Pol. J. Environ. Stud. Vol. 34, No. 2 (2025), 1017-1025
DOI: *10.15244/pjoes/187124* ONLINE PUBLICATION DATE: 2024-06-11

Original Research

Emphasizing Local Wisdom in Peatland Restoration in South Sumatra Indonesia

M. Edi Armanto[1*], Elisa Wildayana[1], Bella Syakina[2]

[1]Faculty of Agriculture, Sriwijaya University, Indralaya Campus, South Sumatra 30820, Indonesia.
[2]Centre for Global Sustainability Studies, Universiti Sains Malaysia, 11800 Penang, Malaysia.

Received: 29 December 2023
Accepted: 13 April 2024

Abstract

In the last three decades, most of the peatlands have been converted into industrial plantations (especially oil palm) and have had positive impacts, however, peatland degradation continues, productivity is decreasing, local wisdom is being lost, and rural poverty is still unresolved. Local wisdom is part of a society's culture, which is closely related to the uniqueness of indigenous people's territories and functions to preserve the environment, balance the ecosystem, and reduce degradation. This research aims to emphasize the importance of local wisdom in peatland restoration. This research was designed using a mixed approach by combining quantitative and qualitative methods. Primary data was collected through field observations and in-depth interviews with key informants from the Peat Restoration Agency, local government, private companies, non-governmental organizations (NGOs), and other local stakeholders. The research resulted in the need to emphasize local wisdom in peatland restoration. Recommendations for local wisdom and its cultivation approaches, namely: Multi-Purpose Tree Species (MPTS) applied with a decentralized approach (participation of farmers and authority delegation); Gelam forest and honey bees through a conservative approach (being more profitable in the long term); Sago cultivation is recommended using the protective approach (natural benefits are greater than their commercial benefits); and an auction system for fishing is implemented with an optimal approach (harmony with the time, quantity, and quality of the environment).

Keywords: Local wisdom, sustainability, managing, peatland degradation

Introduction

In the 18th century, peatland reclamation was carried out in the eastern coastal region of Sumatra to develop traditional agriculture [1]. However, until the 1970s, human settlements in this area were still avoided due to various internal problems with peatlands and problems that arose after reclamation [2]. The internal problems of peatlands, including difficulty in drainage, low fertility, the risk of various diseases (for example, malaria), and difficult road access, make residents less interested in developing them [3]. Since the 1980s, agricultural development has accelerated to meet population growth and the need for food, clothing, and housing, so investors and the government have expanded agricultural development on peatlands [4]. Over the last four decades, many efforts have been made to turn peatlands into areas for cultivating crops

*e-mail: mediarmanto@unsri.ac.id
Tel.: +62 711 580059;
Fax: +62 711 580276

in the broadest sense. There are examples of success achieved, but many more failures have even led to the extinction of peatlands [5].

Various causes of failure in peatland management include a general lack of understanding that peatlands are unique, as are the materials that change them. The special character of the landscape and underlying soil are often not recognized, and reclamation follows the same patterns as mineral soils [6]. This often has terrible consequences: drainage becomes poor, the frequency and magnitude of floods increase, there is a lack of nutrients in plants, and crop yields are poor [7]. These are all reasons why development projects and schemes are abandoned before reaching one harvest cycle [8].

On the east coast of Sumatra, peatlands were planted to develop the transmigration program in 1970, and in 1980, Javanese and Balinese transmigration settlements were placed in this area [9]. Several peat swamp forests have been successfully developed, such as Telang, Saleh, and Air Sugihan, but some areas have failed to be developed, for example, Pulai Rimau in South Sumatra [10]. In areas that fail to develop, the government is forced to assist in the form of rice for the poor (Raskin) so that the transmigrant community can survive. Likewise, the case of developing 1 million ha of peatlands in Central Kalimantan, Indonesia, also failed because the peatlands were unable to support the growth of rice plants [11]. With the failure of peat swamp reclamation, we must all be able to take lessons and gain experience so that the failure of peat swamp reclamation does not happen again [12]. However, it is very unfortunate that this failure is repeated with the reclamation of peatlands for industrial plantations [13].

The high conversion of peatlands into industrial plantations has been promoted by large-scale companies for rapid economic expansion [14]. In non-peat wetlands, the rate of conversion tends to increase significantly more slowly than in peatlands [15]. Conversion of peatlands will interfere with the ecosystem's ability to operate. These elements have played a part in the 1997 and 2015 El Niño-related fires that destroyed 1.4 million hectares of peatlands in Indonesia [16]. Peatland utilities ought to be implemented cautiously based on the findings of comprehensive research and peer evaluations [17]. Fertile peatlands with peat depths of less than one meter were the only ones targeted for development to support plantations and agricultural enterprises [18].

Local wisdom is a collection of community values and behaviors that interact with the environment [19]. It can take the form of values, norms, beliefs, mythical traditions, rituals, customs, art, literary works, symbols, and regulations. It relies on ethics and values in social life, which are considered cultural products of the past and continue to be held as a reference for managing peatland resources and the environment, while local techniques are the technical part of local wisdom [20]. Examples of local wisdom are, for example, Subak in Bali (regulating water management for rice fields) and sacred natural sites (forest preservation for the Baduy tribe, West Java). The research aims to emphasize the importance of local wisdom in peatland restoration.

Material and Methods

Time and Sites of Research

The research is conducted in the Peat Hydrological Unit of the Burnai Sibumbung area, which is administratively located in Ogan Komering Ilir District, South Sumatra Province, Indonesia, between 2020 and 2024. The research location can be seen in Fig. 1.

Data Collection Method

A total of 103 households were interviewed, which represents 20% of the entire 514 population of peatland households, and collected from two villages chosen. The selection of the two villages considered the characteristics of the area, which have clear boundaries with all existing physical components as well as similarities in local regulations owned by the community and implemented in the area. The interview scope was on questions about linkages of peatland degradation and rural poverty in development patterns of peatland restoration. Key informants from important institutions involved in the governance cycle (planning, implementation, monitoring, and evaluation) of peat restoration and related stakeholders were chosen through interviews using purposive and snowball sampling strategies.

The qualitative method seeks to learn about the conditions of a specific degradation caused by land use as well as the thoughts of farmers regarding degradation that has occurred in peatlands. The parameters and variables collected include the income of farmers, types of local wisdom, and land use on peatlands. The collected parameters for peatland degradation included depths and maturity of peatlands; these two parameters are important parameters for determining the level of peatland degradation. Government documents, reports, and scientific papers were utilized as secondary sources of data and information.

Data Analysis

All information gathered was typed (other field notes), scanned (examination of printed papers), or included in questionnaires, for example, including interview findings. Excel software was then utilized to give a more thorough content analysis once the data had been coded according to various parts of the conceptual framework. Tables, graphs, descriptions, and narratives are used to show the results.

The data collected in the form of interview transcripts, policies, and research reports was used in the first codification stage. Furthermore, the vulnerability of the peatland management cycle is also studied, especially in peatland restoration.

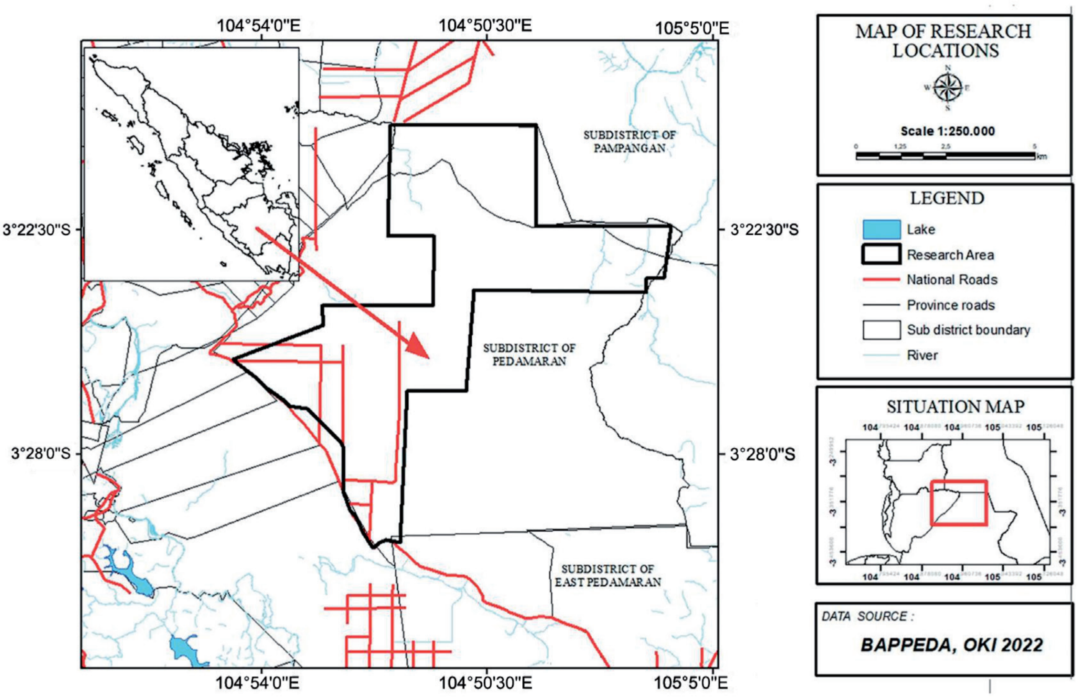

Fig. 1. Research location.

The second codification discussed risk management in the peat restoration governance cycle. The governance mechanisms of peatlands were next examined in the third coding session. The outcomes of the geographical analysis and field measurements were integrated with this analysis. The interrelationships among the various parts were thoroughly examined and cross-checked using program reports, policy documents, transcripts from interviews, and geographic data.

Results and Discussion

Linkages between Peatland Degradation and Rural Welfare

Based on data from the World Resources Institute [21], almost all peatlands in the research sites have been degraded; it was estimated that 24% belonged to the heavily degraded category, 40% were classified as moderately degraded, and around 36% were determined to be lightly degraded.

The results of the field survey succeeded in identifying nine different patterns for peatland restoration while improving rural welfare. They can be divided into three categories according to the peatland degradation phenomenon: degraded peatlands (S1, disaster; S2, useless; S3, tactics); not degraded peatlands (S4, Sceptic; S5, static; S6, strategic); and peatland quality improving (S7, volunteer; S8, happy; and S9, dream). According to local knowledge, the following three peatland restoration patterns can be achieved: S9, dream; S6, strategic; and S8, happy. Examples of the suggested species as priorities 1, 2, and 3 for each pattern are shown in Table 1. This finding is in line with research by other workers [22], who found the same pattern of peatlands in Kalimantan.

Peat degradation and rural poverty are often closely related and mutually influential elements in isolated, generally restricted peatland forest agroecosystems. From a poverty perspective, difficult times and low family incomes encourage more farmers to participate in large-scale illegal logging, which in turn can disrupt various ecological functions and increase the vulnerability of agricultural ecosystems to peatland degradation, especially fires. This pattern places more emphasis on the destruction of peatlands (S1, disaster; S2, useless). This finding is in line with the results of other workers [23].

Before industrial plantations started activities at the research sites, farmers lived in harmony with peatland resources (before the year 2000) and implemented local wisdom with an average household income of around 130-180 US per month. After peatland degradation occurred (starting in 2015, local wisdom was not implemented), household income was only 100-125 US per month. The household income declined after 2015 (without implementing local wisdom) because farmers lost the opportunity to harvest non-timber forest products from peat swamp forests and the negative impact of drainage and illegal logging. This condition is exacerbated by local people from outside the village who carry out fishing using poison and electric shocks, thus causing the destruction of fisheries resources.

Table 1. Linkage patterns (P) between peatland restoration and rural welfare.

RP/RW	RW (-)	RW (0)	RW (+)
RP (-)	P1(Fishing and burning; Fishing with batteries and poison)	P2 (Illegal logging)	P3 (Industrial plantations, Oil palm)
RP (0)	P4 (Slash and burn farming)	P5 (Purun handicraft; Wild animal hunting)	P6 (Jelutong; sap; resin; Gaharu; and fish auction)
RP (+)	P7 (Protected forest; Wildlife preservation)	P8 (Pineapple and Aloe vera cultivation)	P9 (Sago; Gelam forest; Honeybee)

Note: RW, rural welfare; RP, peatland degradation; The shadowed colour means the local wisdom Patterns.

P1 (disaster)	:	An interaction type between environmental changes in peatlands (RP) and rural welfare (RW) occurs when the use of peatlands reduces rural welfare (RW-) and degrades the quality of peatlands (RP-).
P2 (useless)	:	This interaction type in which degradation to the peatlands (RP-) occurs while rural welfare (RW0) is mostly constant.
P3 (tactic)	:	A situation in which using peatlands improves rural welfare (RW+) but degrades the quality of the peatlands (RP-).
P4 (sceptic)	:	An interaction situation in which the usage of peatlands reduces rural welfare (RW-) but does not enhance peatland quality (RP0).
P5 (static)	:	In this interaction type, using peatlands has not decreased the quality of peatlands (RP0) and has shown to be comparatively ineffective in enhancing rural welfare (RW0).
P6 (strategic)	:	In this interaction type, using peatlands can increase rural welfare (RW+), but the quality of the peatlands (RP0) cannot be improved.
P7 (volunteer)	:	An interaction type whereby the usage of peatlands, whilst having an effect on improving the quality of peatlands (RP+), lowers the quality of rural welfare (RW-).
P8 (happy)	:	The interaction type wherein the use of peatlands has an effect on enhancing the quality of the peatlands (RP+), but it has been demonstrated that this use cannot increase rural welfare (RW0).
P9 (dream)	:	The interaction type wherein it has been demonstrated that using peatlands can both enhance rural welfare (RW+) and increase the quality of peatlands (RP+).

Source: Field survey results analysis (2024).

Field Actualization of Nine Patterns

Based on the relationship between nine peatland restoration patterns and rural poverty, most of the research sites were dominated by the S3 (tactic) pattern, with the main commodities being oil palm and acacia. Even though industrial plantations can improve rural welfare (FW+), these efforts are not able to improve the quality of peatlands (PR0) because these two species are not native peatland plants and require continuous drainage (drying), so the groundwater level continues to decline at deeper depths (less than – 50 cm). This drainage action is the beginning of sustainable peatland degradation. This finding supports the results of other studies [24].

Furthermore, the reaction of indigenous farmers to the existence of the industrial plantations was to abandon their farming activities and work as day laborers on these plantations. Those who were less fortunate could not work on the industrial plantations, so they carried out some activities on the peatlands by applying patterns S1 (disaster, namely fishing with batteries and poison, burning) and S2 (useless, for example, illegal logging). Both patterns exacerbate pattern S3 (tactic), so that the pressure received by peatlands becomes heavier and leads to the degradation of peatlands.

The interaction between the four main elements of peatlands, especially hydrological conditions, plant and animal life, peat properties, and carbon deposits, determines peatland ecosystems. If patterns S3 (tactic, performed by industrial plantations), S1 (disaster), and S2 (useless) were performed by the indigenous farmers making land clearing in the peat dome, this would result in damage to peat hydrology, which in turn causes peat subsidence, increased peat damage, and loss of C in the peat dome. The wildfires are becoming more frequent because of all these factors and the resulting climate change. This finding is relevant to the results of other workers [25].

However, when wildfires spread throughout the ecosystem, large peatland and forest fires will harm communities and agricultural land, thereby increasing the possibility of drought and floods. Therefore, an investigation into the socioeconomic response to agricultural or non-agricultural-based programs to reduce poverty is necessary. Apart from that, peat restoration management needs to be well planned to accommodate peatland zoning and the availability of domestic laborers. Therefore, there is no other way. If you want to save peatlands, then the expansion of industrial plantations must be minimized and replaced with native peatland commodities. This result is in line with the results of other workers [26].

Some Efforts to Achieve the Suggested Patterns

On peatlands with depths of less than 1.0 m and hemic and sapric maturity, various crops can grow optimally if proper groundwater management can be carried out. Other employees likewise demonstrated this outcome [27]. However, the field results showed that production and income earned from peatlands were insufficient to support the growing needs and expenditures of families. The three factors that underlie this phenomenon are low agricultural productivity, which is often unresponsive to recent advancements in peatland agronomy; unstable agricultural commodity prices, which are not responsive to market fluctuations and limited demand from small-area and agro-industrial populations; and inadequate transportation infrastructure, which makes it challenging for indigenous farmers to make a living and is not responsive to changes in sale prices. These findings were in line with those of other workers [28], who stated that farmers' lives on peatlands were always related to poverty.

The main constraints preventing indigenous farmers from being able to participate in peatland restoration mechanisms were summarized, as a lack of knowledge about the instability of peatlands turned out to be the most important challenge faced by farmers (31%). This is because the research sites are transmigration areas, where the population was brought from Java Island and was accustomed to up-land farming, which is completely different from peatlands. Till now, there has not been a single institution of either government or NGOs that has been responsible for educating farmers on the spatial and temporal dynamics characteristic of the peatlands. This was exacerbated by climate conditions that were difficult to predict due to the influence of climate change and global warming. While the lack of medium-term credit plays a role of only 10%, this indicates that the farmer was not used to trying to use banking facilities. Furthermore, the constantly revised spatial planning conditions of the transmigration area cause the unclear peatland ownership and legality factor to play a fairly high role (20%). Further variables that may worsen farmers' participation in peatland restoration are the lack of commercial economies of scale, insufficient institutional capacity, and restricted access to rural infrastructure, which are 14; 13; and 12%, respectively. This result is similar to the results of other workers [29].

It will become clear that growing seasonal and annual crops, including trees, can mitigate the negative effects of increasing land conversion brought on by boomerang land expansion, and seasonal mixed farming can lower risks and enhance farmers' sources of income. Other employees likewise demonstrated this outcome [30].

In order to restore peatlands for agricultural use, agricultural activity has to serve a variety of functions in the production of both food and non-food items rather than being limited to agricultural output. This is so that the increases in forest cover brought about by these efforts will most likely contribute to the rehabilitation of the ecosystem. When creating an ecosystem engineering plan for degraded peatlands, three operational assumptions have to be addressed, namely:

1) The establishment of paludiculture and food production on shallow peatlands at the peatland borders has to be the primary focus of agricultural efforts. Hence, the combination of agronomic and silvicultural treatments should maximize the benefits of the selected crop mix.
2) Peat domes should only be revegetated with peat native species that are adapted to that environment, namely red meranti (*Shorea balangeran*), fisheries, Honeybees, Tumeh (*Combretocarpus rotundatus*), and Sago, which can be cultivated in degraded peatlands.
3) When cultivating tree species for peat dome revegetation, start at the edges of the dome and work your way inside. In order to combat poverty, tree species farming can be replaced with Jelutong and Ramin.

The indigenous farmers who live in and around peatland agroecosystems are currently constantly in danger due to the growing push of regional development aimed at profitably exploiting these ecosystems. Rural smallholders frequently farm existing peatlands in an unorganized way because of limited market accessibility and a lack of innovative agriculture. If the peat thickness is more than three meters, the peatlands are frequently viewed as a source of land for future generations. When this occurs, stakeholders frequently disagree about who has access to planted or natural wood so that it can be utilized for farming. In these situations, farmers typically operate on a "first come, first served" basis, which gives the impression that illegal logging and slash-and-burn farming are respectable means of subsistence. This result was indicated by other workers [31]. Patterns of dream (S9), strategic (S6), or happy (S8) can be determined as priorities 1, 2, and 3, respectively.

Selected Local Wisdom Types in the Peatland Restoration

Environmental engineering is necessary to maintain local wisdom, that is, through the social development of society, to maintain traditions passed down from generation to generation as local wisdom. Based on the field results, it turns out that various local wisdoms that can be developed are Multi-Purpose Tree Species (MPTS); Gelam Forest and Honeybee; Sago cultivation; and an auction system for fishing (Table 2). However, it is unfortunate that all this local wisdom has almost

Table 2. Using various forms of local wisdom in peatland restoration.

Local wisdom	Main Key parameters	Application approaches
Multi-Purpose Tree Species (MPTS)	Supporting the sustainable harvest of food and species resources.	Decentralized (participation of farmers, and authority delegation)
Gelam forest and honeybee	Providing firewood and serving as a honeybee colony.	Conservative (being more profitable in the long term)
Sago cultivation	Replacing rice, a primary diet, and serving as a raw resource for industry.	Protective (natural benefits are greater than their commercial benefits)
Auction system for fishing	Catching fish, a raw resource used in industry.	Optimal (harmony with the time, quantity, and quality of the environment)

Source: Field survey results analysis (2024).

disappeared (about 10-20% of local commodities retain it) due to the government's policy of granting concessions to industrial plantations, and most indigenous farmers work in this sector. With peatland restoration, there is an opportunity to reactivate this local wisdom so that peatland degradation can be minimized and create new sources of livelihood for indigenous farmers.

MPTS is beneficial from an ecological and economic perspective and produces wood and non-wood commodities so that cultivating farmers can utilize non-wood commodities from the MPTS plants cultivated without cutting down trees. Some examples of MPTS plants are Sugar Palm (*Arenga pinnata* (Wurmb) Merr.), Guava (*Psidium guajava* L.), Cinnamon (*Cinnamomum verum* L.), and Petai (*Parkia speciosa* Hassk).

Gelam forest (Eucalyptus, *Melaleuca cajuputi*) is a wood that extracts eucalyptus oil sources and has been found growing wild in peatland forest areas. Gelam trees are considered hardy trees because they can withstand conditions of drought, strong winds, or extremely hot temperatures. They are also sometimes considered weeds if they grow outside their original range. Gelam trees are also suitable as attractive landscape plants in gardens. Gelam leaves are used in distilling cajeput, or tea tree oil, used for medicinal and antiseptic purposes. Their leaves are used to treat stomach pain and plague. Their trees treat burns, abdominal pain, cramps, skin diseases, wounds, and various ailments and diseases, such as gout, to treat joint diseases. While the pink/brown gemstone wood has a uniform texture and is popular for carving, cabinet bark pieces of this tree are widely used in the boat-making industry, especially for insulation between boatboard sheets. For honey beekeepers, the dark forest is the most preferred plant for the transfer of bees because it flowers all year round and can produce quality honey.

Honeybee farming has been a legacy passed down from generation to generation and has proven to be able to contribute to the sustainable use of peatland resources. Honeybees are one of the community's local wisdoms. When compared to other commodities, the results of detecting potential hazards indicate that the risks associated with honeybee farming are comparatively manageable. Honeybee colonies are often found in the Gelam forest. Other workers also discovered this cultivation of honeybees [32].

Sago cultivation is derived from Rumbia or Sago (*Metroxylon sagu* Rottb). Before Indian immigrants brought rice to Indonesia, sago flour was a staple food and was consumed in larger numbers than wheat. It has also been passed down through the centuries as a raw resource for manufacturing. Additionally, there is little chance of crop failure with sago production.

Sago is consumed daily, as is Pempek, a traditional fish cake made from tapioca and ground fish meat. This meal originated in the South Sumatra region, in the city of Palembang, Indonesia. Sago became a mainstay, producing flour other than tapioca, taking good care of the environment, and avoiding the import dependence of sago. Preserving sago to save our culture and the local cuisine of Pempek. Based on the Talang Tuwo Inscription made by King Sriwijaya in 684 BC, the people of Sriwijaya planted sago trees. Cultivating sago is the same as performing the mandate of Raja Sriwijaya. So, no wonder, until now, sago has been very much needed by the people of Palembang. Because the order of King Sriwijaya gave birth to the culinary tradition of Pempek, to restore Sago food security, it is necessary to include Sago trees in peat restoration schemes and social forestry to achieve strengthened food security based on the environment.

The auction system for fishing, which has been passed down from generation to generation, can contribute to the sustainable use of fisheries resources. Fish farming was one of the community's local wisdoms in the field of fisheries resources. By taxing the catch, environmental engineers can shift the patterns of use of mobile fishing gear to permanent aquaculture. It is anticipated that farmers will gradually transition to fixed aquaculture patterns to save on fishing expenses. This will keep helping to ensure that fisheries resources in peatland areas are used sustainably. The results of identifying potential threats show that river waters that have auction status have relatively tolerable potential threats compared to non-auction-status water areas.

The dry season, when the water in the peatlands, canals, and rivers recede, is a fish harvest time for indigenous farmers as diverse fish species gather in the remaining puddles. The way people catch fish like this is called fish collecting (melebung), using a variety of means, ranging from hands, nets, and fishing rods. In the past, not all fish were harvested; fish were taken if they were medium to large (over 8 cm in size). Small fish (less than 8 cm) were abandoned because, during the rainy season, the young fish will breed. But now all the fish are taken, including the small ones. Ironically, the dwindling population of these fish makes people more and more "greedy" in fishing, for example, using a battery stun or poison, and fish caught of any size, both large and small, are harvested. This finding is in line with the results of other workers [33].

In addition to rice, fish is the main food source for the indigenous farmers because fish is consumed every day with rice. Fish can be managed on a variety of menus. So, what is feared about the impact of this drought is not just land fires, but also the food crisis. The impact felt by communities settling around peatlands in the dry season became a lesson for the government to maintain remaining peatlands, for example, not allowing clearing peatlands (slash-and-burn farming), stockpiling peatlands, and prohibiting the harvesting of fish that are less than 8 cm in size. If peatlands continue to be overutilized, many rural communities will certainly starve to death, especially during the dry season.

Application Approaches of the Selected Local Wisdom

Based on field facts, it turns out that there were conflicts between industrial plantations and indigenous farmers, especially in managing the peatland restoration. Thus, four approaches are recommended for sustainable peatland restoration based on local wisdom (Table 2), namely:

1) Decentralization approach, namely an approach to authority delegation with participation strategies, linkages, management, and marketing. Its characteristics are community empowerment, location specificity, and commodity zoning. This can be realized by implementing technology to provide benefits to beneficiaries, stakeholders, as well as the environment, and, in line with the revitalization program, for example, by cultivating MPTS plants.
2) Conservative approach, meaning that a business strategy (more profitable in the long term) has to be chosen, even if it seems less profitable in the short term. For example, Gelam Forest and Honeybee do not need drainage of peatlands.
3) Protective approach, meaning to protect peatlands whose natural benefits are greater than their commercial benefits, and in line with ecological restoration, for example, implementing Sago cultivation. Sago does not need drainage of peatlands.
4) The optimal approach, namely peatlands, can be managed in harmony with the time, quantity, and quality that are most optimal and most lasting, continuously bringing benefits, for example, through an auction system for fishing.

Conclusions

Before 2000, when industrial plantations started activities at the research site, household income was approximately 130-180 USD per month because they lived in harmony with nature. But, after 2015, local wisdom was not implemented due to peatland degradation caused by the industrial plantations, and the income significantly decreased to around 100-125 USD only. Farmers lost the opportunity to harvest non-timber forest products from peat swamp forests due to the negative impact of drainage and illegal logging. This is also exacerbated by local people from outside the village; destroying fishery resources through destructive fishing (using poison and electric shocks).

Nine peatland restoration patterns can improve rural welfare and can be grouped based on the peatland phenomenon, namely degraded peatlands cover patterns (S1, disaster; S2, useless; S3, tactics); peatlands are not degraded covering patterns (S4, Sceptic; S5, static; S6, strategic); and peatland quality increases covering patterns (S7, volunteer; S8, happy; and S9, dream). Achieving three local wisdom patterns (S9, dream; S6, strategic; and S8, happy) as priorities 1, 2, and 3.

Recommendations for local wisdom and its cultivation approaches, namely: Multi-Purpose Tree Species (MPTS) applied with a decentralized approach (participation of farmers and authority delegation); Gelam forest and honey bees through a conservative approach (being more profitable in the long term); Sago cultivation is recommended using the protective approach (natural benefits are greater than their commercial benefits), and an auction system for fishing is implemented using the optimal approach (harmony with the time, quantity, and quality of the environment).

Acknowledgments

To our colleagues and students who assisted with this research, the authors would like to thank you. We also thank the locals for their assistance in field research.

Conflict of Interest

The authors so certify that there is no conflict of interest resulting from an overlap between personal and professional obligations or responsibilities, such as those about research funding, prestige, expertise, connections, or reputation that might give rise to issues.

References

1. ARMANTO M.E. Improving rice yield and income of farmers by managing the soil organic carbon in South Sumatra Landscape, Indonesia. Iraqi Journal of Agricultural Sciences, **50** (2), 653, **2019**.
2. WILDAYANA E., ARMANTO M.E. Lebak swamp typology and rice production potency in South Sumatra. Agriekonomika, **7** (1), 30, **2018**.
3. MENDHAM D.S., SAKUNTALADEWI N., RAMAWATI YUWATI T.W., BUDININGSIH K., PRASETYO B.D., HANDOYO. Facilitating new livelihoods to promote peatland restoration in Indonesia - what are the challenges for ensuring sustainable and equitable livelihood transitions? Mires Peat, **30** (04), 14, **2024**.
4. WILDAYANA E., ARMANTO M.E. Dynamics of landuse changes and general perception of farmers on South Sumatra Wetlands. Bulgarian Journal of Agricultural Science, **24** (2), 180, **2018**.
5. LÁZARO-LOBO A., RUIZ-BENITO P., CRUZ-ALONSO V., CASTRO-DÍEZ P. Quantifying carbon storage and sequestration by native and non-native forests under contrasting climate types. Global Change Biology, **29** (16), 4530, **2023**.
6. BYG A., NOVO P., KYLE C. Caring for Cinderella - Perceptions and experiences of peatland restoration in Scotland. People and Nature, **5**, 302, **2023**.
7. ARMANTO M.E. Comparison of chemical properties of peats under different land uses in South Sumatra, Indonesia. Journal of Ecological Engineering, **20** (5), 184, **2019**.
8. ZHAO B., ZHUANG Q. Peatlands and their carbon dynamics in northern high latitudes from 1990 to 2300: A process-based biogeochemistry model analysis. Biogeosciences, **20** (1), 251, **2023**.
9. SAKUNTALADEWI N., MENDHAM D.S., SUBARUDI, ROCHMAYANTO Y., JALILOV S.M., DJAENUDIN D., EFFENDI R., ASTANA S., WIBOWO A. Vulnerability of communities living on peatlands to climate change and peatland degradation: A case study in Tumbang Nusa Village, Central Kalimantan, Indonesia. Mires Peat, **30** (04), 18, **2024**.
10. JALILOV S.M., LESTARI S., WINARNO B., YUWATI T.W., SAKUNTALADEWI N., MENDHAM D. Why is tropical peatland conservation so challenging? Findings from a livelihood assessment in Sumatra, Indonesia. Mires Peat, **30** (03), 20, **2024**.
11. ARMANTO M.E., ADZEMI M.A., WILDAYANA E., IMANUDIN M.S. Land evaluation for paddy cultivation in the reclaimed tidal lowland in Delta Saleh, South Sumatra, Indonesia. Journal of Sustainability Science and Management, **8** (1), 32, **2013**.
12. ARMANTO M.E., ZUHDI MOHD., SETIABUDIDAYA D., NGUDIANTORO, WILDAYANA E., HERMAWAN A., IMANUDIN M.S. Deciphering spatial variability and kriging mapping for soil pH and groundwater levels. Suboptimal Land Journal, **11** (2), 187, **2022**.
13. ARMANTO M.E., WILDAYANA E., SYAKINA B. Deciphering the anthropogenic challenges of peat swamp forest degradation to improve awareness and emphasis on restoration in South Sumatra. Forestry Ideas, **29** (2), 207, **2023**.
14. ARMANTO M.E., WILDAYANA E. Accessibility impact to government programs on the household income contribution at the various livelihood sources of farmers. Agriekonomika Journal, **11** (1), 62, **2022**.
15. ARMANTO M.E., HERMAWAN A., IMANUDIN M.S., WILDAYANA E., SUKARDI., TRIANA A.N. Biomass and soil nutrients turnover affected by different peat vegetation. Journal of Wetlands Environment Management, **11** (1), 31, **2023**.
16. HE N., YAN P., LIU C., XU L., LI M., VAN MEERBEEK K., ZHOU G., ZHOU G., LIU S., ZHOU X., LI S., NIU S., HAN X., BUCKLEY T.N., SACK L., YU G. Predicting ecosystem productivity based on plant community traits. Trends in Plant Science, **28** (1), 43, **2023**.
17. WILDAYANA E., ARMANTO M.E. Empowering indigenous farmers with fish farming on South Sumatra Peatlands. Habitat, **32** (1), 1, **2021**.
18. WILDAYANA E., ARMANTO M.E., IMANUDIN M.S., JUNEDI H. Characterizing and analyzing sonor system in peatlands. Journal of Wetlands Environment Management, **5** (2), 6, **2017**.
19. WILDAYANA E., ARMANTO M.E. Formulating popular policies for peat restoration based on livelihoods of local farmers. Journal of Sustainable Development, **11** (3), 85, **2018**.
20. WILDAYANA E., ADRIANI D., ARMANTO M.E. Livelihoods, household income and indigenous technology in South Sumatra Wetlands. Sriwijaya Journal of Environment, **2** (1), 23, **2017**.
21. SYAKINA B., NOR R.M., ARMANTO M.E. Linkages of peatland degradation and rural poverty in development scenarios of peatland restoration. Geografia-Malaysian Journal of Society and Space, **20** (1), 85, **2024**.
22. WILDAYANA E., ARMANTO M.E., ZAHRI I., ADRIANI D., SYAKINA B. Socio economic factors causing rapid peatlands degradation in South Sumatra. Sriwijaya Journal of Environment, **3** (3), 87, **2019**.
23. SYAKINA B., NOR R.M., ARMANTO M.E. Elucidating indigenous farmers' avoidance of deep peatlands for food crop farming in South Sumatra province, Indonesia. Forestry Ideas, **30** (1), 3, **2024**.
24. WILDAYANA E., ARMANTO M.E., ZAHRI I., ADRIANI D., SYAKINA B. Socio economic factors causing rapid peatlands degradation in South Sumatra. Sriwijaya Journal of Environment, **3** (3), 87, **2019**.
25. WILDAYANA E., ARMANTO M.E. Utilizing non-timber extraction of swamp forests over time for rural livelihoods. Journal of Sustainable Development, **11** (2), 52, **2018**.
26. GROVER S., TREBY S., MENDHAM D.S., YUWATI T.W., SAKUNTALADEWI N., LANGSTON J.D., RAWLUK A. Social and Ecological Dimensions of Tropical Peatland Restoration. Mires Peat, **30** (00), 8, **2024**.
27. FLEMING A., MENDHAM D.S., SAKUNTALADEWI N., GROVER S., JALILOV S.M., PAUL B., NASUTION A.H., LESTARI S., SINCLAIR A.L., RACHMANADI D., YUWATI T.W., WINARNO B. Community perceptions of peat rewetting in Tumbang Nusa Village, Indonesia. Mires Peat, **30** (01), 17, **2024**.
28. TOUMBOUROU T.D., GROVER S., ARIFANTI V.B., BUDININGSIH K., IDRUS N.I., LESTARI S., RACHMANADI D., SAKUNTALADEWI N., SALMINAH M., TREBY S., WINARNO B., YUWATI T.W., RAMAWATI., RAWLUK A. Identifying a shared vision for peatland restoration: Adapting the Delphi method to enhance collaboration. Mires Peat, **30** (02), 24, **2024**.
29. KISSINGER K., YAMANI A., PITRI R.M.N., NASRULLOH A.V. Impacts of forest farmers management on *Lepironia articulata* Retz.: Conservation based on utilization of peat ecosystem biodiversity in South

Kalimantan. Polish Journal of Environmental Studies, **33** (2), 1203, **2024**.
30. SANTIANI S., RUSILOWATI A., SUDARMIN S., NGABEKTI S. Fit-model sustainable competencies of Palangka Raya Indonesia peatlands in the environmental literacy (P-PSEL) Questionnaire for Teacher-Candidates. Polish Journal of Environmental Studies, **32** (2), 1781, **2023**.
31. ELIA A., YULIANTI N. The Socioeconomic conditions of tropical peat farmers: A case study in Central Kalimantan, Indonesia. Polish Journal of Environmental Studies, **31** (5), 4603, **2022**.
32. SALIM A.G., NARENDRA B.H., DHARMAWAN I.W.S., PRATIWI P. Chemical and hydro-physical peat characteristics under agricultural peat land management in Central Kalimantan, Indonesia. Polish Journal of Environmental Studies, **30** (5), 4647, **2021**.
33. ZHANG Y. Building a bridge between biodiversity and ecosystem multifunctionality. Global Change Biology, **29** (16), 4456, **2023**.