Journal of Global Sustainable Agriculture, 5(2): 1-8, Juli 2025 E-ISSN: 2775-3514
DOI: https://doi.org/10.32502/jgsa.v5i2.260 P-ISSN: 2775-3522

Analisis Tipologi Agroforestri dan Kontribusinya terhadap Pertanian Berkelanjutan di Hutan Kemasyarakatan (HKm) Kibuk, Kota Pagaralam, Sumatera Selatan

Analysis of Agroforestry Types and Their Contribution to Sustainable Agriculture in the Community Forest (HKm) Kibuk, Pagaralam City, South Sumatra

Deddy Permana[1*], Supli Effendi Rahim[1], Asvic Helida[1], Jun Harbi[2,3]

[1)] Agricultural Science Study Program, Postgraduate Program, Muhammadiyah University of Palembang, Palembang, Indonesia
[2)] Forestry Study Program, Faculty of Agriculture, Muhammadiyah University of Palembang, Palembang, Indonesia
[3)] Center for Environmental and Sustainable Development, Muhammadiyah University of Palembang, Palembang, Indonesia

[*]Penulis korespondensi: deddy.permana@gmail.com

Received December 2024, Accepted March 2025, Published July 2025

ABSTRAK

Sistem pengelolaan lahan yang dikenal sebagai agroforestri menggabungkan tanaman pertanian dengan vegetasi kehutanan guna meningkatkan produktivitas lahan dan kesejahteraan masyarakat. Penelitian ini bertujuan untuk menganalisis tipologi agroforestri serta kontribusinya terhadap pertanian berkelanjutan di Hutan Kemasyarakatan (HKm) Kibuk, Kota Pagar Alam, Sumatera Selatan. Penelitian ini menggunakan metode campuran dengan pendekatan kualitatif dan kuantitatif. Data diperoleh melalui observasi lapangan, wawancara dengan 23 anggota kelompok tani hutan, serta analisis perubahan tutupan lahan periode 2016–2020. Hasil penelitian menunjukkan bahwa terdapat enam model agroforestri yang diterapkan di HKm Kibuk, dengan dominasi tanaman kopi (Arabika dan Robusta) yang dikombinasikan dengan tanaman pelindung seperti alpukat dan johar, serta tanaman bawah seperti sayuran hortikultura. Model agroforestri kompleks yang melibatkan berbagai jenis pohon penaung memiliki potensi lebih tinggi dalam mendukung ketahanan ekosistem dan meningkatkan kapasitas serapan karbon dibandingkan agroforestri sederhana. Namun, tantangan utama yang dihadapi adalah keterbatasan pengetahuan teknis petani dan akses terhadap pasar. Oleh karena itu, diperlukan strategi peningkatan kapasitas petani melalui pelatihan, insentif kebijakan, serta penguatan skema pembiayaan agar sistem agroforestri yang diterapkan lebih berkelanjutan.

Kata kunci: agroforestri, hutan kemasyarakatan, tipologi agroforestri, HKM Kibuk Pagaralam, pertanian berkelanjutan

ABSTRACT

Agroforestry is a land management approach that combines agricultural crops with woody plants to improve land production and community well-being. This study seeks to examine the typology of agroforestry and its contribution in promoting sustainable agriculture within the Community Forest (HKm) Kibuk, located in Pagar Alam City, South Sumatra. The research methodology employed is a mixed methods approach, incorporating both qualitative and quantitative techniques. Data were collected using field observations, interviews with 23 members of the forest farmer group, and an analysis of land cover alterations from 2016 to 2020. The research findings indicate the implementation of six agroforestry types in HKm Kibuk, predominantly featuring coffee trees (Arabica and Robusta) with protective species like as avocado and acacia, in addition to understorey crops like horticultural vegetables. Complex agroforestry systems incorporating diverse shade tree species possess greater potential for enhancing ecosystem resilience and augmenting carbon sequestration capabilities than simplistic agroforestry models. The primary problems encountered are the farmers' lack technical expertise and restricted market access. Consequently, it is essential to adopt measures that augment farmers' capabilities via training, legislative incentives, and the fortification of financing schemes to ensure the sustainability of implemented agroforestry systems.

Keywords: *agroforestry, social forestry, agroforestry typology, HKM Kibuk Pagaralam, sustainable agriculture*

INTRODUCTION

Forests are ecosystems comprising vast tracts of land that harbor diverse forms of biodiversity (KLHK, 2018). Forests are highly advantageous for the sustainability and equilibrium of life among flora, wildlife, and humans. The government is dedicated to decreasing the rate of deforestation to ensure the sustainability of forests and the preservation of their ecosystems. Recent studies indicate that the deforestation rate has progressively diminished owing to the government's dedication to sustainable forest management techniques. This is crucial for preserving forest biodiversity and keeping equilibrium among plants, animals, and humans. The elevated rate of deforestation presents a significant challenge for Indonesia. Deforestation refers to the reduction of forested land area resulting from conversion (Wahyuni

E-ISSN: 2775-3514
P-ISSN: 2775-3522

et al., 2021). Reducing deforestation protects essential habitats for endangered species and mitigates the effects of climate change.

Between 2005 and 2010, Indonesia's forests faced an average deforestation rate of 0.7 million hectares year (Pujo et al., 2018), whereas from 2013 to 2020, total deforestation amounted to 3.6 million hectares, averaging 0.5 million hectares each year (BPS, 2020). The primary drivers of deforestation include illegal logging, forest fires, and the transformation of forested areas into plantations and agricultural land (Miteva et al., 2015). Furthermore, the population residing in and surrounding forest areas in Indonesia reached 32.5 million in 2014 (BPS, 2014), the majority of whom rely on these forests for their livelihoods. The community's reliance on these forest areas is deemed to heighten the likelihood of accelerating deforestation (Mulyana & Moeis, 2022; Dadang et al., 2024).

The Indonesian government implemented the Social Forestry strategy as a strategy to mitigate deforestation and enhance community welfare. This initiative was designated as one of the national priority programs by President Joko Widodo of the Republic of Indonesia in 2014, aiming for a target of 12.7 million hectares. Social Forestry was initiated in 2016 following the issuance of Minister of Environment and Forestry Regulation Number 83 of 2016 about Social Forestry. The endorsement of social forestry management entails the provision of legal access for forest utilization by social forestry groups for management activities across production, protected, and conservation forest regions, encompassing village forest (HD), community forest (HKm), people's plantation forest (HTR), forestry partnership, and customary forest (HA) schemes (KLHK, 2021). This initiative fundamentally involves granting legal access to communities managing forest areas. The restricted access of communities to forest areas is a contributing factor to the social forestry initiative (Laksemi et al. 2019).

Social Forest Areas have emerged as a significant focus for this research due to their crucial significance in natural resource management and community welfare. The Community Forest (HKm) Kibuk, situated in Agung Lawangan Village, Pagaralam City, necessitates particular focus. The area involved encounters numerous problems, including climate change, land degradation, and scarce natural resources; nonetheless, collaborative initiatives among diverse stakeholders have contributed to forest preservation and enhanced the well-being of the local people. The advancement of agroforestry in HKm Kibuk possesses significant potential to enhance agricultural output, mitigate deforestation, and deliver sustainable ecological and economic advantages to the local population. Nonetheless, the execution of the agroforestry paradigm in this context has not yet been completely optimized.

This research seeks to demonstrate that the implementation of the agroforestry model for farmers in the HKm Kibuk area of Pagaralam city may enhance sustainable agriculture. This research aims to formulate practical recommendations for the effective implementation of agroforestry in the Kibuk community forest area (HKm) by analyzing existing challenges and opportunities. It will also offer genuine guidance for public policy, agricultural practitioners, and other stakeholders to promote sustainable agriculture in similar locations.

RESEARCH METHODOLOGY

Study Area

The research site is located in the Social Forest area, including inside the operational boundary of the Community Forest (HKm) Kibuk Pagar Alam, South Sumatra. This region has been assigned management rights according to the Decree of the Minister of Forestry of the Republic of Indonesia Number: SK. 5756/MENLHK.PSKL/PKPS/PSL.0/10/2017, issued October 30, 2017, encompassing approximately 440 hectares managed by 96 members of the Forest Farmers Group (KTH) within the Bukit Dingin Protected Forest area. The Kibuk Community Forest is administratively placed in Dusun Agung Pauh, Agung Lawangan Village, Dempo Tengah District, Pagaralam City, South Sumatra Province, encompassing both protected and utilization zones. Figure 1 indicates the map of the research location. The data collecting started in November 2024.

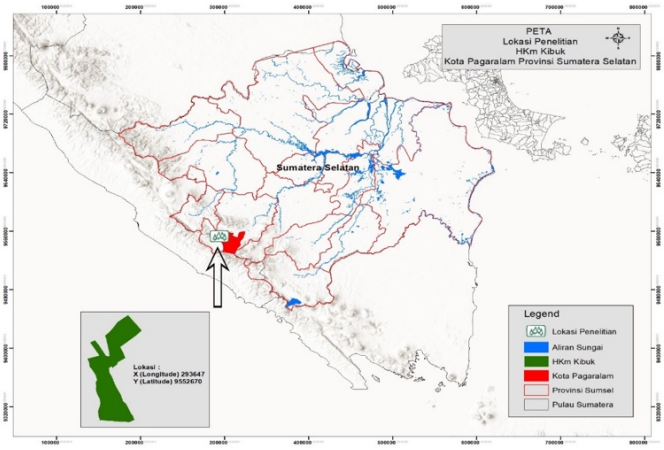

Figure 1. Research Location

Method

This research applies a mixed-methods approach, wherein the collection and analysis of qualitative and quantitative data occur simultaneously. This strategy is employed to improve the likelihood of achieving a more comprehensive knowledge by utilizing established models and impacts assessment methods. This study employs a data analysis strategy that involves scrutinizing current agroforestry models and typologies to discern the patterns and characteristics of the implemented agroforestry systems. This analysis examines research factors, including agroforestry models and compositions, as well as the types of plants forming the typology of these systems.

E-ISSN: 2775-3514
P-ISSN: 2775-3522

This research integrates both primary and secondary data. Primary data is acquired directly from respondents via field observations and interviews, whereas secondary data is gathered from many pertinent sources, including study papers or related documents. The data gathering method entails direct field observation to assess the real conditions of implemented agroforestry, along with interviews to obtain deeper insights from agroforestry practitioners. The primary data sources consist of Focus Group Discussions (FGD) and interviews with 23 members of the Social Forestry Business Group (KUPS), possessing actually experience and expertise in agroforestry activities. This strategy enables the research to acquire a more thorough understanding of the current agroforestry patterns and the determinants of their effectiveness.

RESULTS AND DISCUSSION

Location Overview

The HKm Kibuk working area encompasses 440 hectares within the Bukit Dingin Protected Forest Area, located around Mount Dempo. The vegetation cover consists of secondary forest/natural forest, agroforestry, annual plants/vegetables, and unmanaged shrubs/brush. Notably, the vegetation cover has changed since 2016, following the acquisition of the HKm management permit, and further alterations were observed by 2020 after the issuance of a social forestry management permit.

Figure 2 illustrates that agroforestry cover has increased by 25.59 hectares, annual vegetable crops have expanded by 2.42 hectares, and shrub land has grown by 10.48 hectares. Conversely, natural forest cover has diminished by approximately 38.49 hectares.

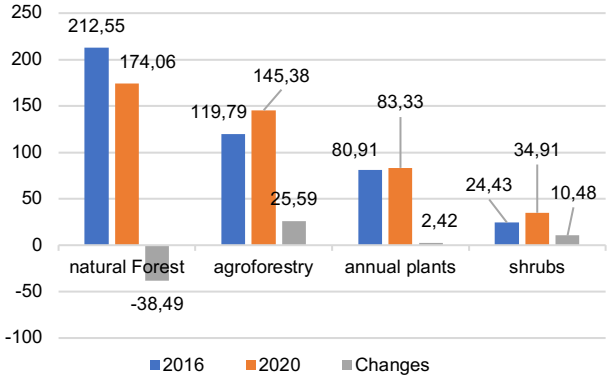

Figure 2. Land Cover Changes in HKm Kibuk (2016-2020) in hectares

The typology details was derived from field observations and comprehensive interviews with members of the Kibuk HKm group. The community group exhibits a high level of knowledge and education among its members. Figure 3 illustrates the educational backgrounds of the 23 informants. Among them, 30% (7 individuals) possess the highest level of education, which is senior high school. The remaining 70% includes 26% with elementary education, 22% with junior high school education, and 13% with diploma qualifications. Additionally, 9% of the informants, totaling 2 individuals, are graduates. The educational attainment of the informants is evenly distributed, with 52% (12 individuals) possessing education beyond high school, in contrast to 48% (11 individuals) who have completed elementary or junior high school education. This may influence the agroforestry typology utilized by the Social Forestry Business Group-KUPS agroforestry members, comprising 24 households. Over 90% pertains to agroforestry. Robusta and Arabica coffee are integrated with shade and understory crops or perennial crops. Recent implementations of Agroforestry Systems have occurred within the last 1 to 5 years for Arabica coffee, while older Agroforestry Systems with Robusta coffee have been established for over 10 years. The average area of cultivated land is 1.5 hectares.

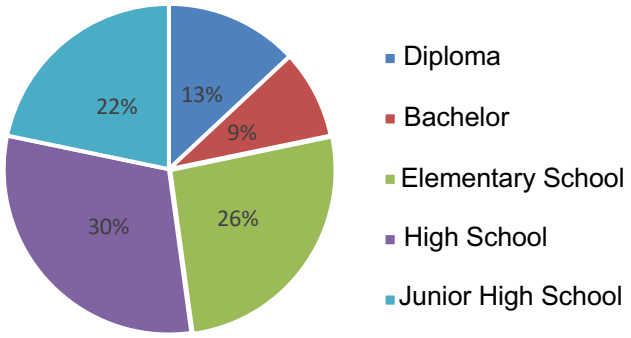

Figure 3. A diagram illustrating the highest level of education attained by the informant.

Typologies of Applied Agroforestry

Six agroforestry typologies are identified based on general observations, as detailed in Table 1. The agroforestry typology models are categorized into six management models that integrate main coffee species (arabica and robusta), multipurpose or protective species (such as avocado, gamal, jackfruit, cinnamon, among others), and understorey plants, which include vegetables and short-term annual crops. Agroforestry management models are designed with ecological and economic factors in mind to meet the objectives of the agroforestry system. The primary crops, Arabica and Robusta coffee, are categorized according to their light, moisture, and nutrient needs. In contrast, multipurpose or protective plants are chosen for their capacity to improve the sustainability of the agroforestry system. The chosen understorey plants should yield economic advantages, enhance soil fertility, and sustain ecosystem equilibrium. The agroforestry typology model implemented at that location is anticipated to improve productivity, sustainability, and the overall welfare of farmers. Table 3 presents various variables that influence the final outcome. Each column denotes a distinct parameter, while each row offers a comprehensive summary of the field conditions. It is essential to emphasize the impact of variable interactions on data interpretation.

Journal of Global Sustainable Agriculture, 5(2): 1-8, Juli 2025
DOI: https://doi.org/10.32502/jgsa.v5i2.260
E-ISSN: 2775-3514
P-ISSN: 2775-3522

Table 1. Agroforestry typology applied in HKm Kibuk

No	Description of Agroforestry System/Model	Types of plants	Image
1	Characterized by newly established Arabica coffee plants intercropped with avocado and Johar shade trees, alongside a productive and dominant layer of undergrowth comprised primarily of vegetables. The system reflects an early-stage agroforestry model integrating perennial crops with intensive vegetable cultivation and is thus classified as an Arabica coffee–vegetable garden agroforestry system, indicative of a transitional phase toward a more diversified and stratified land-use structure.	▪ Arabica coffee (*Coffea arabica*) ▪ Avocado (*Persea americana*) ▪ Johar (*Senna siamea*), vegetables, leek	
2	Defined by the presence of aging robusta coffee plants, a heterogeneous composition of mature shade tree species, and an understory layer that remains unmanaged. Such structural and management characteristics categorize the system within the robusta coffee–avocado agroforestry model, reflecting a low-intensity management approach and complex vertical stratification typical of traditional agroforestry landscapes.	▪ Robusta coffee (*coffea canephora)* ▪ Avocado (*Persea americana*) ▪ Johar (*Senna siamea*) ▪ Litter	
3	Characterized by mature robusta coffee trees, a diverse and established canopy of shade species, and an absence of managed understory vegetation, this system is classified under the robusta coffee–avocado agroforestry typology. The structure indicates a low-input management regime with emphasis on perennial crop interactions and vertical stratification typical of traditional agroforestry landscapes.	▪ Robusta coffee (*coffea canephora)* ▪ Avocado (*Persea americana*) ▪ Johar (*Senna siamea)* ▪ Gamal (*Gliricidia sepium*) ▪ Rutuhan daun dan ranting	
4	Typified by young Arabica coffee plants and recently established shade trees, this agroforestry system features an understory layer of vegetables that is beginning to decline in productivity. However, understory vegetation still dominates the system's spatial composition. Based on these characteristics, the system is categorized as Arabica coffee–understory crop agroforestry, representing a transitional phase marked by decreasing undergrowth productivity and evolving canopy structure.	▪ Arabica coffee (*Coffea arabica*) ▪ Avocado (*Persea americana*) ▪ Jackfruit (*Artocarpus heterophyllus*) ▪ Vegetables, cabbage ▪ Litter	

E-ISSN: 2775-3514
P-ISSN: 2775-3522

5	Represents a recently cleared area for Arabica coffee cultivation, where remnants of felled timber are still present. The system includes the initial establishment of shade trees and small-scale planting of understory vegetable crops. These early-stage structural characteristics categorize it as an Arabica coffee–forest tree agroforestry system, reflecting a transitional land-use phase that integrates perennial crops with regenerating forest components.	▪ Arabica coffee (*Coffea arabica*) ▪ Mahang Damar/ Kayu Sepat (*Macaranga Triloba*) ▪ Mahang (Macaranga sp) ▪ Banana (*Musa sp*) ▪ Vegetables, grass and wild plants	
6	Characterized by the retention of large, mature trees, complemented by small-scale understory cultivation. The system also incorporates the utilization of environmental services, such as shade, biodiversity support, or microclimate regulation. These features position the system within the complex or multistrata forest tree agroforestry category, highlighting a multifunctional land-use approach that balances production and ecological functions.	▪ Arabica coffee (*Coffea arabica*) ▪ Mahang Damar/ Kayu Sepat (*Macaranga Triloba*) ▪ Mahang (*Macaranga sp*) ▪ Binuang (*Macaranga tanarius*) ▪ Tea (*Camellia sinensis*) ▪ Avocado (*Persea americana*) ▪ Grass, shrubs and wild vines	

Table 1 and Table 2 illustrate the presence of six agroforestry typology models in the Kibuk HKm area, primarily characterized by coffee agroforestry in the highlands. Models A, B, C, D, and E represent simple agroforestry based on the predominant commodity type. Model F represents a complex agroforestry system. Agroforestry can be categorized into two types: simple agroforestry and complex agroforestry. Simple agroforestry involves the integration of a single species of woody plant with one or two varieties of agricultural crops. Complex agroforestry integrates the cultivation of multiple tree species alongside various annual plants (De & G., 2000).

Table 2. Typology of Agroforestry Models Implemented in the HKm Kibuk Area

No	Model	Combination of plant types (TPU + TS + TB)	Adopting Households	Category
1	A	Arabica coffee (*Coffea arabica*) + Avocado (*Persea americana*) + Johar (*Senna siamea*) + Vegetable	7	Simple agroforesty
2	B	Kopi Robusta (*Coffea canephora)* + Avocado (*Persea americana*) + Johar (*Senna siamea).*	1	Simple agroforesty
3	C	Kopi Robusta (*Coffea canephora)* + Avocado (*Persea americana*) + Johar (*Senna siamea)* + Gamal (*Gliricidia sepium*)	2	Simple agroforesty
4	D	Arabica coffee (*Coffea arabica*) + Avocado (*Persea americana*) + Jackfruit *(Artocarpus heterophyllus)* + Vegetable, grass	8	Simple agroforesty
5	E	Arabica coffee (*Coffea arabica*) + Kayu Sepat (*Macaranga Triloba*) + Mahang (*Macaranga sp*) + Banana *(Musa sp)* + Vegetable, grass	2	Simple agroforesty
6	F	Kayu Sepat (*Macaranga Triloba*) + Mahang (*Macaranga sp*) + Binuang (*Macaranga tanarius*) + Tea (*Camellia sp*) + Arabica coffee (*Coffea arabica*) + Avocado (*persea americana*) + grass	1	Complex agroforestry

Note: TPU = Primary long-term crop; TS = Multipurpose woody species utilized for their fruits or leaves and functioning as shade trees; TB = Short-cycle annual understory crops, including vegetables and secondary food crops, harvested within a single growing season

E-ISSN: 2775-3514
P-ISSN: 2775-3522

There are two primary typologies of commodity-based agroforestry systems: simple agroforestry and complex agroforestry. Simple agroforestry is characterized by the integration of two to five tree species that serve as shade for the main crop, typically forming a single-layer canopy structure. In contrast, complex agroforestry involves the use of more than five tree species, creating a multilayered or multistrata canopy. This type often includes a combination of trees, shrubs, and grasses, resulting in a more diverse and structurally complex vegetative system. The distinction between the two lies in the diversity of species and the vertical stratification within the system, both of which influence ecological function and management intensity.

Figure 4. Simple agroforestry systems in the HKm Kibuk area

Figure 5. Multistrata agroforestry systems in the HKm Kibuk area

DISCUSSION

This discussion focuses on the benefits and challenges of implementing multistrata agroforestry systems on agricultural land, along with strategies to enhance the sustainability of both food production and environmental outcomes. Through the presence of multilayered canopy structures, multistrata agroforestry provides enhanced protection for primary crops against extreme weather events such as heavy rainfall or excessive heat. However, a key challenge lies in the careful selection of tree species and the implementation of appropriate management practices to ensure that core crops can continue to grow optimally under shaded conditions.

One strategic approach involves integrating local knowledge with scientific frameworks to achieve sustainable agroforestry objectives. Additionally, active participation of farmers as direct stakeholders in the planning and implementation processes is crucial to improving the acceptance and long-term sustainability of multistrata agroforestry practices. When farmers are meaningfully engaged, they are more likely to experience the tangible benefits of agroforestry, including improved crop productivity, income diversification, and ecological restoration.

Furthermore, farmer involvement can help strengthen collaboration between government, communities, and the private sector in supporting sustainable food and environmental systems. In this context, multistrata agroforestry not only offers a promising solution to address climate change challenges, but also represents a viable model for enhancing food and environmental security in the future (World Bank, 2021).

Land Cover Change

Based on research findings, there has been a significant change in land cover in the HKm Kibuk area during the period from 2016 to 2020. The expansion of agroforestry areas by 25.59 hectares indicates a shift in land-use patterns from natural forests toward agroforestry systems. This change aligns with the objectives of the Social Forestry policy, which encourages community participation in the sustainable use of forest resources (MoEF, 2020).

However, the reduction of natural forest cover by 38.49 hectares requires further analysis to assess its ecological impacts, particularly on biodiversity and carbon stocks. Previous studies have shown that the conversion of natural forests to agroforestry systems may lead to a carbon stock reduction of up to 30%, depending on the species composition and management practices (Rahmawati et al., 2019).

Therefore, it is crucial for the government and related stakeholders to conduct a comprehensive evaluation of current forest management policies to minimize biodiversity loss and carbon stock degradation. Strategic actions based on scientific assessments are necessary to ensure the long-term sustainability of forest management. Collaboration among government agencies, local communities, and research institutions is key to conserving natural forests while promoting sustainable resource use.

Moreover, such policy evaluations should be conducted transparently and involve active participation from all stakeholders (Legal-Political Framework for Indigenous Forest and Mining Governance in South Kalimantan, 2023-2024). Regular monitoring and evaluation are also essential to assess the effectiveness of implemented policies and to identify corrective actions. Concrete steps must be taken to maintain forest sustainability, protect biodiversity, and conserve carbon stocks, thereby preserving ecological balance and supporting the survival of diverse life forms.

Transparent forest management and active stakeholder involvement can be supported through the

development of incentive schemes for communities that contribute to forest conservation and carbon emission reductions (Kennedy, 2024). Engaging younger generations in the management of customary forests is also critical and can be achieved through educational programs that integrate traditional and scientific forest management knowledge.

Agroforestry Typologies

Agroforestry typologies applied in the HKm Kibuk area are grouped into six models based on the combinations of primary crops, multipurpose trees, and understory plants. Most households adopt simple agroforestry systems dominated by Arabica and Robusta coffee, while complex agroforestry systems are only found in a limited portion of the area.

The dominance of simple agroforestry reflects farmers' tendency to prioritize short-term economic returns by combining coffee with vegetables. However, such models have ecological limitations due to the reduced vegetative layering compared to complex agroforestry systems (Hairiah et al., 2016). Therefore, strategies are needed to encourage the adoption of complex agroforestry models to enhance ecosystem resilience and crop diversification (Atangana et al., 2013).

One strategy includes involving farmers in training and technical assistance programs so they can better understand the long-term benefits of complex agroforestry systems. In addition, government support in the form of seed subsidies tailored to desired agroforestry patterns can help motivate farmers to transition. Through such initiatives, the adoption of complex agroforestry may increase, thereby improving both long-term economic benefits and ecological sustainability in the area.

Socio-Economic Factors Influencing Agroforestry Implementation

The diverse educational backgrounds of HKm Kibuk group members contribute to varying levels of agroforestry adoption. With 52% of respondents having completed at least high school, there is significant potential to adopt more complex and sustainable agroforestry practices. However, key challenges remain, particularly the availability of resources and technical knowledge related to optimal land management.

Interview data revealed that most farmers manage around 1.5 hectares of land, which significantly influences the type of agroforestry model adopted. Previous studies have indicated that land size and market access are primary determinants of agroforestry sustainability in social forestry areas (Suharjito et al., 2018). Nonetheless, further research is needed to identify other influencing factors that affect successful agroforestry implementation at the farm level.

Local knowledge and active farmer participation in decision-making are also critical to agroforestry sustainability. Integrating traditional knowledge into cocoa-based agroforestry practices, for example, has proven beneficial in enhancing farmers' technical capacity and strengthening their role in implementation (Aris et al., 2023). Agroforestry not only empowers local communities and improves their livelihoods but also strengthens their role in the sustainable management of natural resources (Triwanto, 2023). Despite the potential, various barriers still limit agroforestry adoption, including policy frameworks, access to resources and markets, and farmer knowledge and skills (Muhammad & Muhammad, 2024).

Agroforestry Management Implications for Sustainable Agriculture

The sustainability of agroforestry in HKm Kibuk depends on maintaining a balance between ecological and economic considerations. Coffee-based agroforestry models have the potential to improve household incomes, but must be supported by policies that promote soil conservation and crop diversification to ensure long-term system viability. Emphasis should also be placed on integrating timber species with food crops to maintain high productivity without causing environmental degradation.

Effective agroforestry management also involves the social dimension, particularly community participation in decision-making processes concerning natural resource use. In this way, agroforestry can be sustained over the long term and provide lasting benefits to both local communities and the environment.

From an ecological perspective, increasing the adoption of complex agroforestry systems may serve as a climate change mitigation strategy through enhanced carbon sequestration and biodiversity conservation. A study by Roshetko et al. (2017) highlighted that multistrata agroforestry systems can improve soil carbon stocks by up to 40% compared to monoculture systems. From a socio-economic perspective, improving farmers' capacities through training and mentorship is essential to deepen their understanding of the long-term advantages of complex agroforestry. Additionally, better market access and financial mechanisms are required to enable farmers to invest in more sustainable agroforestry practices.

CONCLUSION

The implementation of agroforestry in HKm Kibuk has shown significant progress in terms of land expansion and crop diversification. Nonetheless, ecological and socio-economic challenges continue to hinder the optimal adoption of sustainable agroforestry practices.

The typology of agroforestry systems practiced by farmers in HKm Kibuk can be classified into two main categories: simple and complex agroforestry. These systems typically combine primary crops such as Arabica and Robusta coffee with shade trees like avocado, jackfruit, and *Gliricidia*, alongside understory horticultural crops. The most widely adopted model is the simple agroforestry system, particularly the combination of Arabica coffee with productive vegetables. Meanwhile, the complex or multistrata agroforestry models offer a better balance between

ecological sustainability and economic benefits. Collectively, these systems contribute to the development of sustainable agriculture within the social forestry landscape, enhancing local community welfare.

To further strengthen the sustainability of agroforestry in HKm Kibuk, several recommendations are proposed:

1. Promote the adoption of complex agroforestry systems through targeted incentives and technical training for farmers;
2. Enhance market access for agroforestry products to improve their economic value;
3. Develop supportive financing schemes that enable long-term investment in sustainable agroforestry; and
4. Strengthen land conservation and rehabilitation policies to ensure ecological balance is maintained.

REFERENCES

Abimanyu, R. 2023. Keterkaitan Kebijakan Perhutanan Sosial Dalam Upaya Penyelesaian Konflik Tenurial di Kawasan Hutan. *Jurnal Wahana Forestra*. 18(2): 93-104.

Aris, Muhammad, Belasius, Krista, Veronica, Ria, Yuliara, Nurjannatul, Ainun. (2023). Pengembangan Agroforestri Berbasis Kakao Menggunakan Pengetahuan Tradisional Di Perbatasan Indonesia-Malaysia (Studi Kasus Kabupaten Mahakam Ulu.

Atangana, A., Khasa, D., Chang, S., & Degrande, A. (2013). Tropical Agroforestry. Springer Science & Business Media.

De, & G. (2000). Agroforestri Indonesia: Beda sistem beda pendekatan.

World Bank (2021). Pengembangan Pertanian Secara Berkelanjutan di Lahan.

Dadang, A., Purnama, H., & Sartika, D. D. (2024). Pengembangan Kapasitas Kelompok Tani Hutan Kibuk Dalam Tata Kelola Perhutanan Sosial Yang Baik (Good Forest Governance) Di Kota Pagaralam. 21:1.

Hairiah, K., et al. (2016). *Agroforestry for Sustainable Land Management*. Bogor: IPB Press.

Kennedy. (2024). Fundamental Management Journal 9.

[KLHK] Kementerian Lingkungan Hidup dan Kehutanan. (2020). *Peraturan Perhutanan Sosial dan Implementasinya*.

Miteva, D. A., Loucks, C. J., & Pattanayak, S. K. (2015). Social and environmental impacts of forest management certification in Indonesia. PLoS ONE, 10(7). doi: 10.1371/journal.pone.0129675

Muhammad, & Muhammad. (2024). LAMBDA Jurnal Ilmiah Pendidikan MIPA dan Aplikasinya 4 no.

Politik Hukum Pengelolaan Hutan Adat dan Pertambangan di Kalimantan Selatan Tahun 2023. (2024).

Pujo, Sofhani, T. F., Gunawan, B., & Syamsudin, T. S. (2018). Community capacity building in social forestry development: A review. In Journal of Regional and City Planning. 29 (2): 113–126. ITB Journal Publisher. doi: 10.5614/jrcp.2018.29.2.3

Rahmawati, S., et al. (2019). *Impact of Agroforestry on Carbon Stock and Land Productivity*. Journal of Forestry Research, 8(3), 125-139.

Roshetko, J. M., et al. (2017). *Agroforestry Systems and Their Carbon Sequestration Potential*. Agroforestry Journal, 42(2), 77-95.

Suharjito, D., et al. (2018). *Social Forestry and Sustainable Livelihoods in Indonesia*. Indonesian Journal of Forestry, 15(1), 45-60.

Triwanto. (2023). Peran Agroforestri dalam ketahanan pangan dan kelestarian Lingkungan Secara Berkelanjutan. UMMPress.

Wahyuni, H., & Suranto, S. (2021). Dampak Deforestasi Hutan Skala Besar terhadap Pemanasan Global di Indonesia. JIIP: Jurnal Ilmiah Ilmu Pemerintahan, 6(1), 148–162. doi: 10.14710/jiip.v6i1.10083.

E-ISSN: 2775-3514
P-ISSN: 2775-3522