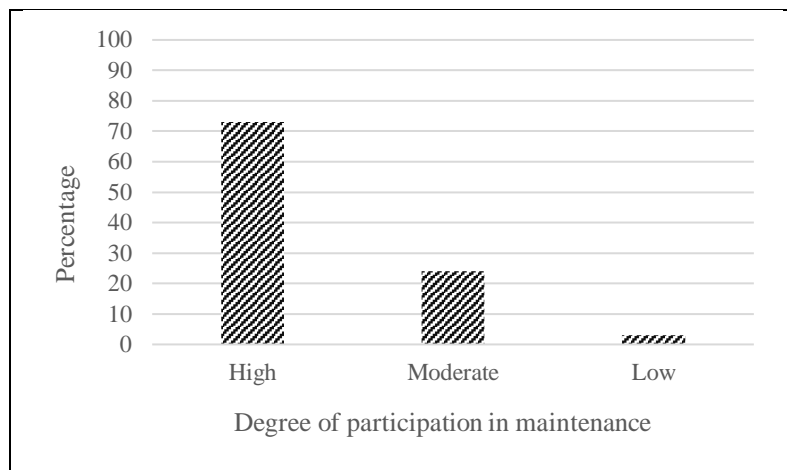


Figure 3 Degree of community participation possibility in the maintenance of restoration

As presented in Figure 3, the degree of community participation possibility on the maintenance of restoration is dominated by high category (73%). Community participation with medium category and

low category were 25% and 3%, respectively. A high proportion of the community's role in maintenance will be able to support the successfulness of restoration.

3.7 Degree of community participation possibility in the monitoring of restoration

The degree of community participation possibility in the monitoring of restoration is graphically illustrated in Figure 4.

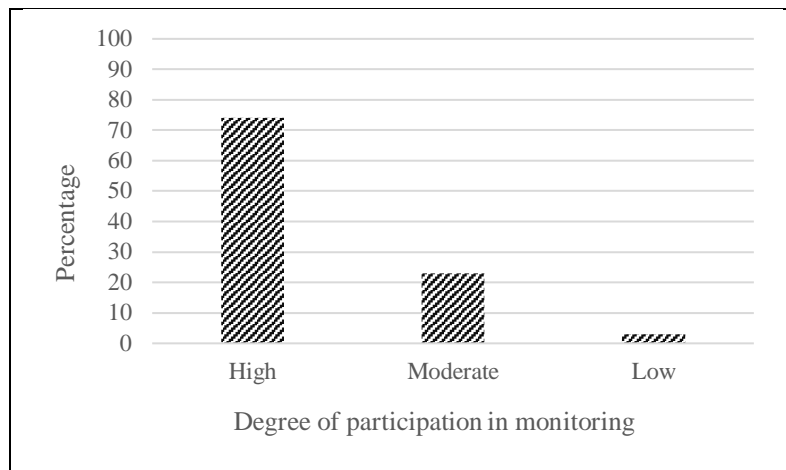


Figure 4 Degree of community participation possibility in the monitoring of restoration

Figure 4 showed that the community had a high possibility to participate in the monitoring of restoration activities (74%). The possibility of people in the medium category and low category were 24% and 3%, respectively.

3.8 The average degree of community participation possibility

The average degree of community participation possibility in all stages to be carried out in the restoration activities is presented in Figure 5.

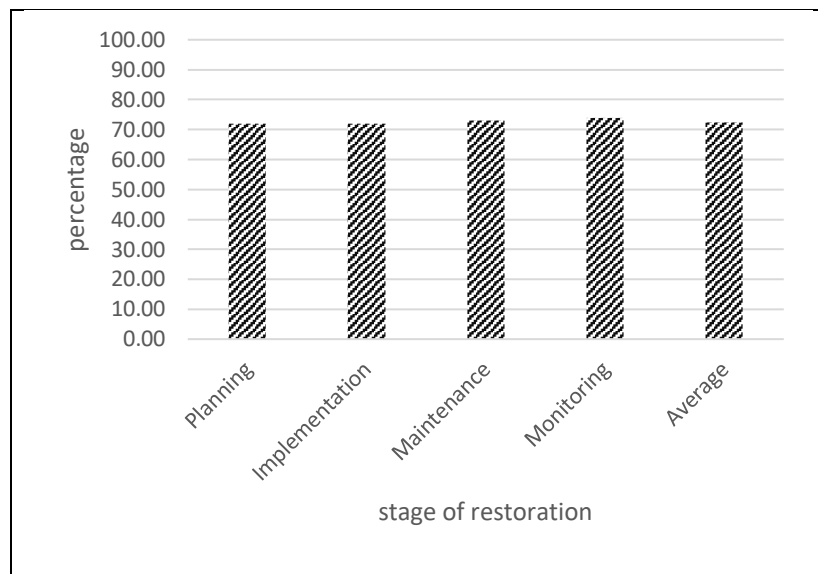


Figure 5 Degree of community participation possibility in restoration activities

According to Figure 5, the average degree of community participation possibility in the planning, implementation, maintenance, and monitoring of rehabilitation and restoration activities had a high category with a percentage of 72.75%. The degree of participation possibility was obtained from the results of respondent's answers stating that they would participate in the activities. This shows that the community has a good understanding of the aims and objectives of the restoration activities.

3.9 Determination of Plant Types

Before planting, determining the type of plant for restoration is important. The plants chosen can be those proposed by the community, e.g. rare local plants which hard to find in the study area. The plants can also the ones recommended, the ones preferred and the ones most suitable to be planted according to the community. Vegetation analysis on both study area and natural forests on its surrounding were also influencing plant selection.

A. Selection of plant types based on people's perceptions

The selection of plants that suitable for restoration activities based on community opinion has a weight proportion of 40%. In accordance with four reasons which to select tree species based on community perceptions, each reason has a proportion of 10%. The types of plants suitable to use in planning restoration activities are presented in Table 11.

Table 11 Plant type based on community perception (20 top rankings)

No.	Plant Type (local name)	1	2	3	4	Total Score x Weight
1	Rubber plant	1.0	0.7	1.3	0.8	3.80
2	Rambutan	1.0	1.1	1.1	0.9	3.65
3	Teak	1.2	0.6	0.7	0.5	3.00
4	Durian	-	1.3	1.2	1.0	3.00
5	Dammar	0.6	1.0	1.0	0.6	2.90
6	Cempedak	0.8	0.8	0.6	0.7	2.55
7	Orange	0.1	1.2	0.8	0.8	2.50
8	Mahagony	-	0.6	0.9	0.3	1.65
9	Black Dammar	0.3	0.9	0.5	-	1.70
10	Merbau	0.7	0.7	-	0.2	1.50
11	Meranti	0.5	0.5	0.3	-	1.30
12	Jabon	0.5	0.5	-	-	1.00
13	Mangosteen	0.2	0.3	0.3	-	0.80
14	Stinkbean	-	0.4	0.3	-	0.70
15	Cocoa	0.2	-	0.4	-	0.60
16	Semantok	0.4	-	-	0.3	0.55
17	Mango	0.1	0.1	0.1	0.1	0.35
18	Sengon	0.1	0.2	-	-	0.30
19	Rose apple	-	-	-	0.2	0.10
20	Langsat	0.1	-	-	-	0.10

The most suitable species to plan on the restoration activity in Lengan watershed by community preference is rubber plant (*Hevea brasiliensis*) with score value 3.8. This was in accordance with [8], who stated that the rubber plant is a type of plantation that has high economic value. Rubber latex can be processed into rubber sheets, chunks, or crumbs (raw material for rubber industry). Rubberwood can be used to make furniture and other home appliances.

Ecologically, rubber plant easier adapted in environment. According to [9], the rubber plant is very prospective to be developed in the watershed area due to its excellent adaptability to various agroclimatic conditions.

B. Plant type based on analysis of vegetation in natural forests

Plant species selection based on natural forest vegetation analysis is one of a necessary step to be done to find out the types of plants found in natural forests around the planning area for restoration activities. Natural forest vegetation analysis provided information on tree species that can be a reference in determining the type of tree to be selected for planning restoration activities, according to the statement of Clewell et.al 2005 cited in [6]. Vegetation analysis was carried out to determine the composition of vegetation types and structures forest from the plant community.

The analysis of natural forest vegetation was carried out on natural forests around the planning area for restoration activities. The valuation of plant species derived from the analysis of natural forest vegetation has a percentage of 60%. The types of trees obtained are presented in Table 12.

Table 12 Plant type based on vegetation analysis in natural forest (20 top rankings)

No	Name of plants (local name)	INP (%)	Total Score x Weight
1	Bayur	26	9.0
2	Meranti	20	8.4
3	Benoang	18	7.8
4	Matoa	14	7.2
5	Marak	13	6.6
6	Jengkol	11	6.0
7	Pulai	10	5.4
8	Durian	10	5.4
9	Meranti Batu	9	4.8
10	Gusi Biang	9	4.8
11	Gara Tar-Tar	9	4.8
12	Meranti Gembung	9	4.8
13	Rubber plant	9	4.8
14	Capet	8	4.2
15	Sukun	8	4.2
16	Redas Malaysia	8	4.2
17	Raja	7	3.6
18	Karim Balang	7	3.6
19	Kabu	7	3.6
20	Ndeleng	7	3.6

According to Table 12, bayur (*Pterosperium javanicum*) has the highest Important Value Index (IVI) of 26% and has a total score of 24. Bayur is a plant species of lowland forest which is good to cultivate and has health, economic, and ecological benefits.

The determination of plant species for Lapan watershed restoration activities planning was also considered the community perceptions and the results of natural forest vegetation analysis. Scoring analysis of the types of plants obtained from vegetation analysis generated plant species as presented in Table 13.

Table 13 Most suitable plant types for restoration activities in Lengan watershed

No.	Name of plants (local name)	Total Score x Weight
1	Meranti	9.7
2	Bayur	9.0
3	Rubber plant	8.6
4	Durian	8.4
5	Benoang	7.8
6	Matoa	7.2
7	Marak	6.6
8	Jengkol	6.0
9	Pulai	5.4
10	Meranti Batu	4.8

Table 13 shows the type of plants that have the highest rank 10 out of 56 plant species based on community perception and analysis of natural forest vegetation. These plants were eligible because easily found in natural forests around the location of planning for restoration activities. According to [6] who stated that the principle of determination was to choose the type of plant that was widely available at the natural forest ecosystem near the restoration site.

The said species were lowland forest vegetation. According to [10] who expressed that bayur, meranti, durian, meranti batu, and marak were lowland forest species. Benoang is also lowland rainforest species [11]. According to [12], jengkol is able to adapted well and able to grow at various heights: low and high plains, but the perfect quality of fruit pods and seeds obtained from the lowlands. According to [13], the rubber plant basically grows optimally in the lowlands. Matoa is a typical type of lowland rainforest (Westphal and Jansen (1989) in [13]. According to [15], pulai grows in lowland and mountainous forests and also found in secondary forests. This was in accordance with the conditions of the Lengan watershed which was at the altitude of 300-700 m above sea level. Lowland ecosystems are located at the altitude of 0 - 1,000 m above sea level.

4 Conclusion

1. The degree of community participation possibility in forest landscape rehabilitation and restoration activities in Lengan watershed was in high category with an average value of 74.25%.
2. The types of plants that suitable for Lengan watershed restoration were meranti (*Shorea* sp), bayur (*Pterospermum javanicum*), rubber plant (*Hevea brasiliensis*), durian (*Durio zibethinus*), benoang (*Octomeles sumatrana*), matoa (*Pometia pinnata*), marak (*Macaranga indica*),

jengkol (*Pithecellobium jiringa*), pulau (*Alstonia scholaris*), and meranti batu (*Shorea parvifolia*).

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