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Problems and Potential of Swamp Ecosystems to Support Economic Development: Case Study in Tapin Regency

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Abstract

This study explores the challenges and economic potential of swamp ecosystems in supporting sustainable regional development in Tapin Regency, South Kalimantan. Employing a descriptive-exploratory qualitative approach, data were obtained through field observations, semi-structured interviews with community members, government officials, and stakeholders, as well as analysis of secondary documents. The research focused on two sub-districts—South Candi Laras and North Candi Laras—which are characterized by extensive swamp areas and active community utilization. The results indicate that the swamp ecosystem in the region plays a vital role in supporting local livelihoods across four main sectors: fisheries, swamp-based agriculture, livestock, and tourism. Inland fisheries, including pond and cage cultivation, show significant annual productivity, especially in North Candi Laras. Agriculture, dominated by seasonal rice farming, contributes substantially to regional food security. Livestock activities, particularly duck and buffalo farming, demonstrate compatibility with swamp conditions and offer opportunities for expansion. Tourism, although still underdeveloped, holds strong potential for nature-based and river tourism. However, various constraints impede optimal development, including poor infrastructure, limited access to markets, environmental degradation, and low community capacity in resource governance. The study highlights that community empowerment, local participation, and context-sensitive policy interventions are critical for enhancing the sustainable management of swamp resources. Furthermore, integrating ecological conservation with economic utilization is essential to transform swamp ecosystems into strategic assets for inclusive and resilient development. This research serves as a foundation for further studies on participatory regional planning and ecosystem-based economic strategies in wetland regions.

Keywords: Swamp Ecosystems; Sustainable Development; Fisheries; Agriculture; Tapin Regency

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INTRODUCTION

Wetland ecosystems, including swamps, are increasingly recognized for their critical role in maintaining global ecological balance and supporting human well-being. Swamps function as vital ecological infrastructure by regulating hydrological cycles, storing water, controlling floods, sequestering carbon, and providing habitats for a wide range of biodiversity. In addition to these ecological services, swamps contribute directly to the socio-economic resilience of surrounding communities through agricultural production, fisheries, and the harvesting of non-timber forest products (Nasruddin & Efendi, 2022). Despite their significant contributions, swamp ecosystems remain underappreciated in the formulation of development policies. They are often perceived as marginal lands due to their seasonal inundation, limited accessibility, and the technical challenges associated with their management and conversion.

Such perceptions have contributed to the systematic exclusion of swamps from mainstream economic development strategies. Yet, evidence increasingly supports the notion that swamp lands, if managed sustainably, possess immense potential to support both national

food security agendas and regional economic development goals. In regions like South Kalimantan, the economic importance of wetland ecosystems has become more apparent. These landscapes are rich in natural resources such as fish, timber, and agricultural produce, which serve as primary livelihoods for local populations (Owiti et al., 2024; Shaddiq et al., 2024). Their ecological functions—ranging from erosion control and sediment trapping to serving as buffers against wave energy and climate regulation—are integral to the stability of surrounding ecosystems and communities (Meidamayani et al., 2021; Ofem & Bassey, 2023).

Despite these advantages, swamp ecosystems are increasingly threatened by unsustainable land-use practices, land conversion pressures, resource overexploitation, and a lack of integrated planning frameworks. The degradation of swamps not only reduces ecological function but also exacerbates socio-economic inequalities, particularly in rural areas where communities rely directly on the ecosystem for subsistence. Addressing these dual challenges—ecological degradation and socio-economic vulnerability—requires a paradigm shift in swamp management: from resource exploitation to integrated and sustainable utilization (Fajri et al., 2020). This demands the incorporation of ecological-economic frameworks in planning and decision-making processes, which can safeguard environmental integrity while simultaneously enhancing community welfare.

In Indonesia, swamp lands cover a substantial portion of the landscape, spread across key islands such as Kalimantan, Papua, and Sumatra. According to Kurnia et al. (2021), Indonesia possesses approximately 33.4 million hectares of swamp ecosystems, of which 13.29 million hectares are categorized as lowland swamps and 20.1 million hectares as tidal swamps. A notable portion—around 41%—is considered suitable for agriculture, yet only 6.77 million hectares have been utilized, largely through government programs (3.77 million hectares) and community-led initiatives (3.0 million hectares) (Sakir et al., 2021). This underutilization suggests a missed opportunity for optimizing land resources in a manner that balances ecological preservation and socio-economic advancement.

South Kalimantan is among the provinces with the most extensive swamp ecosystems, comprising both lowland and tidal varieties. These ecosystems not only support biodiversity but also sustain various economic activities, including freshwater fisheries, rice farming, and wetland-based ecotourism. In particular, South Kalimantan has approximately 1.14 million hectares of swamp lands, of which 763,207 hectares are deemed suitable for reclamation into agricultural areas. The remainder functions as natural water retention basins, playing a critical role in hydrological regulation during the rainy season. This duality of function—economic and ecological—highlights the necessity for balanced and informed swamp land development strategies.

Within South Kalimantan, Tapin Regency emerges as a compelling case for studying the dynamics of swamp-based development. The regency includes two key subdistricts—South Candi Laras and North Candi Laras—where swamp lands are central to the local economy. In these areas, the community has historically relied on swamps for rice cultivation, aquaculture, livestock rearing, and the collection of plant-based materials for home industries. Yet, despite this longstanding relationship with swamp ecosystems, utilization remains suboptimal. Technical and infrastructural constraints—such as sedimentation, deteriorating water quality, climate change vulnerability, and limited access to agricultural technology—continue to hinder productive use. Moreover, the lack of integrated land-use planning exacerbates conflicts between conservation goals and economic development interests.

These challenges underscore the urgency of adopting a more holistic and sustainable approach to swamp management in Tapin Regency. The present research is motivated by the need to reassess the role of swamp ecosystems as strategic resources in rural development planning. While conventional development models have prioritized dryland-based economic sectors, there is growing recognition that underutilized ecosystems such as swamps can serve as alternative development platforms, especially in regions where land and water resources

intersect. Through the integration of ecological conservation with economic utilization, swamp lands can be transformed into productive landscapes that contribute meaningfully to regional income and community well-being (Arbi et al., 2024; Muthmainnah et al., 2012).

Accordingly, this study seeks to bridge the knowledge gap by conducting an in-depth analysis of swamp land utilization and its impact on local economic development in Tapin Regency. The research aims to answer three core questions. First, what are the socio-economic and ecological consequences of converting swamp land into agricultural areas? This includes understanding the trade-offs between food production and ecosystem services. Second, which commodities—agricultural crops, aquaculture species, and livestock—are best suited for sustainable development on swamp land? Identifying locally adapted and economically viable commodities is crucial to maximizing productivity while minimizing environmental risk. Third, what swamp management models can be applied to ensure sustainability without compromising the swamp's function as a hydrological buffer, erosion control mechanism, and biodiversity reservoir?

These questions are explored through a qualitative, descriptive-exploratory methodology that integrates field observation, stakeholder interviews, and document analysis. By focusing on the specific socio-ecological context of Tapin Regency, the study seeks to contribute a conceptual framework for sustainable swamp ecosystem development—one that aligns with national priorities for green economy transition and community-based resource management.

Ultimately, this study emphasizes the importance of transforming the perception of swamps from marginal lands to multifunctional landscapes. By uncovering the potential embedded within these ecosystems, it becomes possible to formulate development strategies that are both inclusive and environmentally sustainable. The findings of this research are expected to serve as a reference for policymakers, practitioners, and academics in designing integrated wetland management models that are grounded in local realities and responsive to both ecological imperatives and socio-economic aspirations.

METHOD

This study employed a qualitative descriptive-exploratory approach to examine the utilization of swamp ecosystems and their potential to support regional economic development in Tapin Regency, South Kalimantan. The chosen approach allowed for an in-depth exploration of the socio-ecological dynamics that shape land use practices, as well as the perceptions and experiences of the local community in managing and benefitting from swamp resources. Tapin Regency was selected as the study site due to the extensive distribution of swamp land in the area and the presence of active community-based economic activities that rely on the swamp environment.

The research was conducted specifically in two sub-districts: South Candi Laras and North Candi Laras. These areas represent key zones of swamp utilization with a variety of land uses including rice farming, inland fisheries, aquaculture using cages and ponds, livestock production, and emerging ecotourism potential. Field observations and consultations with local institutions confirmed that these sub-districts possess both ecological significance and community engagement in swamp-based livelihoods. The study focused on understanding the real conditions and constraints of swamp management while highlighting opportunities for sustainable economic development.

Data for the study were collected from both primary and secondary sources. Primary data were obtained through field observations, semi-structured interviews with key informants, and focus group discussions (FGDs) involving community members and local stakeholders. Observations were used to document land characteristics, water conditions, agricultural practices, aquaculture systems, and livestock rearing in the swamp environment. Interviews explored detailed insights into community practices, resource challenges, economic contributions of swamp-based sectors, and local strategies to adapt to environmental

conditions. FGDs facilitated discussions on broader development issues such as infrastructure, access to markets, and institutional support, as well as community aspirations for tourism development. Secondary data were drawn from official reports and documents issued by local government agencies, including regional planning documents from Bappeda, statistical data from BPS, and reports from the Environmental, Agricultural, and Fisheries Services.

Informants in the study were selected using purposive and snowball sampling techniques. Initial participants were identified based on their direct involvement in swamp utilization activities, such as farmers cultivating rice on seasonal swamp land, fishers operating in inland water bodies, aquaculture practitioners managing cages and ponds, and livestock breeders raising ducks, goats, and buffalo adapted to swamp conditions. Through referrals, additional participants were recruited to ensure a diversity of perspectives. The sample also included local business actors involved in processing or marketing swamp-based products, as well as government officials and development practitioners familiar with wetland policy and management.

The data collection process was designed to capture the multidimensional aspects of swamp use. Field observations were particularly useful in identifying physical conditions and verifying production practices across different sectors. Interviews provided qualitative depth regarding the productivity levels, constraints, and innovations being implemented at the local level. For example, informants in North Candi Laras reported the cultivation of economically valuable fish species such as *Haruan* and *Toman*, while those in South Candi Laras emphasized the use of swamp rice varieties like IR 66. Likewise, the livestock sector was reported to be growing steadily with a focus on traditional species such as ducks and swamp buffalo, supported by locally available feed sources. The potential for tourism was also noted through the presence of scenic swamp landscapes, river networks, and fishing areas with recreational value.

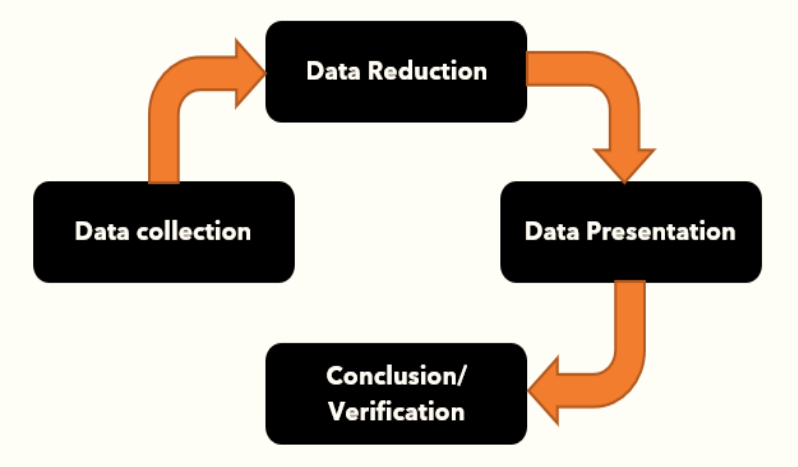

Figure 1. Stages of research data analysis

Data analysis followed a thematic qualitative approach. The analytical process adopted the framework proposed by Miles and Huberman, which involves four interconnected stages: data collection, data reduction, data presentation, and conclusion drawing and verification. These stages are illustrated in Figure 1, which depicts the iterative nature of qualitative data analysis where findings are continuously refined through engagement with the data. After raw data were collected, it was reduced into manageable codes and themes. This was followed by organizing the data into matrices and narrative displays to highlight sectoral patterns and community responses. The final step involved drawing conclusions that reflect the realities on the ground, cross-checked through triangulation with secondary data and multiple informants. This iterative process allowed for the validation of findings and ensured their reliability across sources and methods.

RESULTS AND DISCUSSION

Economic Characteristics of the Swamp Ecosystem of Tapin Regency

The swamp ecosystem in Tapin Regency represents a vital economic landscape characterized by its close integration with the livelihoods of surrounding communities. As of 2024, the total population within the study area reached 27,716 people, with 12,234 residents in South Candi Laras District and 17,229 in North Candi Laras District. Over the past five years, population growth rates have remained modest, averaging 1.07% annually in South Candi Laras and 0.96% in North Candi Laras. Interview data suggest that these figures are influenced more by migration patterns than by natural population growth, as younger populations frequently relocate to nearby urban centers for employment opportunities.

The geographic characteristics of the region—dominated by swamp land—have significantly shaped the local economy and transport infrastructure. Due to limited accessibility by road, river transport remains the primary mode of mobility and logistics. Boats and small vessels are still commonly used to market agricultural and fishery products, while basic necessities are transported from urban centers such as Banjarmasin. This reliance on river transportation underscores both the adaptive strategies of local communities and the infrastructural constraints that limit regional economic integration.

The economic structure in Tapin Regency is fundamentally supported by four main sectors: fisheries, agriculture, livestock, and tourism. Each of these sectors reflects the multifunctional value of the swamp ecosystem and highlights the local community's adaptation to seasonal hydrological dynamics.

Challenges and Potential for Economic Development in Swamp Ecosystems

The topography of the land located in the lowlands with a slope ranging from 0-3% makes most of the planning area a surface runoff area or a water catchment area. The existence of swamps is a source of raw water for several rivers and tributaries that flow in and around the area. The physical condition of the swampy land makes the traditional wisdom of residents who still maintain the pattern of building houses with stilt houses a potential to maintain sustainability and support the water management system in the area. However, other problems are still faced in the area, namely, difficult road access. Opening land access is difficult and expensive, causing low access to movement to the area itself, so that dependence on river infrastructure as a means of transportation is still very high. This has an impact on economic movement, which is still slow due to limited road access. If seen further, the study area has quite high economic potential with a good level of productivity. Four superior commodities have high potential in economic development in this area, namely, in the fields of fisheries, agriculture, livestock, and tourism. The results of interviews and observations in two areas in Tapin Regency, namely South Candi Laras and North Candi Laras, have promising potential. Even the production results in these 4 fields are quite high.

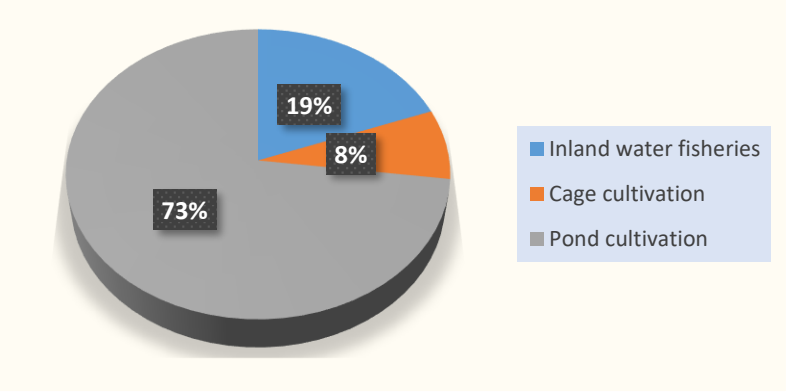

Figure 2. Productivity of the fisheries sector

Fishery businesses in the study area consist of three types, namely inland fisheries, cage aquaculture, and pond cultivation (Figure 2). Inland fisheries are fisheries businesses that utilize free waters on land, including rivers, swamps, lakes, and others. The results of observations and interviews show that the productivity of inland fisheries in all study areas reaches 9.90 tons per year, with an average development of 0.20 tons/year (South Candi Laras District) and 9.70 tons/year (North Candi Laras District). Meanwhile, cage cultivation, which is generally carried out on the banks of rivers that cross the study area, shows an average development of 3-5 tons/year. And finally,y in pond cultivation with an average annual production of 17.00 tons (South Candi Laras) and 20.50 tons (North Candi Laras).

The development of fisheries areas is aimed at the development and protection of fish that typically live in swamp environments and have high economic value. Haruan (*Channa striata*) and Toman (*Channa micropeltes*) are found in Rawana Village, Candi Laras Utara District. Meanwhile, in Baringin Village, Candi Laras Selatan District, there are Siamese Gourami (*Trichogaster pestalaris*), Swamp Gourami (*Trichogaster trichopterus*), and Betok (*Anabas testudineus*), which are the focus of their cultivation. With this potential, the projection for the development of fisheries areas can include Rawana Village, Batatas Village, and Buas-buas Village, Candi Laras Utara District, and Candi Laras Selatan District in Tapin Regency.

In the agricultural sector, data related to the types of food crops cultivated are rice, legumes, and tubers. The production or harvest of rice can reach 52,162 tons/year. Other production results are sweet potatoes, 2.20 tons/year, and peanuts, 750 tons/year. The productivity of the agricultural sector is presented in Table 1.

Table 1. Agricultural results of swamp land in Tapin Regency

Types of Agricultural	Land productivity (tons/year)	
	South Candi Laras	North Candi Laras
Rice	29,579	22,583
Sweet potato	2.20	-
Peanuts	750	-

The typical condition of the swamp area in the study area is the existence of swamps that are flooded throughout the year and can only be planted during the dry season, therefore, their management must be adjusted to their physical properties. The development of swamp land is related to the fluctuating conditions of swamp water inundation during the dry and rainy seasons. Water inundation zoning is divided into several levels (watun). The process of draining swamps is the right time to develop potential agricultural land. Selection of superior varieties and commodity diversification can be managed through coordination from government agencies and farmer groups. Irrigation and drainage infrastructure have now also been developed in swamp areas.

In the livestock sector, this area also has quite a large potential. The results of observations and interviews obtained data that the livestock sector is already large and starting to develop with a focus on livestock managed, namely native chickens, ducks, goats, cows, and buffalo. The livestock area development strategy is aimed at raising livestock commodities that are native and specific types in swampy areas, for example, large livestock and poultry. The types of livestock that have been developed are types of livestock that already have economic value, such as ducks and swamp buffalo.

Meanwhile, tourism has not been developed. In the study area, there are also lowland swamps, which are different from tidal swamps. Lowland can be periodically inundated (shallow lowland) or inundated throughout the year, or even in the dry season (monotonous swamp). Based on the drainage zone, lowland swamps can be divided into three types, namely shallow, middle, and deep lowland swamps. Shallow lowland swamps are located in areas with high topography along river levees with a flood depth of around 50 cm for less than 3 months.

Middle lowland swamps are a type of lowland swamp a positioned after shallow lowland swamps (between shallow lowland swamps and deep lowland swamps, with a flood depth of between 50-100 cm and a flood duration of 3-6 months. Development of tourism activities by using the diversity and natural uniqueness of the area, with the development of new activities and tourist attractions that are possible. From the results of field identification, various tourism potentials can be developed such as: 1) River transportation tourism, which stretches from Panggang Lake connecting Negara, Margasari, Marabahan to Banjarmasin, 2) Freshwater natural fishing which is spread throughout the area and is generally centered as a distribution and collection place for anglers in Margasari City. The concept of tourism development in this area is directed towards nature and educational tourism by emphasizing the utilization of the potential for natural beauty and uniqueness as optimally as possible, without making significant changes to existing conditions.

Based on the results of the study of the analysis of determining potential commodities in the study area, namely the analysis of production contribution, analysis of consumption levels, and analysis of land productivity, the study area has economic prospects in the inland fisheries, livestock, agriculture,e with agro-industry development, and tourism sectors. In the agricultural sector, it has the potential to develop IR 66 rice varieties and local varieties. In the fisheries sector, it has the potential to develop Patin fish (*Pangasius, sp*), Tilapia (*Oreochromis niloticus*), Pepuyu (*Anabas testudineus*), Bawal Tawar (*Colossoma macropomum*), and Haruan (*Channa striata mun*). While livestock has the potential to develop native chicken, goat, and duck farms. The tourism sector, because it has not been developed, has high prospects for development in the form of water tourism packages or agro-tourism.

However, several challenges must be faced in developing the economy in swamp ecosystems such as the study area. The relatively isolated and little-touched area conditions require the development of adequate infrastructure and facilities so that, by opening access to the area, it will be possible to optimize the use of natural resource potential. Obstacles that are often faced in developing swamp tourism are related to accessibility and the lack of supporting facilities in the swamp area (Nofiansyah & Khoirunnisa, 2024). The development of infrastructure and facilities is also intended to optimize efforts to maintain the sustainability of the area's function as the main water catchment area in Tapin Regency, as well as a supplier of water discharge in several large and small rivers around it.

Community empowerment plays a pivotal role in ensuring the sustainability of development programs, particularly in regions like Tapin Regency where socio-economic resilience is closely tied to localized resource management. Empowerment emphasizes the importance of shifting from top-down governance to participatory approaches that foster local ownership, autonomy, and accountability. By actively involving communities in planning and decision-making processes, development interventions can better align with local needs, values, and priorities. According to Hasibuan et al. (2023), community-centric programs are effective because they facilitate deeper engagement, which directly enhances the community's capacity to manage their own development and improves quality of life. Similarly, Qomariah et al. (2022) argue that active participation leads to increased program efficiency and ownership, thereby reinforcing the community's willingness to maintain and protect the results of implemented projects.

Initial empowerment strategies should focus on raising awareness and building the capacity of community members to formulate and articulate their own development plans. This participatory planning process enhances emotional attachment and responsibility toward project outcomes, contributing to long-term sustainability. Azzahra and Sugiarso (2022) highlight that active community involvement, such as women's participation in rural programs, significantly correlates with the effectiveness of empowerment initiatives. Furthermore, Preston et al. (2010) demonstrate that involvement in local health planning leads to improved

service delivery and better health outcomes, showcasing the broader applicability of empowerment principles.

Nonetheless, a fundamental dilemma persists. While communities are increasingly expected to lead localized planning, many remain influenced by historically entrenched paradigms that have relegated them to passive roles—executors of externally designed programs rather than co-creators. This tension between endogenous (community-driven) and exogenous (externally induced) participation is well documented, with Hermawan and Hutagalung (2019) noting that externally imposed initiatives can inadvertently undermine authentic empowerment efforts. Nkwake (2013) further emphasizes the importance of understanding how participation influences program outcomes, stressing that sustainable development depends on the presence of genuine community agency rather than superficial involvement.

To overcome this barrier, community empowerment strategies must prioritize inclusive facilitation and collaborative execution. This includes fostering a sense of shared responsibility among stakeholders and ensuring that communities are engaged not only during the planning stages but also throughout implementation and monitoring. Putra et al. (2021) affirm that stakeholder engagement enriches program design and boosts the likelihood of success by grounding interventions in local realities. Ultimately, as Naku et al. (2021) assert, when communities perceive development programs as their own, they are more likely to ensure the continuity and success of such initiatives. In the context of swamp-based economic development in Tapin, strengthening community agency is thus not only a policy imperative but also a practical strategy for achieving equitable and lasting outcomes.

CONCLUSION

This study concludes that the swamp ecosystem in Tapin Regency possesses significant potential to support regional economic development across multiple sectors, provided that management is aligned with ecological sustainability principles. First, agricultural development should prioritize the adaptive use of swamp land through minimal land alteration. Utilizing the surjan cultivation system, key commodities such as rice and various horticultural crops—including vegetables, oranges, sapodilla, bananas, and mangoes—can be effectively developed. Rice cultivation is particularly recommended in areas within a 2-kilometer radius of the Negara River levee, where soil conditions are more favorable.

Second, fishery development must focus on the conservation and sustainable utilization of local fish species that hold high economic value. Cultivation methods such as cage and pond aquaculture should be enhanced while preserving the ecological integrity of the swamp. Indigenous swamp fish—including *Haruan* and *Toman*—must be prioritized, and environmentally harmful fishing practices strictly prohibited. Furthermore, the expansion of freshwater aquaculture must be carefully regulated, especially in ecologically sensitive and protected zones.

Third, the livestock sector presents promising prospects, particularly for large ruminants and poultry adapted to swamp conditions. Community-established livestock systems, especially those involving local duck breeds such as Alabio ducks, should be scaled up as regionally competitive commodities. Ensuring the availability of local feed resources will be key to supporting the sector's sustainable growth.

Fourth, tourism development should be strategically oriented toward the ecological and cultural uniqueness of swamp landscapes. Opportunities lie in promoting nature-based and educational tourism that leverages the scenic value of the Negara River and surrounding lowland swamp environments. The development of essential infrastructure—particularly roads and bridges in the Margasari-Rantau and Margasari-Marabahan corridors—will be crucial in unlocking the region’s tourism potential, reducing geographic isolation, and enhancing the economic well-being of local communities.

RECOMMENDATION

The findings of this study are expected to serve as a reference for future research focused on the formulation of integrated and sustainable regional development strategies, particularly in areas with swamp ecosystems. Further studies are recommended to explore the implementation of participatory governance models, ecological-economic trade-offs, and sectoral synergies to optimize the role of swamp resources in supporting resilient and inclusive local economies.

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