

SUSTAINABLE ECOLOGICAL PLANNING STUDY OF SEBERANG FISHERMAN VILLAGE RESIDENTIAL AREA, PALUH KURAU, NORTH SUMATRA PROVINCE

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Abstract

Seberang Fishermen's Village, Paluh Kurau, Muara Belawan, North Sumatra Province, is an area that functions as a residence and fishing ground. Slum areas, inconsistencies in spatial planning, limited land, irregular buildings with poor quality, high density, disease susceptibility, poor infrastructure, vulnerability to social problems and poverty are the problems facing microorganisms in Seberang Fishermen's Village, Paluh Kurau. This study used qualitative methods with a descriptive approach to provide an assessment of organizational planning strategies, focusing on harmony through the linkages and unity between policies, natural conditions, economics, and socio-cultural aspects, while considering ecological values in line with national development goals. The study concluded that planning focuses on increasing community empowerment, ecological planning, and enhancing the community's social capital structure.

Keywords: *Seberang Fishermen's Village Settlement, National Development, Sustainable Ecology, Community Empowerment, Social Capital Structure.*

INTRODUCTION

Settlement is an area that functions as a residence and a place to carry out activities, a space for living and livelihood (Andreas, Nurjannah & Saleh, 2014), which is bound by spatial functions such as the Seberang Fisherman's Village, Paluh Kurau, Muara Belawan, North Sumatra, plays an important role in the local economy, especially fishing activities. Activities that become the identity of the settlement are implemented in the use of space both personally in one residence and communal spaces along the coast of the settlement area (Egam & Rengkung, 2016). Coastal areas with strategic potential, diversity of marine natural resources, ecotourism-based destinations, unique fishing culture, mangrove ecosystems and marine tourism face challenges and conflicts related to spatial and environmental management. The spatial planning of village settlements with land capacity requires a study that is integrated with the environmental ecosystem and social conditions of the community in a sustainable manner, supports community welfare, and preserves the environment (Sitorus, 2010; Arsyad, 2010). Fishing activities are a unity between fishermen, fish and their ecosystem (Wiadnya, 2005).



Figure 1. Location Map

Seberang Fisherman's Village, Paluh Kurau Village, Hamparan Perak District, Deli Serdang Regency, North Sumatra Province, a coastal area inhabited by fishermen. The area covers 26.25 km² with a density of 4,187% people/km². Seberang Fisherman's Village is a fishing village that can be reached by 4 or 2 wheeled vehicles then continued by boat to the village about 1 hour's journey from Medan City, located at sea level geographically bordered by:

- North of Paluh Kurau Village
- South of the Belawan Estuary
- East of Paluh Nonang
- West of Paluh Lumbu.



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Figure 3. Seberang Fisherman's Village Settlement, Paluh Kurau, North Sumatra

The Seberang Fishermen's Village was formed organically, growing among settlements and fishing activities in an unorganized, limited and dense environment in the waters, vulnerable to environmental problems, water pollution, sedimentation, erosion, health and decline of the mangrove ecosystem (Li et al., 2018). The increase in population and the expansion of fishing activities do not pay attention to the carrying capacity of the land and the environment, thus threatening the sustainability of coastal areas (Adam & Ade Surya, 2013). The development of coastal areas must be able to produce social, economic, and environmental benefits, not cause degradation (Chen et al., 2019). The majority of the community are traditional fishermen with the highest level of activity in coastal areas, requiring space that is directly accessible to the water area (Artiningrum, 2017). Low economic levels, understanding, low education and government limitations in coordination and supervision are obstacles to environmental conservation in sustainable spatial management (Mukidi, 2018), so that the carrying capacity of the land is not optimally utilized (Yunithea, 2023). The environment is a spatial unity with all objects, forces, conditions, and living creatures, including humans and their behavior, which affect the continuity of life and the well-being of humans and other living creatures. (Law No. 4, concerning Basic Provisions for Environmental Management, 1982).



Figure 4. Belawan Estuary, North Sumatra

The main problem phenomenon is the planning of the fishermen's settlement in Seberang Fisherman's Village, Paluh Kurau on the coast of Muara Belawan, through a settlement planning strategy that pays attention to harmony through the linkages and unity between policies, natural conditions, economics and socio-culture that consider ecological values. (Frick & Mulyani, 2006).

LITERATURE REVIEW

Spatial

Based on Law No. 26 of 2007 concerning Spatial Planning, the classification of spatial planning is differentiated based on the system, main function of the area, administrative area, area activities, and strategic value of the area.

- a. Spatial planning based on the system consists of regional systems and urban systems.
- b. Spatial planning based on the main function of the area consists of protected areas and cultivation areas.
- c. Spatial planning based on administrative areas consists of national spatial planning, provincial spatial planning, urban spatial planning and rural spatial planning.
- d. Spatial planning based on the strategic value of the area consists of spatial planning of the areanational strategic, provincial strategic area spatial planning, and district/city strategic area spatial planning.

The Concept of Sustainable Development

Urban and regional planning contributes to sustainable development, closely linked to three complementary dimensions: social development and inclusion, sustainable economic growth, and environmental protection and management (UN-Habitat, 2015). The concept of sustainable development encompasses three main dimensions: economic, social, and environmental, which are interconnected with economic development, environmental quality, and social equality. Mohan Munasinghe (2019) outlines the three pillars of sustainable development:

1. Economics, namely maximizing income by maintaining or increasing capital reserves.
2. Ecology, namely maintaining and preserving physical and biological systems.
3. Socio-cultural, namely maintaining the stability of the social and cultural system.

Ecological Architecture Concept

The definition of Ecological Architecture is the planning of an environment or building that is in harmony with its natural surroundings, based on the view of the existence of a reciprocal relationship between living things and their environment, about living things in their habitat, about the structure and function of ecosystems that require thorough knowledge of natural resource systems, cultural characteristics, and other relevant data that support the harmony of humans and nature. (Rustam, H. 2012).

METHOD APPROACH

This research uses a qualitative method with a descriptive approach. Qualitative methods are research procedures that produce data in the form of written or oral works from observed people's behavior (Bogdan & Taylor, 1975) as quoted by Moleong (2017). This approach is directed at the setting and individuals holistically, expressed descriptively in the form of facts about an object, phenomenon, indication, and condition that are described, described, interpreted, and concluded in a systematic written form (Creswell, 2017; Yin 2000 in Milanie et al., 2020; Abdiyanto, 2020; Milanie et al., 2021). The main focus is to explore the ecological, economic, social, and cultural aspects of the Kampung Nelayan Seberang residential area. After collecting the data, the data was analyzed using a qualitative approach. Miles, Huberman, and Saldana (2018) in "Qualitative Data Analysis: A Methods Sourcebook" state that the qualitative data analysis process consists of three main stages: data reduction, data presentation, and conclusion drawing. The purpose of this study is to:study of sustainable ecological planning in the Seberang Fisherman's Village area, Paluh Kurau, Muara Belawan, North Sumatra Province.

DISCUSSION

What are the conditions and utilization of the Seberang Fishermen's Village space?

The physical and social conditions of space geographically in relation to policies and socio-cultural conditions which are variables in the review of sustainable regional planning which have an impact on economic, ecological and socio-cultural development are:

1. Utilization of Residential Space

Settlements along the coastline and coastal areas are characterized by irregularly constructed houses, lacking structure, and inadequate facilities and infrastructure, particularly clean water networks. Poor sanitation and

unmanaged wastewater disposal systems are the cause of coastal environmental pollution, negatively impacting ecosystem quality, water quality, and public health, as well as the threat of abrasion due to land use, climate change, and human activity. (Pouye, et al. 2022).

2. Utilization of Fisheries Space

Uncoordinated use of fisheries space creates an imbalance between the fisheries sector and other sectors, such as housing and tourism. The sustainability of mangrove ecosystems and mangrove forests is threatened by land conversion for housing and industrial activities (Senoaji & Hidayat, 2017).

3. Role of Government

The development of spatial utilization zoning plans takes into account the interests of the fisheries, residential, tourism, and environmental sustainability sectors as an implementation of sustainable spatial planning policies (Jamal, F., 2019). Limited oversight and law enforcement have resulted in suboptimal policy outcomes.

4. Seberang Fisherman's Village Community

The community's life depends on the traditional fishing sector as its main source of income, generally work as traditional fishermen. (source: environmental head in Seberang Fisherman's Village, Wiyah) Low income and education conditions result in limited knowledge about the importance of quality of life apart from the desire to improve the economy. The Seberang Fisherman's Village community received [KABAYA Program \(Empowered Coastal Village\)](#) by PT Pertamina Patra Niaga Fuel Terminal Medan, as an effort to improve the social and economic welfare of the community. However, The community still needs government support in terms of knowledge, technical and capital for the development of fisheries activities and the development of ecosystem-based tourism potential.

Physical and Non-Physical Factors Influencing Sustainable Ecological Planning in the Seberang Fisherman's Village Settlement Area

Seberang Fisherman's Village, was originally an uninhabited water area at the Belawan estuary, due to its geographical factors located in estuary waters that directly border the sea and are strategic for mooring ships, the area was chosen to be used as a place to carry out fishing activities as well as settle as a residence by the majority of coastal residents who work as fishermen, whose lives depend on marine products (Noegroho, et al., 2017). Coastal communities have unique characteristics related to the region's economic characteristics, cultural background, and the availability of supporting facilities and infrastructure (Nasution, Z, et al., 2007). Their culture, in harmony with nature, simple adaptive technology, and inability to control resources lead to uncertain incomes. Disadvantages in terms of income, health, and education levels have led to the deteriorating living conditions of coastal fishermen (Kusnadi, et al., 2003). The region, largely at sea level, has a tropical climate with a maximum temperature of 33°C, influenced by two seasons: the dry season and the rainy season. Dense, slum-like settlements line the coast, littered with trash beneath stilt houses, and difficult access for outsiders, who must travel by sea.



Figure 4. Stilt House and Garbage

Regional planning is needed to improve the quality of life for the community, harmonize with the coastal ecosystem, and accommodate the unique socio-cultural values of coastal communities. Several aspects of ecological planning in the settlement of Kampung Nelayan Seberang include:

1. Geographical and Natural Conditions

The utilization of the relatively long coastline, as well as land partially located in the water, is vulnerable to tidal flooding and abrasion (Renny, 2021), threatening residential and fisheries areas. Land use increasingly shifting into the water and mangrove areas, narrowing of waterways, sedimentation from household waste and fishing activities, and exploitation of mangrove areas also threaten the sustainability of natural resources and exacerbate the tsunami-prone coastal buffer zone (Tri et al., 2024).

2. Social and Demographic Factors

Population growth and its activities affect the needs of the area, it is necessary to analyze the needs between the relationship of activities with the facilities and infrastructure that support life physically and non-physically (Jayadinata, 1992), for example the number of residents and density of the provision of learning facilities, health, recreational parks, transportation and sports as well as a clean, healthy environment, security guarantees and employment (Tahil & Nahdatunnisa, 2020). Rapoport, (1977) explores the meaning of the environment that "the role of the social environment (or context) on human behavior in the social environment", in order to understand the meaning of the environment cognitively and translate it into architecture.

3. Economic Factors

Fishermen's income from fishing activities dominates the use of coastal and marine areas for fishing and fish farming (Halim, 2013). Overexploitation reduces the sustainability of fish catches (Pratama, 2023). The natural beauty of the coast and the culture of fishing communities can attract tourists if supported by investment in tourism facilities and infrastructure (Wardhani, 2011).

4. Spatial Planning Policies and Regulations

Poorly coordinated, overlapping and poorly implemented policies lead to spatial irregularities and environmental damage (McHarg, 1969). Planning limitations in appropriate spatial planning and land grouping their capabilities and the principle of sustainability (Rustiadi et al., 2009), causing people to build settlements and economic activities without paying attention to the long-term environmental impact.

5. Socio-Cultural Factors and Local Knowledge

Local wisdom relates to ways of life and sustainable use of natural resources, particularly fisheries. Changes in community values and perceptions of spatial use have also been impacted by economic diversification, including the development of the tourism sector. (Blamey, 2018). Ecotourism can be an effective tool in coastal area management (Mulyadi & Fitriani, 2012). Responsible use of natural resources in synergy with conservation provides economic benefits for local communities, but still hampered by limited facilities and infrastructure, knowledge and access to training and education.

How the Sustainable Ecological Planning Strategy of Seberang Fishing Village

1. Economy

Economic improvement is not only about utilizing the potential of natural resources but also improving human resources in the form of community capabilities and independence through empowerment, to transform community growth as a real community strength, and also to protect and fight for socio-economic values and interests in all aspects of life, not only including strengthening individuals but also social institutions (Nasution, Z, et al, 2007). Entrepreneurship as an effort to increase opportunities and potential economic value through management and operational activities related to added value (Mbizi et al., 2013). Coastal economic improvement program through empowerment and entrepreneurship of coastal communities (Andreas & Enni, S, 2016), may include:

a. Institutional Development:

Based on the social capital structure to strengthen the synergy of relationships between fishermen in coastal community groups with each other (Astuty, et al., 2006).

b. Human Resource Development:

Skills training through outreach, education and training related to improving fisheries activities (Zamzani, 2010).

c. Economic Empowerment:

Development of small and medium enterprises such as marine product derivative processing businesses and community-based ecotourism (Satriaji, 2023).

d. Environmental Management:

Instilling awareness of environmental carrying capacity in development with development and environmental policies (Mitchell, 2000), as follows:

1. Based on the meaning of development.
2. Focus on the quality of development.
3. Fulfillment of the principles of basic life needs: employment, food, energy, water and sanitation.
4. Ensure the sustainability of every growth.
5. Encourage conservation efforts and improvement of natural and human resources.
6. Environmentally friendly technology.
7. Consideration of environmental and economic synergy in decision making.

2. Ecology

Principles of ecology according to Frick, H., & Mulyani, TH (2006) which can be applied to develop physical and non-physical potential of the area:

a. Spatial Planning Concept

1. Law No. 1 of 2014, Concerning Amendments to Law No. 27 of 2007, Concerning Management of Coastal Areas and Small Islands.

Article 31

Community Empowerment is an effort to provide facilities, encouragement or assistance to communities and traditional fishermen so that they are able to determine the best choices in utilizing Coastal Resources and Small Islands sustainably.

2. Republic of Indonesia Government Regulation Number 38 of 2011, Concerning Rivers:

Article 30

(2) The use of rivers as referred to in paragraph (1) includes use for:

- a. household;
- b. agriculture;
- c. environmental sanitation;
- d. industry;
- e. tourism;
- f. sports;
- g. defense;
- h. fisheries;
- i. power generation; and
- j. transportation.

(3) River development as referred to in paragraph (1) is carried out without damaging the river ecosystem, taking into account the characteristics of the river, the preservation of biodiversity, as well as the unique characteristics and aspirations of the local area/community.

3. PP RI Number 14 of 2016, Zoning Regulations concerning the provisions of spatial utilization requirements and their control for each designated block/zone whose zoning is stipulated in the detailed spatial planning. The classification criteria for zones and sub-zones of cultivation areas consist of: residential zones, trade and service zones, office zones, industrial zones, public service facility zones, other designated zones, special designated zones, and mixed designated zones.
4. North Sumatra Provincial Regulation No. 4 of 2019, the zoning plan for coastal areas and small islands of North Sumatra Province 2019-2039, with the main priorities including conservation, development of marine tourism, increasing fisheries production, and sustainable infrastructure development must be integrated with the Spatial Plan (RTR) by considering the function of space, direction of development and long-term allocation for the use of water areas as areas of population activity both residential and fisheries economic activities that guarantee land use regulation, intensity and density control of the physical density of buildings with KDB, KLB, GSB and building height as well as providing protection for mangrove conservation areas and mangrove protected forests.
5. Srinivasan & Sudhakar (2018) in Urban Planning and Zoning state that zoning creates efficient land use. Determining the type of use and treatment within an ecosystem can reduce conflict between existing activities, ensuring sustainability (Seta, 1991).

b. Footprint Concept

The site includes micro and macro analyses of climate, various ecosystems and their interrelationships, surface and subsurface hydrology, vegetation, and subsurface soil conditions. The soil conditions of a site determine the engineering suitability of the site to support buildings, infrastructure, natural and built environments (White, ET, 1983).

1. Land plots for fishermen's settlements should take into account:
 - Conditions have good supporting capacity for construction savings and effective land use in coastal areas with limited land.
 - The site orientation follows the pattern of community fishing activities.
 - Freedom from tidal flood waters or high tides, so that certain elevations are taken into account.
 - Mud sedimentation makes it difficult for boats to moor.
 - Able to provide good environmental facilities and infrastructure.
2. Spatial character is a unity of physical space of buildings, both the mass composition and form of buildings in a residential environment due to the influence of factors of development of community life (Kustiandiningrum, et al., 2015). The mass of buildings that are close to each other to form units that are relatively close and dense, and are directly connected to waters and the sea as a place of production and activity needs (Hakim, et al., 2014).

c. Climatology

Factors and climate conditions that influence planning include:

1. Sun
The orientation of the building mass is determined by reviewing the angles of the sun, to regulate the amount of sunlight entering through the openings, optimizing open spaces as active spaces for processing salted fish and drying fishing gear, as well as passive spaces as social interaction spaces (Junawan & Suhartina, 2016).
2. Temperature
The relatively high temperature in coastal areas determines the direction of visibility in order to provide comfort for community activities, both residential and fishing.
3. Wind
Wind is a consideration in the orientation, shape, and permeability of buildings and the built environment. Wind direction and speed influence ocean wave height. Strong gusts from certain directions can cause higher waves in coastal areas. Furthermore, wind direction significantly influences the orientation of ship moorings, depending on the direction of high tide and low tide.

d. Environment

The utilization of spatial functions in accordance with natural conditions and the potential of natural resources and human resources, as a form of harmony between the socio-cultural image of community life and its environment. Regional planning must be able to provide protection against the dangers of natural disasters, such as high tidal waves and tornadoes. Protection of protected areas has an impact on the sustainability of life, protected forests act as a breeding ground for marine biota, tidal wave barriers, air/temperature neutralizers (maintaining air quality), protect areas from natural disasters and have the potential as tourist attractions (Soemarno, 1986).

e. Facilities and infrastructure

Facilities and infrastructure support sustainability activities sustainable human development. Planning and development of infrastructure must be integrated. Provision of infrastructure in coastal areas is oriented towards serving marine and fisheries activities and housing. Other social facilities include schools for educational advancement, clinics or community health centers, and places of worship, all integrated with road infrastructure, clean water, sanitation, electricity, and communications.

3. Socio-cultural

The need for mutual cooperation in building togetherness and kinship within a community that is interconnected with one another in life (Sulistyo & Widjajanti, 2018). Social interactions that occur in residential areas, activities and the same livelihoods, with local wisdom and traditional knowledge are influential social capital to move togetherness to achieve shared progress (Inayah, 2012). Social capital strengthens the tradition of togetherness and mutual trust in

society which is maintained by maintaining the values and norms in the characteristics and culture of coastal communities (Supriono, 2009).

CONCLUSION

Coastal area planning is oriented towards human activities, in harmony with the environment and in accordance with the goals of sustainable national development, so it can be concluded that:

1. Increasing the empowerment of the Seberang Fisherman's Village community, through non-governmental organizations to strengthen the social function of the community in an effort to improve the quality of life through human resource training as capital for increasing productivity and economic income, while maintaining the existence of the character of local wisdom traditions.
2. Ecological and environmentally friendly planning, with the principles:
 - a. Providing limits on the movement of residential growth and activities towards conservation, prioritizing the allocation of conservation land as a priority with compensation for the expansion of conservation land for the use of residential land as anticipation of:
 - The impact of climate change resulting in rising sea levels.
 - Environmental pollution conservation.
 - Conflicts between the use of conservation land and the increase in residential and fishery land.
 - b. Vertical residential development using environmentally friendly materials that are in accordance with the vernacular characteristics of coastal buildings spatially integrates residential and activity centers, using the lower space for shared communal spaces in the form of moorings or piers as an effort to empower limited land.
 - c. The area's buildings are oriented towards the wind direction, as the main guideline for determining the orientation of the building mass in relation to the direction of the sea and the direction of the high and low tides.
 - d. The facilities and infrastructure required are:
 1. A boat mooring or pier, as a center for fishing activities which is also used as a space for social interaction.
 2. Other public facilities: education, health and worship facilities.
 3. Supporting facilities for kiosks, markets and buffer zones in the form of mangroves and mangrove forests.
 4. Clean water network because the village is located above the sea.
 5. Sanitation and waste management.
 - e. Suggestions for the use of regional space to comply with policies on Spatial Planning and gradual redevelopment on land that is in accordance with policies and in accordance with planning concepts.
3. Improving the structure of social capital in society through education and outreach so that the function of social capital can be maintained and built in traditions, norms and values as a proactive force in efforts to unite and build participation and solutions to resolve conflicts in the lives of coastal fishing communities.

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