Analysis of Plant Diversity Agroforestry In The Mount Lawu Natural Forest Area

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Abstract

The natural forest area of Mount Lawu, with various plant compositions, can be landscaped by humans to produce diverse landscape characters in the natural forest area. The solution for implementing the Agroforestry system is very appropriate because land management with this system is to overcome problems arising from changes in land use and soil and water conservation. The research aims to analyze plant diversity in agroforestry practices with services in natural landscape water conservation and develop strategies in agroforestry services. This research was carried out on the natural forest of Mount Lawu, using the fast AgroBiodiversity Appraisal method. The research results show that the composition of the vegetation structure at the research location varies greatly with a high agroforestry diversity index. The practice of agroforestry in the natural forest of Mount Lawu at an altitude of 1600 above sea level with the highest important index value is dominated by the plant species Arenga pinnata, pine merkusi, and paraserientes falcataria. In the slope area of 2200 meters above sea level, the plant species are dominated by Acacia decurrens, while at an altitude of 2800 meters above sea level, the plant species are dominated by Fuchsia magellanica, Anaphalis javanica, Casuarina junghuniana.

Keywords: *Plant vegetation, plant composition, agroforestry and conservation.*

I. INTRODUCTION

Nature protection and preservation is the process of protecting forest areas. This activity has been carried out for over a century in various parts of the world. However, there are still areas for improvement in determining criteria and indicators for hydrological function as an environmental service. The impact of the lack of careful management of forest land in regional management has resulted in the emergence of policies that require significant investments, such as reforestation of forest areas, where the results still need to be commensurate with the costs incurred. At a certain level of rainfall, the hydrological function is related to the land's ability to absorb water, especially for: (1) buffering hills when it rains, (2) water transmission, (3) providing quality water, (4) releasing water slowly, and (5) reduce erosion. The role of land use systems in a landscape can be assessed from the perspective of changes in evapotranspiration levels related to the presence of trees, soil infiltration rates associated with the physical condition of the soil, and drainage rates related to the drainage network at the landscape scale [1]. Trees that exist in nature have good land cover; in all their forms, they can affect water forests. The tree cover can be in the form of natural forests, natural regeneration of plants in forests, cultivated trees, or trees as hedge plants.

Most of the areas with varying heights in the Mount Lawu Natural Forest are the main source of water that flows to the surrounding population as raw water for the Magetan Regency Drinking Water Company.The results of field observations show that in the upstream part of the natural forest area, there has been no change in land use, but in the middle area, there is still little land use process, but in the low area, there is quite a large amount of land use. This change occurred due to the conversion of forest land to other uses. As a result, landslides and floods in downstream areas are closely related to changes in land use [2]. Changes in the conversion of forest land to other uses can be observed with the naked eye. Furthermore, in this area, there are frequent landslides and floods in downstream areas [3]. The impact on the ecosystem

is a decrease in the quality of environmental services, such as a decrease in the ability to bind carbon in genetic resources, hydrology, and the loss of various flora and fauna.

Agroforestry is expected to help optimize the results of sustainable land use to ensure and improve people's living needs. Other land uses, such as agroforestry, can be developed to enhance community welfare and benefit the broader community [4]. Characteristics of a sustainable system include the absence of a decline in crop production over time and the lack of environmental pollution. An ecologically oriented concept should be carried out with a conservation mission with the principle of full use but still caring for the environment. Society refers to socio-cultural aspects, namely society's spiritual and physical well-being. The third concept is realized in the economic field through environmental services by providing a sense of comfort that is willing to be exchanged for material returns [5]. This condition reflects the optimal conservation of natural resources by the adopted land use system. This research aims to analyze the diversity of plant species in agroforestry practices that provide water conservation services in the Gunung Lawu Natural Forest area and develop strategies for developing agroforestry as an environmental service.

II. METHODS

The research was carried out on agroforestry land in the natural forest of Mount Lawu, namely the highest area, 2800 meters above sea level; the middle area, 2200 meters above sea level, and the low area, 2200 meters above sea level. Field research activities were carried out for three months, from January to March 2021. Details of data types, sources, and uses guided the data collected in this research. Data collection includes physical, biological, and management data to analyze the diversity of plant types in agroforestry. This data was obtained through field observations, interviews, literature studies, and requests for official data from relevant agencies, including local villages, the Irrigation Service, agroforestry management communities, and PDAM. The methodology used is Rapid Agro-Biodiversity Appraisal, a tool designed to determine the views of various parties related to biodiversity conservation. The method uses techniques commonly used in RRA (Rapid Rural Appraisal), approaches to exploring local wisdom, and stakeholder analysis. Determining the composition of dominant tree species uses the critical value index (INP), which is calculated using the formula:

Important Value Index (INP) = KR+DR+FR

KR = Relative Density

DR = Relative Dominance

FR = Next Relative Frequency

III. RESULTS AND DISCUSSIONS

The diversity is at an altitude of 1600 m above sea level around the nearest Girimulyo village. The environmental conditions at this height are steep rocks, with the left side being a ravine or indentation of around 150 m. There are eight species of trees belonging to 12 families. The Importance Value Index (INP) of plant species, which is the highest among other plant species in the growth level of trees, poles, and saplings, is from the Casuarinaceae family with the type pine (*C. junghuniana*), sugar palm tree (*Arenga pinnata*) and the Oxalidaceae family with the starfruit type (*C. junghuniana*). Averrhoa bilimbi L). The vegetation and environmental conditions are very dense and still very natural. The plants that dominate are Horsfielda glabra and various types of ferns. The fern type Gleichenia linnearis dominates. The vegetation in the field was also found to be a type of grass, namely Cyperus rotundus. The ability of the palm tree species (*Arenga pinnata*) to occupy most of the research location shows that this species can adapt to the environmental conditions at the research location. Human intervention, the spread and development of vegetation, is greatly influenced by environmental factors such as climate and nutrient availability. [6] The local community considers palm trees (*Arenga pinnata*) to be able to store rainwater and reduce the impact of erosion.

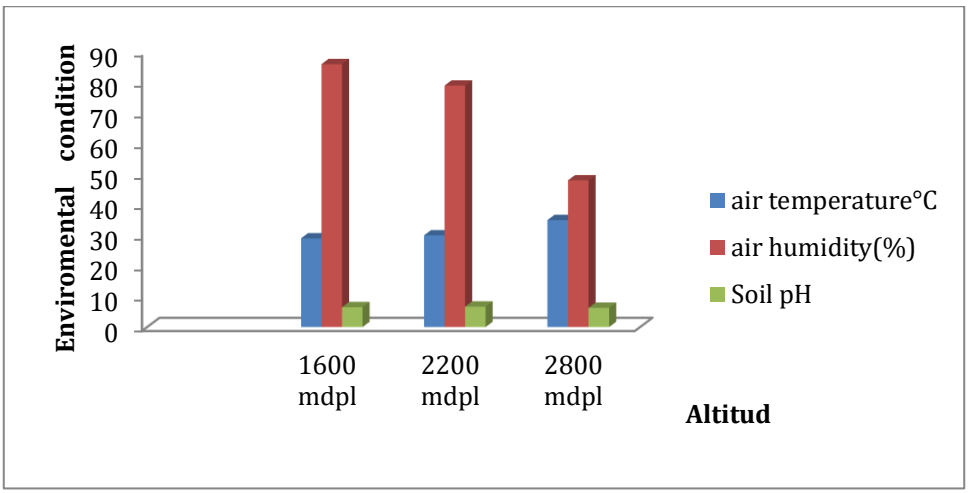

Fig 1. Condition of The Research Area

Communities around forest areas believe that sugar palm (*Arenga pinnata)*, albizzia (*Paraserientes falcataria*), and pine (*Pinus merkusii*) can prevent erosion on natural riverbanks. Fig trees are considered capable of conserving water in the dry season. Agroforestry plants that are tall and have deep roots, such as rambutan and mango, can help conserve soil and water. Diversity of plant types in agroforestry at 2200 meters above sea level. At this height, seven types of trees belong to 9 families. The Fabaceae type dominates the plants; the most prominent plant is Acacia decurrens, with the highest INP (Importance Value Index) among plant types; there are also reeds and enduro flowers. People in the middle think Acacia decurrens can prevent erosion on natural banks. The Acacia decurrens tree is considered capable of conserving water in the dry season. Altitude 2,800 m above sea level. It is located on the eastern part of the mountain, about 4 kilometers from the top, and is generally dominated by reed plants. In this area, the forest still grows naturally without human intervention; the road climbs to the top of the mountain, with the right side of the road being a ravine and the left side being a ravine. This has made forest preservation in the peak area influential in erosion and maintaining the natural forest area as the leading provider of clean water and irrigation

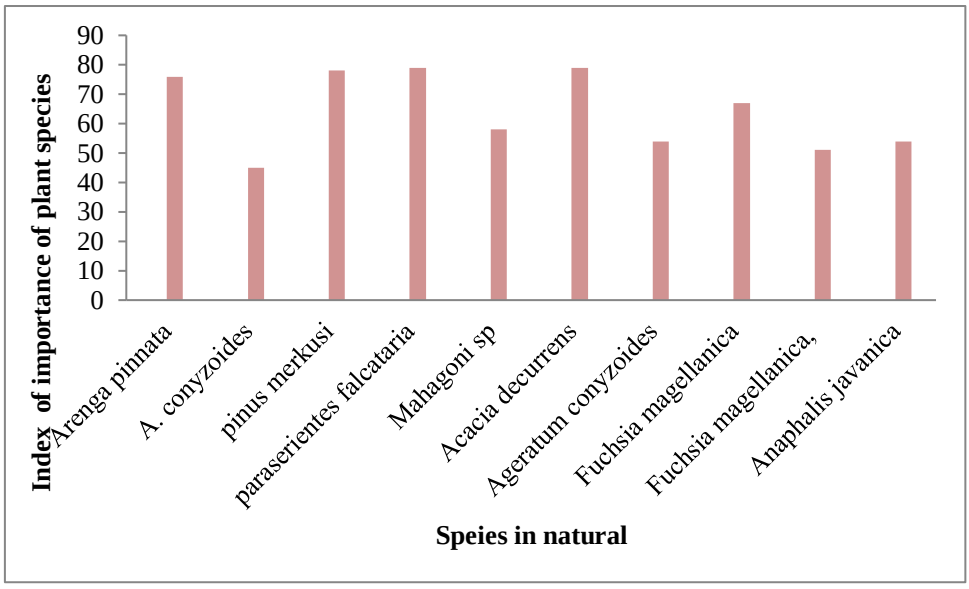

Fig 2. Index of Tthe Importance of Plant Species in The Natural Forest of Mount Lawu

The Importance Value Index of plant types in agroforestry practices at an altitude of 1600 - 2800 m above sea level in the natural forest of Mount Lawu in the form of the use of plants in agroforestry practices by farmers for the production of leaves, fruit, and stems. Farmers in this area make palm fruit their mainstay product, followed by candlenut fruit and other crop production, such as fruit, kakau, and durian. Apart from that, farmers also use forest tree trunks to make wood. Agroforestry farmers at an altitude of 1600 m above

sea level make palm fruit, durian, and petai their mainstay products; apart from that, farmers also use the leaves for animal feed and kitchen spices. Agroforestry plantations are not a subsistence system. However, it was deliberately developed for commercial production by relying on tree resources that have economic value. The flexibility of agroforestry can be seen in developing specific products that can gain new commercial value due to market developments, such as wood and fruit [6]. Community perception of the vital value of agroforestry plants in natural forest areas greatly influences soil and water conservation. So people also plant bamboo (Bamboo sp) and sengo (Paraserientes falcataria) to prevent erosion on natural banks. In an agroforestry system, tree vegetation, with its robust root system, can hold soil particles from eroding to maintain soil stability.

Meanwhile, undergrowth (seasonal agricultural plants) can reduce the kinetic energy of rain generated by tree vegetation, thereby reducing erosion and increasing the opportunity for rainwater to infiltrate. Another important aspect is the canopy structure of the layered agroforestry system, tree types and understory plants. The composition of this vegetation is related to its role and function in evaporation and transpiration, rain interception, and microclimate. In this respect, some agroforestry systems are similar to forests [7] A critical aspect of understanding an agroforest landscape is its species composition. Each species has characteristics, abundance, distribution, trophic position, and ecological role. Therefore, it is essential to understand the species and their roles when designing strategies for conservation and restoration [8]. Natural forest areas include biological, physical, social, and economic processes; thus, natural forests are often used as units for landscape planning and natural resource management [9]. However, deforestation makes natural forest areas vulnerable to drastic landscape changes [10]. Deforestation can affect landscape patterns or structures because it changes landscape composition, such as loss or decline of forest cover, or landscape configuration, such as spatial connectivity and fragmentation of landscape elements, for example, forest patches [11]. The product development strategy in conservation activities is to increase management quality and access to external parties in carrying out conservation activities and adding value,e to additional services from agroforestry cultivation [12].

IV. CONCLUSION

The results of the study show that the dominant species in the Mount Lawu natural forest area are dominated by sugar palm and sengon. There are various types of trees in agroforestry, so it is necessary to increase the protection of plant species diversity in agroforestry practices, especially plants that have environmental service functions in soil and water conservation efforts, including candlenut, sugar palm, sengon, bamboo. The need for agroforestry cultivation and its benefits, as well as the application of compensation for environmental services from other communities far from the area to communities in the area.

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