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Building Social-Ecological Resilience in Batukaras Coastal Tourism Village, Indonesia

Ade Tri Putra*[1]

[1]*Development Studies, Bandung Institute of Technology, Indonesia*

*Corresponding Author: *adetriputra1@gmail.com*

Abstract: Batukaras Village in Cijulang District, Pangandaran Regency, is known as a beach tourism area, as mandated by Village Regulation No. 5 of 2020, aiming to establish itself as an integrated and leading tourist destination. However, climate change and the intensification of coastal activities have increased pressure on marine resources and accelerated coastal environmental degradation. These conditions have created challenges that threaten ecological balance, local livelihoods, and the long-term sustainability of tourism. This study explores socio-ecological responses to environmental and social disruptions in Batukaras. Using a qualitative case study approach, data were collected through observation, documentation, literature review, and in-depth interviews with key informants. The analysis adopts a Social-Ecological Resilience (SER) framework to understand community adaptive capacities and institutional responses. Data analysis combined SER indicators with triangulation techniques to describe patterns of environmental change and socio-ecological interactions within the coastal tourism area based on observed phenomena. The phenomenon examined is the increasing socio-ecological vulnerability in Batukaras resulting from climate change, intensified coastal tourism activities, and tsunami hazards. The study identifies local adaptive responses, including efforts to coexist with environmental changes and limited governmental initiatives promoting ecosystem protection and social equity. In-depth interviews involved nine key informants, including village officials, tourism actors, community leaders, and local residents. To enhance resilience, the study recommends improving resource management, strengthening stakeholder participation in sustainable tourism planning, reinforcing collaborative governance, and integrating local knowledge into policy design to support long-term community welfare, adaptive capacity, disaster preparedness, and environmental sustainability.

Keywords: Coastal, Social-Ecological Resilience, Sustainable Tourism

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Introduction

Batukaras Village, located in the Cijulang District of Pangandaran Regency, Indonesia, has been officially recognized as a Regional Strategic Tourism Area (Regional Regulation Pangandaran, 2018). Supported by Village Regulation Batukaras (2020), the village is well known for its tourist attractions, particularly Batukaras Beach and the nearby mangrove forests, which play a central role in the community's tourism-based economy. The local vision emphasizes a cohesive and sustainable tourism approach aimed at fostering prosperity by ensuring a pleasant, clean, safe, welcoming environment that provides unforgettable experiences.

Even with these goals, Batukaras encounter serious ecological issues. Fluctuations in weather patterns, including intense rains and shifting winds, have resulted in tidal floods and excessive sediment, hindering tourism entry and harming local attractions (Kompas, 2022; Somantri, 2023). The shared utilization of coastal areas

for both tourism and conventional fishing has negatively impacted environmental conditions and diminished the resilience of ecosystems (Maman, 2023). Insufficient safeguarding of mangrove forests and restrictions in infrastructure have additionally obstructed the community's capacity to gain advantages from tourism (Ayi, 2023). According to Indonesia Statistics in Pangandaran (2023), tourist arrivals peaked in 2018 at 593,717 visits, followed by a decline in subsequent years, reaching 349,278 in 2020. A moderate recovery occurred in 2021, with 380,577 visits, indicating a gradual resurgence of tourism activity after the crisis.

The Village Report of Batukaras (2022), flood occurrences start at the conclusion of the dry season and intensify as the rainy season arrives, which generally runs from December to February. The most severe floods are observed between October and February, showcasing the significant rainfall that typifies this period. Potholes and muddy pathways become serious concerns, indicating that the village's road infrastructure suffers considerably from intense rainfall and inadequate drainage. These infrastructural difficulties significantly impact coastal tourism, especially by restricting access and diminishing the effectiveness and attractiveness of tourism-related facilities.

To address these issues, it is essential to embrace a Social-Ecological Resilience (SER) viewpoint that looks into the intricate reliance between natural systems and human actions. SER offers a structure to evaluate how communities adjust to transformations, resolve resource disputes, and maintain socio-ecological roles over time. As resilience diminishes, vulnerability rises, endangering the ability to adapt and innovate (Folke, 2006).

According to Anderies et al. (2004), a social-ecological system is defined as an integrated system composed of a resource, the users of that resource, the public infrastructure (physical and institutional), and the providers of that infrastructure, all of which interact within a context of external social, economic, and environmental settings. Inadequate management of the interconnections between resources, resource users, and public infrastructure may lead to overexploitation and environmental degradation, thereby indicating a considerable vulnerability in the sustainability of coastal ecosystems (Anderies et al., 2004; Hafsaridewi et al., 2018; Sjafrie, 2018; Muliani et al., 2018).

Furthermore, the Social-Ecological System (SES) framework, as proposed by Ostrom (2009), analyzes the dynamic interactions between humans and nature in the context of sustainable resource management. It comprises four core components: the resource system, resource units, governance system, and actors. The system is dynamically interconnected between human activities that affect and are affected by ecosystems, a relationship known as social-ecological connectivity (Ostrom, 2009; Virapongse and Alessa, 2016; Taghilou et al., 2022).

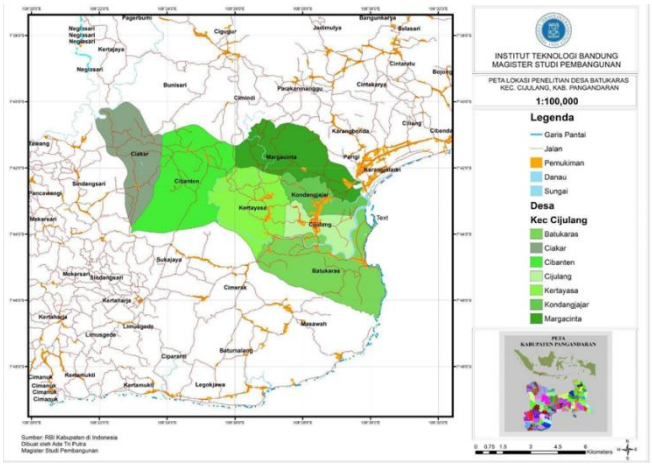
In this study, SER is used to analyze the interrelation between coastal ecosystems and tourism activities in Batukaras Village, with the goal of enhancing local resilience, promoting adaptive capacity, and supporting sustainable development. Moreover, the Social-Ecological Production Landscapes and Seascapes (SEPLS) framework developed by UNU-IAS (2014) provides key indicators for resilience, such as biodiversity conservation, social equity, local knowledge systems, and collaborative governance. Local knowledge and cultural practices play a pivotal role in maintaining the resilience of socio-ecological production landscapes and seascapes (SEPLS), as they embody traditional wisdom in sustainable natural resource management, while strengthening community governance particularly in facilitating intergenerational knowledge transfer is essential to ensure long-term sustainability, and the application of indicator-based participatory approaches further enhances community legitimacy and improves the

accuracy and relevance of policy interventions in landscape management (ANU IAS, 2014; Lee et al., 2020; Aydin et al., 2018).

Based on the foregoing context, this study focuses on examining how local communities in Batukaras Village respond to and adapt to socio-ecological disruptions arising from climate change and intensified coastal activities. It also analyzes the roles of local institutions and governance arrangements in shaping these adaptive responses and managing coastal tourism resources. Furthermore, the study explores the implications of these community and institutional responses for strengthening social-ecological resilience and enhancing sustainable coastal tourism governance in Batukaras Village. This research is urgent due to the increasing socio-ecological vulnerability of Batukaras Village driven by climate change, coastal tourism pressures, and disaster risks, which threaten the sustainability of local livelihoods and coastal ecosystems.

Methodology

This study employed a qualitative descriptive approach, aiming to explore and understand the dynamics of socio-ecological systems and resilience in the context of coastal tourism. As stated by Creswell (2016), qualitative methods are suitable for examining social phenomena experienced by individuals or groups. A case study approach was adopted to explore in-depth the interactions between tourism and coastal ecosystems in Batukaras Village. This method enables the researcher to gather detailed contextual information from multiple sources, including stakeholders involved in coastal activities (Creswell, 2012).



(Source: Processed by Putra, 2023)

Figure 1. Research Location Map of Batukaras Village, Cijulang District, Pangandaran Regency

The research was conducted in Batukaras Village, Cijulang District, Pangandaran Regency, West Java, Indonesia (see **Figure 1**). This location includes two main coastal tourism objects: Batukaras Beach and the Mangrove Forest, both located in Batukaras and Sanghiangkalang hamlets. These areas are known for their ecological and economic significance and classified as regional tourism strategic zones. The coordinate point of Batukaras Village is at 7°45'20.0"S 108° 28' 51.7"E. The interview data were collected from February to April 2023. The study used both primary and secondary data sources. Primary data were obtained through in-depth interviews with selected key informants using purposive sampling. Informants included representatives from the Department of Tourism and Culture, Department of Marine and Fisheries, Village Officials, the Village Community Empowerment Agency, Mangrove Forest Guardian, and Tourism Awareness

Groups. Secondary data were collected from relevant Government Documents, Regulations, Geospatial Documents, and the Central Bureau of Statistics Pangandaran. Data were collected using three primary techniques: direct observation of social-ecological interactions during tourism activities; semi-structured interviews guided by pre-determined questions with flexibility for deeper exploration; and document analysis to verify and enrich primary data through the review of relevant policies, regulations, and historical records. This study assesses Batukaras coastal tourism through key SES and resilience indicators, including resource system condition, user interactions, resource units, and governance structures. Findings show ecological pressure on mangrove and coastal systems, adaptive shifts in community livelihoods, and the presence of regulatory mechanisms for tourism and fisheries management. Social and ecological resilience is reflected in community participation, collaborative governance, ecosystem protection efforts, and livelihood diversification. Strengthening institutional coordination and sustainable resource management remains essential to enhance overall socio-ecological resilience

Results and discussions

Learning to Live in Change and Uncertainty

1. Community Responses to Coastal Development Initiatives

> *"Port infrastructure is essential, especially to support tourism activities. Until now, the shoreline has been crowded with fishing boats, which interfere with tourism operations"* (Ganjar, Coordinator of the Coastal Fishery Port, Batukaras Village, interview April 3, 2023)
>
> *"The planned zoning for fishermen aims to remove boats from the main tourist beach. However, there has been no implementation yet. The designated port location is near the fishermen's residential area. Therefore, it needs to be facilitated so that boats do not occupy tourist areas"* (Tourism Awareness Group, interview, April 3, 2023)
>
> *"Fishing activities influence the coastal zone, particularly due to the presence of fishing boats that interfere with tourism activities. In addition, weather conditions also affect fishing operations"* (Mardiana, Junior Expert in Capture Fisheries Production Management, Department of Marine Affairs, Fisheries, and Food Security Pangandaran Regency, interview April 5, 2023)

The development of port infrastructure in Batukaras Village is crucial to support the integration between fisheries and coastal tourism activities. Currently, the shoreline is congested with fishing boats, which has led to spatial conflict and interference with tourism operations, particularly on the main beach area. Although zoning plans have been proposed to relocate fishing vessels away from primary tourism zones, there has been no implementation to date. The proposed relocation site is situated near the fishermen's residential areas, which requires infrastructural support to ensure effective and sustainable separation of uses. Furthermore, the coexistence of tourism and fishing activities presents challenges not only in terms of spatial overlap but also due to environmental factors such as weather conditions, which influence fishing patterns and vessel movements. According to the Batukaras Report (2023), fish production showed a consistent upward trend from 2020 to 2022. Output increased from 216,265 kg in 2020 to 303,402 kg in 2021, and peaked at 659,878 kg in 2022. This growth reflects improved fishing activities, resource availability, or enhanced management practices in the fisheries sector. Resilience in socio-ecology is significantly shaped by the system's adaptive capacity, knowledge co-production, and sustained innovation (Folke, 2006). Mangrove ecotourism contributes significantly to economic growth, coastal ecosystem

conservation, and the enhancement of local livelihoods to mitigate potential adverse effects (Moussa et al., 2024)

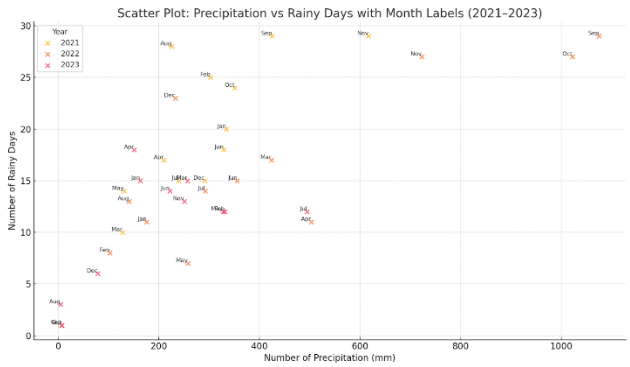
2. Community-Based Initiatives Supporting Tourism Activities

(Source: Putra, 2023)

Figure 2. Conditions Batukaras Mangrove

> *"Access to the mangrove forest is still inadequate. During the rainy season, the path becomes muddy and difficult to traverse. The route currently used passes through aquaculture ponds, which are not suitable for public access. Previously, the parking area consisted only of compacted sand and gravel, without any concrete or asphalt pavement. During peak seasons, both cars and motorcycles are parked far from the mangrove site due to limited space. There is not even a drainage system, let alone proper road infrastructure leading to the area"* (Tourism Awareness Group, Batukaras Village, interview April 3, 2023)

Access to the Batukaras mangrove ecotourism area remains inadequate (see **Figure 2**). During the rainy season, the path becomes muddy and difficult to traverse, and the current route passing through aquaculture ponds is unsuitable for public use. Parking facilities are limited, consisting only of unpaved sand and gravel, forcing visitors to park far from the site during peak seasons. Additionally, the lack of drainage and proper road infrastructure further restricts accessibility. These limitations underscore the urgent need for basic, sustainable infrastructure to support mangrove tourism development. Regardless of the situation, the findings from this study indicate that community-based tourism, which fosters a specific connection within a socio-ecological framework and aims for sustainability, has the potential to enhance the resilience of socio-ecosystems, thereby lowering their risk. Based on this understanding, a more reliable approach could be developed to assess the sustainability of community-based tourism. The concept of socio-ecological resilience could be incorporated into various models that aim to evaluate the impact of CBT (Cumming et al., 2005; Kibicho, 2008; Okazaki, 2008; Simpson, 2008)



(Source: Statistics Indonesia, Pangandaran Regency, 2023)

Figure 3. Precipitation and Rainy Days with Month 2021-2023

In September 2022, over 1000 mm of rainfall was recorded alongside 29 rainy days, indicating intense and frequent rainfall (see **Figure 3**). Extreme patterns were observed in September and October 2022, with exceptionally high rainfall (>1000 mm) and more than 25 rainy days. In contrast, August to October 2023 experienced minimal rainfall (5–7.5 mm) and only 1–3 rainy days, reflecting a pronounced dry season. Seasonally, months like January, February, March, and November generally mark the wet period, whereas August to October 2023 stands out as a distinctly dry interval. Strategies and guidelines for managing tourism destinations after natural disasters, including planning, marketing, trust, cooperation, and resilience (Estevao and Costa, 2020). Muliani et al. (2018) present a case study of socio-ecological systems in the coastal villages of Subang Regency, Indonesia, showing that these systems are shaped by interactions between marine resources (fisheries and mangroves) and local communities as primary users. Inter-village connectivity operates through social (education and fishermen institutions) and ecological (shared fishing grounds and mangrove use) networks, forming an integrated system. The study also identifies key coastal constraints, including environmental degradation, land-use change, and socio-economic vulnerability, which challenge sustainable management.

Social Justice Government

1. Social Capital for Coastal Cooperation Activities

   "Private sector participation, particularly through investment, has contributed to job creation in rural tourism sectors such as hotels, homestays, and restaurants." (Somantri, Head of Batukaras Village, interview April 6, 2023)

   "Surfing and photography services typically receive guidance from the village administration and the tourism office, particularly regarding the establishment of coastal tourism preservation groups" (Maman, The Village Community Empowerment Agency, interview April 6, 2023)

Private sector investment has contributed to employment growth in Batukaras Village's tourism sector, particularly in hospitality services such as lodging and dining. Simultaneously, local tourism micro-enterprises including surfing and photography are supported through institutional guidance and the formation of tourism preservation groups, enhancing community-based coastal tourism initiatives. According to Indonesia Statistics in Pangandaran (2023), Batukaras Village exhibits the highest concentration of accommodation facilities in the Cijulang Subdistrict, with a total of 92 establishments comprising 14 hotels and 78 guesthouses. Individuals within and across communities are interconnected through collaborative networks that facilitate the management of resources and the exchange of materials, skills, and knowledge (ANU IAS, 2014)

2. Government Management Rights for Coastal Tourism Activities

(Source: The Village Government, 2023)

Figure 4. Village-based waste management plays a critical role in promoting environmental sustainability at the local level

> *"Tourism waste management in Batukaras Village is primarily funded through tourism levies. Since 2020, efforts toward independent waste management have been initiated, starting with Batukaras Hamlet, while two other hamlets are in progress. Waste handling facilities include a 3R (Reduce, Reuse, Recycle) waste station equipped with machines for processing organic and inorganic waste, supported by a program from the West Java provincial government. The village government has also provided waste separation and incineration tools in two hamlets, particularly in tourist areas such as Batukaras and Sanghiangkalang, which are still managed by the local government. In some areas, waste is independently managed through open burning, including in home gardens. However, improper waste disposal remains an issue, as some residents continue to dump waste into rivers due to the inconvenience of proper handling"* (Somantri, Head of Batukaras Village, interview April 1, 2023)

Since 2020, Batukaras Village has implemented a tourism-funded waste management system, beginning with community-led efforts in Batukaras Hamlet and expanding to others (see **Figure 4**). A 3R (Reduce, Reuse, Recycle) facility, supported by the local government, serves as the core infrastructure for processing organic and inorganic waste. The village administration has also equipped key tourist areas such as Batukaras and Sanghiangkalang with waste separation and incineration tools. However, challenges persist, including open burning and river dumping, driven by limited infrastructure access and inadequate public compliance. According to the Batukaras Village Report (2022), the village sanitation infrastructure consists of 1 temporary waste disposal site, 2 cart-based waste transport units, and 64 waste bins; additionally, sanitation services are supported by 2 individual waste management personnel. This indicates a basic but operational community-based waste management system. The resilience of a landscape or seascape is reflected in its capacity to recover and regenerate following environmental disturbances such as extreme weather events, climate-induced stressors, or anthropogenic pressures and is often supported by institutional mechanisms, including formal legislation, policy frameworks, or customary systems (ANU IAS, 2014)

3. Government Protection of Marine Ecosystems

> *"Fishing activity regulations, ranging from national to local levels, emphasize the use of environmentally friendly and non-destructive fishing gear, in accordance with sustainable marine capture guidelines. A fish marketing program has also been implemented, requiring all fishers in the Fish Landing Base of Batukaras and Nusawiru Hamlets to report their marine catches. This initiative facilitates direct transactions between fishers and buyers"* (Mardiana, Junior Expert in Capture Fisheries Production Management, Department of Marine Affairs, Fisheries, and Food Security, Pangandaran Regency, interview April 5, 2023)

Law No. 45 of 2009 on Fisheries prohibits the use or possession of fishing tools that threaten marine resource sustainability. In addition to fisher and tourism group empowerment, the Environmental Agency promotes environmental and disaster awareness through targeted programs. Social learning encompassing knowledge, education, and technology is a key principle of social systems. According to the Batukaras Report (2019), the distribution of fishing gear in the area reflects a dominance of traditional methods, line fishing is the most widely used, with approximately 7.000 units, followed by nets totaling 68 units, and seine nets with 22 units, additionally aquaculture-based tools such as ponds and fish cages account for 8 and 6 units, respectively, this composition suggests a reliance on small-scale and artisanal fishing practices.

> *"There are indeed conservation efforts in place, including the protection of juvenile fish, sharks, and lobsters, which are listed on public awareness*

posters as prohibited species from being captured and sold to the Fish Landing Base due to their protected status. Mangrove management, however, remains under the authority of the village government, and infrastructure development, particularly bridge construction, remains a challenge" (Ganjar, Coordinator of the Coastal Fishery Port, Batukaras Village, interview April 3, 2023)

Regulations on fishing practices in Batukaras, from national to village level, promote the use of eco-friendly, non-destructive gear aligned with sustainable marine capture principles. A mandatory reporting system for fish catches has been implemented at the Fish Landing Bases of Batukaras and Nusawiru to support direct fishers-to-buyers transactions. Conservation measures are also in place, including the protection of juvenile fish, sharks, and lobsters, which are listed on public awareness posters as prohibited from capture and trade. While mangrove management remains under village authority, infrastructure constraints, such as incomplete bridge construction, continue to limit conservation and access efforts. The proposed framework has the potential to enhance the capacity of decision-makers engaged in local coastal governance to more effectively manage for social-ecological resilience (Fallon et al., 2022). This study by Sjafrie (2018) demonstrates that interactions among ecological resources, resource users, and public infrastructure providers generate an interconnected pattern of utilization within the seagrass-based socio-ecological system. Consequently, ecological disturbances have direct and cascading effects on the socio-economic conditions of coastal communities, underscoring the need for integrated and adaptive management approaches.

Protection of Marine Landscape Ecosystems and Biodiversity

1. Awareness in Building the Capacity of Tourism Stakeholder Groups

"Since the mangrove bridge was damaged, there has been no further action either from the government or the local community, so the initiative has not continued. Occasionally, if there are university students conducting community service, I accompany them to the mangrove forest. However, there is still no formal management in place, only sporadic maintenance or monitoring efforts. At present, the bridge is no longer functional, and we are unable to maintain it, neither the government nor the community is able to intervene. It is a dilemma, and I am uncertain about the solution" (Dede, Mangrove Forest Guardian of Batukaras, interview April 9, 2023)

The damage to the mangrove bridge in Batukaras has led to a complete halt in conservation and management activities. Neither the government nor the local community has taken further action, resulting in the discontinuation of previous initiatives. Limited engagement only occurs during Student Community Service Programs, yet no formal management system is in place. Currently, the bridge is non-functional, and neither party possesses the capacity to undertake repairs. This situation reflects a governance dilemma and highlights the lack of institutional response to damaged ecosystem infrastructure. The importance of participatory approaches and local knowledge is crucial for enhancing landscape resilience, as it fosters the strengthening of socio-ecological systems through cross-sectoral planning and community collaboration with policymakers (Aydin et al., 2018)

2. Building Capacity to Respond to Environmental Challenges

"The Batukaras Surfing Club is a hobby-based community organization committed to environmental conservation efforts. At the regency level, there is the Regional Disaster Management Agency, which focuses more on mangrove-related mitigation" (Hadi Somantri, Head of Batukaras Village, interview April 1, 2023)

> *"Waste is inevitably present. There are several waste collection systems, including the use of waste seminator vehicles and public bins, although their effectiveness remains limited. Waste management is a concern, especially regarding the number and adequacy of available waste facilities. Waste generated from tourism activities is particularly challenging, given the limited number of waste transport vehicles. I hope the 3R-based waste management system (Reduce, Reuse, Recycle) can be improved"* (Tourism Awareness Group, Batukaras Village, interview April 3, 2023)

Community-based and institutional responses to environmental management in Batukaras demonstrate both initiative and limitation. The Batukaras Surfing Club, rooted in recreational interests, plays an active role in local conservation efforts, while at the institutional level, the Regional Disaster Management Agency contributes primarily through mangrove-related mitigation strategies. However, environmental challenges persist, particularly in waste management. Despite the existence of waste collection systems such as public bins and waste seminator vehicles, their coverage and effectiveness are insufficient, especially during peak tourism periods. The inadequacy of waste transport facilities hinders sustainable practices, prompting local stakeholders to advocate for the enhancement of a 3R (Reduce, Reuse, Recycle) based management approach. The landscape or seascape is supported by capable, accountable, and transparent local institutions that play a crucial role in ensuring effective and participatory governance (ANU IAS, 2014). Sustainable local-based solutions and resilience enhancement strategies are essential, as those presented benefit local communities, policymakers, practitioners, researchers, and a broader audience (Nishi & Hashimoto, 2022). The dynamic interaction between natural systems and human activities characterizes coastal diversity, making integrated and adaptive management essential to ensure ecological sustainability and socio-economic resilience (Virapongse & Alessa, 2016)

Diversity of Coastal Resource Potentials

1. Enhancing Livelihood Products Based on Biodiversity

> *"There are several similar products, such as coconuts and coffee for consumption, which are sold to tourists that utilize the available natural resources by the local community. What's most needed now are training programs for micro, small, and medium enterprises, as well as improved infrastructure, particularly in the tourism sector. So far, progress has been gradual, supported mainly by the local government and the community's own awareness"* (Somantri, Head of Batukaras Village, interview April 1, 2023)

> *"There are cooperatives such as Village Unit Cooperatives or joint business groups supported by the village cooperative system. Occasionally, the local government also participates or provides assistance. The management of capture fisheries includes the establishment of Village Unit Cooperatives for fishers, with their catch sold to restaurants in the Batukaras tourism area"* (Ganjar, Coordinator of the Coastal Fishery Port, Batukaras Village, interview April 3, 2023)

Local economic activities in Batukaras demonstrate a strong reliance on natural resource utilization and community-based enterprise. Coconut Products, Coffee, and Seafood are commonly marketed to tourists, reflecting the integration of environmental assets into the village's informal economy. The development of Micro, Small, and Medium Enterprises remains gradual, driven primarily by local awareness and limited support from the local government. Institutional frameworks, such as Village Unit Cooperatives and joint business groups, play a role in facilitating Small-Scale Entrepreneurship. In the fisheries sector, MSMEs enable fishers to supply local tourism-related businesses, although challenges persist in terms of capacity-building, infrastructure, and broader market integration. Based on data provided by Statistics Indonesia in Pangandaran Regency (2023), the main estate crops cultivated include coconut and coffee; in total,

coconut production reached 3,92 million coconuts over a planted area of 400 hectares; meanwhile, coffee production amounted to 1,880 kilograms, cultivated on a relatively smaller area of 2 hectares. Strengthening training programs and improving infrastructure are identified as key priorities for sustainable economic growth. The socio-economic infrastructure in the area is considered sufficient to support the daily activities and well-being of the community (ANU IAS, 2014).

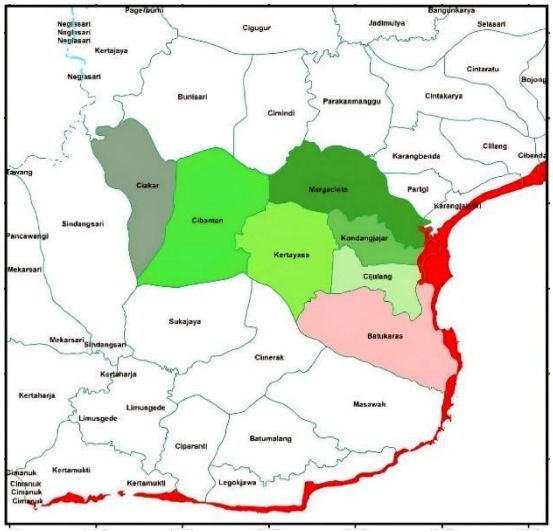
2. Efforts to Diversify Livelihoods Beyond Marine Resource Utilization

> *"Regarding coastal livelihoods, a significant number of residents have transitioned to rice cultivation, utilizing both privately owned plots and land owned by others. Informal cultivation also occurs on parcels that remain undeveloped. This pattern is evident in Sanghiangkalang Hamlet, located near Bojong Salawe"* (Maman, The Village Community Empowerment Agency, interview April 6, 2023)

Coastal communities in Batukaras have increasingly turned to rice farming, utilizing both owned and informally accessed land to support food security. In Sanghiangkalang, unused private land has been cultivated by residents, reflecting a community-driven adaptation to livelihood challenges. Livelihood improvements within landscapes and seascapes are closely associated with the innovative and sustainable utilization of local biodiversity, which supports both economic development and ecosystem conservation (ANU IAS, 2014). The indicators hold significant importance for local communities and for the conservation of biodiversity managed by them for their livelihoods (Cockburn et al., 2020).

3. Safety Measures for Coastal and Marine Tourism Activities

> *"It has been quite good from the cadre formation process to the establishment of the Community Early Awareness Forum. It has been implemented. The village was ready; the forum was established in 2019. Approximately once a year, there is training focused on disaster preparedness and early warning"* (Maman, The Village Community Empowerment Agency, interview April 6, 2023)



(Source: Processed by Putra, 2023)

Figure 5. The Tsunami Hazard Map (red line) from Indonesia Geospatial

Batukaras Village has demonstrated preparedness through the establishment of the Community Early Awareness Forum in 2019. Supported by regular annual training on disaster preparedness and early warning, the forum reflects structured community-based risk reduction efforts from cadre formation to institutional implementation. (see **Figure 5)** shows the tsunami hazard map with red lines indicating high-risk zones,

primarily in coastal lowlands and gently sloping terrains, based on topographic features and processed using data from Indonesia Geospatial. The community possesses the capacity to relocate in response to shifting production opportunities, thereby avoiding land degradation and unsustainable resource exploitation (ANU IAS, 2014). Vulnerability assessments are applied in coastal communities reliant on tourism emphasis on water and socio-economic impacts, and the need for locally-informed case studies in small coastal communities (Ngo et al., 2022; Lawyer et al., 2023). Coastal ecosystems provide critical protection functions, including shoreline stabilization, wave attenuation, and buffering against storm surges and coastal erosion, thereby reducing vulnerability of coastal communities to environmental hazards (Sjafrie, 2018).

Conclusion

This study reveals that both climate change and socio-cultural dynamics significantly affect the condition of coastal tourism in Batukaras Village. The degradation of environmental quality in beach and mangrove areas, coupled with insufficient infrastructure and limited accessibility, illustrates the region's vulnerability. Nevertheless, local communities exhibit socio-ecological resilience through self-managed waste practices, the development of community-based educational tourism, and strategic collaborations with academic and governmental institutions for disaster mitigation. To strengthen adaptive capacity, structured policy frameworks and strategic interventions are required. Key implications include: (1) the formulation of climate adaptation policies and spatial regulation for fishing boat mooring zones; (2) enhanced coordination in managing waste and related infrastructure; (3) improvement of tourism access and facilities; (4) multi-stakeholder consolidation to support ecosystem conservation; and (5) advancement of disaster preparedness through education, evacuation planning, and innovative coastal protection technologies. The findings indicate that governance and institutional coordination emerge as relatively strong SER dimensions, whereas ecological management capacity and community-based environmental monitoring remain comparatively weak. These weaker indicators should therefore be prioritized in future policy interventions, particularly through strengthening local adaptive capacity, participatory ecosystem management, and cross-sectoral collaboration to enhance overall socio-ecological resilience.

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