

Dynamics of Coastal Land Use Change and Prospects for Sustainable Marine Ecotourism in Nusa Penida Island

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ABSTRACT

Nusa Penida has rich marine ecosystems, such as coral reefs and mangroves, which are residents' main source of income through fisheries, seaweed cultivation, and tourism. Land use change in Jungut Batu Village, Nusa Lembongan, has implications for the environment and economy in the coastal area of Nusa Penida. This study uses secondary data and Google Earth software to analyze changes in the area. From 2009 to 2020, significant changes occurred from seaweed cultivation to tourism land and back to seaweed cultivation during the pandemic. This analysis reflects the evolving economic dynamics and environmental impacts. The transformation from cultivated land to a marine ecotourism destination demonstrates an evolution in approaches to sustainable land use. However, the negative impacts of mass tourism highlight the need for a shift towards environmentally friendly and sustainable tourism. Collaboration between communities, tourism actors, government, and continued research is key in developing an effective and sustainable ecotourism model for Nusa Penida.

INTRODUCTION

As an area with great biological and non-biological potential, coastal areas play an important role in providing environmental services such as transportation, industry, and tourism, which have a significant impact on the economy, especially in an archipelagic country like Indonesia (Bengen, 2001). The Nusa Penida area in Bali, Indonesia, is an example of a coastal area rich in important marine ecosystems, including seagrass beds, mangrove forests, and coral reefs, which are home to a variety of marine species (Jubaedah & Anas, 2019). With a population of around 45,000, Nusa Penida's main sources of income are seaweed farming, marine ecotourism, and capture fisheries, despite frequent conflicts of interest between tourism, fisheries, and other activities in the area (Fauzi et al., 2009; Harjadi, 2016). This challenge emphasizes the importance of further research on digitally mediated coastal area management and utilization to ensure long-term sustainability (Sanjaya et al., 2022).

Coastal areas are strategic areas where land and sea meet, and have significant biological and non-biological potential. As an easily accessible area, this area supports various environmental service activities such as transportation, industry, and tourism. In Indonesia, an archipelagic country, the tourism sector is a major pillar of the economy. One of the prominent coastal areas is the Nusa Penida region in Bali, which has a rich marine ecosystem and abundant natural resources, but also faces complex management challenges due to the intensity of coastal resource utilization.

LITERATURE REVIEW

The coastal area is the meeting space between land and ocean that has enormous biological and non-biological potential (Bengen, 2001). As an area with a high level of accessibility, it includes environmental services activities such as transportation, industry, and tourism. Indonesia as an archipelago relies on tourism as the center of the economy. The Nusa Penida region is located off the southeast coast of Bali Island, Indonesia, and covers 200 km² of coastal waters surrounding the three main islands of Penida, Lembongan and Ceningan. Many important marine ecosystems can be found in this area, such as seagrass beds, mangrove forests and coral reefs (Jubaedah & Anas, 2019). A marine biodiversity assessment in 2008 found 298 coral species and 576 fish species, including five new species (Allen 2008; Turak and De Vantier 2009).

The main sources of income for Nusa Penida's 45,000 residents are seaweed farming, marine ecotourism, and capture fisheries. Local fishermen hunt sharks, reef fish, and schools of small pelagic fish that form in the strong currents between Bali and Lombok. Most of the island's coral reefs are covered with seaweed cultivation, which also provides a reliable source of income for many local households. Most tourists go to Nusa Lembongan, which is famous among divers for its reliable shoals of manta rays and sunfish every year. As a result, Nusa Penida. Due to the intensive utilization of coastal resources in small coastal areas, there is a high risk of conflict between these activities. Typical conflicts include tourism and fisheries, tourism and seaweed farming, and between local communities and tourism operators. Regional changes continue to be made each year, following the changing times (Fauzi et al., 2009).

In reality, economic considerations usually take precedence over sustainability and land-carrying capacity (land feasibility) in land use in coastal areas. Before maximizing land use, (Harjadi, 2016) underlines that the determination of land suitability must be evaluated. There is a need for research on the management and direction of digitally mediated utilization of coastal areas (Sanjaya et al., 2022).

METHODOLOGY

The research site is located in Jungut Batu Village, Nusa Lembongan, Bali. This location was taken because the overall area in Nusa Penida, Nusa Lembongan experienced higher regional changes each time following the times. The method used was observation.



Figure 1. Map 1 of Jungut Batu Village Area

In this study using secondary data by applying Google Earth Pro software. By taking the location of Nusa Lembongan as an example of land change each year, and then analyzing for regional changes each year. In addition, references to journals, final assignments, the internet, and books supporting materials are used to collect secondary data. After data collection, quantitative modeling techniques were applied to collect and analyze the data (Fauzi et al., 2009). Due to the lack of data on the area of seaweed cultivation, an estimate of the area was made using Google Earth Pro. This area was then made the initial boundary that became the benchmark for area change. This 340 m² area is not the actual area but in this study, it is assumed to know the area of change of seaweed cultivation area into an area for tourism activities. By using the historical imagery feature, we can see changes in the area every year. The initial data collection as the starting benchmark area was taken from 2009, in the following year this initial benchmark remains and is used as a comparison material for changes in the initial area of seaweed cultivation to tourism land.

RESEARCH RESULT

Jungut Batu Village is one of the villages on the island of Nusa Lembongan that continues to grow over time. This growth can be seen by changes in land use both from idle land to built-up areas, as well as changes in function from residential areas to trade areas. Based on field observations, the utilization of the coastal area consists of: Tourism, trade, industry, and seaweed

cultivation. In writing, KKP together with an NGO, namely CTC, has classified several areas in Nusa Penida (Figure 1). The jungut batu area itself in the MPA zoning is explained that there are only seaweed cultivation and tourism areas.

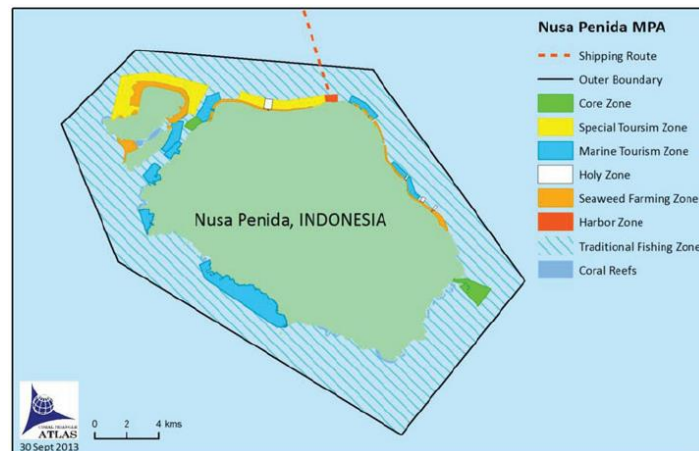


Figure 2. Map 1. Zonation MPA Nusa Penida

The results of the analysis of changes in the Jungut Batu Village area are shown in Figure 3. Based on the results of the analysis of changes in the area, there are changes in the last 10 years. From the results of historical imagery obtained in 2009 the residents of Jungut Batu Village were seaweed farmers, over time many villagers switched professions in the tourism sector, by seeing the loss of seaweed cultivation in 2016-2019. In 2020 the land turned back into seaweed cultivation land, due to the covid pandemic. The absence of tourists coming to the Nusa Lembongan area is the main reason why the land changed back to seaweed cultivation.

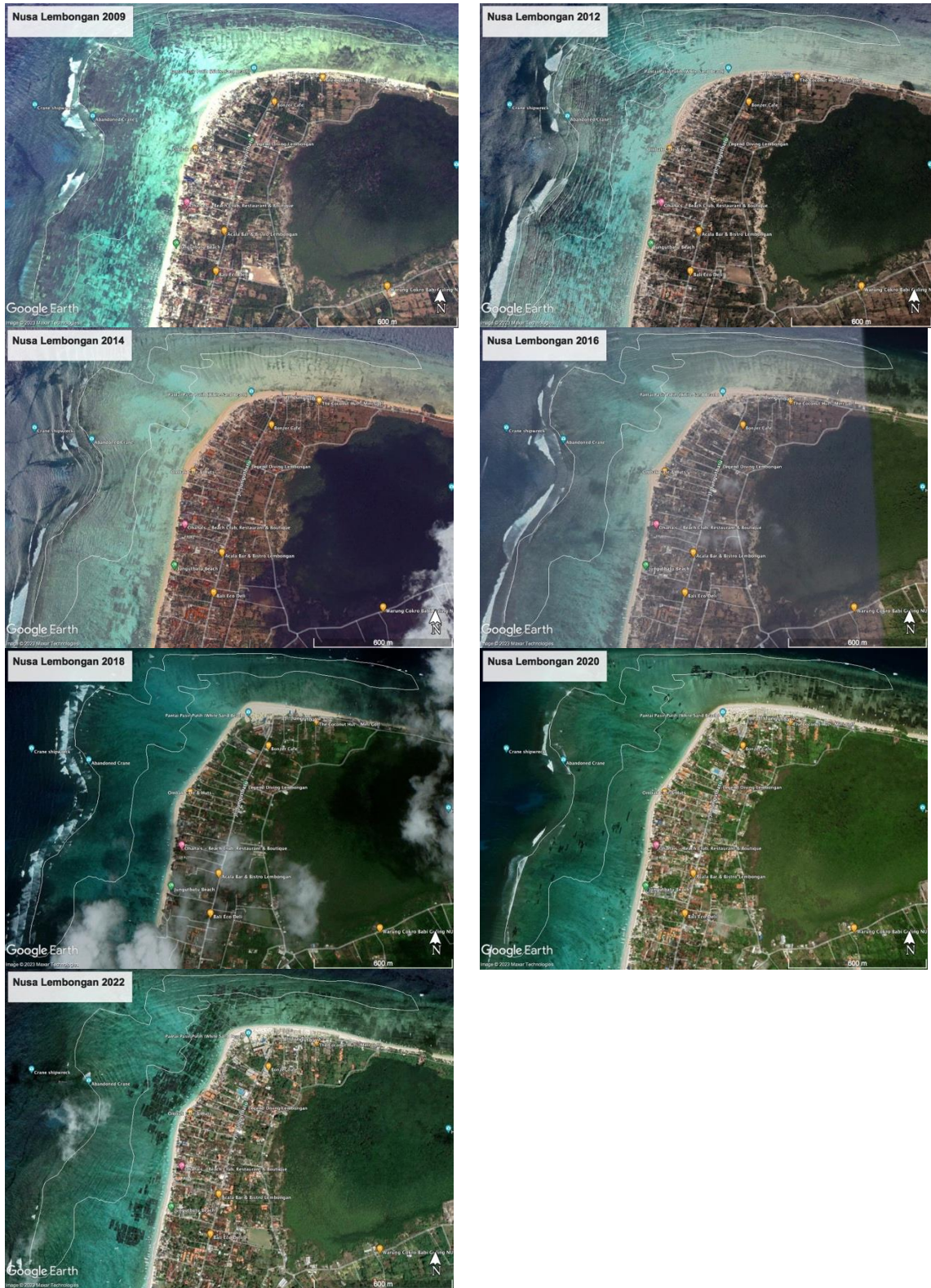


Figure 3. Map 2. Changes in Jungut Batu Village Area

Nusa Penida is divided into seven major areas: seaweed farming, holy temple, harbor, sustainable fisheries, marine tourism, and special marine tourism (BPS 2012). These conservation areas can be utilized sustainably to improve the local economy. In addition, the creation of conservation areas is also an effort to improve the standard of living of local communities. Land suitability, natural phenomena, climate change and environmental pollution will all be affected by land changes over time. If land is exploited without sustainable conservation efforts to ensure sustainability, the impacts will be severe (Jubaedah & Anas, 2019).

Due to human activities and natural disasters, densely populated coastal areas experience various adverse impacts. Coastal areas are also vulnerable to disasters other than those caused by humans. Sea level rise, abrasion, tsunamis and earthquakes are some of the natural disasters that pose hazards to coastal areas. The risk matrix that will arise from sustainable utilization without a regional rehabilitation area requires further research (Hidayah & Suharyo, 2018).

This can be seen from local residents' statements that abrasion has occurred because in the past the sea level and coastline were wider than they are now. The type of land use in a region or area correlates with activity and population growth. As a result, the rate of land use change increases in areas with more intense population growth and activities. From an economic point of view, this land use change can provide benefits. However, from an environmental perspective, it poses a threat to the sustainability and carrying capacity of coastal resources if not managed properly (Jubaedah & Anas, 2019).

The transition from seaweed farming to ecotourism illustrates how our understanding of sustainable land use has evolved. On the other hand, the adverse impacts of mass tourism on ecosystems are increasingly evident. As a result, ecotourism and sustainability are beginning to emerge as alternative types of travel. Three main aspects, namely, development methods, general characteristics, and visitor behavior, can be used to describe this change in tourism ideas (Yulianda et al., 2018).

A unique endeavor, marine ecotourism incorporates many conservation-related efforts. Combining tourism and conservation is a wonderful idea that will benefit all stakeholders, but only if clear principles, legal frameworks, financial and economic planning, and ecological impact assessments are established and enforced will these benefits be realized. A creative, sustainable and financially successful method of conservation efforts is ecotourism (Yulianda et al., 2018).

The coastal and marine environment, which includes physical, biological, chemical, social, cultural, political, economic and legal activities, is closely related to the growth of ecotourism. Therefore, ecotourism policy development must be carried out thoroughly, both in terms of time and space, because both processes are interdependent. Effective communication between the community and the parties involved in the tourism industry, coupled with adequate community development (Fauzi et al., 2009). Further research also

needs to be done on the risk matrix that will occur if further regional changes are made so that it can be anticipated.

DISCUSSION

The development of Jungut Batu Village on Nusa Lembongan Island reflects the dynamics of land use change triggered by economic and social factors. The change in land use from seaweed cultivation to tourism area shows how local communities respond to the economic opportunities offered by the tourism sector. However, when the COVID-19 pandemic hit, the change was reversed with the land returning to seaweed cultivation, indicating a high dependence on the tourism sector. In addition, this change in land use also has a negative impact on the sustainability of coastal ecosystems, especially when not accompanied by adequate conservation efforts. The level of abrasion reported by local residents is one indicator that unsustainable land exploitation can pose a serious threat to environmental carrying capacity. Therefore, an ecotourism approach that combines conservation with tourism activities needs to be developed as a solution to support the local economy without damaging the ecosystem. The importance of developing a comprehensive and collaborative ecotourism policy between communities, industry players, and the government is becoming increasingly clear, especially in facing the risks of environmental change and natural disasters in coastal areas. Further research is needed to identify the risk matrix that may arise from further changes in the area so that they can be anticipated effectively.

CONCLUSIONS AND RECOMMENDATIONS

Nusa Penida has zoning that covers several areas including seaweed farming and tourism. This transformation demonstrates conservation efforts and sustainable land use to support the local economy and improve community welfare. However, this land use change also creates significant environmental impacts such as coastal abrasion and threats to coastal resources.

Meanwhile, mass tourism causes negative impacts on the environment, encouraging the development of eco-friendly and sustainable tourism. Ecotourism is a solution that combines conservation and tourism for the good of all parties. However, it requires strong collaboration between communities, tourism actors and the government and further research to anticipate the risks of further regional changes that could occur in the future.

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