



Characteristics of Community Forests Management in Makmur District, Bireuen Regency

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ABSTRACT

Community forests provide local economic sustenance through timber and non-timber forest products that support rural livelihoods. The ecological, biophysical and management aspects of community forests in Makmur District within the Bireuen Regency in Aceh Province of Indonesia were investigated. Using mixed-methods, descriptive case studies were conducted. Primary information was gathered through questionnaires, field observations, and semi-structured interviews with 30 community forest farmers and four key informants. The findings were presented using descriptive statistics to summarize quantitative data, while qualitative information was used to clarify and enhance the interpretation of results. The study reveals that community forests are typically managed on relatively small landholdings, with 73% of respondents cultivating between 1 and 2 ha. Among the respondents, 87% preferred mixed-species planting and agroforestry (90%) as their dominant management method. Most farmers described their soil conditions as moderate (73%) and drought as being the main factor limiting soil fertility (50%). Most of the land was possessed by individuals (57%) while 87% of those polled worked in forested areas that produced both timber and non-timber products. The contribution of community forests to total household income was 25-50% (77% of respondents reported it). Farmers cited limited capital and labour (73%) as the main limitations, followed by inadequate marketing prospects (57%). The Makmur District community forests combine diversified production with agroforestry practices to sustain households. Community forest management could be sustained in the long run by improving technical management, strengthening farmer institutions and increasing access to financial as well as marketing support.

Keywords: Agroforestry, Community Forest, Forest Management, Livelihood, Rural

1. Introduction

Indonesian forests have faced mounting pressures over the past few decades due to population growth, conversion of forestland for other uses, illegal logging activities, forest fires, and changes in land cover, among other issues. These impacts have become severe to the point that both descriptive and historical studies document a significant shift in forest cover in Indonesia. The Indonesian government's assessment of forest cover in the country reveals that there has been a net decrease in forest cover by approximately 104 thousand hectares between 2021 and 2022. Apart from the efforts to promote community forests (Indonesian term: *hutan rakyat*) as a sustainable forest management practice, community forests have triggered significant adaptation measures in the conservation strategies for ecosystems, among them being the encouragement of agroforestry practices. Community forests are established and managed by local communities on privately owned land. Community forests are part of community-based forest management that employs the Forestry and Land Rehabilitation Act No. 23/2021. This regulation guides the establishment and appraisal procedures for community forests in Indonesia. Community forests comprise independently growing woody flora species managed by the landowners. A wide range of forest products plays a pivotal role in improving the livelihoods

of the rural poor in addition to contributing to the country's timber supply. Therefore, community forests are an important innovation in forest management and conservation.

Community forests provide not only ecological but also socio-economic services. For instance, plantation establishment on privately owned land improves the soil's physical properties, enhances water infiltration, reduces erosion, and subsequently, lowers the risk of landslides and floods while also storing carbon in the soil and biomass for climate change adaptation [2], [5], [6]. Furthermore, agroforestry is extensively practiced in community forests to offer multiple products by planting various woody plants and agricultural crops in combination with large-scale plantations while also contributing to ecological conservation through diversification. The establishment of multiple woody vegetation layers in agroecosystems enhances the resilience of the agroforestry system to biotic and abiotic threats while also raising the competitive abilities of the component species.

Aceh Province is endowed with vast forest resources, and local communities participate extensively in managing timber trees on privately owned land. The agroforestry practice in Aceh is widespread among farmers who engage in timber production, large-scale plantations, and food crop cultivation. Both the household income and environmental sustainability in Aceh are augmented through domestic agroforestry practices. Bireuen Regency is one of the regions in Aceh that has ample potential for developing community forests. Many inhabitants engage in subsistence agriculture, large-scale plantations, and forestry activities as their primary livelihood sources. Community forest management in the area has developed as a result of the region's biophysical and socio-economic characteristics. Earlier studies demonstrate community forest management's reliance on biophysical conditions, agricultural practices, land tenure systems, and economic incentives [7], [8]. It has been established that the combination of timber trees and agricultural/plantation crops in agroforestry systems contributes to higher farm income as well as soil fertility. The planting of a wide variety of trees such as *sengon*, mahogany, teak, candlenut, and durian is significant in meeting the economic needs of the household while also ensuring food security.

An evaluation of community forests is critical in providing an insight into the current status of community-based forest management in the study area. The information generated from the analysis is vital in developing policies that promote community-based forest management, agroforestry, land-use productivity, and community empowerment programs for forest farmers. By evaluating the characteristics of community-based forest management, it will be possible to identify indicators of success and failure, as well as the conditions necessary for effective community-based forest management, and formulate appropriate policy recommendations.

Recent studies highlight the dependence of community-based forest management on biophysical, social, and economic factors. Ecological functions and forest management are determined by biophysical factors in a given ecosystem, whereas community participation in forest management is dictated by social and economic factors such as land tenure systems and financial status. Agroforestry-based management practices have been found to increase farm income diversification and, consequently, raise the overall income of farming households while also boosting land's ecological functions. The security of land tenure has been found to encourage farmers to adopt tree planting on a large scale for an extended period of time. Forest farmer groups also play a crucial role in providing information, technology, and institutional support, as well as accessing credit and other forms of financial assistance to promote forest product exploitation. However, research conducted in different geographical locations indicates that biophysical characteristics and land-use practices are key determinants of successful community forest management practices. Although there have been several studies on community-based forest management in different parts of Indonesia, there is a need for more research on the characteristics of community forests in Makmur District, Bireuen Regency. Information on biophysical, vegetation characteristics, agroforestry practices, utilization of forest products, socio-economic factors affecting the forests, and institutional support is limited, thus creating a need for further investigation. This study attempts to address these gaps in the existing knowledge by assessing the characteristics of community forest management in Makmur District. These findings will be useful in formulating effective forest management strategies that can help promote the long-term sustainability of community forests.

This study aims to examine the characteristics of community-based forest management in Makmur District, Bireuen Regency, by evaluating various aspects of community-based forest management, including biophysical conditions, vegetation characteristics, agroforestry practices, land ownership status, forest product

utilization, socio-economic characteristics, and institutional support. Field observations, vegetation assessments, interviews, and questionnaire surveys were conducted to obtain information on the current status of community-based forest management in the study area. The findings of this study will serve as a reference regarding the current status of community forests in Makmur District, thus facilitating more efficient policy formulation by local government officials, forest extension officers, farmer groups, and other stakeholders in promoting community-based forest management approaches.

In addition, this study will contribute to the body of knowledge on community-based forest management by generating empirical evidence on the biophysical, management, and socio-economic aspects of community forests at the local level. Although community-based forest management practices vary from one region to another and necessitate localized investigations, community-based forest management research in Indonesia has been gaining traction and has seen extensive study, with most of the previous research being concentrated in Java. There is a lack of community-based forest management studies that take into account biophysical characteristics, vegetation structure, agroforestry practices, utilization of forest products, and institutional factors in Aceh Province.

2. Materials and Methods

The study population comprised community forest farmers from Seunebok Baro Village and Pandak Village, situated in Makmur District. 47 community forest owners were included in the study population, which was located in Seunebok Baro (5°09'39" N and 96°52'05" E) and Pandak villages (5°09'00" N and 96°52'00" E), Makmur District, Bireuen Regency. Participants were selected through purposive sampling based on the following conditions: (1) possessing and managing community forest land for a minimum of five years, (2) participation in forest management initiatives, and (3) willingness to participate. The selection process involved the participation of 30 people, who represented roughly 64% of the eligible people. All eligible respondents met the selection criteria, and the sample size was deemed to be adequate in assessing community forest management characteristics. The study involved 30 community forest farmers as respondents and four key informants, including village officials and forestry extension officers. Key informants were selected based on their knowledge of community forest management, involvement, and local forest governance. This research utilized both primary and secondary data. Primary data were collected using questionnaires, field observations, and interviews with community forest farmers and relevant stakeholders. Secondary information was gathered from government reports, institutional documents, and scientific publications related to community forest management.

Semi-structured interviews, direct field observations, and document reviews were employed to collect data. They used a structured interview guide comprising open-ended and closed questions for both respondents and key informants. The gathered information encompassed respondent demographic information (age, education, occupation, and farming experience), ownership and management history of land, agroforestry practices, tree species composition, forest product usage, impact of forest activities on household income, management constraints, institutional support. Further investigations into village conditions, extension services, and community forest development programs were conducted through interviews with key informants. The duration of each interview was roughly 30-60 minutes, with local speakers being used as and when necessary to ensure clear communication and accurate responses. Field experiments were conducted on community forest plots to record vegetation characteristics and management practices. An objective plot selection process was conducted to reflect current management systems in the area studied. Researched species of trees, crop related products, and patterns of agroforestry adopted by farmers. Community forest areas were studied to determine the variety of plant species and recorded vegetation data. Data analysis was a combination of quantitative and qualitative methods. By using questionnaires and field observations, qualitative information was received on land ownership, agroforestry systems, forest product utilization, and socio-economic features through tabulation, frequency distribution, or percentage calculations. Qualitative data obtained from interviews were analyzed through organization of data, thematic categorization, and interpretation of patterns related to management practices, land-use history, institutional support, community perspectives, etc. The reliability of the results was enhanced by utilizing triangulation, which involved comparing information from various sources and methods. Source triangulation involved comparing answers from farmers, key informants, and supporting documents, while methodological triangulation emphasized the consistency of the questionnaire, field observations, interviews, or secondary information.

3. Results and Discussion

Ecological Characteristics of Community Forests

The Seuneubok Baro and Pandak Villages' community forests exhibit ecological traits as depicted in Table 1. The study area's community forests are mainly small-scale managed forests (Figure 1). Among the respondents, 22 had community forest areas of 1-2 ha, while 17% owned land areas larger than 2 ha.

Table 1. Ecological characteristics of community forests in Seuneubok Baro and Pandak Villages

No	Variable	Category	Frequency (n)	Percentage (%)
1.	Land area owned	1–2 ha	22	73
2.		>2 ha	5	17
3.		0.5–1 ha	3	10
4.		<0.5 ha	0	0
5.	Non-timber crops planted between trees	Other crops	15	50
6.		Areca nut and coconut	8	27
7.		Fruit trees	4	13
8.		No intercroops	3	10



Figure 1. Condition of community forests managed by farmers in Seuneubok Baro Village.

In addition, most farmers applied agroforestry practices by planting various crops between tree stands, with other agricultural crops being the most commonly cultivated intercroops (Figure 2). In general, community forests in the study area are managed on a small scale, reflecting the dominance of this landholding size (1–2 hectares). Agroforestry practices—evidenced by the presence of various intercroops among tree stands—are widely employed by farmers to optimize land use and generate supplementary income. The majority of landholdings fall within the 1–2 hectare category; specifically, 22 out of the 30 surveyed households (73%) manage land within this size range.



Figure 2. Agroforestry practices in community forests of Seuneubok Baro Village.

Community forest management in Makmur District relies primarily on small-scale operations run by farming households. By adjusting cropping patterns and landholding sizes, farmers can balance their choice of tree species with household economic needs while also adapting to the biophysical conditions of their land. The study reveals that agroforestry is a prevalent practice in the area, with 27 out of 30 respondents (90%) utilizing the space between tree stands to cultivate agricultural crops and plantation species. This land-use pattern demonstrates the widespread adoption of agroforestry systems by the local community to optimize land utilization. By adopting these techniques, farmers can generate short-term income from annual crops and plantations while waiting for timber trees to reach harvestable age.

However, the study also found that 13 out of the 30 participants (43%) experienced pest and disease outbreaks in their local forest areas. While interviews with local farmers highlighted various issues, the study did not identify the specific pest or disease species involved. Most of these disturbances appeared to originate during the trees' early growth stages; in community forests, such issues can reduce potential productivity by lowering survival rates.

In addition to these biological disturbances, many farmers said recent changes in rainfall patterns -- particularly longer dry periods -- have affected tree growth and development. ". Although interviews with farmers yielded reports of problems, the study did not identify specific pests or diseases based on systematic methods. The disturbances were mainly observed in young trees during their initial growth, which could potentially decrease survival rates and limit the productivity potential of community forests. In addition to these biological disturbances, many farmers said recent changes in rainfall patterns -- particularly longer dry periods -- have affected tree growth and development. ". In the context of ecological conditions, community forest management has incorporated many elements of sustainable land-use practices in Makmur District. Agroforestry is becoming increasingly popular and diverse plant species are being merged to demonstrate the flexibility of local communities in managing their resources in response to environmental and economic factors. Farmers can increase land area between tree stands for crops and reduce reliance on a single source of raw materials as the main commodity, rather than from forest, to produce it.

The utilization of agroforestry promotes the optimal functioning of ecosystems by utilizing various plant life to support their respective functions. In the long run, timber trees are advantageous as they provide soil fertility and environmental stability, whereas seasonal crops offer more immediate economic benefits for households. The diversity of plant species in an ecosystem makes it more complex than a monoculture plantation, which improves resilience to environmental and climate-related pressures.

Biophysical Characteristics of Community Forests

Community forest biophysical conditions and community forest management practices, Makmur District (Table 2). Among the respondents, 87% reported that they regularly planted mixed species, while 26 farmers also managed forests with different tree species. The management approach that was most commonly used by 27 respondents (90%) was agroforestry. The integrated approach of these systems involved the cultivation of agricultural and plantation crops in spaces between tree stands, resulting in a combination of timber and non-timber products.

The condition of their forest soils was classified as moderate by 73% of respondents, who were 22 in number. Drought was identified as the most widespread soil limitation by 15% of those surveyed. The outcomes indicate that community forest management in the area is largely dependent on diversified planting systems, although environmental constraints may affect forest productivity.

Mixed-cropping systems involving the use of timber trees, plantation crops, and fruit trees were adopted by most respondents. The study revealed that. About 90% of those surveyed adopted agroforestry practices, while the rest managed their land through relatively simple farming systems that met basic household needs. In their respective community forest areas, respondents perceived the soil conditions as being of average or satisfactory. The assessment was based on soil fertility, crop growth, and land productivity data collected from farmers in the field. In terms of soil quality, the majority (22 farmers; 73%) classified their soil as moderate, while only a small proportion of respondents labeled it as either fertile or poor.

Table 2. Biophysical characteristics and management practices of community forests in Makmur District (n = 30)

No	Variable	Category	Frequency (n)	Percentage (%)
1.	Tree species planted	Mixed tree species	26	87
2.		Mahogany	3	10
3.		Sengon	1	3
4.	Other crops cultivated	Teak	0	0
5.		Plantation crops	14	47
6.		Other crops	14	47
7.		No additional crops	2	7
8.	Planting system	Food crops	0	0
9.		Agroforestry	27	90
10.		Boundary planting	2	7
11.		Other systems	1	3
12.	Soil condition	Monoculture	0	0
13.		Moderate	22	73
14.		Fertile	3	10
15.		Infertile	2	7
16.	Main soil fertility constraints	Barren	3	10
17.		Drought	15	50
18.		Declining soil fertility	8	27
19.		No problems	7	23
20.		Erosion	0	0

Structured interviews and field investigations were conducted to assess soil conditions using indicators of fertility, vegetation growth performance, and productivity of cultivated crops. These evaluations categorized soil into fertile, moderate, infertile, and arid. Although most areas had relatively suitable soil, in other places the dry season was less fertile and water availability was limited. Differences in plant growth performance between community forest stands were partly caused by these conditions. According to field observations, forest management was largely dependent on the current soil quality, with only a few farmers using fertilizers regularly. The main focus of routine maintenance was weed control and land cleaning, but fertilization and pruning were occasionally performed based on farmers' needs and resources.

The management of a community forest is affected by its biophysical features. The suitable tree species and site conditions are responsible for enhancing plant growth, timber production, and the quality of forest products. Therefore, it is important to have knowledge of the local environmental factors in order to develop appropriate and sustainable community forest management strategies. The predominance of mixed-cropping systems suggests that local communities have gained practical experience in combining tree species with agricultural and plantation crops to optimize land use in accordance with local environmental conditions. During the interviews, farmers chose tree and crop combinations based on various factors such as their suitability for local environmental conditions, economic value of the input from consumers, availability of planting materials (such as seeds or plants), and existing farming practices.

The presence of diverse vegetation in community forests can enhance ecosystem processes. Recent studies indicate that different types of agroforestry systems have the potential to improve soil properties, both physically and chemically, through greater litter input, nutrient cycling (e.g. Nevertheless, this research concentrated on the arrangement and management features of vegetation and did not directly examine the properties of soil. The outcomes are consistent with earlier research that has shown agroforestry systems increase soil organic matter content, moisture retention and low levels of erosion as opposed to the monocrop rate [13]. It has been suggested that plant diversity can help stabilize ecosystems and improve land resilience in light of climate change [14].

Despite these advantages, the limited frequency of fertilizer application suggests that nutrient management practices among community forest farmers could still be improved to support better forest growth and productivity. Consequently, greater adoption of simple silviculture technologies including organic fertilization, soil and water conservation measures, regular pruning, and systematic plantation maintenance is required to improve long-term land productivity and forest sustainability.

Management Systems and Socioeconomic Contributions

A summary of the socioeconomic and management systems of community forest owners in Makmur District (Table 3). The findings include patterns of land grab, management restrictions, forest product usage, income contribution, and government grants given to community forest owners. In communities with a population of

17 individuals, 57% reported that they were the most landowners on inherited land. The survey also revealed this fact. Farmers who were in private forest areas with a mix of timber and non-timber products (26 respondents; 87%) had varying incomes. The importance of forest activities in supporting household economies was highlighted by a survey where 77% of respondents claimed that forest-generated income made up 25-50% of total household income.

According to the survey conducted with 22 respondents, the main challenges facing forest management were access to capital and labour availability (73%). Sheep ownership is the dominant form of land owned, a fact that illustrates how family-owned land plays incredibly important in maintaining forest management within communities for generations. Forests are regarded as productive assets that can be passed down to future generations, and long-term ownership patterns encourage farmers to conserve tree resources. In the area covered by the study, community forests provide a range of economic benefits including timber production as well as various non-timber products from fruits to plantation crops.

The use of all these items in conjunction allows households to have more income while reducing their dependence on one commodity. Furthermore, surveys indicated that tree planting was typically done in accordance with household budgetary constraints rather than adhering to a predetermined harvesting schedule. This tradition demonstrates that community forests act as malleable economic reserves for rural communities. In addition to being a source of current income, standing trees are also considered as long-term savings that can be used when farmers face pressing economic needs.

Table 3. Management systems and socioeconomic characteristics of community forest owners in Makmur District (n = 30)

No	Characteristics	Category	Frequency (n)	Percentage (%)
1.	Land acquisition source	Inherited land	17	57
2.		Purchased land	9	30
3.		Leased land	4	13
4.	Land ownership status	Private ownership	17	57
5.		Family shared ownership	8	27
6.		Community group ownership	3	10
7.		Village government ownership	2	7
8.	Main challenges in forest management	Limited capital and labor	22	73
9.		Pest and disease problems	3	10
10.		Marketing constraints	3	10
11.		Other challenges	2	7
12.	Products produced from community forests	Mixed products (timber and non-timber products)	26	87
13.		Fruits	4	13
14.		Timber only	0	0
15.		Latex/resin	0	0
	Utilization of forest products	Partly sold and partly consumed	14	47
		Sold	12	40
		Stored for future needs	4	13
		Consumed only	0	0
	Annual income from community forests	< IDR 5 million	1	3
		IDR 5–10 million	20	67
		IDR 10–20 million	7	23
		> IDR 20 million	2	7
	Contribution to household income	<25%	1	3
		25–50%	23	77
		51–75%	5	17
		>75%	1	3
	Government support received	Tree seedlings	20	67
		Training	5	17
		Financial assistance	5	17
		No assistance	0	0
	Main challenges for community forest development	Capital and marketing limitations	17	57
		Combined challenges (capital, marketing, seedlings, pests/diseases)	12	40
		Lack of superior seedlings	1	3
		Pest and disease only	0	0

These results show community forests in Makmur District, where timber is not cut but uses are being played significant role as part of local livelihood strategies. A combination of forest products can be obtained by

households, reducing the need for one commodity and accessing multiple sources of income. Earlier studies have indicated that agroforestry systems with diverse characteristics can enhance livelihood stability by minimizing the impact of market price fluctuations and household income variations. Out of those who participated, there are 87% managed forests that produced both timber and non-timber products. Even though livelihood stability wasn't quantified directly, a range of products suggests that community forests offer households alternative economic options.

Previous studies have indicated that community forests contribute to rural livelihoods by generating income, creating jobs, and increasing access to forest resources. Similarly, other studies have demonstrated that diversified production systems can enhance household stability by decreasing susceptibility to market fluctuations and reliance on individual commodities. Despite this, the management challenges still impact the benefits of community forests. A lack of financial support, limited market networks and access to improved cultivation technologies were reported by farmers as challenges. These limitations need to be addressed through strengthened farmer organisations, better access into and through financial support available, greater technical assistance as well as capacity building programmes.

The implementation of these interventions can enhance the forest's productivity and ensure the long-term sustainability of community forests. Generally speaking, the results indicate that community forest management in Makmur District can contribute to sustainable forest control by encouraging various agroforestry practices and products from diverse forest areas with appropriate forest use. However, this study did not provide a comprehensive evaluation of sustainability indicators. Moreover, it is imperative to enhance government support, forestry extension programs, and farmer organizations in order to make communities' forests more competitive while also increasing their role in sustainable forest development and the welfare of rural areas.

4. Conclusion

Integrated management of community forests in Bireuen Regency's Makmur District involves smallholder-based approach, agroforestry practices, mixed species planting and diversified forest product use. Among the 22 respondents who managed forest areas of 1-2-1 ha, 73% reported using agroforestry systems and 87% followed mixed timber/non-timber production. In 23 interviews, 77% of respondents reported that forest-based income contributed 25-50% of total household earnings, highlighting the importance of forests in supporting household economies. The majority of people (17 respondents; 57%) believed that inherited land ownership was the primary factor in maintaining community forest management through generations through family-owned land. However, the main hindrances to further development are limited access to capital and labor (22; 73%), as well as marketing difficulties (17; 57%). Nevertheless, Overall, this study provides insights into the ecological, management and socioeconomic features of community forests in Makmur District and emphasizes importance of strengthened support systems for sustainable community forest development.

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