

The Socioeconomic Conditions of Tropical Peat Farmers: A Case Study in Tumbang Nusa Village, Central Kalimantan, Indonesia

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Abstract: - The Indonesian government, like the rest of the world, should be concerned about peatland farmer processes. This is due to the negative environmental effects of poor management, such as peatland fires. The Indonesian government has devised a peatland forest conservation program that incorporates it into sustainable agricultural activities in order to raise the standard of living of peatland residents while also preventing forest fires. The objective of this study was to determine the socioeconomic conditions of farmers who successfully manage peatlands. This study was conducted in Tumbang Nusa Village, Jabiren Raya Regency, Central Kalimantan, Indonesia, a region prone to peatland fires, using a qualitative descriptive method. The data were collected through 84 participants filling out questionnaires and nine informants being interviewed. Among the data collected are land ownership, plant species, farmer's motivation, farmer's income, the economic value of forests to rural communities, and farmer's understanding of peatlands and their management. According to the findings, most of the land maintained by farmers was their own, but some farmers did manage the land of others. Endangered trees found in swamps, such as *Dyera sp.*, *Shorea belangiran*, and others, are commonly planted. Farmers, in general, have a solid understanding of peatlands and how to manage them, albeit they had failures in the past due to incorrect techniques. They are generally motivated to preserve peatlands in order to generate a significant profit. They can make between USD 189.75 and USD 607.2 per month from agricultural and non-forest products, which puts them in the high-income category. Because of the numerous benefits, they believe that peatland forests must be protected in order to survive. However, it is clear from this study that they still require advice and assistance in sustainable peatland management, particularly in the use of cutting-edge technologies. Finally, the study's implications are discussed, along with several suggestions for future research.

Key-Words: - socio-economics, agriculture, peatland, sustainable management

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1 Introduction

It is generally accepted that peatlands are a type of ecosystem that contributes to biodiversity, climate regulation, and human well-being [1]–[4]. With such a vital role, its management must be a priority, particularly in Indonesia. This is due to the fact that Indonesia has the largest tropical landmass with extensive peatlands [5]. In Indonesia, peatlands can be found in Kalimantan, Sumatra, and Papua [6]–[8]. Peatlands have become a source of livelihood for the people who live near them in terms of human welfare [9]. Therefore, adequate peatland management is required to avoid harmful environmental consequences such as forest and peatland fires, which occur every year.

However, it is reported that peatland mismanagement has resulted in a drop in environmental quality. According to data obtained from peatland conversion in Southeast Asia, a 10 Mha conversion produced as much as 132-159 million tons of carbon into the air, posing a health and life threat to the surrounding ecosystem [8], [10]–[12]. This is due to the enormous amount of carbon in peatlands [8]. Furthermore, poor management will result in flood disasters as a result of land subsidence [9], [13].

This type of mishandling has occurred in Indonesia. Forest and peatland fires occur practically

every year in this area. This management issue has been around for quite some time. The islands of Sumatra and Kalimantan were cleared extensively in 1970 with the goal of developing them [9], [14], [15]. Large-scale land clearing was carried out in Central Kalimantan as early as 1995, although it was only stopped a few years later due to environmental issues.

Therefore, the Indonesian government has launched a number of attempts to halt community forest encroachment operations and prevent further forest and peat land degradation. The government's actions were announced by revoking the Peatland Restoration Agency in Presidential Regulation No. 1 of 2016 [9], [16], [17]. The agency's efforts to prevent forest and peatland destruction have taken an integrated approach that includes hydrological restoration, revegetation using endemic species, and restoring livelihoods in the surrounding community [9]. Livelihood rejuvenation is accomplished by introducing new crops, such as fish and beekeeping. These attempts, however, have not been entirely successful [18]. The limitations of cultivation techniques and local species propagation have impeded the revegetation endeavor. Meanwhile, community apathy has delayed efforts to revive livelihoods because the process takes a long time and has unclear economic values [9], [19].

In order to overcome these challenges, the Peatland Restoration Agency must continue to

investigate various cultivating strategies with a rapid propagation process in order to fulfil the peatland restoration goal as efficiently as possible [20]. One of these endeavors is to use agroforestry as an alternate technique of farming by combining tree planting with other crops. Of course, this is done with the goal of benefiting the community in terms of social, economic, and environmental factors.

Tumbang Nusa Village in Central Kalimantan, Indonesia, is one of the areas where this approach is being implemented. Agroforestry methods have enhanced agricultural and forest production, according to several research [21]–[23]. Of course, this has something to do with raising people's income. Furthermore, this approach has the potential to increase soil quality.

Because of their involvement in land restoration operations, which initially received little response, the socioeconomic situations in the community are interesting to investigate further. Therefore, this research looked into sociological and economic values in agricultural operations, such as the manufacturing process, distribution, and consumption of goods and services, as well as perceived wealth.

2 Methods

This study investigates the perspectives of farmers in Tumbang Nusa Village, Jabiren Raya Regency, Central Kalimantan, Indonesia, in a qualitative descriptive study, that is typically used to evaluate a phenomenon, event, or social condition by gathering qualitative data and performing descriptive analysis [24], [25]. The research setting was chosen based on the characteristics of the village's development and environmental circumstances, which include peatland with a vast area that the land can be used as a source of income for the farmers in this village. In 2015, a catastrophic fire struck this community, resulting in the loss of natural trees of considerable economic value. This community is also a focus for the Peat Reforestation Agency program because of these features.

2.1 Participants

Nine farmers in Tumbang Nusa Village, Jabiren Raya Regency, Central Kalimantan, Indonesia, participated in this study. They were chosen for interviews using a purposeful sampling technique with criteria that had to be met, including 1) agroforestry expertise; 2) experience with land loss due to fire; 3) education level; and 4) involvement in agroforestry training. Table 1 shows the characteristics of the interview participants in this study.

Table 1. Characteristics of research participants

Informant	Age (years)	Education level	Ethnicity	Previous agroforestry training
1	50	Diploma 3	Javanese	Land and Forest Fire Control
2	55	Junior high school	Javanese	Never
3	51	Senior high school	Javanese	Land and Forest Fire Control
4	48	Senior high school	Lampung	Never
5	60	Junior high school	Dayak	Never
6	47	Senior high school	Javanese	Never
7	43	Senior high school	Sundanese	Land and Forest Fire Control
8	43	Senior high school	Sundanese	Never
9	45	Senior high school	Javanese	Never

Meanwhile, other data were collected by having 84 participants complete out questionnaires. These 84 participants were chosen using a purposive sampling technique, which required them to meet certain criteria, including working as farmers or having other farm-related employment.

2.2 Data collection and data analysis

A total of 84 participants completed questionnaires, and nine informants were interviewed using a snowball technique. The topics covered in the interviews included agroforestry methods, peatlands, and the community's socio-cultural values of forests. Nine informants were interviewed using a specifically constructed questionnaire, which made the interview activities semi-closed with the goal of gathering additional data. The interviews were also taped so that more information could be gathered and the data could be analyzed more broadly to determine the data's significance. The data were gathered by firsthand observation on the informants' land in addition to interviews. To get a complete picture of the informants' perspectives on peatland management and agroforestry cultivation, all data were evaluated methodically and meticulously. As a result, the informants' collective experience with peatland and its conservation would be gathered at the end.

3 Results and Discussion

3.1 Land ownership and vegetation types

According to the results, there are two types of land ownership: 1) land tenure originating from a 2-hectare transmigration quota (consisting of a 0.25-hectare yard and a 1.75-hectare farming land) and 2) land

tenure acquired through a sale process [9]. There are also farmers who do not have a certificate of ownership or who are just managers of land owned by others without paying rent. Two informants, on the other hand, have land certificates as proof of ownership.

Dyera sp., *Hevea brasiliensis*, and *Shorea belangiran* trees are the most common plants planted by farmers on their land. Of course, they also plant other short-term crops. Farmers that use agroforestry initiatives as a solution to lower yields use this farming system. Meanwhile, a tiny number of other farmers, like the fourth and eighth informants, continue to plant only one variety of tree. Table 2 shows the vegetation that has been put on their land.

Table 2 demonstrates that most farmers use a terracing technique, in which one piece of land is planted with numerous types of plants with varying harvest times. They do this in order to bridge the gap between harvests by harvesting crops having a short harvest period. Monoculture farming is used by informants 4 and 8. They have long-term objectives or investments. They do this because farming is not their primary occupation. They also do not do frequent land inspections.

Table 2. Types of crops and tree plants grown on peatland by farmers

Informant	Land area (ha)	Type of crops and tree plants
1	2	<i>Dyera sp.</i> , tubers, fruits, <i>Hevea brasiliensis</i>
2	5	<i>Dyera sp.</i> , <i>Shorea belangiran</i> , <i>Capsicum annum L.</i> , fruits
3	2	<i>Dyera sp.</i> , fruits, tubers, <i>shorea belangiran</i>
4	2	<i>Shorea belangiran</i>
5	8	Mulberry, <i>Shorea belangiran</i> , <i>Alseodaphne sp.</i> , <i>Combretocarpus rotundatus</i> , <i>Dyera sp.</i> , <i>Alstonia scholaris</i> , <i>Hevea brasiliensis</i>
6	2	<i>Dyera sp.</i> , fruits, <i>Hevea brasiliensis</i>
7	2	<i>Hevea brasiliensis</i> , <i>Hevea brasiliensis</i> , fruits
8	3	<i>Dyera sp.</i>
9	3	<i>Paraserianthes falcataria</i> , tubers, fruits, <i>Hevea brasiliensis</i>

3.2 Motivation of farmers in managing peatlands

Each farmer's motive for land management is different. Five factors contribute to this variation in motivation: 1) readiness to do; 2) willingness to leave other things/tasks; 3) allocated time; 4) willingness to pay; and 5) persistence. The diverse motivations of

the farmers can be seen by looking at these five things. However, one of the most powerful motivations is to earn more money. Farmers who are driven to raise their income spend more time cultivating and are more willing to participate in government programs such as agroforestry [9]. Other motives include government programs, technical advancements, and pressure from particular groups, all of which force farmers to manage peatlands. Figure 1 depicts the motivation of farmers in further depth.

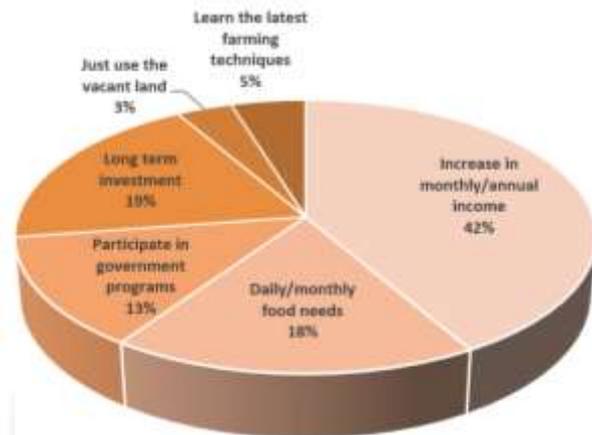


Figure 1. Farmers' motivation for peatland management

The participants under investigation expect government programs to boost their income, according to the data in Figure 1. This expectation is the driving force behind the community's efforts to manage peatlands, despite the fact that they are aware that peatland management necessitates the use of proper procedures. Furthermore, 18% of respondents said they farmed to meet their dietary needs, such as tubers, rice, and fruits. People with this type of drive are typically those whose primary occupation is not farming, such as teachers, office employees, and others. They engage in farming activities for a variety of reasons, such as a hobby or to fill up their weekends. Another reason is investment, which is typically a motivator for those who have a big source of income and do not work in agriculture as their primary occupation. They do not, on the whole, manage their land as intensively as farmers do. They will continue to harvest the land for a long time until the vegetation they plant is in a marketable state. Other motives are provided by agricultural communities with limited resources, such as small plots of land or those who are simply attempting to engage in farming activities.

3.3 Farmers' income from peatland processing

Farmers' primary reason for carrying out their tasks is to make money. Farming, growing animals

(chickens, bees, goats), fish cultivation, and tree nurseries are all part of their efforts. The informants' annual income from these activities ranged from USD 2,277 to USD 7,286.4. Their monthly salary ranges from USD 189.75 to USD 607.2. According to the statistics, their average monthly salary is USD 376.67. Seven informants said that they make more than USD 376.67 per month, while the rest make between USD 172.52 and USD 241.51 per month.

This information is a breath of fresh air for peatland farmers in Tumbang Nusa Village, Central Kalimantan, Indonesia, as they pursue economic development. This is due to the comparatively high value of the income. According to data from the Central Statistics Agency, the Indonesian people's income is divided into five categories: 1) very high-income group (>USD 241.51 per month); 2) high-income group (USD 172.51 – 241.51); 3) middle-income group (USD 103.50 to USD 172.51); and low-income group (less than USD 103.50) [5]. According to these figures, farmers' average monthly income falls into the very high-income category [9], [26], [27].

The findings of this study back up previous research by [26] that peatland farmers earn an average monthly income of USD 308.26, with income coming from agroforestry land management activities as well as non-land activities like raising livestock or other non-agricultural sources. Agriculture, animal husbandry, and fishing all provide more money, according to this study. The seven informants did not earn much money from the agricultural sector, but they believed that planting trees would have a long-term economic impact. *Dyera sp.*, a swamp tree [28], is the type of tree they usually plant. Of course, this tree is ideal for peatland restoration and the processing of its products such as logs, boards, plywood, and pulp. Farmers also grow rubber trees on the same area as these trees, as these trees can yield sap with a high economic value. As a result, in addition to being economically beneficial, this tree-planting strategy can also help to maintain peatland quality. This is consistent with [28] research, which indicates that planting this type of tree, along with rubber trees, results in a Net Present Value of USD 4,816.36, a BCR of 8.68, and an Internal Rate of Return of 29 [9], [27]. This is also supported by [27] that growing *Dyer sp.* and rubber in agroforestry can provide an NVP of USD 638.10, a BCR of 5.35, and an IRR of 24.1 [27]. These data are further corroborated by informants' assertions that planting these two trees will result in long-term savings, since they will no longer need to tap rubber sap for everyday needs. Even if the tree planting density is increased, their revenue will grow as well. Typically, more senior farmers with a higher level of

knowledge perform this planting compaction.

3.4 Farmers' knowledge of peatlands and their management

The residents of Tumbang Nusa village in Central Kalimantan, Indonesia, have their knowledge shaped by their ethnicity. Transmigrants from Java (Javanese and Sundanese) typically require a lengthy time of adaptation before they are capable of managing peatlands effectively. Typically, they manage the property based on their experience and failures. Indeed, it took them ten years to master agricultural peatland management techniques. Additionally, they discovered the management strategy by accident, where they increase the quality of the soil by burning peat and weeds. However, because this technique has a high danger of igniting forest fires, it is no longer employed [9]. This demonstrates the community's commitment to preventing peatland fires, despite the fact that it reduces rice and other crop yields. Currently, enhancing the quality of peat soil is primarily accomplished through the use of manure and inorganic fertilizers. The indigenous Dayak people of Kalimantan do not manage land for agricultural purposes. Typically, they rely on peat soil for fishing operations as a means of subsistence. They have, however, begun to channel this inclination towards agricultural pursuits as they recognize the economic benefits of land management through farming.

Farmers do not understand the need of tree planting for peatland conservation, according to nine of the nine informants. They also have no idea that deforestation reduces the peat soil surface. Deforestation activities can produce changes in the peatland's character, such as decomposition, in addition to land subsidence.

Because there is still a lot of abandoned land, peatland in Tumbang Nusa Village, Central Kalimantan, Indonesia, is prone to flames. The community was keen to avoid fires when clearing land, so they agreed to participate in a government-sponsored program including forest replanting combined with agriculture. Because fires are uncommon, this effort is considered a success. Agricultural operations, however, continue to produce soil subsidence of 0.41 – 3.21 cm per year when an agroforestry system is used [15], [20], [29]. Furthermore, by preventing peatlands from being burned, agricultural productivity, such as rice, has been lowered. As a result, the government should shift its focus away from agroforestry and toward other enterprises such as beekeeping, goat farming, and fish farming. Adaptive intercropping farming can be used in locations with low soil surface. Meanwhile, to avoid community losses due to peatland fire

prevention, the government should begin developing technology-based land management without burning [30].

Although there are still some bad situations that need to be assessed, land restoration operations such as tree planting have yielded positive effects. The *Belangiran* tree (*Shorea belangiran*) has been successfully planted in the village of Tumbang Nusa, in the territory belonging to the Research and Development Agency for Forests and the Sebangau National Park. Even the fifth informant states that he has been successful in running local tree nurseries for a variety of species, including *Meranti* trees (*Shorea sp.*), *Alstonia pneumatophore*, and others. People who participate in agroforestry have a strong understanding of nursery procedures, land management, and agriculture. As a result, in addition to planting the tree seeds they develop on the land, they also sell the seeds to other farmers. Under these circumstances, it is believed that information was exchanged amongst farmers as well as from the government to farmers. Several research that have built socioecological models have found that there is a two-way exchange of information about conservation initiatives between one area and another [31].

3.5 The value of the forest in the village community

All of the facts points to the same explanation: the forest is extremely vital to their life. There is, however, a distinction in these values between farmers from beyond the island of Kalimantan (transmigrants) and farmers from Kalimantan (the Dayak people). Peatlands are fully focused on farming activities with an agroforestry system for transmigrant farmers. Meanwhile, peatlands are viewed as a source of protein by farmers on the island of Kalimantan, particularly the Dayak people, who create results from the fisheries sector, where they have used this activity to meet their daily needs since the beginning [32]. Informants 2 and 3 also mentioned that the forest provides sustenance for their animals, such as the *uyah-uyah* shrub (*Stenomurus secundiflorus*). In addition, in the area of Tumbang Nusa Village there are irrigation canals that have been neglected, where these irrigation channels also provide benefits for increasing income because they produce *purun* (articulated *Lepironia*) plants. All informants explained that the community also used the land around the house where they lived by planting it with rubber trees.

All of the informants in the agricultural program with agroforestry stated that the trees planted provide positive environmental benefits such as beauty, tranquility, shade, fresh air due to improved oxygen

sources, and coolness. It is also possible to say that they have derived the benefits beginning beneath (tubers), above ground (chilies, veggies, and other crops), and above the trees (fruits). As a result, the entire community believes that the forest and its environment must be conserved because it provides people with food and shelter.

4 Conclusion

In Tumbang Nusa Village, Central Kalimantan, good peatland management has benefited the community, particularly agroforestry producers. Their monthly income ranges from USD 189.75 to USD 607.20, putting them in the high to very high income category. People may easily satisfy their everyday demands due to the high value of this revenue. With this additional income, the community become more driven to improve land management practices, including agroforestry. The management is also founded on community understanding of peat soils and their management, which began with the use of burning techniques and has progressed to the use of inorganic and occasional fertilizers. This is motivated by their desire to prevent forest fires, as they recognize that replanting trees offers numerous benefits, including shade, comfort, cooling, calm, beauty, and fresh air.

This study also has significant implications for government follow-up. The first concerns the agroforestry program's long-term viability, which has been repeated to the community on peatlands, but the community's response has been negative because the process takes so long. This is due to their motivation, which, according to the findings of this study, focuses on growing revenue in a shorter period of time. As a result, the government continues to push the agroforestry program while simultaneously developing agricultural and horticulture techniques that can produce speedier results. Using technology is, of course, the better option. The second implication is that the government's agroforestry effort can improve the variety of plants that can be grown. Because it is linked to lower agricultural yields on peatlands without burning, the government began to give alternate options using an agroforestry system based on short-term intercropping farming. Furthermore, the government has the ability to establish mentoring programs and provide technical assistance to the community.

However, this study has certain limitations. Although this study was able to provide a fairly comprehensive understanding of the topic under investigation, it was conducted using a limited sample size. As a result, future study should include a larger number of samples in order to get more reliable findings. In addition, future researchers should adopt a quantitative or mixed-methods approach. Finally, conducting similar research in different parts of

Indonesia and around the world will yield more reliable findings and conclusions.

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