Tree Composition On Light Intensity In Agroforestry Systems In People's Forests

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Abstract.

Developing an agroforestry system with conventional community forest plants has several obstacles, such as altitude, temperature, humidity, availability of nutrients, and light intensity, causing forest plants not to grow optimally. Agroforestry is one way to overcome problems on land, one of which needs more light intensity for the growth of forest plants. This research aims to determine optimal sunlight for developing forest plants using an agroforestry system. This research was carried out in the community forest area of Magetan Regency. The survey method used in community forest areas was by taking samples of 6 stand structure compositions and 6 plots in six villages. The parameters observed included the number of branches, crown diameter, plant type, height, and light intensity. Light intensity is measured using a lux meter placed under the canopy. The research results showed that the tree composition Albizzia+Mahagoni+Tectona+Mangifera let of light at 12.01, while the lowest was the tree with the composition Mahagoni+Tectona+ Tamarindus sp+ Gmelina sp.

Keywords: *Community forest, light intensity, agroforestry and community forest.*

I. INTRODUCTION

The government is currently trying to meet the food needs of its people so that they remain prosperous and have adequate food availability. Limited agricultural land and the increasing need for farm products are also diverse, but the capacity of agricultural land is limited; hence, it is necessary to look for alternative places to improve the situation, and one of them is forests [1]. Water efforts are needed to develop an agroforestry system [2]. An agroforestry system is characterized by tree components and annual plants in the same space and time. The tree-growing space is divided into two parts: the space above and below the ground. The arrangement of space above the ground is intended so that the canopy develops optimally and aims to reduce competition for the intensity of sunlight [3].

The arrangement of space below the ground is intended so that the roots develop optimally, reducing competition for nutrients and water and providing space for the roots to spread in the soil [4]. At the same time, agroforestry plants also have obstacles, namely the lack of light intensity, which causes plants not to grow optimally. Planting with an agroforestry system means light intensity is an essential factor in the plant growth process. Light plays a vital role in the photosynthesis process in plants [5]. Widening the canopy distance can meet the need for light intensity if the source of light intensity is the sun. Forest plants can grow optimally if the light intensity and quality required by the plants are sufficient. Adjusting the composition of the trees can also meet the intensity and color quality of light required by the plants. This research aims to determine the optimal intensity of sunlight on the growth of forest plants using an agroforestry system.

II. METHODS

This research was carried out in the community forest area of Magetan Regency. The study was conducted in the rainy season from December to March 2022.

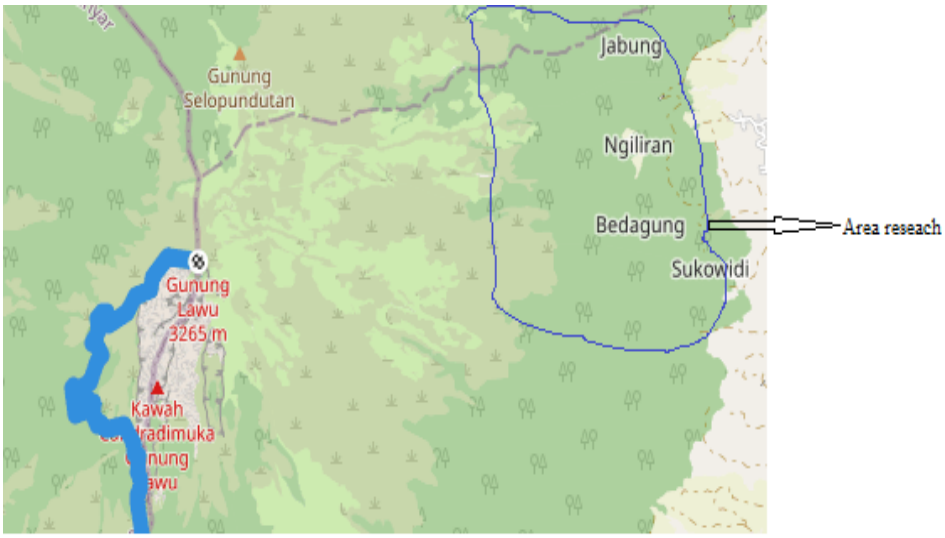

Fig 1. Research area

The survey method used determined the community forest area in one Panekan sub-district, then determined six 20 X 20 m plots, calculated the height and types of trees in the plots, and measured the light intensity. Sun. Tree dimensions (height, diameter, and crown) were measured on each sample plot. Tree height was measured using a tool such as a Haga hypsometer; tree diameter was measured using a measuring tape, and tree crowns were measured using a compass and measuring tape. Measuring light intensity, temperature, and humidity use a tool for measuring sunlight intensity, namely a lux meter. The part of the lux meter that is sensitive to light is directed at the reflection of the incident light; the intensity can be seen on the scale. The Lux meter works with a light sensor.

The Lux meter is enough to be held at a height of 75 cm above the forest floor. The display screen will display the lighting level at the measurement point. Temperature and humidity measurements are carried out using a thermohygrometer. The parameters observed included the number of branches, tree height, tree type, and intensity under the canopy, which were measured seven times a day at 9 am, 9.45, 10.45, in the afternoon at 12.01, 13.15, 14.01, and in the evening at 15.01.The data was processed using SPSS and supported by literature data, which were then analyzed using descriptive analysis.This is done to determine which types of agricultural plants are suitable and can grow optimally with different structures.

III. RESULTS AND DISCUSSIONS

The level of light intensity during the research, from morning to evening, changed because the source of sunlight experienced rotation, thus determining changes in the intensity of sunlight. In the morning measurement at 9 am, it reached 3490 lux; in the afternoon measurement at 12 pm, it reached 7870 lux; and in the afternoon measurement at 3 pm, it reached 4320 lux. Based on light intensity measurements using a lux meter, the highest light intensity was obtained at noon. This measurement is precise when the intensity is high, so the light produced is higher than at 9 am or 3 pm.

When measuring light intensity under a canopy with compound leaves, the light intensity level is highest during daytime measurements, whereas in this measurement, the sun's intensity is directly above the canopy, resulting in a higher light intensity compared to measurements at 9 am or 3 pm. The temperature and humidity in the darkroom in the morning reach 19.8 - 25.4°C with RH 47 - 49%. During the day, the temperature reaches 28.6 - 30.5°C with RH 37-41%; in the afternoon, the temperature reaches 27.5 - 28 .8°C with RH34 - 39%. Based on the results of the variance test, the level of light intensity has a very significant effect on the number of leaves and canopy diameter. The higher the light intensity level, the more optimal plant growth will be, thus providing the best results on the variables of crown diameter and number of leaves [6].

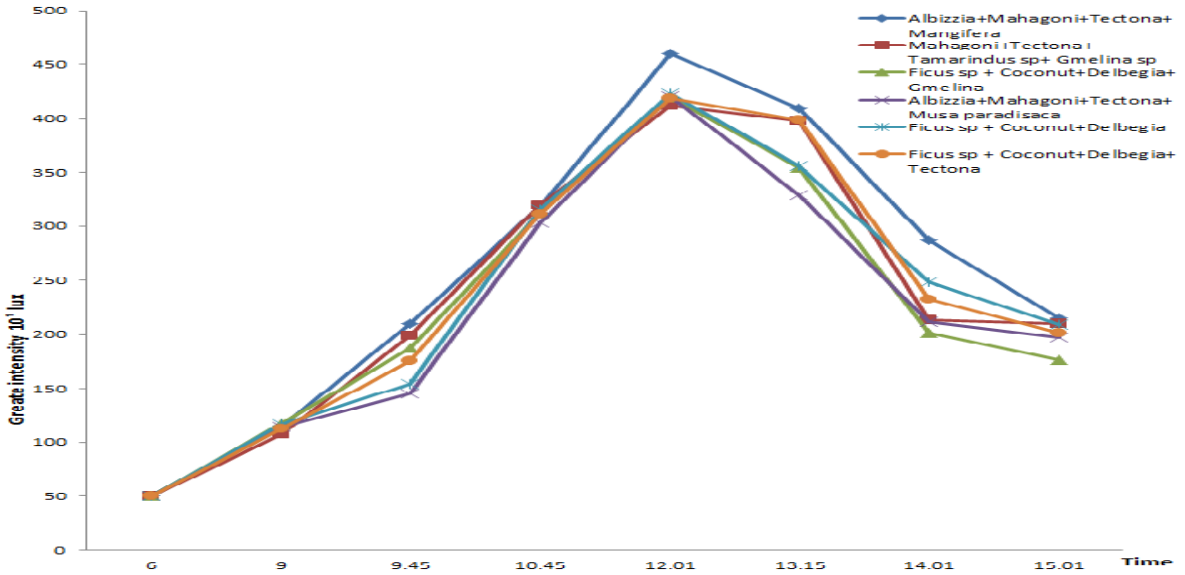

Fig 2. Light Intensity 10^1 lux

From the research results in Figure 2, the light intensity measurements in forest tree stands show that the highest light intensity was at 12.01 WIB for Albizzia+Mahagoni+Tectona+Mangifera . In contrast, the lowest intensity was for the structure Mahagoni+Tectona+ Tamarindus sp+ Gmelina sp . This difference occurs due to cloud cover and different measurement times. According to [7], the reception of solar radiation on the earth's surface varies significantly according to place and time. According to location, this is mainly due to differences in latitude and atmospheric conditions, especially clouds. On a micro-scale, the direction of the slope dramatically determines the amount of radiation received. Time differences in radiation occur within a day (from morning to evening) and seasonally. Low light intensity due to too dense shade for types that require light (intolerant) will cause etiolation. Meanwhile, excessive light intensity will disrupt growth and even death for tolerant plants [8].

The agroforestry pattern involves various types of plants as components, whether in the form of trees, shrubs, lianas, or annual plants. In selecting the types of plants to be developed, it is necessary to adapt them to local ecological conditions, such as climate or rainfall, topography, altitude, and land (marginal or fertile) [9]. Types of trees suitable as components in an agroforestry system are in the form of trees that can be used for various purposes and have multiple benefits or multipurpose trees and shrub species [10]. Trees planted in agroforestry systems produce wood, fruit, and leaves that can be used as human food or animal feed. The types of trees that will be selected as components in an agroforestry system must be able to provide benefits. These benefits include providing results that can be used by local residents, having a good effect on hydrological processes, and improving and increasing land productivity.

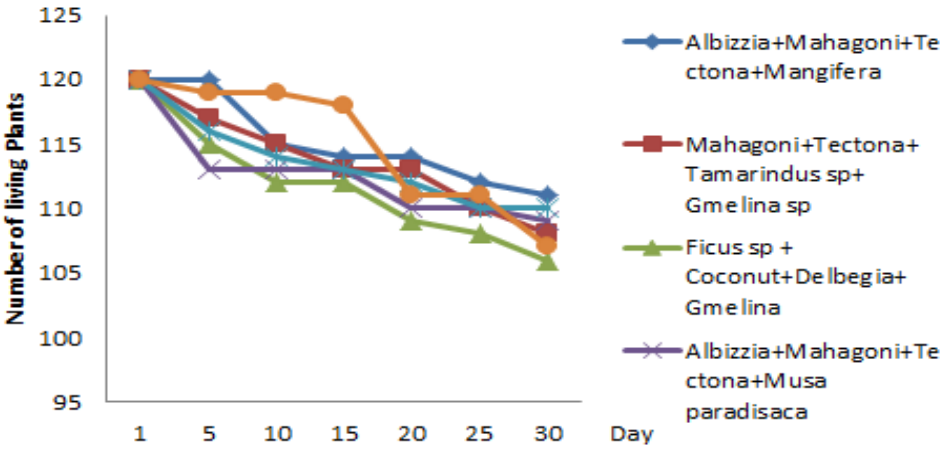

Fig 3. Average Plant Life in Various Canopy Compositions

The results of the research carried out can be seen in Figure 3, which shows that the Albizzia+Mahagoni+Tectona+Mangifera canopy structure provided the highest number of plants up to 30

days of measurement with 111 types of understory plants, while the lowest plant structure was Ficus sp + Coconut+Delbegia+ Gmelina with 106 kinds of plants. Lower. This is based on research conducted [11] humidity and air temperature are microclimate components that greatly influence plant growth, and each is related to creating optimal environmental conditions for plants. The structure of the plant provides enough light to ensure that many of the lower bodies can survive. Our research provides practical recommendations for selecting annual plants suitable for planting under tree compositions with varying degrees of light intensity. These recommendations apply to both high and low light conditions, as light is the primary requirement for the survival of understory plants. We suggest several types of agricultural plants that can be effectively grown using an intercropping system under forest trees: .

Lemongrass

Citronella has the following growing conditions: it lives at an altitude of 200 – 1,000 m above sea level with an ideal height of 350 – 600 m above sea level. At this altitude, citronella produces a good yield and high-quality aluminum. The optimum growing temperature is 18° – 25° C, which requires rainfall of around 1,800 – 2,500 mm/year and even distribution of rain throughout the ten months. Rainfall is a solvent for nutrients, forming starch and sugar and helping form cells and enzymes. Citronella is suitable for growing in soil that is fertile and loose. It contains a lot of organic material, with an optimum soil pH of 6.0 – 7.5, ideal for growing in various soil contours (flat, sloping, or hilly). Still, yellow-brown Mediterranean soil or sandy chocolate is very suitable as a medium for growing lemongrass.

Porang

The Latin name Amorphophallus muelleri, porang is a type of herbal plant that can grow up to 1.5 meters high. It grows around tropical forests and can only grow under supporting trees. Porang can survive on any soil 0 to 700 meters above sea level. It has significant advantages, and of course, porang has many benefits. Porang contains carbohydrates, fat, mineral protein, vitamins, dietary fiber, calcium oxalate crystals, and alkaloids. Porang is widely used as a raw material for flour, water purifiers, cosmetics, glue, and jelly. 1. The Porang plant is rich in fiber. Because it contains a lot of glucomannan, porang can be an alternative flour ingredient. This ingredient is essential for the food industry because of its natural fiber content. It can be used as a substitute for jelly, speeding up the feeling of fullness and slowing down stomach emptying. The glucomannan content works to reduce calorie intake in the body. 2. Porang Plant Can Control Blood Sugar. The glucomannan content in porang can help control blood sugar levels in people living with diabetes. The glucomannan content will suppress the production of the hormone ghrelin (a hormone that triggers hunger) so that appetite is controlled and carbohydrate absorption is slowed down.3. Can Reduce Cholesterol Glucomannan will increase the amount of cholesterol excreted in the feces. So, the amount of cholesterol in the blood will be much less

Ganyong

Tubers Canna cultivation is relatively easy because it does not require too tricky environmental conditions. However, to get high yields, you must consider good cultivation techniques to provide a suitable environment for canna growth. The environmental requirements for growing canna are at an altitude of 0 - 2000 m above sea level; light intensity is medium-high, the number of rainy months is 6 - 9 months, with fertile soil and contains lots of humus [12]. This plant cannot withstand areas with strong winds because this plant has fragile stems and is not strong enough to withstand wind attacks. Ganyong grows very well in tropical areas, but this plant can also survive in icy areas even though the process of forming mature tubers is quite long This plant is often cultivated in yards/yards, both in open and shaded areas, so this plant is suitable for planting under stands . .

Garut

Tubers arrowroot plants (*Maranta arundinacea* L) can grow optimally under tree cover with minimum sunlight levels, so this plant has the potential to be cultivated in community forests, home gardens, and green areas. This plant can grow on soil with poor fertility, although it must be fertilized for best production. This plant does not require special care and has few pests and diseases. This plant does not have to receive direct sunlight because the plant tolerates 30-70% shade Arrowroot starch can be used as an alternative to replace or substitute wheat flour as a raw material for making cakes, noodles, dry bread, baby porridge, and diet food as a substitute for rice, as well as being used in the chemical, cosmetic, fertilizer, liquid sugar and pharmaceutical industries. Arrowroot plants are unsuitable for planting in often flooded soil because the roots will lack oxygen and become poisoned, causing them to wilt and rot. The type of soil suitable for forming tubers has a crumbly structure, with a clay, dust, and sand content of 1:1:1 and a soil acidity (pH) of 5-8. Soil derived from limestone parent material or sandstone sediment with a pH of 5-8 is very suitable for the growth of arrowroot tubers .

IV. CONCLUSION

The amount of light intensity transmitted to the land's surface on different types of tree structures will influence the number of understory plants that can survive. The Albizzia+Mahagoni+Tectona+Mangifera tree structure provides a light intensity until 15.01, high enough for plants under the stand so that 111 plants can survive, while the light intensity with the tree structure Ficus sp + Coconut+Delbegia+Gmelina provides a light intensity low enough for plants under a stand that can survive as many as 106 plants.

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