The management pattern and potential wood of community forest in Parakan Muncang Village, Naggung District, Bogor Regency

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Abstract. Community Forest is an alternative to meet the needs of industrial wood raw materials and plays a role in increasing income and welfare of farmer households. The purpose of this study was to determine the potential for stands of community forests and the community forest management patterns applied by forest farmers. The research location is in Parakan Muncang Village, Naggung District, Bogor Regency. Sampling of respondents using the census method. The data collection method used was a field survey approach and interviews using a questionnaire. The potential for community forest stands in Parakan Muncang Village is 543.75 m³, while the potential per hectare is 32.478 m³. The highest potential is Sengon wood by 51.95%, Teak by 16.16% and Puspa by 9.89%. The pattern of community forest management that is applied is 12.5% of the respondents use the pure community forest pattern (monoculture) and 87.5% use the agroforestry pattern. The cropping pattern in agroforestry forests uses a border tree planting, where wood plants are planted around agricultural crops using a random / irregular cropping pattern.

1. Introduction
According to Darusman and Suhardjito (2006) [1] Community Forests have very significant potential in global national forest management. Community forest businesses, especially in the West Bogor area, have developed quite rapidly. The demand for raw materials for the wood industry in the West Bogor region has also experienced a fairly high increase. This condition is beneficial for community forest farmers to increase their household income. Hardjanto et al. (2017) [2] stated that the energy community forest business in the West Bogor area plays an important role in increasing the income of community forest farmers and makes a significant contribution to reducing community poverty by 10% and is able to absorb labor by 12.7%.

Like most people in the Naggung sub-district, the people of Parakan Muncang village are mostly farming and gardening. The dependence of some people on illegal gold mining on Pongkor mountain...
is very worrying. The community needs another form of business that can support their household economy.

However, the farmers who own the land still manage it in a mediocre and simple way. This is in addition due to lack of knowledge, limited information received by the public. So that the potential obtained from the existence of community forests is not optimal. Therefore this research is needed to obtain data and information related to the potential of stands and community forest management patterns in Parakan Muncang village, so that later it can be used as a basis for planning so that the potential of community forests grows and develops optimally to improve people's welfare.

Several studies on Community Forests have been carried out, among others, by Atikoh (2016) [3] stating that Community Forests in Gunung Bunder 2 Village use an agroforestry business pattern, where the contribution to farmers' income is only 6.5%, which means that community forest business is only a sideline farming business. This is almost the same as the condition in Parakan Muncang Village, where community forests are only as additional income for farmers. Febriana (2018) [4] stated that the potential for community forest stands is 1,213,586 m³, the management pattern applied is in the form of pure and mixed community forests. According to Nadya (2019) [5] the contribution of Community Forests in Sadeng Village, Bogor Regency was 42.2%, the people of Sadeng Village already had a fairly large income from community forest products with an average net income of Rp. 17,002.436/year/farmer. The management pattern applied is agroforestry. In Asyiddiqi (2016) [6] the potential for community forest stands in Bantargadung District, Sukabumi Regency. of 65,831.87 m² with monoculture and mixed community forest management patterns. From these four preliminary studies, agroforestry methods are commonly used by farmers who have limited land and minimize the risk of failure in their timber plantation business and earn additional income from other types of crops, such as agricultural crops and NTFPs.

The formulation of the problem from this research is how big the potential of community forest stands in Parakan Muncang Village and how the management pattern is applied by forest farmers. This study aims to determine how much potential community forest stands and management patterns applied by forest farmers in Parakan Muncang Village, Nanggung District, Bogor Regency.

2. Research method

2.1. Locus and research time

The research was conducted from October to December 2020 which took place in Parakan Muncang Village, Nanggung District, Bogor Regency. The reasons for choosing this location are, among others, that no one has ever studied the potential of community forests in Parakan Muncang village, the location is quite close and easy to reach by researchers, and most of the people in this village make a living as farmers and gardeners.

2.2. Respondent selection method

The sample in this study was taken using the census method. According to Supriyanto and Machfudz (2010) [7], the census method, also known as saturated sampling, is a sampling method in which all members of the population are used as samples. This census method is applied when the population is small or less than 30 people. The population in Parakan Muncang Village that is used as a sample is people who have a community forest area of at least 0.25 ha. The number of farmers who have a minimum land area of 0.25 ha is 16 people.

2.3. Method of collecting data

The data collected are primary and secondary data. Primary data was obtained by looking for stand potential, the first thing to do was to take tree samples to obtain stand potential data. The stand inventory method used is the Stratified Systematic Sampling with Random Start method, where the area to be sampled is first grouped based on the type of plant. Then the samples were taken in groups with a sampling intensity (IS) of 20%. Sampling of the tree is done with a zig zag system with certain
intervals. The next step is marking the sampled trees, then measuring tree height (measured at chest height) and free height of tree branches.

2.4. Data processing and analysis method

2.4.1. Quantitative Analysis. Quantitative analysis is used to provide an explanation of the potential of community forest vegetation in Parakan Muncang Village. To calculate the alleged potential of wood in the community forest of Parakan Muncang Village, it is started by calculating the potential of vegetation in the community forest belonging to the respondents.

The potential of forest stands in this study is the volume of community forest stands calculated using the formula [4]:

\[ V_a = BA \times ta \times fa \] (1)

Information:
Va : tree volume type a (m³)
BA : base area (m²)
ta : branch free height type a (m)
fa : shape number type a (0.7)

To measure the LBDs of a tree use the formula:

\[ Base \ area = \frac{1}{4} \times \pi \times Da^2 \] (2)

Information:
\[ \pi \] : konstanta 3.14
Da : branch diameter batang tree, type a (m)

Potential data obtained from the results of the study were then processed by means of tabulation of data and analyzed descriptively quantitatively.

2.4.2. Qualitative Analysis

Qualitative descriptive analysis is used to explain the management pattern applied by community forest farmers in Parakan Muncang Village. Descriptive qualitative analysis method according to Winartha (2006) [8] is a method that analyzes, describes and summarizes various circumstances/conditions and situations from various kinds of data collected, in the form of results from interviews or observations regarding the object of the problem being studied, which occurred in field.

3. Results and discussion

3.1. Results

3.1.1. Population and sample. Parakan Muncang Village which is administratively located in the Nanggung sub-district, based on the results of the author's interviews with village stakeholders, namely the village head and competent staff in it, as well as direct interviews with the people who manage community forests. present in Table 1.
Table 1. Number of Samples Based on Community Forest Land Ownership Area.

| No. | Land Area (ha) | Population | Sample |
|-----|----------------|------------|--------|
| 1   | 0.25           | 5          | 5      |
| 2   | 0.27           | 1          | 1      |
| 3   | 0.3            | 4          | 4      |
| 4   | 0.4            | 1          | 1      |
| 5   | 0.5            | 1          | 1      |
| 6   | 0.55           | 2          | 2      |
| 7   | 0.6            | 1          | 1      |
| 8   | 0.7            | 1          | 1      |
|     | Jumlah         | 16         | 16     |

3.1.2. Characteristics. Respondent data can be seen in the following pie chart:

![Respondent's Age](image1)

![Respondent's Education](image2)

3.1.3. The potential of community forest stands. The implementation of community forest management implemented by the farmers of Parakan Muncang Village is divided into two categories, namely monoculture community forest planted with one type of plant and community forest agroforestry, where the planting of wood plants consists of more than one type of plant. The total production of community forest wood in Parakan Muncang Village based on the results of the study is presented in Table 2 below.

Table 2. The Potential of Community Forest Stands.

| No  | Tree Species | Large (ha) | Average Tree Age (year) | Average Potency Tree Species (m³) | Total Potential (m³) |
|-----|--------------|------------|-------------------------|----------------------------------|----------------------|
| 1.  | Jati         | 0.25       | 12                      | 0.06                             | 18.66                |
| 2.  | Jati         | 0.25       | 14                      | 0.10                             | 10.43                |
| 3.  | Sengon Afrika | 0.25      | 5                       | 0.34                             | 34.43                |
| 4.  | Sengon       | 0.25       | 6                       | 0.24                             | 21.01                |
|     | Jati         | 7          | 0.12                    | 5.05                             |                      |
| 5.  | Sengon       | 0.25       | 7                       | 0.04                             | 1.69                 |
From the tabulation of research data, it was found that the total potential of community forests in Parakan Muncang Village was 543.75 m$^3$ with a total area of 6.07 hectares owned by respondents. The potential of community forest stands in Parakan Muncang Village based on the type of plant.

### Table 3. Wood Potential Per Tree Species.

| No. | Tree Species | Area (Ha) | Numer of Tress (Stands) | Vol/Tree (m$^3$) | Total Vol (m$^3$) | Procentage (%) | Potential (m$^3$/ha) |
|-----|--------------|-----------|-------------------------|-----------------|------------------|----------------|-----------------------|
| 1.  | Jati (*Tectona grandis*) | 0.25 | 300 | 0.06 | 18.66 | 74.64 | 74.64 |
|     |              | 0.25 | 100 | 0.10 | 10.43 | 41.72 |
|     |              | 0.25 | 48 | 0.04 | 1.69 | 6.76 |
|     |              | 0.6 | 992 | 0.06 | 58.33 | 97.22 |
|     | Total        | 1.35 | 89.11 | 16.16 | 220.34 |
|     | Average      |     | 55.085 |

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|   |   |   |   |   |
|---|---|---|---|---|
| 2. | Sengon (*Albizia chinensis*) | 0.5 | 85 | 0.39 | 33.26 |
|   |   | 0.25 | 88 | 0.24 | 21.01 |
|   |   | 0.25 | 100 | 0.34 | 34.43 |
|   |   | 0.55 | 44 | 0.21 | 9.23 |
|   |   | 0.3 | 32 | 0.77 | 24.54 |
|   |   | 0.25 | 50 | 0.28 | 13.91 |
|   |   | 0.27 | 103 | 0.26 | 27.03 |
|   |   | 0.3 | 105 | 0.10 | 10.33 |
|   |   | 0.4 | 40 | 0.10 | 4.04 |
|   |   | 0.3 | 35 | 0.23 | 8.09 |
|   |   | 0.55 | 200 | 0.43 | 86.38 |
|   |   | 0.7 | 45 | 0.31 | 14.08 |
| Total | 4.62 | 286.34 | 51.95 | 792.26 |
| Average | 6.59 |
| 3. | Puspa (*Schima wallichii*) | 0.27 | 25 | 0.06 | 1.413 |
|   |   | 0.3 | 30 | 0.07 | 1.71 |
|   |   | 0.4 | 170 | 0.42 | 44.46 |
|   |   | 0.7 | 100 | 0.08 | 6.62 |
|   |   | 0.6 | 15 | 0.02 | 0.31 |
| Total | 2.27 | 54.52 | 9.89 | 132.05 |
| Average | 26.41 |
| 4. | Afrika (*Maesopsis eminii*) | 0.25 | 48 | 0.11 | 5.05 |
|   |   | 0.25 | 50 | 0.10 | 4.89 |
|   |   | 0.55 | 27 | 0.13 | 3.49 |
|   |   | 0.3 | 95 | 0.07 | 6.28 |
|   |   | 0.3 | 23 | 0.05 | 1.19 |
|   |   | 0.4 | 30 | 0.13 | 3.81 |
|   |   | 0.3 | 51 | 0.11 | 5.56 |
|   |   | 0.55 | 60 | 0.04 | 2.1 |
|   |   | 0.7 | 20 | 0.27 | 5.31 |
| Total | 3.6 | 37.69 | 6.93 | 110.43 |
| Average | 12.27 |
| 5. | Damar (*Agathis dammara*) | 0.25 | 20 | 0.14 | 2.81 |
| Total | 0.25 | 2.81 | 0.5 | 11.24 |
| Average | 11.24 |
| 6. | Akasia (*Acasia mangium*) | 0.5 | 16 | 0.31 | 5.013 |
|   |   | 0.7 | 20 | 0.27 | 5.31 |
| Total | 10.32 | 1.89 | 17.606 |
| Average | 8.803 |
| 7. | Jati Belanda (*Gmelina arborea*) | 0.5 | 27 | 0.20 | 5.36 |
|   |   | 0.3 | 298 | 0.003 | 0.92 |
| Total | 6.29 | 1.15 | 13.78 |
| Average | 6.89 |
| 8. | Mindi (*Melia azedarach*) | 0.5 | 18 | 0.81 | 14.57 |
| Total | 14.57 | 2.67 | 29.14 |
| Average | 29.14 |
| 9. | Meranti (*Shorea leprosula*) | 0.55 | 140 | 0.30 | 42.10 |
| Total | 42.10 | 13.78 | 76.54 |
| Average | 29.14 |
### 3.1.4. Management pattern of community forest

From the research results, there are two types of community forest in Parakan Muncang Village, namely:

a. Monoculture pattern

There are only 2 (two) people (12.5%) of community forest farmers in Parakan Muncang Village who apply monoculture or similar plant management patterns. These two farmers have a monoculture community forest planted with pure teak without any intercrops or other types of plants.

b. Agroforestry pattern

Based on the results of interviews and direct observations in the field, there are 14 farmers applying the agroforestry community forest management pattern. Farmers who apply the agroforestry pattern plant their land in addition to community timber plants, as well as fruit trees, interspersed with secondary crops, and seasonal crops. They also have rice fields.

The arrangement or planting pattern of woody plants applied by all communities who apply the agroforestry community forest pattern is generally irregular in spacing. According to Darusman and Suhardjito (2006) [1] if the components of perennials are planted with a path pattern on the edge or around the agricultural land, it is referred to as uneven distribution. If there is a combination of agrisilviculture and silvopasture, when woody plants (both community forest plants and fruit and secondary crops) are planted around the land for the purpose of protecting agricultural crops/seasonal crops and also functioning as living fences, it is called border tree planting. Between wood plants, farmers plant herbal plants such as ginger, lemongrass, turmeric, galangal and other types of herbal plants.

### 3.2. Discussion

#### 3.2.1. Respondent’s characteristic

From the results of research on community forests in Parakan Muncang Village, Nanggung District, which fall into the category of forest farmers based on their land area, there are only 16 farmers. Based on the village monograph data, most of the residents of Parakan Muncang Village are farmers, who manage their land in addition to agriculture as well as planting land with woody plants. In this study, the authors limit only those who have a minimum of 0.25 hectares of land that are included in the category of community forest farmers. The method used in taking respondents is the census method.

Based on the age characteristics data presented in table 1, residents who manage community forests are 40-60 years old and over. Generally, community forest farmers in Parakan Muncang Village have an elementary level education, only a few people have a bachelor’s degree. The age factor of farmers who are generally old and the level of education of farmers who are classified as low greatly affects the process of receiving information, applying knowledge and farmers’ behavior in managing their land.

#### 3.2.2. The wood potential of community forest

Types of community forest timber plants planted by farmers on their lands include Teak, Sengon, Puspa, Afrika/ Manii, Damar, Acacia, Gmelina/ Dutch Teak, Mindi and Meranti. The average potential for community forest stands based on the results of tabulated data (Table 3) is 32,478 m³/Ha. There are several relevant preliminary studies that can be used as a reference for research on the potential of community forest stands. For example, the research by Febritana et al (2018) with the thesis title Estimating the Potential of Standing Trees and Contribution of Community Income from Community Forest Products in Cigudeg District, Bogor
Regency, obtained the stand yield per hectare of 118,169 m³/ha. The results of research from Heruwanto et al. (2016) with the title of the thesis entitled Macro’s Nutrient Stock (N, P, K, Ca & Mg) on Sengon (Paraserianthes falcataria (L)) wich Aged 5 Year, obtained a stand average potential of 433,205 m³/ha.

Community forest in Parakan Muncang Village, wood plants are planted on the edge/surrounding of the land, namely as a land barrier and protective of agricultural crops, called the planting of a fence pattern. People do not depend on their livelihoods from their wood crops, they still depend on seasonal crops, fruit crops and rice fields.

There are several factors that affect the level of motivation of farmers, namely age, income, farming experience, education level, farmer group activities, extension activities and access to information [9].

The potential of community forests in Parakan Muncang Village can be increased again, the participation of related parties is very influential, from the results of interviews with forest farmers, they almost never get directions from forestry/agricultural extension workers, so farmers manage their land armed with knowledge and experience which is passed down from generation to generation.

This type of sengon plant is mostly planted by farmers on their land for the reasons, among others, seeds are easy to get, the price of seeds is not expensive, easy to care for, quick to grow the wood, easy to market and the selling price is quite high. Farmers usually start selling their sengon trees at the age of 4-6 years with a diameter of more than 20 cm, besides that there is no special treatment by farmers on their sengon plants, so the costs incurred by farmers are not so large. Although there are some trees that have died due to pests or diseases, it does not make forest farmers suffer big losses because of planting sengon. Sengon trees that are attacked by pests or diseases by farmers are cut down, then the wood is used as firewood, so that these pests or diseases do not spread quickly to other plants. Pests and diseases on sengon itself do not spread sporadically because farmers grow various types of plants, this is one of the causes of more controlled pests and diseases in sengon.

Farmers who plant African or manii species aim not only to take the wood, but also to use the leaves for animal feed. African seeds (manii) are easy to get. If there is an African tree that is mature, usually there are many seedlings under it, so farmers do not need to buy the seeds.

The type of community forest wood plant other than sengon which has high economic value planted by farmers in Parakan Muncang Village is damar according to respondents, besides the high selling price, farmers can also harvest from the resin. As we know, resin damar also has a fairly high economic value.

Dutch teak or Gmelina plants have also been planted by community forest farmers because this species grows fast, can be harvested in a short cycle, has good wood characteristics and also has high economic value. Gmelina can be harvested at the age of 7-10 years. It turns out that in addition to what was mentioned earlier, gmelina trees also have benefits as carbon sinks [10].

The potential for meranti and puspa species is also quite large, there are several respondents who plant these types on their land. Meranti and puspa produce high quality wood, the characteristics of the wood are close to prime. Meranti and puspa wood are types of wood that are suitable for use as furniture, building construction and paper making materials.

3.2.3. Management Pattern of Community Forest. Awang (2005) [11] expressed the opinion that the main purpose of community forest exploitation is to improve the welfare of farmers, besides that there are several benefits derived from community forest enterprises, including:

- Timber and other forest products
- Soil and water preservation
- Protection of agricultural crops
- Wildlife protection

According to Handoko et al. (2012) [12] there are several factors that influence the form of community forest management, namely the goals of local institutions, pressure on local institutions
and knowledge of farmers. Of the three factors mentioned above, the factor that most influences the pattern of community forest management in Parakan Muncang Village is the knowledge of farmers.

From the results of grouping respondents, data on the percentage of farmers who manage their land with a monoculture community forest system is 12.5%, while most farmers use an agroforestry community forest management pattern, as much as 87.5%. Of the two forest land owners who cultivate pure teak (monoculture), it is known that they are immigrants, not natives of Parakan Muncang Village. They invest by planting pure teak without a mixture of other plants.

A total of 14 respondent farmers in Parakan Muncang Village applied agroforestry community forest management patterns. According to Abdi (2010) [13], agroforestry management patterns are very commonly used by the community because this system is more promising, can produce a lot of food and also various kinds of management schemes. Their land is generally divided into rice fields, which are planted with rice and other seasonal crops, while the fields are planted with timber, fruit, herbaceous and secondary crops.

Community Forest Farmers in Parakan Muncang Village use an agroforestry pattern, by planting wood plants around their land (fence pattern), while their main priority is fruit and secondary crops. For them, wood plants are only a distraction, investment/saving, and also to limit their garden/land area. Farmers do not use certain regular cropping patterns, woody plants are planted at random distances.

The agroforestry pattern is applied by most forest farmers due to the conditions of forest farmers who have specific goals and motivations such as ecological, economic and social. The ecological goals to be achieved are more efficient use of natural resources, regulate water management, prevent erosion, and reduce critical land. The economic goals that can be obtained by community forest farmers in Parakan Muncang Village are the diversity of results obtained from their land and an increase in production volume which affects the welfare of farmers. The social goal to be achieved is to provide job opportunities, so as to reduce unemployment and also divert from illegal livelihoods such as illegal gold mining (PETI).

The use of agroforestry patterns is closely related to the limited land ownership which only ranges from 0 – 0.5 ha. With the pattern of agroforestry management, farmers can optimize the results of their land use in a sustainable manner, to ensure welfare and improve the standard of living of forest farmers. Forest farmers are of the opinion that the combination of woody plants, seasonal crops and fruit trees is very profitable, from the results of their wood crops they use it for long-term needs or urgent needs that are at any time, while meeting daily, weekly and monthly needs for living needs, children's schools it is obtained from non-timber crops (seasonal crops, secondary crops and fruit crops).

Community forest land management using a teak monoculture system applies a 3 m x 3 m spacing pattern, before planting there are land preparation activities such as making planting holes and fertilizing, seed preparation activities and embroidery. However, farmers who use a monoculture pattern do not carry out thinning activities. Therefore, the plants found at the time of the study generally grew tall with relatively long branch-free stems, but the diameter of the stems was small, and the growth was not good. Thinning activities need to be carried out during the pole and tree phase, while the method can be done by selective logging so that it does not only get the product in terms of quantitative, but also gets the product qualitatively.

According to Malamassam (2019) [14] thinning should be done to reduce the number of trees so that later it will increase the growth of stand diameter increments, improve tree health by leaving only healthy stands, reduce nutrient competition between stands, remove stands with abnormal growth so that in the future they will only focus on growth. only stands that are of good quality and healthy. Thinning is also very influential in providing intermediate financial returns from thinning results. It is hoped that in the future it will be able to create a balance between biological interests and economic interests in order to obtain maximum res.

Farmers who apply agroforestry management patterns carry out land preparation activities, fertilizing at the beginning of planting, making planting holes. As for the procurement of seeds, they
do it in stages due to limited capital/money. Agroforestry pattern farmers do not apply embroidery and thinning activities. There is no spacing arrangement. This is what causes the potential of the stand to be very small, because the free height of the branch is very low, even though the diameter of the stand is large. Stand conditions like this greatly affect the selling price. Community forest farmers in Parakan Muncang Village sell their timber plants in the form of trees/stands on the land, the buyers (entrepreneurs) cut the stands and process them. Collector traders or middlemen are market players who act as intermediaries between community forest farmers and the sawmill industry or other consumers. These middlemen usually buy timber from farmers at a price based on the estimated stand volume. The price is agreed between the farmer and the middleman so that a mutually agreed price is reached.

4. Conclusions and suggestions

4.1. Conclusions
1. The community forest management pattern applied by forest farmers in Parakan Muncang Village is a monoculture pattern of 12.5% and an agroforestry pattern of 87.5%.
2. The potential of community forest stands in Parakan Muncang Village is 32,478 m³/ha which the highest potential is Sengon wood by 51.95%, Teak by 16.16% and Puspa by 9.89%.

4.2. Suggestions
1. Established a forum for Forest Farmers Groups so that forest farmers can establish partnerships with relevant stakeholders to increase their level of economic income.
2. Increased understanding of farmers by conducting training activities so that farmers can improve their land management more intensively so that farmers can increase the potential of their land.
3. Increasing the understanding of community forest farmers on the importance of having a license to use community timber plantations.

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