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Settings of Teak Community Forest of *Tectona grandis* L.F Results in the Delay Cutting System as Environmental Sustainability Development in South Konawe Regency, Indonesia

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ABSTRACT

The community forest was previously managed simply by cutting down the system needed to meet the needs of community life. The results obtained by the community with the system are less than optimal and not sustainable. This study aims to analyze the size of the Teak (Tectona grandis L.F) community forest cutting allowance in the settings of harvesting delayed forest products in the Mepokoaso Farmer Group in South Konawe Regency. This research was conducted in community forests in Watudemba Village (Palangga District) and Ulu Lakara Village (South Palangga District), South Konawe Regency from June to August 2018. The object of research is divided into two, namely farmers and teak community forests. Data is collected by census for the first object of 8 (eight) farmers and for the second object using a random sampling method to place 17 plots. Analysis of cut data uses a method based on area and increment. Findings revealed that Palangga and South Palangga sub-districts in South Konawe Regency have the same type of soil and different types of soil. The Palangga Subdistrict has Gleisol soil type with an area of 1.396.3 ha or 7.9%, Mediteran area of 4.117.1 ha or 23.2% and Pedsolik area of 12.266.6 ha or 69%. While South Palangga Subdistrict has Kambisol soil type with an area of 2.578.72 ha or 20.1%, Litosol with an area of 3.547.28 ha or 27.7%, Mediteran with an area of 1.678.37 ha or 13.1% and Pedsolik with an area of 5.000.62 ha or 39.1%. Regulation of teak community forest products in the delayed cutting system is based on the area having a yield of 0.66 ha.year-1 (117.44 $m^3.year^{-1}$) and the method based on volume-increment using the Von Mantel approach has a harvest yield of 234.88 $m^3.year^{-1}$. Whereas based on the Austrian approach it has a harvest yield of 134.85 $m^3.year^{-1}$.

KEY WORDS: ***cutting quota, delayed cutting system, setting of forest products, teak community forest, type of soil***

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INTRODUCTION

The many benefits obtained from the development of community forests, make many areas in Indonesia, especially Watudemba Village, Palangga District and Ulu Lakara Village, South Palangga District, South Konawe Regency which develop teak community forests (*Tectona grandis* L.F). The community forest was previously managed simply by cutting down the system needed to meet the needs of community life. The results obtained by the community with the system are less than optimal and not sustainable. Anticipating the problem, in 2016 the people who are members of the Mepokoaso Forest Farmers Group (FFG), participated in the delayed cutting system program which was considered as a solution to overcome the need for cutting system. According to Eldeeb et al. [1], the succession of forest management systems in the world and especially in Indonesia shows the uncontrolled destruction of forests. It was triggered by the existence of a forest management paradigm in timber extraction [2]. Although this paradigm later turned into timber management which was a little more advanced at the level of the concept, but the practice is not much different from the era of timber mining which still continues to this day. The application of conventional forest management systems has failed due to human concern which is only oriented to economic benefits alone, without regard to aspects of ecosystem balance. It was then made worse by increasing population. The logical consequence of the increase in population is the increasing need for food, fuel wood, wood for tools and carpentry, livestock forage food and a decrease in the ratio of agricultural land ownership [3].

The increasing social and economic problems that lead to forest destruction, a new forest management paradigm is needed [4]. Thus, through the 8th World Forestry Congress in Jakarta in the theme of forest for people, the paradigm of timber management changed to a more holistic and comprehensive social forestry addressing the problems of community welfare and environmental sustainability [5]. One implementation of the social forestry paradigm is the development of community forests.

The development of community forests has many benefits, both from the economic and ecological aspects [6]. The economic benefits of community forests can help meet the demand for wood, increase community income and be able to provide employment, while the ecological benefits of increasing the productivity of critical land, able to play a positive role in controlling erosion, improving soil fertility, regulating water systems, providing oxygen, and carbon sink.

Cutting delayed system is a scheme to not cut or delay the felling of trees in order to reach the age of harvesting in order to obtain optimal economic and ecological value of the tree [7]. In order to achieve the fulfillment of economic and ecological benefits in accordance with the objectives of the delayed felling program loan from the Public Service Agency for the Center for Forest Development Financing, forest product regulation is needed. Thus, based on the description, this study aims to analyze the regulation of teak community forest products in the delayed logging system.

MATERIAL AND METDOS

Research location and time

This research was carried out in a community forest in the delayed cutting system in Watudemba Village, Palangga District and Ulu Lakara Village, South Palangga District, South Konawe Regency. The research was conducted from June to August 2018. The topography of Watudemba Village is at an altitude of 136 m above sea level, while Ulu Lakara Village is at an altitude of 23 m above sea level. The location of Watudemba Village is in the forest, most of which are outside the forest area. However, a small portion is included in the forest area. Meanwhile, Ulu Lakara Village has a large portion of the forest outside the forest area, but a small part is inside the protected forest.

Population and sample

The community, namely the community forest farmer group with a delayed felling system in Watudemba Village, Palangga District and Ulu Lakara Village, South Palangga District, totaling 8 people. The selection of respondents uses a census approach, meaning that the use of the entire population without having to draw research samples as units of observation. If the subject is less than 100 peoples should all be taken, if the subject is large or more than 100 peoples can be taken 10-15% or 20-25%. Population (teak stands), namely: all teak stands included in the delayed felling program in Watudemba village, Palangga sub-district and Ulu Lakara village, South Palangga sub-district with an area of 13.2 ha. While the area of tree samples in this study was determined with an intensity of 5% of the population that is 0.66 ha. Where, the area of one plot is 0.04 ha, so the number of plots taken is 17 units. Placement of plots is done by using random sampling without replacement ie members of the population who have been selected do not have the opportunity to be re-elected as samples.

Research variable

The variable observed in this study was tree growth include: diameter (cm), tree height (m), volume (m^3), increment volume (m^3), cutting rotation, and land area.

Data analysis

Analysis of the data used in this study to determine the regulation of harvest results using the

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analysis of methods based on area and method based on volume-increment [8].

1) The Method based on area

$$Ht = \frac{A}{R} \quad \text{..... (1)}$$

Where:
Ht = yield of felling (ha.y^{-1})
A = Area of forest area (ha)
R = Rotation length (20 years)

2) The method based on volume-incremen

The approach to regulating harvest yields used in this method is:

a. Von Matel's Approach

$$Ht = \frac{2 .AG}{R} \quad \text{..... (2)}$$

Where:
Ht = yield of felling (m^3.y^{-1})
AG = Actual stand reservoir (m^3)
R

b. Austria Approach

$$Ht = Ia - \frac{Vn-Va}{R} \quad \text{..... (3)}$$

This formula is used when the contents of the stand are <normal

$$Ht = Ia + \frac{Va-Vn}{R} \quad \text{..... (4)}$$

This formula is used when the contents of the stand are > normal
Where:
Ht= yield of felling (m^3.y^{-1})
Ia = Actual average volume increment (m^3)
Vn = normal stand volume (m^3)
Va = volume of stands in the field (m^3)
R = Rotation/cycle (20 years)

RESULTS

Communities that develop

The community forests in Watudemba Village, Palangga Subdistrict and Ulu Lakara Village, South Palangga Subdistrict are included in the Mepokoaso FFG with a postponed cutting system, based on interviews that the community members of the community forest farmer groups have received loan funds from the government through the Center of Public Service Agency and Forest Development Financing by making teak stands as collateral for manager loans. The delay period for the felling system that has been set is 8 years which is obtained based on the cutting cycle which is 20 years, where when the loan agreement is reached, the teak age has reached 12 years.

Arrangement of yields of teak (Tectona grandis L.f) community forest rationing by area

The use of area-based methods in determining ration yields first calculates the area of logged plots with the same area. The area of felling is based on the area of teak community forest in the delayed logging system of 0.66 ha/year with a total of 20 cutting plots.

Arrangement of teak forest ration result (tectona grandis l.f) based on volume and riap

The arrangement of harvest yields based on volume and increment in this study uses the Von Mantel and Austrian approaches.

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Table 1. Results of teak (*Tectona grandis* L.F) community forest felling based on volume and increment

No.	Based on Volume and Riap	
	Approach	Cutting Ration Results ($m^3.y^{-1}$)
1	Von Montel	234.88
2	Austria	138.85

Source: Processed from Primary Data, 2018

DISCUSSION

Result showed that's during of the period manager is required to return the principal amount on an annual basis plus an interest rate of 6% per year. If the loan cannot be returned annually or until the time limit specified, repayments are made in the 8th (eighth) year as a whole. This was done because at the end of the teak community forest cycle can be harvested. The yield settings method is the most important thing to do in community forests in determining the felling volume (ration) so that the number of fells is equal to the total increment of all stands without reducing forest potential. The arrangement of harvesting ration results in this study uses a method based on area and based on volume and increment.

The harvested quota was obtained from the area of teak community forest area divided by a cycle of 20 years. Based on the calculation of 0.66 ha, based on the calculation result, the stand volume was 117.44 m^3. The important thing to know in carrying out logging based on area is to pay attention to fertility that is relatively the same. The method of regulating harvest yields based on area can be effective if the logging system is used with the assumption that fertility is relatively the same that is above normal teak growth. Based on the conditions in the field, the growth of teak stands is relatively similar to fertile. This can be seen from the actual volume at the predicted age of 20 years obtained by 177.94 $m^3.ha^{-1}$. Meanwhile, based on the normal stand table at the age of 20 years with bonita IV a volume of 110.5 $m^3.ha^{-1}$ was obtained.

Determination of cutting quota according to Von Mantel, begins with the determination of the actual standing reservoir or volume in the field. The actual volume in this study was 177.94 $m^3.ha^{-1}$. As for the total area of 13.2 ha, the actual volume is 2348.78 m^3. When using the Von Mantel formula an annual harvest ration of 234.88 $m^3.year^{-1}$ is obtained (Table 1.) Determination of the cutting allowance according to the Austrian method is done by determining the normal standing volume earlier. The normal standing volume for teak stands in this study refers to the Wolf Von Wulffing normal teak stand table. Based on the table by using a 20-year rotation prediction, where at the time of data collection in the field the age of the teak stands around 14 years, so the prediction for the average height up to that age should be added to the average height growth for 6 years. Thus, an average height of 20 years is obtained at 23 meters. From the age of 20 years and 23 meters high, Bonita IV was obtained. By paying attention to bonita IV at the age of 20 years and the volume of tree wood (Vbm) a normal standing volume of 110.5 $m3.ha^{-1}$ is obtained. Next thing to know is the average actual volume increment (MAI). The average increase in actual volume per year is the volume in the field at the time of data collection divided by the age of 14 years, so that a gain of 6.84 $m^3.year^{-1}$ is obtained. By using the Austrian formula, a harvest quota of 134.85 $m^3.year^{-1}$ was obtained (Table 1).

The larger ration calculation for the two approaches is the Von Mantel approach. In calculating the results of felling rations, the Von Mantel approach uses only stand volume in the field without considering increment. In contrast to the Austrian approach in calculating the yield of harvest considerations increment. In addition, the drawings from the Von Mantel approach have drawbacks. Use of the Von Mantel approach illustrates the similarity between total volume and increment, whereas the growth of stand volume should be sigmoid (like the letter S).

The lower the yield of felling, the better it is to be used, compared to the yield of larger felling. However, the results of logging rations that have a large value can be used, but taking into account field conditions. Based on the conditions in the field that the growth of teak stands when viewed from the increase in diameter and volume can be said to be good. The quality of growing sites is an indication of the ability of a land to reproduce. This means that the better the quality of the place to grow, it will enable the ability to produce a better growth of stands.

One of the natural environmental factors which is certain to influence the growth and yield of teak plants is the soil factor. Palangga and South Palangga sub-districts in South Konawe Regency have the same type of soil and different types of soil. South Palangga Subdistrict has Gleisol soil type with an area of 1.396.3 ha or 7.9%, Mediteran area of 4.117.1 ha or 23.2% and Pedsolik area of 12.266.6 ha or 69%. While South Palangga Subdistrict has Kambisol soil type with an area of 2.578.72 ha or 20.1%, Litosol with an area of 3.547.28 ha or 27.7%, Mediteran with an area of 1.678.37 ha or 13.1% and Pedsolik with an area of 5.000.62 ha or 39.1%.

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The type of soil at the research location is suitable for teak growing sites with calcareous or Mediterranean soil types. In line with the results of research by Widiatmala et al. [9], that in Indonesia, teak plants in calcareous soils with a slightly acidic to neutral pH have good growth ability. Teak stands can grow and produce well in a variety of conditions, but high productivity can only be achieved in locations with good soil and environmental conditions. The best growth in teak plants is also supported by climatic conditions in the study area. Watudemba and Ulu Lakara villages are generally tropical with a maximum temperature of 32^0C and a minimum of 23^0C. Average air pressure of 1,010.4 billion with average humidity of 82 percent. Wind speed generally runs normally at around 3 $m.s^{-1}$. The highest rainfall and rainy days in Palangga and South Palangga Sub-districts, Konawe Selatan District in the 2008-2017 period were highest in May with rainfall of 278.05 mm and rainy days occurred for 18 days. While the lowest amount of rainfall occurred in August with rainfall of 59.36 mm and rainy days occurred for 9 days.

The climatic conditions such as rainfall and rainy days, solar radiation, humidity and other climatic elements put good pressure on the conditions of the study area, thus providing good carrying capacity on the growth of teak plants in his research that climate is one of the most important factors for determining plant growth, climate elements such as air temperature, solar radiation, and humidity support and play an important role in plant production. The best growth in plants is also supported by climatic conditions in the area. Climatic conditions such as rainfall and rainy days, solar radiation, humidity and other climatic elements put good pressure on the conditions of the study area, thus providing a good carrying capacity on the growth of teak plants. According to research Karyatin et al. [10], that's climate is one of the most important factors for determining plant growth, climate elements such as air temperature, solar radiation, and humidity support and play an important role in plant production.

CONCLUSIONS AND RECOMMENDATION

Findings in this research showed that the regulation of teak community forest products in the delayed cutting system is based on the area having a yield of 0.66 $ha.year^{-1}$ (117.44 $m^3.\ year^{-1}$) and the method based on volume-increment using the Von Mantel approach has a harvest yield of 234.88 $m^3.year^{-1}$. Whereas based on the Austrian approach it has a harvest yield of 134.85 $m^3.year^{-1}$.

This research discover that's the best growth in plants is also supported by climatic conditions in the area. Climatic conditions such as rainfall and rainy days, solar radiation, humidity and other climatic elements put good pressure on the conditions of the study area, thus providing a good carrying capacity on the growth of teak plants. This study will help the researcher to understanding the aims to analyze the size of the Teak (*Tectona grandis* L.f) community forest cutting allowance in the settings of harvesting delayed forest products. Thus, a new theory that's the the quality of growing sites is an indication of the ability of a land to reproduce.

Conflict of interest

All authors declare that there is no conflict of interest in this paper.

REFERENCES

1. *Eldeeb O, Proschazka P, Maitah M (2015) Causes for deforestation in Indonesia: corruption and palm tree plantation. Asian Social Science. 11(27):120-214, DOI: 10.5539/ass.v11n27p120.*
2. *Handayani IGAKR, Sulistiyono, Leonard AT, Gunardi A, Najicha FU (2018) Environmental management strategy in mining activities in forest area accordance with the based justice in Indonesia. Journal of Legal, Ethical and Regulatory. 21(2):2-8.*
3. *Corona P, Cutini A, Chiavetta U, Paoletti E (2016) Forest-Food Nexus: a Topical opportunity for Human Well-Being and Silviculture. Annals of Silvicultural Research. 40(1):1-10.*
4. *FAO (2012) Forest Management and Climate Change: a Literature Review. Food and Agriculture Organization of the United Nations. Rome. http://www.fao.org/3/md012e/md012e00.pdf. Accesed 5 October 2020.*
5. *Fisher MR, Dhiaulhaq A, Sahidem MAK (2019) The politics, economies, and ecologies of Indonesia's third generation of social forestry: An introduction to the special section. Forest and Society. 3(1):152-170. DOI: 10.24259/fs.v3i1.6348.*
6. *Bowler D, Buyung LA, Healey JR, Jones JPG, Knight T, Pullin AS (2019) Theevidence base for community forest management as a mechanism for supplying global environmentalbenefits and improving local welfare, CEE review 08-011 (SR48). Environmental Evidence, August 20, 2019, downloaded from: www. Environmentalevidence.org/SR48.html.*
7. *Hiesl P, Crandall MS, Weiskittel AR, Benjamin JG (2016) Evaluating the long-term influence of alternative commercial thinning regimes and harvesting systems on projected net present value of precommercially thinned spruce-fir stands in northern Maine. Canadian Journal of Forest Research. 47(2):203-214, DOI: 10.1139/cjfr-2016-0228.*
8. *Bettinger P, Boston K, Siry JP, Grebner DL (2009) Forest Management and Planning. Academic Press. California.*
9. *Widiatmaka A, Mediranto, Widjaja H (2015) Characteristics, Soil Classification, and teak plantations growth (Tectona grandis Linn f.) "Unggul Nusantara" varieties in Ciampea, Bogor Regency. Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan. 5(1):87-90.*

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10. *Karyatin S, Ardianto, Syafrudin M (2016) The fluctuation of micro climate in education forest Forestry Faculty Mulawarman University. Jurnal Agrifor. 15(1):83-92.*