Ecotourism in a Hazardous Small-Volcanic Island: Tidore Island, Indonesia

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Abstract. Being known as a small island with the highest volcano in North Maluku Province, Tidore Island is also famed for its exotic ecotourism potential. There are many benefits for areas that have good ecotourism potential, but it is necessary to consider the potential for local disasters. Kie Matubu Volcano is currently in a dormant status and is likely to be active at any time. Regional planning and disaster mitigation should thus go hand in hand, but the complexity of the geographical conditions of a small island requires various prior analyses. This research aims to integrate ecotourism mentioned in Regional Planning with disaster mitigation action in Tidore Island. Combining spatial analysis and social vulnerability can provide an overview of the integration planning and disaster management in this small volcanic island to improve community resilience. However, it still calls for some actions to develop ecotourism areas that co-occur with disaster mitigation efforts. Several villages with high social vulnerability in the western, southern, and eastern parts of the island require additional infrastructures (e.g., port terminals) and functional disaster evacuation facilities as the important aspect while disaster occurs.

1. Introduction

Tidore Island has become one of the preferable ecotourism destinations in North Maluku Province. Exotic natural panoramas blended with cultural-historical sites create an enchanting paradise in eastern Indonesia. Tidore Island is worthy of further development because its strategic position and many coastal areas make a transitional zone between terrestrial and marine ecosystems, showing the potential for natural resources and offering ecosystem services that can be used as an ecotourism attraction. Located adjacent to Ternate and Halmahera Islands, it is part of a compound network of supporting tourism facilities and sites, including lodging services, restaurants, and other ecotourism attractions on the neighboring islands.

Tidore Island is administratively included in Tidore Island City with eight subdistricts, consisting of ten other islands: Mare, Maitara, Failonga, Sibu, Woda, Raja, Guratu, Tameng, Joji, and Taba. However, only a few are inhabited. Tidore Island is among the most populous islands, with more than 18,000
residents [2,4]. It is dominated by slightly steep (8–16°) and steep (16–35°) slopes with a radial centrifugal drainage pattern [4]. Despite the high ecotourism potential of the island based on its Regional Planning [3,4], the regional development unfortunately remains partial, especially compared with that of Halmahera Island. Many aspects like the infrastructure condition, centers of economic activities, health and education facilities reflect such discrepancy. Furthermore, the potential for volcanic disasters from Kie Matubu Volcano worsens the condition. In general, volcanic eruption can produce various of hazard. The vital and critical infrastructures will can also be impacted by this, especially the one with not really proper function in the normal day [5]. Figure 1 depicts Kie Matubu Volcano on Tidore Island as the research site, and Figure 2 shows Maitara and Tidore Islands photographed from Lake Ngade in Ternate Island, which is a popular natural tourist spot on Ternate Island.

![Figure 1. Administrative map of Tidore Island.](image1)

![Figure 2. Aerial view of Maitara Island and Tidore Island from Lake Ngade in the southern part of Ternate Island.](image2)
Kie Matubu on Tidore Island, with a peak at 1,730 masl, is the highest volcano in the North Maluku Province. On this island, there is a caldera with a diameter of 2 km in the north and a stratovolcano structure with a circular conical peak in the south [2,3,4]. The condition of this active volcano, whose volcanic activities may increase at a time, is similar to that of Sinabung Volcano in 2010 [8,9]. At that time, most communities nearby Sinabung refused to evacuate due to the lack of literacy and information exposure regarding the dangers of the volcano. Therefore, the community’s capacity in dealing with potential volcanic disasters in Tidore Island should necessarily be improved [6].

Like many others region, ecotourism is one of the crucial sectors for a region [6,9]. The spatial planning of Tidore Island City for 2013–2033 has been developed according to a spatial planning study, an integrative system for spatial planning, utilization, and control. It regulates spatial planning strategies on a regional scale, one of which is concerning ecotourism development as stated in article 42 paragraph 2b. Such development requires complex management, derived from the city spatial planning, that combines the Development Plans for Protected Areas and Cultivation Areas [1].

Integrated ecotourism management with disaster mitigation in small islands demands a comprehensive analysis of the transportation sector, protected areas—so as not to overlap with the development of tourism designated areas—disaster evacuation facilities, and regional vulnerability characteristics. It also entails the strategic roles of various parties, including government, industry/private sector, academics, local communities, and media [10].

2. Methods

Primary data in this research included maps of spatial patterns from the Regional Planning database and structures of Tidore Island covering the Port Terminal Plan, Disaster Evacuation Facilities, and the Distribution of Protected Areas. In addition, this research overlaid these maps with the social vulnerability class, which was generated using five parameters: demographics, education, health, institution, and social insurance [10]. Some of these inputs were used as the basis for performing spatial analysis as a part of the overlay analysis.

This research also employed field observations on Tidore Island and its surroundings and interviews with the Regional Disaster Management Agency in term of their perspective of local disaster, business actors, and tourists in ecotourism designated areas to earn their view of disaster in the visited ecotourism site they visit. The combination of spatial analysis and field observations can strengthen and enrich the materials analyzed in this research.

3. Result and Discussion

3.1 Development of Ecotourism Areas on Tidore Island

The tourism sector plays an essential role in increasing regional income [6, 9, 13]. There are sevenecotourism designated areas in Tidore Island regulated in the Spatial Planning of Tidore Island City in 2013-2033, namely (1) Luku Celeng Waterfall in Kalaodi Village, East Tidore Subdistrict, (2) Ake Sahu Beach in Mafututu Village, East Tidore, (3) Taman Cobo Beach in Mafututu Village, East Tidore, (4) Rum Beach in Rum Village, North Tidore, (5) Gamgau Beach in Mafututu Village, East Tidore, (6) Maitara Island in North Tidore, and (7) Mare Island in South Tidore (see Figure 3). Because of this small island condition, their development should include protecting biodiversity in their surroundings and establishing supporting facilities and attractions, such as ports, early warning systems, and agro-fishery activities.

In political ecology, ecotourism development studies are principally expected to be sustainable and promote the welfare of local communities. Interdisciplinary political ecology conceptually integrates and intertwines many perspectives, i.e., social, cultural, economic, and environmental processes at various ranges of levels and scales [1, 11, 12]. The penta-helix development proposed by Lindberg and Riyanto [9] supports the combination of these perspectives. Combining the role of many parties, i.e., government, industry/private sectors, academics, local communities, and media, in developing ecotourism, the penta-helix development model can be used as an effective strategy for Tidore Island.
Each party has a specific role (see Table 1), facilitating both the regional government and local communities to benefit from promoting their welfare.

| Party                        | Role                                                                 |
|------------------------------|----------------------------------------------------------------------|
| Government                   | Ministry of National Development Planning/National Development Planning Agency, Ministry of Village, Development of Disadvantaged Regions and Transmigration, Ministry of Tourism, Tourism Office, Social Office |
| Industry/Private Sector      | Resort developer, Restaurant developer, Dive center, Boat company |
| Academics                    | Research Institute/Study Group such as from the University of Gadjah Mada and University of Khairun |
| Local Communities            | Tourism Awareness Group (Pokdarwis), Fishermen, Women Farmers      |
| Media                        | Online Social Media                                                  |

The development of optimal ecotourism areas will potentially encourage the emergence of other economic activities, including the constructions of hotels, restaurants, boarding houses, local guide services, the development of road, transportation, and internet networks, health facilities, training centers, and other activities with promising economic values for local communities.

3.2 Integration of Ecotourism Development and Disaster Management

Risk reduction and disaster mitigation in small islands require a more comprehensive analysis because the physical and socio-economic limitations are inclined to depend on larger islands nearby. The concept of Sister Island is currently being developed to bridge the gap between disaster management in small islands and their limitations. It enables neighboring islands to support small islands with a high disaster vulnerability during the wake of a natural disaster [14].

In the case of Tidore Island, the potential for the Kie Matubu volcanic disaster remains possible even though the volcano is currently in its rest phase. Therefore, risk reduction measures and disaster management preparations are prerequisites to improving community resilience. Furthermore, the tourism sector can also boost human capital in Tidore Island. Analyses of the regional development strategy for Tidore Island City, social vulnerability, and local community’s perception of their vulnerability are combined in this research and presented in a single frame to obtain a detailed overview regarding applicable attempts to optimize the ecotourism development in Tidore Island and enhance community resilience.

Based on the island’s social vulnerability [9], two villages in the east had a high social vulnerability, namely Indonesiana and Gamtuflunge. Two other villages in the west had a moderate social vulnerability: Faboharu and Bobo. Likewise, two villages in the south were moderately socially vulnerable: Gurabatu and Seli (Figure 3). The increase in social vulnerability class in Tidore Island is in
line with the number of residents in each village. The larger the population, the higher the social vulnerability of a village.

Figure 3. Map integrating regional development and social vulnerability of Tidore Island.

Seven ecotourism designated areas listed in the Regional Planning of Tidore Island City 2013–2033 have not been integrated with facilities that accommodate the potential disaster on a small island evacuation due to their distant location from the planned port terminals. One of these areas is located in Indonesiana Village, which has a high social vulnerability. The port terminals serve as a means of in-and-out transportation for future ecotourism activities. They also play an essential role in the disaster evacuation process to reach surrounding islands. All these are in line with the function of the evacuation facilities set in spatial planning.

As a small island with volcanic hazards and other potential coastal disasters such as extreme waves, strom and abrasion, Tidore Island needs robust human resources to deal with these, including business actors in ecotourism areas and local and foreign tourists. However, for business actors at Rumi Beach in
North Tidore (number 4 in Figure 3, Figure 4a), natural disasters are rarely heard of and have yet to pose real threats. Instead, they perceive the decline of visitors due to a non-natural disaster, the Covid-19 pandemic, as the more frightening threat. Likewise, local tourists from Ternate Island (across Tidore Island) who were currently visiting Rum Beach (Figure 4b) also felt the same way. Nevertheless, they were more familiar with the tidal and tsunami evacuation routes (Figure 4c) and had more careful considerations when they intended to participate in ecotourism activities. For instance, because the only way to reach tourist sites on Tidore Island from the surrounding islands is by boat, prior to taking a trip to Tidore Island by a ferry boat, they often checked the weather conditions on the day. Considering that the northern part of Tidore Island is a tsunami-prone area [2], the regional government needs to map out convenient evacuation routes [19], contain development and activities in coastal areas, and adopt nonstructural mitigation measures, such as growing tsunami-retaining plants. Such mitigation attempt has been carried out and proven effective by the Japanese government in dealing with earthquakes and the Tohoku tsunami in the east part of Japan [15, 16, 17].

4. Conclusion
This research aims to integrate the strategy of developing Tidore Island City, especially the ecotourism development in Tidore Island, with the threatening disaster aspects. The integration takes into account aspects of social vulnerability, spatial patterns and structure, and the perception of the local communities and tourists. Tidore Island, as a small volcanic island, has considerable challenges in preparing and enhancing the local community’s resilience to disasters. It takes a comprehensive regional development plan to achieve such resilience. However, there is still a lack of integration between priority ecotourism areas and the supporting facilities, i.e., ports as a means of transferring people to nearby islands during evacuation. Likewise, evacuation facilities have not been built equally in areas with high social vulnerability which will make it difficult for local communities to evacuate themselves in the event of a disaster (e.g., in Indonesiana Village, East Tidore). The tourism sector can be the mainstay of this region in promoting community welfare and improving social
resilience to disasters. The dominance of priority ecotourism areas in the Spatial Planning of Tidore Island requires further analysis to optimally achieve these goals: (i) increased capacity and disaster knowledge of local communities, business actors, and tourists, (ii) the addition of disaster evacuation facilities in Seli, Gurabatu, Bobo, and Pobaharu Villages, and (iii) optimized constructive nonstructural mitigation efforts for effective coastal disaster risk reduction in Tidore Island.

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