

Dry Land Management Using Agroforestry Systems In Trenggalek Regency, East Java

Anang Susanto^{1*}, Arman Harahap², Maria Julissa Ek-Ramos³, Steven Taniwan⁴

¹Departemen of Agricultural Science, of Merdeka Madiun University, Madiun East Java, Indonesia

²Labuhanbatu University, Labuhanbatu, North Sumatra, Indonesia

³Universidad Autónoma de Nuevo León, Facultad de Ciencias Biológicas,
San Nicolás de los Garza, Nuevo León, Mexico

⁴Department of Agricultural Sciences, University of Helsinki, Helsinki, 00014, Finland

*Corresponden Author:

Email: asmadiun@yahoo.com

Abstract.

Dryland management with an agroforestry system is essential and urgent. Currently, the existence of forests has experienced pressure on forest areas and forest resources, which threatens the integrity of forest areas due to the increase in land area, which is categorized as dry. This research aims to determine the size of dry land and the dominant factors that drive the damage rate. This research aims to analyze agroforestry systems with cropping patterns on dry land. This research uses survey, analysis, and needs analysis methods of decent living. Results The agroforestry system used to develop critical land is a human effort to control its reciprocal relationship with natural resources, with the hope that expanding the use of dry land by implementing a directed and planned agroforestry system for the people can improve the economy of the people around the primary forest which is based on forest products. The development of dry land management with an agroforestry system in community forest areas as a result of reforestation and forest development project activities from an institutional aspect is also able to foster farmer innovation in increasing the productivity of their land, one of which is the success of building community forests as a group on marginal land.

Keywords: Forest areas, orest development, natural resources and land management.

I. INTRODUCTION

Indonesia is an archipelago country blessed with natural resources in the form of tropical natural forests containing various flora and fauna. The natural wealth in Indonesia's forests is part of the world's invaluable natural wealth and is dry land capital for implementing Indonesia's development. Forests are known to have a very diverse influence on life, including developing and providing a good atmosphere with a stable oxygen component, providing fuel, providing water, protecting the soil against erosion, providing a place for all living things to live, and producing building materials. [1] The increase in degraded land in Indonesia is increasing. Forests that are already dry cover an area of 48.5 million ha of the 120.35 million ha of forest in Indonesia and 71.85 million hectares of remaining forest.

The existence of dry land for development and forest use must be carried out wisely without exceeding the forest's ability to repair itself. [3] . Wisdom in managing and utilizing wood will significantly determine the sustainability and security of the germplasm. The increasing need for space for various economic activities and rapid population growth have caused pressure on forest areas and forest resources. [2,10]. Pressure occurs in multiple forms and intensities, which ultimately threatens the integrity of forest areas due to the increasing scope of land that is categorized as dry. Agroforestry systems have an essential role in sustainable agroecosystems because they increase carbon assimilation into the atmosphere by soil and plants, cycle nutrients, increase biodiversity, and reduce damage to the soil. [4,8]. However, the magnitude of ecosystem services and their provision depends on the type of agroforestry system used (e.g., silvopasture), as well as climatic factors [11,15]. This research aims to analyze an agroforestry system with planting patterns on dry land.

II. METHODS

This research was conducted in Trenggalek Regency, East Java Province. This research was conducted from May to September 2021. The materials used were soil maps, topographic maps, demographic data, rainfall data, and chemicals for soil analysis in the laboratory. The tools used are survey equipment, soil drill, sample ring, knife, compass for directions, writing tools, work map, Global Positioning System (GPS), Global Information System (GIS) software, and digital camera.



Fig 1. Map Location Reset In Trenggalek

This research uses a survey method, starting with making land unit maps (soil type maps, topographic maps, and land use maps); these land unit maps are used as working maps. Biophysical data collection consists of physical and chemical properties of soil, soil characteristics, and climate. This research was carried out by identifying vegetation components cultivated by farmers in dryland areas.

III. RESULTS AND DISCUSSIONS

1. *Forest Preservation With Agroforestry*

A forest is a system in which various components are related. These components include humans, animals, other living creatures, and natural resources. The interactions carried out by living and non-living elements in a forest area form a united ecosystem to preserve life. Highland forest ecosystems in the form of mountain and highland rainforests function as water catchment areas and regulate water circulation in nature. The central forest ecosystem (lowland rainforest, swamps, and other wetlands) is where life activities occur. The downstream ecosystem is also known as the coastal ecosystem, with the primary vegetation consisting of coastal plant types and mangroves, which are water users. The leading causes of drought on forest land are land use that exceeds its carrying capacity and indiscriminate land use conversion [9]. An increase in extreme events such as floods and drought characterizes drought in forest areas. Humans suffer the main losses from drought in forest land as one of the users with high pollution content in water bodies such as rivers and lakes. The cause of forest destruction is the lack of understanding of the function of environmental services in forest management by humans as the most influential forest users [6]. Management of agroforestry systems in forest areas is defined as human efforts to control the reciprocal relationship between natural resources and humans in forest use and all its activities, to foster sustainability and harmony of the ecosystem, and to increase the benefits of natural resources for humans sustainably.

Forest conservation activities with agroforestry include actions such as a) space management through efforts to regulate land use with a soil agroforestry system in a broad sense, b) water resource management through an agroforestry system, development, use and control of the destructive power of water, c) vegetation management which includes management forests and other types of terrestrial vegetation which

have production and protection functions for land and water as well as d) fostering human awareness and abilities including developing institutional capacity in the efficient use of natural resources wisely, so that it plays a role in forest conservation. The ultimate goal of management with an agroforestry system on dry land is to create sustainable conditions for vegetation, soil, and water resources to provide optimal and sustainable benefits for human welfare. Integration between sectors in forest management is a necessity that must be implemented by all parties to realize the ultimate goal of preserving nature. Handling dry land forests requires exceptional management that is multi-sectoral, cross-regional. Considering the principles of interdependence, the interrelationship between various natural resource management activities and the development of human activities using natural resources, supported by multiple scientific disciplines throughout the forest area with an agroforestry system, is considered [5]. Sustainable forests will produce healthy places that can protect water supplies, shelter forests, plants, and wildlife, and keep the soil fertile, ultimately providing prosperity to the humans who live on them.

2. Results of The Reforestation Project

Forestry development outside forest areas is directed at three (3) main activities, namely (1) community forests, (2) community forests, and (3) various forestry businesses. In community forest development, actions are directed at priority areas with high potential for community forest development and are close to wood processing industry centers, especially on people's land. The precise objectives of community forest development are a) increasing rural communities' income while increasing welfare to alleviate poverty, b). meet the needs of communities using wood raw materials for industry, carpentry wood, and energy wood). improve soil cover, prevent erosion and loss of nutrients, and reduce evapotranspiration; d) improve water infiltration, soil structure, soil pH and organic content, e) improve microclimate and protect springs, f) empower rural communities, g) create fields work, increase business activities and increase state income [7]. In this way, directed and planned development of community forests is expected to improve the economy of the people around the forest, which mainly relies on forest products (both wood and non-timber). On the island of Java, community forest development carried out by the government has been positively responded to by the community by developing community forests. On independently owned land, rice fields that have been converted into sengon (*Paraserianthes falcataria*) plantation forests

Table 1. Types and components of agroforestry systems in the Dry Lands of Trenggalek Regency

Classification of Agroforestry systems	Agroforestry System Components	Location Specific
Agroforestry-S,P	Sengon + bananas + corn + goat farming	Kampak
Agroforestry -J, P	Tectona + banana + chili + goat farming	Munjungan
Agroforestry -M,P	Mahogany + papaya + chili + goat farming	Dongko
Agroforestry -A,P	Accasia + banana + jackfruit + goat farming	Watu limo
Agroforestry -R,P	Rasamala + puspa + coffee + chili	Pule
Agroforestry -J,K	Jabon + coffee+citronella	Karangan
Agroforestry -P,P	Tusam + banana + cassava	Durenan

3. Ekonomi

In general, there are three reasons for planting woody plants on people's dry land; the first is the increasing price of people's wood, which is getting better so that planting woody plants is considered more profitable than planting annual crops; the second is the opinion that woody plants are a form of life savings. Which is easy to take and easy to sell to farmers whenever they need it to meet their daily needs, The last one is that these woody plants were not planted intentionally but are only natural seedlings from pre-existing woody plant parents [14]. The economic value of community wood occurs due to an increase in the use value of community wood, which was initially only used as raw material for small industries (material for making soap boxes, soy sauce boxes, wood for public housing, as well as fuel for non-wood small sectors such as burning limestone barrels, bricks, roof tiles and so on). Its use has increased as a raw material for medium- and large-scale wood processing industries (for paper, plywood, and furniture) [13]. The development of community forests has also formed an agribusiness chain, starting from the on-farm management chain to off-farm management.

In the on-farm management chain, entrepreneurs/input providers for community forest farming grow and develop, both for the provision of seeds/seedlings, fertilizer, and supporting agricultural equipment, up to the emergence of entrepreneurs who specialize in wood harvesting. Currently, in the off-farm chain, growing and developing transportation entrepreneurs transporting harvested timber from felling locations to collectors and industry, traders in harvested timber, sawmill entrepreneurs, and entrepreneurs in the wood processing industry. From this community forest management, an economic chain has emerged that can open job vacancies in various fields. As a productive business unit considering the diversity of physical and non-physical factors, a community forest area requires different management (managerial) treatment from one location to another. A series of on-farm community forest management activities, starting from the process of providing seeds, seeding, planting, maintaining, harvesting, marketing, and processing the results, which are supported by the institutional role of the group, will greatly determine the final income received by community forest entrepreneurs [12]

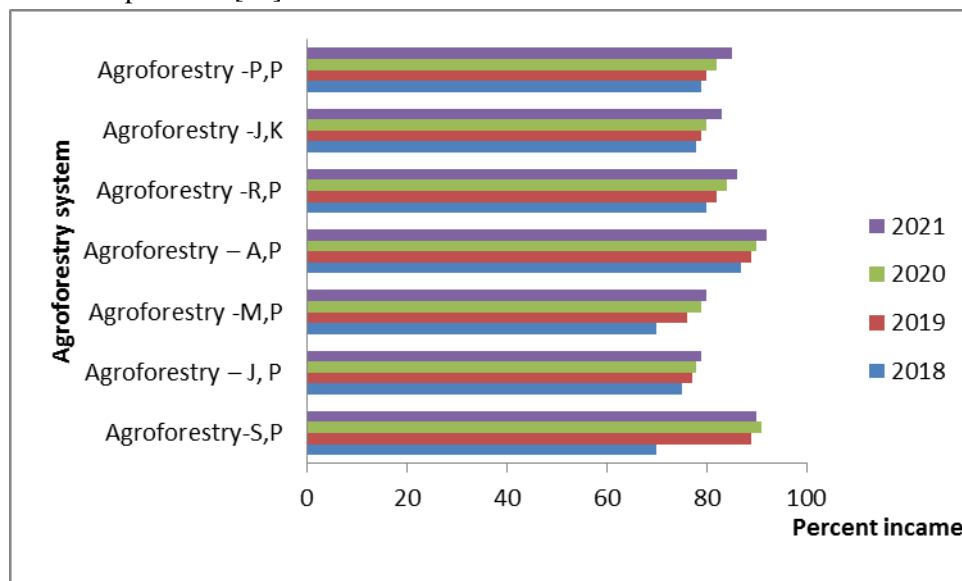


Fig 2. Farmers' Income Using the Agroforestry System Each Year

4. Social

The development of community forests on dry land, as a result of reforestation project activities from an institutional aspect, has fostered farmer innovation in increasing the productivity of their land, one of which is the success of building community forests as a group on marginal land. The formation of dry land community forest farmer groups as a forum for uniting community forest farmers in carrying out community forest farming has yet to resolve the economic problems of its members. This is because farmers did not initiate the formation of this group to gather and try to solve the issues they faced together. It was generally formed to meet the demands of implementing an agricultural/forestry development project. This condition has a direct impact on the formation of a vast number of farmer groups. However, almost 80% of them do not function as fundamental groups or as groups whose members do not feel attached to their group. Thus, organizationally (officially registered), various farmer groups are known, starting from dry land farmer groups, forest farmer groups, honey bee farmer groups, etc. Still, their existence is no more than just a nameplate. Or, it could be said that they have a management and membership structure that is not functioning, have rules that are not implemented, and have an administrative complement that is only filled in for project records. This condition can also be seen in forming community forest farmer groups, whose members, on average, only have a relatively small amount of land (< 0.2 ha) and a low level of education.

Low (generally only elementary school level) locations that need liberation facilities and infrastructure do not support them. Regular gatherings of members once a month or once a week normally do not function as a means of exchanging market information and farming technology but rather serve as a medium for holding joint social gatherings [17]. Several field notes show that the above conditions were formed due to several things, namely: (1) the root of the formation of farmer groups is the artisan group, so these joint artisan activities have generally been going on for some time; (2) farmers do not know what to do

with their groups. , (3) difficulties for farmers to ask for help from relevant agencies (both extension workers and other local officials) to provide extension services to them, (4) extension workers' working areas too broad and limited extension infrastructure, so the reach of the extension activities they carry out is minimal (note: in general, a field forestry instructor oversees three villages as their extension work area)

IV. CONCLUSION

The development of community forests has also formed an agribusiness chain that starts from the chain of on-farm management to off-farm management. The formation of community forest farmer groups as a forum for uniting community forest farmers in carrying out community forest farming has, in fact, not been able to solve the economic problems of its members. This condition directly impacts the formation of many farmer groups, but almost 80% do not function as natural groups.

REFERENCES

- [1] Marti Winarni, AnangSusanto , Dobashi Nunes, 2023, Agroforestry As An Alternative To Facing Climate Change In The Community, Ponorogo Regency, International Journal of Science and Environment
- [2] Indah RekyaniPuspitawati, Anang Susanto, 2022. Albizia Forest Management System In The MadiunDistric International Journal of Science and Environment Vol. 2 No. 3
- [3] Wulandari, C. Inoue, M. 2018. The Importance of Social Learning for the Development of Community Based Forest Management in Indonesia: The Case of Community Forestry in Lampung Province. *Small-scale Forestry*. Vol. 17, No. 3. Hal. 361–376
- [4] Vettorazzi, C.A., & Valente, R.A. (2016). Priority areas for forest restoration aiming at the conservation of water resources. *Ecological Engineering*, 94, 255-267. doi: 10.1016/j.ecoleng.2016.05.069
- [5] Smethurst, P.J., Almeida, A.C., & Loos, R.A. (2015). Stream flow unaffected by Eucalyptus plantation harvesting implicates water use by the native forest streamside reserve. *Journal of Hydrology: Regional Studies*, 3, 187-198. doi:10.1016/j.ejrh.2014. 11.002
- [6] Recanatesi, F., Tolli, M., Lord, R. (2014). Multi criteria analysis to evaluate the best location of plants for renewable energy by forest biomass: a case study in Central Italy. *Applied Mathematical Sciences*, 8(129), 6447–6458. doi:10.12988/ams. 2014. 46451
- [7] Baral, H., & Lee, S.M. (2016). Sustainable Bioenergy Systems to Restore and Valorize Degraded Land. Brief no. 37 Center for International Forestry Research. Bogor, Indonesia
- [8] Azmy, M., Nor Izaida, I., and Awang Noor, A.G. (2013). Agroforestry education and professional level links in Peninsular Malaysia. *Journal of Sustainability Science and Management*, 8(2), 161-170.
- [9] Sauer T.J.,Dold,C.,Ashworth, A.J.,Nieman,C.C.,Hernandez-Ramirez, G., Philipp, D.Gennadiev, A.N.,and Chendev, Y.G. (2021) Agroforestry practices for soil conservation and resilient agriculture. In: Udawatta R.P., Jose S. (eds) *Agroforestry and Ecosystem Services*.Springer, Cham.
- [10] Musa, F., Lile, N.A., Hdan, D.D.M. (2019). Agroforestry practices contribution towards socioeconomics: A case study of Tawau Communities in Malaysia. *Agriculture & Forestry*, 65(1), 65-72.
- [11] Junaidi, E.(2013).The role of the application of agroforestry to the watershed (DAS) Cisadane. *Agroforestry Research*, 1(1), 41- 50
- [12] Wijitkosum, S. (2021). Factor influencing land degradation sensitivity and desertification in a drought prone watershed in Thailand. *International Soil and Water Conservation Research*, 9 (2), 217-228. <https://doi.org/10.1016/j.iswcr.2020.10.005>.
- [13] Anang Susanto, Indah Rekyani Puspitawati, Lucas William Mendes 2023, Income Analysis Of Coffee Farmers In The Albizia Forest Area Based On Agroforestry, International Journal of Science and Environment
- [14] Indah Rekyani Puspitawati, Anang Susanto,(2021) Potential Plants Developed With Agroforestry System For Forest Land Rehabilitation In East Java, International Journal of Science and Environment
- [15] Nesbitt, L., Hotte, N., Barron, S., Cowan, J. and Sheppard, S. R.J. 2017. The Social and Economic Value of Cultural Ecosystem Services Provided By Urban
- [16] Edrisi, S.A., & Abhilash, P.C. (2016). Exploring marginal land degraded lands for biomass and bioenergy production: an Indian scenario. *Renewable and Sustainable Energy Reviews*, 54, 1537-1551.
- [17] Romano, G.,Sasso, P.D., Liuzzi, G.T., & Gentile, F. (2015). Multi-criteria decision analysis for land suitability mapping in a rural area of Southern Italy. *Land Use Policy*, 48, 131–143.