

Adaptive Capacity of Indonesian Peatland Communities Facing Resource Loss and Fires Threats: Studies on Purun (*Eleocharis dulcis*) Craftsmen



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ABSTRACT

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This study investigates the adaptive capacity of peatland communities, specifically purun artisans, in response to the transformation of peatlands into oil palm concessions and the devastating impact of land fires on purun raw materials. Traditional reliance on purun as a primary income source is gradually diminishing, with alternative economic opportunities non-peat based becoming increasingly scarce. Utilizing a descriptive qualitative methodology, this research integrates in-depth interviews, observations, and a comprehensive literature review to examine the resilience of these communities amidst environmental change. One hundred individuals from purun artisan groups at the study site were interviewed to gather data on socio-economic transition and adaptation strategies. The findings suggest the current adaptive capacity of these communities is in a precarious state, indicating a need for interventions to enhance resilience and sustainable livelihoods. This research underscores the pressing issue of peatland conversion and its socio-economic implications, making a significant contribution to the discourse on community resilience and peatland management. It also calls for further exploration into viable alternative income sources and capacity-building strategies to safeguard these communities' future.

1. INTRODUCTION

Significant transformations in Indonesia's peatlands over recent decades have been driven by governmental initiatives aiming to augment societal welfare through the exploitation of peatland resources. To orchestrate and streamline peat restoration across Indonesia, particularly in priority provinces such as South Sumatra, Jambi, South Kalimantan, West Kalimantan, Central Kalimantan, Riau, and Papua, the Peat and Mangrove Restoration Agency (BRGM) was established under the Presidential Regulation of the Republic of Indonesia Number 1 of 2016 [1]. Three core programs were initiated: rewetting, revegetation, and livelihood revitalization.

Livelihood revitalization, through environmentally conscious peat management, can enhance community welfare by enabling local communities to utilize peatlands for sustenance and income generation. In South Sumatra Province, indigenous peat plants, specifically purun plants (*Eleocharis dulcis*), are exploited [2]. Dating back to the 1970s, inhabitants of the Ogan Komering Ilir (OKI) Regency residing near peatlands have leveraged purun plants to produce woven products. This weaving culture, particularly among women, has been transmitted across generations.

Yet, the forest and peatland fires of 2015 inflicted considerable damage. Approximately 2.6 million hectares of land were scorched, 34% of which was peatland [3]. This catastrophe had a profound impact on the purun community

inhabiting the peatland area, inciting fears of a purun raw material shortage. Deteriorating water and peatland conditions further exacerbated the problem, leading to a decline in purun plant quality. Consequently, income generation and livelihood opportunities diminished, and poverty proliferated.

These circumstances pose a significant threat to the livelihoods of the purun populations dwelling near peatlands. Vulnerability is articulated in terms of the capacity of individuals and social groups to respond, cope with, or adapt to external challenges threatening their livelihoods and welfare. The presence of threats that augment a community's susceptibility necessitates the ability to adapt to restore optimal conditions [4].

Adaptive capacity is defined as the ability of a system to manage change by leveraging available opportunities to mitigate risks and undesirable consequences [5]. Additionally, adaptive capacity could be considered as the capacity to respond to challenges via learning, information acquisition, and the collaborative development of practical strategies [6]. Given this, the exploration of the adaptive capacity of peatland communities amid these challenges becomes essential. This paper aims to probe the adaptive capacities of peatland residents in sustaining their livelihoods and community welfare. The theoretical framework is presented in Section 2, followed by the methodology in Section 3. Section 4 shares narratives about the adaptive capacity of individuals in response to the threat of resource loss and fires.

2. LITERATURE REVIEW

To comprehend the adaptive capacity of communities residing near peatlands, it is necessary to define the idea precisely. Adaptive capacity, as said, is the ability or capacity of a system to better deal with current and future pressures [6].

In this instance, the intended pressure consists of disturbances such as the threat of loss of peatlands that are converted into plantations [7] and ecological disasters such as fires on peatlands that are abandoned in a damaged state [8], causing local communities such as purun craftsmen who have been dependent on peatlands to be disrupted [9].

Although, as we shall see, the community confirmed this in multiple interviews, they claimed that the perceived dangers had not significantly impacted their economy. This indicates that the current issues are deemed to be in a manageable state and have not impeded daily life. Yet, this does not mean that populations living near peatlands will be free of social and ecological challenges, as the trend for these threats to increase will continue.

This study describes the adaptive capacity of communities surrounding peatlands. Individual adaptation capability can be viewed as a function of the individual's access to diverse resources [6]. People with greater access to assistance have greater adaptability than those without access. Therefore, a distinct method must be utilized when assessing adaptive capacity at the community level.

At the community level, adaptive capacity emphasizes collective readiness to respond to threats. The extent of a system's adaptive capacity will define its ability to modify or alter its traits and behavior in response to real or predicted stress [10]. Adaptation differs from adaptive capacity in that adaptation is a change in the behavior and characteristics of a system that enhances its ability to cope with external stress or a reaction to a stressor [11]. Adaptation differs from coping in that coping strategies consist mostly of several short-term responses to conditions that endanger livelihood systems, and frequently take the shape of emergency measures. In contrast, adaptation strategies are dependent on characteristics such as cultural values, which take longer to evolve. Change, including how people, households, and communities adjust their economic activities and local and institutional arrangements to ensure their livelihoods [12].

Adaptive capacity is how people and groups can retain, recall, and use their memories and experiences to learn, generate new ideas, and reorganize their resources in response to a changing environment. Also, there are good connections with people inside and outside the community, making sharing learning experiences and outcomes simple and self-organizing or reorganizing when no one from the outside can provide guidance or obtain resources. Hence, institutional memory, innovative learning, and connectedness form the basis of adaptive capacity at the community level [13].

Institutional memory is the cumulative experience and local knowledge of a group or community, which is gathered through group observations and retained in a variety of forms, including written documents, rituals, or repeated rites carried out in accordance with group membership throughout time. In addition, individuals or communities can use the information and knowledge they possess to create a new adaptation to environmental changes or prevent repeating past errors; this is known as Innovative learning [13].

Moreover, interpersonal, and social connections enhance the dissemination of institutional memory and inventive

learning (connectedness). These connections may be informal social networks, formal organizational networks, or social capital [10]. These networks will add to the community's capacity to communicate, store, and retrieve information and to act collectively in response to shifting situations. The robustness or fragility of the community will be determined by the quality of these links. Consequently, the community's adaptive capacity in dealing with socio-ecological threats can be inferred from the community's knowledge and experience, its capacity to utilize this knowledge and experience, and the network of relationships among community members that emerges through collective action.

3. MATERIALS AND METHOD

The research was undertaken in the Ogan Komering Ilir (OKI) District subdistricts of Pedamaran, East Pedamaran, and Pangkalan Lampam (Figure 1). According to research conducted by Wildayana et al. [1], purun grows on the physiographic kind of peat found in the Pedamaran and Komering rivers and is unaffected by river and ocean tides. From 2018, OKI Regency has participated directly in the Indonesian Peat and Mangrove Restoration Agency's (BRGM) livelihood revitalization initiative. In addition, one of the three research locations is referred to as the "City of Mats".

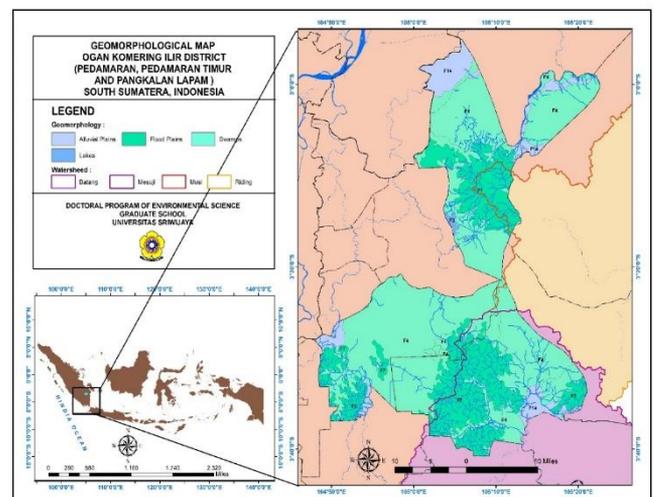


Figure 1. The study area in South Sumatra, Indonesia

Qualitative research methods were applied to a descriptive research design to explain the adaptability of purun artisans. This qualitative method concentrates on studying a community by collecting data from a collection of its members' experiences and arranging the significance of these experiences in chronological order. This study uses a narrative-descriptive methodology because adaptive capacity resides in situations where artisans encounter threats and pressures that require them to adapt to these conditions.

In this qualitative study, 100 informants were selected for in-depth interviews using a sampling technique that captures variations in the manifestations of a phenomenon because each informant associated with the phenomenon has its own characteristics [14]. If adding informants yields no additional information or data, the number of informants is determined by data saturation. In addition, we established several specific criteria, such as artisans who have resided at the research site

for an extended period of time and evolved into purun artisans. In addition, we identified groups of purun artisans in each of these subdistricts by examining the proportion of these groups. These three regions also contain communities where purun artisans constitute most of the population.

This research utilizes primary and secondary data and information sources, including in-depth interviews, interviews with key informants, observations, and literature reviews from relevant literature. Open discussions were used to conduct in-depth interviews with purun craftsmen. This assists in acquiring information about the primary adaptive capacities of purun artisans. In previous research [9], the interview was also used to determine the vulnerability and resource accessibility of purun artisans. In addition, we conducted key informant interviews with participants in the activities of purun artisans. Representatives from the Regional Peat Restoration Team, village leaders, and Purun Institute directors were the primary sources of information for this study. Before the interview, several preparatory steps were taken. We establish a personal rapport with each informant, among other things. Then, we sought information regarding the purun artisans' practices at the research site by investigating their past and present connections with government and local agencies. We conducted unstructured interviews with key informants and asked more open-ended questions because they were more effective at eliciting the views and opinions of each informant [15].

During the participatory observation, community activities surrounding purun peatlands were also observed through statements. This observation was made following an interview with purun artisans to learn their methods. Several informants typically began collecting purun in the field between 8 am and 9 am (Western Indonesian Time). Then, we returned to the home of the artisans to observe the purun process, which was used to create the basic material for weaving.

Data analysis utilized qualitative descriptive research. This analysis involved reduction, presentation, and conclusion drawing. We followed the method described by Miles et al. [16]. We analysed the data after all the information was gathered through in-depth interviews and observations. To contribute arguments to the discussion section, we examined and analyzed keyword-based observations and conducted literature reviews. We also categorize data on artisans' adaptability, including experience, innovation capacity, and connectivity. To avoid data and interpretation errors, we also triangulate data sources, in which a second informant confirms the information acquired from the first [17]. In addition, we have an official research permit and are registered with the local government agency as a research procedure.

4. RESULTS AND DISCUSSION

To become resilient, communities have the adaptive capacity to respond to stresses or threats by leveraging natural and human resources, such as institutional memory, innovative learning, and connectedness [13]. The results will be organized according to these three crucial factors.

4.1 Institutional memory

Many communities in Indonesia, including the Komerling, Ogan, Malay, Sakai, Bugis, Banjar, Dayak, Dani, Asmat,

Kamoro, and Korowai, have inhabited peatlands for thousands of years [17]. They have the knowledge to manage peat and woodland areas to avoid ecological or supernatural disasters. This is due to the fact that the community possesses a diversity of experiences and local knowledge that has been passed down from generation to generation and has been retained over time [13].

People around study have relied on peat bogs for their everyday needs for millennia. Manual collection of peat swamp commodities without the use of fire is the norm. Using purun plants as raw materials for weaving and reselling them to the community is one of these enterprises.

Purun weaving is a tradition as well as a source of income. Weavers are typically ladies whose moms and grandmothers taught them to weave at a young age. Their primary motivation is to assist their husbands in meeting the demands of the household. In addition, they receive extra benefits, such as filling their free time, making them healthier, reducing their stress, and providing for their requirements. One of the reasons they continue these practices from generation to generation is the cultural significance of preserving their local knowledge.

In the past, purun plants were braided to suit all a family's needs. The process of creating purun handicrafts is highly time-consuming because they undergo multiple processing steps. The purun stems are dehydrated, sanitized, and sliced to the required size. This weaving practice is typically performed at home during leisure time. Mats, purses, hats, tissue boxes, rice baskets, sandals, etc. are among the products made from mats.

The benefits of these instruments are utilized for both indoor and outdoor activities, including gardening, Thanksgiving gatherings, and other gatherings. As for the function of the purun mat, in addition to seating, it was used to dry rice in the yard. The local population is growing interested in acquiring Purun-woven instruments to supplement their household requirements. Because plastic tools were scarce in the past, this gives purun matting an economic value. Several individuals are beginning to concentrate on creating purun crafts and then selling them to locals that require them. At traditional markets, the community's woven goods are exchanged for rice, fish, and palm sugar. In sum, the community has, for a very long time, utilized purun plants on peatlands for domestic purposes.

Yet, the modernisation of society brought about a change in the use of purun craft tools. The emergence of plastic household goods has diminished the market value of the community's traditional purun handmade instruments. Market rivalry is becoming more complex, and various local handcraft equipment must still be considered; a few individuals still utilize purun devices, such as hats, for gardening activities.

Due to an increase in land fires, the drying of peatlands poses a threat to the purun artisan community. The cause of the problem is the fires used to clear and prepare land for plantations and industrial forest plantations. Its fast development promotes the extensive drainage and transformation of peat bog habitats [18]. Moreover, deforestation and the draining of peatlands, which are believed to increase soil fertility, contribute to fires [19, 20]. The community saw a deterioration in the quality of purun plants following the commencement of forest exploitation. Formerly, only peatlands were considered by plantations and firms in the forest industry as potential land. These entities are more interested in mineral fields since conducting business on mineral properties is more efficient and profitable from an

economic standpoint. Yet, in tandem with the depletion of mineral-rich regions and the strong economic potential of peatlands, the business began to expand fast. Peatlands are seen as a new commodities option for capital accumulation [21].

Furthermore, the frequent occurrence of fires on peatlands has caused the peat where puruns reside to dry out and overflow during the rainy season. Large fires reaching up to 60 meters in height ravaged the peat forest ecology, destroying timber, wild animals, and plantation crops, such as *meranti*, *jelutung*, *gelam*, rubber, and ferns, which are the community's source of income. The flames also generated very dense smoke, reducing visibility to two to three meters and preventing inhabitants from working or attending school. Also prone to collisions are motor vehicles traversing peatlands. Obviously, this will have a big influence on the community income decline.

Different efforts to put out fires in the community are frequently made. In the past, community members worked together to extinguish fires using improvised equipment such as buckets and raw leaves. Even though the government has made it easier to extinguish flames by providing fire vehicles and water pumps, the thick peat makes it difficult to approach and extinguish the fires. One of the artisans and purun takers acknowledged this.

"Based on what has happened in the past, we really hope that purun land can have clear boundaries between the community and the company, and that we can have our own water machine to put out fires so that we can all protect the land together" (K, 2022).

In addition, interviews with informants revealed that purun raw ingredients are becoming increasingly difficult to acquire today. This is due to a combination of factors, including the diminishing area of Lebak Purun peatlands because of conversion to oil palm concessions and the yearly flood catastrophes that have occurred since 2004, with the most intense floods occurring in 2004 and 2018. According to the respondents, the water prevented purun collectors from entering the peat bog to collect purun. In addition, this flood prevented the village's rice fields from being sown with rice and other crops. This is consistent with research [22] indicating that peatlands converted to oil palm plantations are more susceptible to flooding than peat-friendly planting schemes.

4.2 Innovative learning

The experience gained by the purun artisan community about challenges such as land fires and water depletion in peatlands has encouraged them to implement creative measures. The potential of purun resources enables communities to develop new techniques for coping with threats to their way of life. This is consistent with Folke's research [23], which indicates that when disturbances arise, a healthy socio-ecological system can generate possibilities to do new things, innovate, and build enterprises.

The purun craftsmen community and the communities surrounding the peatlands take advantage of the potential of the swamp, which is handled through corporate innovation groups. The innovation business activity commenced with a visit by the South Sumatra Provincial Peat Restoration Team (TRGD) and the Indonesian Peat and Mangrove Restoration Agency (BRGM) as part of a livelihood revitalization program aimed at enhancing community welfare and developing local

potential through the utilization of peat commodities such as purun to generate additional community income.

To empower the community, committees are formed, training is provided, and funding for infrastructure and services is provided. The group's handicraft enterprises sell basket bags, tissue boxes, carpets, etc. Yet, the marketing barrier resides in the ineffectiveness of local handicrafts, such as the low purchasing power of the people, who are accustomed to utilizing factory-made goods rather than local handicrafts. Also, the business group has yet to identify a suitable marketing channel as a liaison or collector of product outcomes. The lack of understanding on the part of the artisans regarding online branding has resulted in weaker product sales to potential customers [24]. Business groupings tend to be inhibited, and business continuity is necessary.

Despite this, the Community Empowerment Service claimed to have examined the village's potential on multiple occasions. Using technology, this phase aimed to introduce purun items to outsiders through the local youth.

"We recommend empowering youngsters who understand information and technology to share and introduce purun to the broader community, so that the community will be more motivated to engage in future production and innovation" (R, 2022).

However, the innovation efforts made to date have not yet been able to raise the revenue of the community. The innovation implementation business is still new and inadequately managed; thus the management might be improved. The artisans also tend to collaborate less and prefer to work alone, so they have limited synergy to form a new company group. It is envisaged that if artisans collaborate, their businesses will be more structured, their productivity will rise, and they will be able to compete on regional and national marketplaces.

In addition, Purun artisans have not conducted proper business planning and management, as seen by the lack of a system for recording financial cash flow, raw materials, labor, etc. These unsustainable business limits have left the purun artisans indifferent to new economic alternatives. Purun artisans must also get experience in innovation for purun conservation on peatlands or the production of long-lived plants such as *jelutung* and *meranti*, which are peculiar to the forests around peatlands and can be used as an alternative revenue source.

Formally, purun artisans have formed connections with government and non-government agencies to support initiatives to strengthen community life. Both have received instruction on boosting product quality, including product variations and motifs for handicrafts and marketing strategies. It is essential to conserve culture in this manner so that it can serve as a point of differentiation from provincial handicrafts. The innovation strategy endeavor is a community developed with external backing to carry out economic activities through new methods in response to the environmental conditions [11].

To prevent land fires, the community innovated by constructing border canals on each side of their garden. The size of the perimeter canal is around two to three meters to prevent the fire from spreading to other regions. Also, the waterways serve to keep the ground moist during the extended summer changes. If there is a fire, the residents use the water in the canal using buckets to water it. In addition, efforts are constantly made to clear weeds or plants along the garden boundaries to prevent the spread of fires from one garden to another.

4.3 Connectedness

Community interaction with formal and informal parties inside and outside of the community is necessary for a better quality of life [13]. Kinship ties play a significant role in community connectedness. Mutual aid in daily life, such as house construction, Thanksgiving celebrations, and funerals, exemplifies the actual actions made by community members.

Many forms of collective activity are developed through interactions between community members, such as artisan organizations for craftswomen and religious study groups. This activity preserves family relationships between communities and facilitates the construction of public interest facilities, such as village meetings and to aid families affected by tragedy.

Moreover, village heads and community leaders as stakeholders play a significant role in the development of cooperative economic operations for the craftsmen community. This is in accordance with Topkins's research, which suggests that the district should incorporate a variety of stakeholders in collective action [25]. The collective action of the purun artisans' community at the research site includes community leaders, religious leaders, and government representatives. Stakeholders move according to their domains, such as religious leaders strengthening the community through the formation of religious study groups, the cleaning of places of worship, and religious meetings.

In mobilizing the adaptive capacity of the community, however, people tend to place more trust in community leaders than in government officials. This is because local community leaders and government officials have experienced a conflict of interest in pursuing their separate objectives. The sole purpose of the competition is to maximize profits through resource control. A portion of the community is suspicious and mistrustful of the performance of government officials because they are perceived to lack the enthusiasm to drive adaptation actions and to be unfavorable to the community, thereby creating an impression of neglect that renders the community indifferent. This has resulted in bias between community leaders and village government officials, and vice versa; thus, it has become a public concern.

The community has received government assistance by distributing the '*raskin*' (rice for the poor) assistance program. In the meanwhile, the Ministry of Agriculture has supplied farming communities with fertilizers, insecticides, and other medicines. In addition to contributing fire extinguishers and water pumps, the forestry service was also involved. Increasingly, public relations with government agencies and non-governmental organizations are focused on economic, social, ecological, and political cooperation projects. The initiative offered for peatland villages is primarily geared toward environmental improvement. These activities are related to fire management, peat restoration, and forest replanting. However, the community acknowledges that the current implementation of the program has not yet had a substantial influence on improvements in the community's basic requirements. The Peat Restoration Team reacted by stating that all existing programs have been returned to each village.

"We are always constant, but we give back to the community by implementing existing grant programs. We provide the same training and programs, but the results differ, so they cannot all be compared" (E, 2022).

5. CONCLUSIONS

The results indicated that the adaptive capacity of the peatland-dwelling purun artisan's community was lacking due to the community's lack of knowledge in overcoming threats and disturbances such as reduced peatlands where purun lived, ongoing land fires, and the drying up of water in peatlands, which has led to a decline in purun quality. In addition, the community has not been able to increase its members' willingness to participate and their awareness of the importance of participating in ongoing community activities.

Other findings pertaining to the ability to innovate indicate that the purun artisans community has limited creative skills, particularly in terms of capital and concepts that can be developed to adapt to technological advancements and current economic conditions. New economic opportunities are also largely unaffected by connections with outsiders, this is due to the feeble status of the community in the absence of a significant leadership role, and the programs implemented tend not to be influenced by the community's circumstances. As a result, planning can be made more effective and systematic and cannot be isolated from the support of personnel with specialized knowledge. As a result of a lack of trust and synergy in enhancing adaptive capacity, the community's relations with external parties have not yet had an effect, and it is in a fragile state.

Therefore, based on the aforementioned findings, we recommend several measures to increase the community's adaptive capacity in the face of pressures and threats, including the need for good collaboration between village heads and community leaders, religious leaders, and local communities to carry out extinguishing actions collectively, and the maximization of empowerment programs from local institutions or the government to improve society and village economic businesses sustainably.

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