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Original Research

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

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Abstract

Peatlands, as a type of ecosystem, are widely accepted to contribute to biodiversity, climate regulation, and human well-being. In comparison, it is reported that mismanagement of peatlands has resulted in a decline in environmental quality. To overcome this obstacle, the government should continue to investigate various cultivating strategies that allow for rapid propagation in order to accomplish the peatland restoration goal as efficiently as possible. However, due to the involvement in land restoration operations that initially met with little support from peatland farmers, their socioeconomic situation warranted further investigation. Therefore, this study examined the socioeconomic values associated with agricultural operations. This study employed a qualitative descriptive method and was conducted in Tumbang Nusa Village, Jabiren Raya Regency, Central Kalimantan, Indonesia, a region prone to peatland fires. The data were collected via interviews with 45 key informants. Land ownership, plant species, farmer motivations, farmer income, the value of forests to peatland farmers, and their understanding of peatlands and management were all collected. The findings indicate that successful peatland cultivation and management have benefited the farmer community. Land tenure is divided into two categories for peatland farmers: those derived from a 2-hectare transmigration quota and those acquired through a sale process. They, in general, have a firm grasp on peatlands and how to manage them, despite past failures due to ineffective techniques. They grow both short- and long-term plants, with the majority motivated by a desire to increase income from peatland cultivation and management. They earn between USD 2,277 and USD 7,286.4 per year from agricultural and non-agricultural products, placing them in the category of high-income individuals. While farmers from Java and indigenous people manage peatlands differently, they share a common goal: preventing peatland fires so they can continue to reap the economic benefits of land management through farming. Finally, they believe that the forest is necessary for survival, believing that peatland forests must be protected in order to survive. However, this study demonstrates that they continue to require guidance and assistance with sustainable peatland management that takes into account the socioeconomic functions of peatlands, strikes a balance between environmental protection and local community development,

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and employs cutting-edge technologies. Finally, the implications of the study are discussed, along with several recommendations for future research.

Keywords: agriculture, peatland, Indonesia, sustainable management, socioeconomics

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 fulfill 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]. However, human activities in managing land can cause environmental problems [10-13]. Therefore, adequate peatland management is required to avoid harmful environmental consequences such as forest and peatland fires, which occur every year [11].

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 between 132-159 million tons of carbon into the air, posing a health and life threat to the surrounding ecosystem [8, 14-16]. This is due to the enormous amount of carbon in peatlands [8]. Furthermore, poor management can result in flood disasters as a result of land subsidence [9, 17]. This type of mishandling has occurred in Indonesia. Forest and peatland fires occur practically every year. 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, 18-19]. Large-scale land clearing was carried out in Central Kalimantan in 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 a presidential regulation [9, 20-21]. The agency's efforts to prevent forest and peatland destruction had taken an integrated approach that included hydrological restoration, revegetation using endemic species, and restoring livelihoods in the surrounding community [9]. Livelihood rejuvenation was accomplished by introducing new crops, such as fish and beekeeping. These attempts, however, have not been entirely successful [22]. 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, 23].

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 [24]. 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 [25-27]. This has something to do with raising people's income. Furthermore, this approach has the potential to increase soil quality. Because of the 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 socioeconomic values in agricultural operations, such as land ownership, plant species, farmer's motivation, economic value of forests to rural communities, and farmer's understanding of peatlands and their management, as well as perceived wealth.

Material and Methods

This study investigated the perspectives of farmers in Tumbang Nusa Village, Jabiren Raya Regency, Central Kalimantan, Indonesia (Fig. 1), with a qualitative descriptive approach, that is typically used to evaluate a phenomenon, event, or social condition by gathering qualitative data and performing descriptive analysis [28-29]. 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 area, resulting in the loss of natural trees of considerable economic value. The community of the area is also a focus for the Peatland Reforestation Agency program because of these features.

Participants

The current study enrolled a total of 45 participants, chosen for interviews using a purposive sampling technique. They were 49.1 years old on average, with the majority (69%) having graduated from senior high school, nine (20%) having completed an undergraduate

Fig. 1. Research site.

degree, and five (11%) having completed an advanced diploma. In addition, their ethnic origins were diverse, with the majority (55%) being Javanese, followed by Sundanese, Dayak, and Lampung ethnic origins at 22%, 11%, and 11%, respectively. The majority of them (67%) received no land and forest fire control training, while the remainder did. We explained the study's purpose in detail and assured them that their privacy and anonymity would be protected. By taking part in the study, they consented to the use of the collected data.

Data Collection and Data Analysis

This study adopted interviews for data collection. To get a complete picture of the informants' perspectives on peatland management and agroforestry cultivation, all data were analyzed and interpreted methodically and meticulously. Thus, the results of the interviews were divided into several categories, including land ownership and vegetation types, farmer motivation in managing peatlands, farmer income from peatland management, farmer knowledge of peatlands and their management, and the forest's significance for the peatland farmers. To ensure the validity and accuracy of the information, findings were re-reported and triangulated to the key participants. The triangulation is described as an almost mandatory method for verifying findings [29]. As a result, the informants' collective experience with peatland and its conservation would be concluded at the end.

Results and Discussion

Land Ownership and Vegetation Types

Looking at the land ownership and vegetation types, the results of the interviews provide some insight into land ownership and vegetation types. Two types of land ownership have been identified: 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. Other informants, on the other hand, have land certificates as proof of ownership.

In addition, it was found that *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 continue to plant only one variety of plant. Their land is also 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 other participants. 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. In other words, farming generates a sizable portion of their total income, but it is not their primary occupation [30].

Thus, peatland agriculture has expanded in response to market demand and local socioeconomic and institutional capacity, as evidenced by this finding, which also supports previous findings [31]. Vegetable, fruit, and perennial crop farming is currently prevalent in peatland areas [32]. Farmers in Central Kalimantan choose crop varieties based on a number of factors, including familiarity with and knowledge of the species, accessibility to seeds and nurseries, accessibility to markets, personal importance of the species, availability and size of local markets for alternative crops, and harvest frequency [33].

Motivation of Farmers in Managing Peatlands

Regarding participants' motivation in managing their peatlands, it was found that each farmer's motive for land management is different (Fig. 2). However, it implies that one of the most powerful motivation is the desire 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.

The participants under investigation expect government programs to boost their income. This expectation is the driving force behind their efforts to manage peatlands, despite the fact that they are aware that peatland management necessitates the use of proper procedures. Furthermore, 17% of them said they farmed to meet their dietary needs, such as tubers, rice, and fruits. Farmers with this type of drive are typically those whose primary occupation is not farming [30], such as teachers, office employees, and others. They

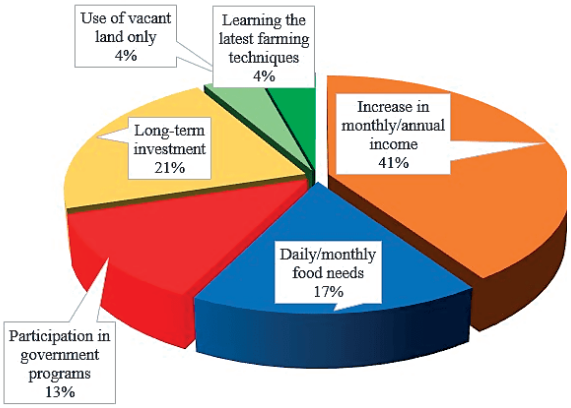

Fig. 2. Farmers' motivation for peatland management.

engage in farming activities for a variety of reasons, such as a hobby or to fill up their weekends [34]. 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 [35]. 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 [36].

Farmers' Income from Peatland Management

As previously implied, the primary motivation for farmers to perform their duties is financial gain. 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 172.52 to USD 607.2. From the income point of view, their environmental risk attitudes are strongly influenced by this aspect [37].

This information is a breath of fresh air for the peatland farmers as they pursue economic development. This is due to the comparatively high value of income. According to data from the Central Statistics Agency, the Indonesian people's income is divided into four 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 4) 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, 38, 39].

The findings of this study back up previous research [38] 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. Several informants did not earn money from the agricultural sector, but they believed that planting trees would have a long-term economic impact. *Dyera* sp., a swamp tree [40], is the type of tree they mostly 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 what is stated in the literature [40], which indicates that planting this type of tree, along with rubber trees, results in a Net Present Value (NPV) of USD 4,816.36, a BCR of 8.68, and an Internal Rate of Return (IRR) of 29 [9, 39]. This also supports the previous finding [39] that growing *Dyer* Sp. and rubber tree in agroforestry can provide an NPV of USD 638.10, a BCR of 5.35, and an IRR of 24.1 [31]. These data are further corroborated by informants' assertions that planting these two types of 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. Thus, increases in household, district, provincial, and national incomes can be attributed in large part to the shift to agricultural production on peatlands [31].

Farmers' Knowledge of Peatland Agriculture

Regarding farmers' knowledge of peatlands and their management, the findings of interviews indicate that ethnicity of farmers influences their knowledge of agriculture. The transmigrants from the Java island (Javanese and Sundanese) typically required a lengthy time of adaptation before they were capable of managing peatlands effectively. Typically, they managed their land based on their experience and failures. Indeed, it took them years to master agricultural peatland management techniques. Additionally, they discovered the management strategy by accident, where they increased 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 their 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. In other words, this is consistent with previous research that found that when peat is drained and fertilized, it can support the growth of almost all

kinds of crops, including vegetable and plantation crops [32], supporting the livelihoods of local people and contributing to the national economy [31].

Therefore, farmers' lack of knowledge about peatland conservation means that they do not realize that deforestation reduces the peat soil surface. Peatland decomposition can occur as a result of deforestation, as well as land subsidence [38-40]. Because there is still a lot of abandoned land, the peatland is prone to flames. The farmer 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 now 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 [19, 24, 44]. 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 [45].

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 territory belonging to the Research and Development Agency for Forests and the Sebangau National Park. Farmers who participate in agroforestry have a strong understanding of nursery procedures, land management, and agriculture. As a result, in addition to planting tree seeds they grow on the land, they also sell the seeds to other farmers. Under these circumstances, it is believed that information is 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 [46].

The Forest's Value to Peatland Farmers

All findings regarding the forest's value to peatland farmers point 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 make money from the fisheries sector, where they have carried out this activity to meet their daily needs since the beginning [47]. The forest also provides sustenance for their animals, such as the *uyah-uyah* shrub (*stenomurus secundiflorus*). All informants explained that they also make use of land around their houses 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 farmer community believes that forest and its environment must be conserved because they provide them with food and shelter. This finding supports what was previously found that in addition to their environmental importance, tropical peatlands are now being recognized for their growing social and economic value as well. In terms of environmental benefits, the ability to store large amounts of carbon is by far their most important one [31]. It is estimated that peatlands hold approximately 5% of all terrestrial carbon on the planet [48].

Conclusions

Based on the findings and discussion above, it is evident that successful peatland cultivation and management have benefited the farmer community. The peatland farmers hold two types of land tenure: those derived from a 2-hectare transmigration quota and those acquired through a sale process. They grow both short- and long-term plants, with almost all of them motivated by a desire to increase income from peatland cultivation and management. They can earn between USD 2,277 and USD 7,286.4 per year from peatland management and other sources of income, such as raising livestock (goats, chickens, fish, and trees), fish farming, and tree nurseries. Although farmers from Java and indigenous people manage peatlands differently, they share a common goal: to prevent peatland fires so that they can continue to reap the economic benefits of land management through farming. Finally, the forest is critical to their life.

This study also has significant implications. Despite the numerous difficulties and problems, especially with regard to the responsible management of peatland, it does provide a variety of socioeconomic functions that may be beneficial to nearby communities [31, 49]. Peatland has both market and non-market values, but there are also trade-offs between environmental and development goals. Therefore, the findings of this research can be used by the government to consider the issue of peatland's socioeconomic functions and balance the needs of environmental protection and local community development [31]. For example, adopting well-designed agri-environment schemes, if necessary,

is also a viable option [50-51]. Governments and policymakers can promote the agroforestry program while also developing agricultural and horticulture techniques that yield faster results. Using technology is, of course, the better option [45-47]. Furthermore, the government's agroforestry efforts can broaden the plant variety available. Because it is linked to lower agricultural yields on peatlands without burning, the government can start offering alternatives like an agroforestry system based on short-term intercropping farming. Finally, the government has the ability to establish mentoring programs and provide technical assistance to the farmer community [55-58].

However, this study has certain limitations. While this study was able to provide a fairly comprehensive understanding of the topic at hand, it requires additional research with a larger sample size to obtain more reliable findings. Additionally, future researchers should employ quantitative or mixed-methods research designs. Finally, conducting similar research in different parts of Indonesia and of the world will yield more reliable findings and conclusions.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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