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THE ROLE OF SENGON FORESTS IN CLIMATE-BASED AGROFESTRY IN BLITAR

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Abstract :
The condition of the land, as the main capital for farmers in their efforts to produce food, is greatly influenced by climate factors, namely rainfall, temperature, and humidity, which can be beneficial or detrimental. The purpose of this study was to determine the daily pattern of soil temperature and humidity at different depths under sengon-peanut stands. The importance of soil temperature and humidity data is that they can be used as input for agroforestry management. The study used a survey method, a specific location, and a specific time. This study was conducted in the KPH Blitar Forest, East Java. The study was conducted for three (3) months, starting from November 2022 to January 2023. The average soil humidity was 78.39% at a depth of 10 cm, 78.76% at a depth of 15 cm, 78.77% at a depth of 20 cm, and 79.28% at a depth of 25 cm. The average soil temperature at 25 cm is 28.89°C, at 10 cm it is 29.04°C, at 20 cm it is 28.94°C, and at 15 cm it is 29.01°C. Conversely, the deeper the soil, the higher the soil moisture tends to be.

Keywords : *Production, Agroforestry, Farmers, Depth, Temperature*

INTRODUCTION

Sunlight is the main component of photosynthesis and energy formation, as well as for plant growth and development (Frisilia et al., 2021). The physiological state of plants is strongly influenced by factors such as soil conditions and micrometeorological conditions. (Beuschel et al., 2020) stated that at the beginning of their growth, plants are more influenced by the microclimate, and gradually the meso and macroclimates will influence subsequent plant growth. Several climatic elements that can affect plant growth are rainfall, temperature, humidity, wind, sunlight, and evapotranspiration. Fluctuations in air and soil temperatures are closely related to the energy exchange processes in the atmosphere, so optimizing the soil-water-root system needs improvement (Guo et al., 2021). The temperature distribution in the soil depends on several factors, including thermal conductivity, heat capacity, and soil color (Bucheli et al., 2017)

The condition of the land as the main capital for farmers in the effort to produce food is greatly influenced by climatic elements, namely rain, temperature, and humidity, where these influences are often beneficial but sometimes also detrimental. Agroforestry is one form of land use that combines trees, shrubs, and annual crops in one area of land. The application of this combination of several plant types makes the function and role of agroforestry

closer to those of forestry than to agriculture, plantations, vacant land, or abandoned land. Various types of legume plants, including vegetables, annual plants, plantation crops, and forestry plants, can grow well on critical lands and are recommended as alternative crops in agroforestry systems (Mila et al., 2024). These types of plants can adapt to climatic conditions with rainfall ranging from 600-2500 mm year-1, air temperature ranging from 18-35°C, and air humidity ranging from 50-85% (Assholihat et al., 2019). Several studies on soil temperature and moisture across different land-use types have been reported. However, research on soil temperature and moisture at different depths in agroforestry applications is still rarely reported. The purpose of this study was to determine the daily pattern of soil temperature and moisture at different depths under sengon-peanut stands. The importance of soil temperature and moisture data is that they can be used as input for agroforestry management.

RESEARCH METHOD

The research uses a survey method, a specific location, and a specific time. This research was conducted in the Forest of KPH Blitar, East Java. The research was conducted for three (3) months, starting from November 2022 to January 2023. Tools and Materials Some of the tools and materials used in this research include: 1. Meter, 2. Plastic rope, 3. Environment meter 4. Sickle and hoe. 5. Soil drill. 6. Stationery 7. Plastic bags 8. Raincoat. Five plots each measuring 10 m × 10 m are located on a fairly flat land class. Sengon and peanut plants are about 3 years old. Measurements of soil temperature and humidity at several depths were conducted for 20 days. Measurements were carried out in the morning (07.00-08.00 WIB), afternoon (12.00-13.00 WIB), and evening (15.00-17.00 WIB)

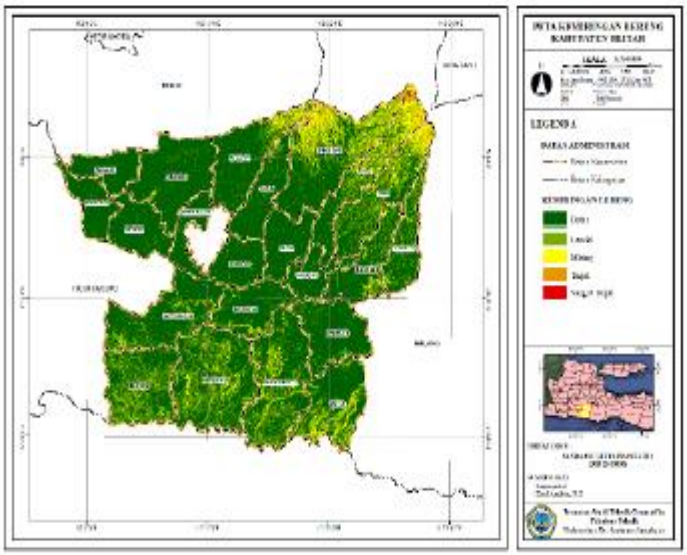

Figure 1. Research allocation map

FINDINGS AND DISCUSSION

The measurement results obtained under sengon stands show an average soil temperature of around 29.04ºC at a depth of 10 cm, 29.01ºC at 15 cm, 28.94ºC at 20 cm, and 28.89ºC at 25 cm. The results of daily soil temperature measurements under sengon-peanut stands at different soil depths (10 cm, 15 cm, 20 cm, and 25 cm) are presented in Table 1.

Table 1. Daily soil temperature under sengon-peanut stands at different soil depths

Soil Temperature (ºC)				
	Sengon - peanuts			
02/11/2023	10(cm)	15(cm)	20(cm)	25(cm)
07/11/2023	29,1	29,0	28,9	28,8
12/11/2023	29,0	29,0	28,9	28,9
17/11/2023	29,2	29,0	29,0	28,9
23/11/2023	28,9	29,1	28,9	28,8
28/11/2023	29,1	29,0	29,0	28,9
03/12/2023	28,9	29,1	29,0	28,9
08/12/2023	29,1	28,9	28,9	29,0
13/12/2023	29,1	29,0	29,1	28,9
18/12/2023	29,1	29,0	28,9	28,9
23/12/2023	29,0	29,1	28,9	29,0
28/12/2023	29,0	29,0	28,9	28,9
02/01/2024	29,1	29,0	28,9	28,9
02/01/2024	29,1	29,0	29,0	28,9
07/01/2024	28,9	28,9	28,9	28,9
12/01/2024	28,9	29,0	28,9	28,9
17/01/2024	29,0	29,0	28,9	28,8
22/01/2024	29,0	29,1	28,9	28,9
27/01/2024	29,1	29,0	29,0	28,9
30/01/2024	29,1	29,1	28,9	28,8
Average	29,04	29,01	28,94	28,89

The results show that the deeper the soil, the lower the average soil temperature in the sengon-peanut plot. This indicates that soil temperature fluctuations depend on soil depth. The deeper the soil layer, the smaller the temperature fluctuations up to the attenuation depth (Cherubin, et al, 2019). The average soil temperature at a depth of 25 cm in the sengon forest was the lowest at 28.89°C, while at a depth of 10 cm in the sengon forest it was the highest at 29.04°C.

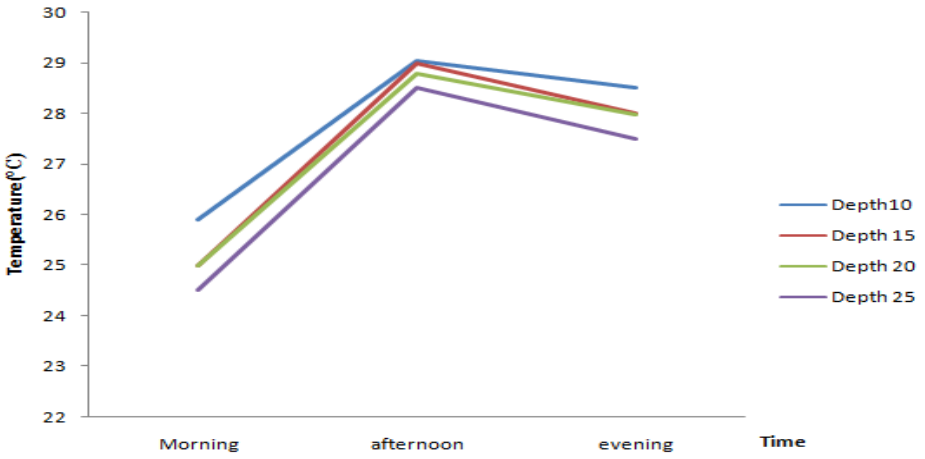

Figure 2 : . Daily soil temperature under sengon-peanut stands at different soil depths

Soil moisture at different depths by measurement date. Soil moisture measurements were conducted in the morning and afternoon at four depths (10 cm, 15 cm, 20 cm, and 25 cm) in the sengon forest. The average soil moisture in the sengon forest was 78.39% at 10 cm, 78.76% at 15 cm, 78.7% at 20 cm, and 79.28% at 25 cm. The results showed that the average daily soil moisture in the sengon-peanut plot was greater the deeper the soil moisture. This is in accordance with research conducted by Bucheli et al. (2017), which found that differences in soil moisture depend on several factors, including heat conductivity, heat capacity, and soil color. The average soil moisture based on different soil depths in the sengon-peanut plot is presented in Table 2.

Table 2. Daily soil moisture results of sengon-peanut plots at different depths.

soil moisture(%)				
	Sengon - peanuts			
	10(cm)	15(cm)	20(cm)	25(cm)
02/11/2023	72,5	72,9	73,1	74,2
12/11/2023	75,5	72,9	79,4	78,1
23/11/2023	80,1	80,3	75,2	79,6
03/12/2023	80,5	81,0	80,1	80,2
13/12/2023	79,5	81,1	79,2	80,3
23/12/2023	79,3	79,9	73,1	80,1
02/01/2024	78,9	78,8	80,2	80,1
12/01/2024	77,6	79,9	79,1	79,2
22/01/2024	80,5	80,9	81,2	79,8
30/01/2024	79,5	79,9	81,1	81,2
average	78,39	78,76	78,77	79,28

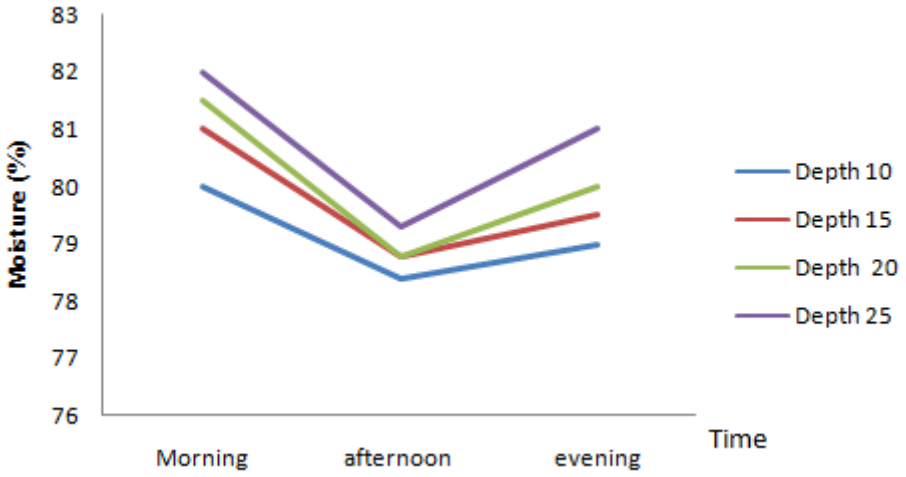

Figure 3. Soil moisture under sengon-peanut stands

In general, factors affecting soil temperature and soil moisture are divided into external (weather), internal, and topographic factors. The topographic factors that most influence soil temperature fluctuations at different depths in the research location are surface slope and ground cover vegetation. Research plots located in flat classes (>5%) exhibit fluctuations in soil temperature and moisture at different depths (Jahed et al., 2014). Ground cover vegetation, a combination of forestry plant types (sengon and peanuts), affects average daily soil temperature and moisture at the research location (Hasannudin et al., 2022). The average soil temperature at different soil depths under sengon-peanut stands is higher than the average soil temperature in other agroforestry areas (Siqueira et al., 2020) and in the forest (Naharuddin et al., 2019).

CONCLUSION

The soil temperature under sengon-peanut stands tends to decrease with increasing soil depth. The average soil temperature at a depth of 25 cm is 28.89°C, the average soil temperature at a depth of 10 cm is 29.04°C, while the soil temperature at a depth of 20 cm is 28.94°C, and the soil temperature at a depth of 15 cm is 29.01°C. Conversely, the deeper the soil, the higher the soil moisture tends to be. The average soil moisture in sengon forests is 78.39% at a depth of 10 cm, 78.76% at a depth of 15 cm, 78.7% at a depth of 20 cm, and 79.28% at a depth of 25 cm in plots planted with sengon-peanuts

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