Disaster Mitigation Model for Sustainable Tourism Development at the Nam Salu Openpit Geosite: Insights from the Belitong UNESCO Global Geopark

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Abstract

This research aims to develop an effective disaster mitigation model to support sustainable tourism development at the Nam Salu Openpit Geosite, which is an integral part of the Belitong UNESCO Global Geopark. The qualitative approach method uses descriptive methods through case studies, namely the Open Pit Nam Salu (OPNS) geosite. The results of research conducted regarding the Open Pit Nam Salu (OPNS) Geosite in East Belitung revealed that the potential threat of disaster to this tourist site is very significant. The main factors influencing the vulnerability of OPNS Geosites to natural disasters include ecosystem damage due to unmanaged mining activities, changes in the landscape caused by intensive mining practices, and disruption of slope stability due to excessive exploitation of natural resources. In addition, climate change can also worsen the risk of disasters, including landslides and coastal erosion. Therefore, it is necessary to carry out structured disaster mitigation measures, including an early warning system, emergency management training, regular risk mapping, evacuation planning, development of a disaster information center, as well as education and public awareness programs to maintain the sustainability of the OPNS Geosite as a safe tourist destination. and sustainable.

Keywords: *Disaster Mitigation Model, Sustainable Tourism Development, Nam Salu Openpit Geosite, Belitong UNESCO Global Geopark.*

A. INTRODUCTION

A geopark is an integrated geographical area which collects various sites and natural landscapes that contain important geological value and is managed with a holistic concept for the purposes of conservation, education and sustainable development (Setyadi, 2012). The process of determining and managing the management model uses a bottom -up approach that involves all stakeholders, both local (including local communities) and regional, by integrating 3 (three) elements of diversity, namely: geological diversity (geodiversity), biodiversity and cultural diversity (Eder & Patzak, 2004).

Geoparks utilize geological heritage (geoheritage) which is correlated with local natural and cultural heritage to foster awareness and understanding of key issues faced by society, such as sustainable use of natural resources, mitigating the impacts of climate change, and reducing the risk of natural disasters (Indrayati & Lestari, 2021). The hope is that within the geopark, the existence of valuable geological heritage can

be preserved and enjoyed for future generations. And at the same time encouraging improvements in the welfare of local communities (Hermawan & Brahmanto, 2018).

Geoparks implement a multilevel status system, starting from local geoparks to international geoparks (UNESCO Global Geopark) (Fauzi & Misni, 2016). The determination of national geopark status is carried out by the Indonesian National Geopark Committee, while at the international level, national geoparks throughout the world are expected to join the Global Geopark Network (GGN) under the auspices of UNESCO (Hermawan & Ghani, 2018). Since its founding in 2004, GGN has focused on establishing quality standards and developing the best model for regional management that integrates the protection of Earth heritage sites in sustainable regional economic development strategies (Sulistyadi et al, 2019). Determination of UNESCO Global Geopark (UGG) status requires assessment by the UNESCO Global Geopark Council, with the main requirements being world-scale geological heritage and preparation of documents based on UNESCO guidelines (Paskova & Zelenka, 2018). The granting of UGG status has a period of four years before requiring revalidation through a comprehensive review process of its performance and quality of management (Du & Girault, 2018).

In 2021, Belitong Geopark was recognized as a UNESCO Global Geopark (UGG), joining 9 other locations in Indonesia. This complements the 185 geoparks in 48 countries around the world that are members of the Global Geopark Network (GGN) (Aryanto et al, 2022). Belitong Geopark is not only famous for its valuable geological heritage, but also for its rich biodiversity. In it live various endemic flora and fauna, such as Hampala Fish, Toman Fish, Bangka Tarsier, Pelanduk, Siaw Bird, and Kelaras Squirrel. Native plants such as the Pelawan Tree, Simpor Laki Tree, Sisilan Tree, and Nibong Palay Tree can also be found there (Budi, 2022). This biodiversity has become a source of herbal medicines for local communities. This achievement made the Belitong Geopark achieve the highest rating among national geoparks in Indonesia which were proposed to become UNESCO Global Geoparks, with a score reaching 850 out of 1000 points, confirming its status as a globally important tourism and conservation destination (Kompas, 2023).

Belitong Geopark is managed by a Management Body which was formed based on a Joint Decree from the Regent of Belitung and the Regent of East Belitung. The Belitung Geopark Management Board is staffed by experts who occupy various positions, including Advisors, Steering Team, General Chair, Expert Staff, Secretariat, and other divisions with a clear and detailed organizational structure. There are 17 (seventeen) geosites spread across the Belitong Geopark area (see Figure 1). The selection of geosites is not only based on their unique geological value, but also the readiness of the management community, accessibility conditions and other factors (Budi, 2022).



Figure 1 Map of the distribution of 17 Geosites in the Beliton Geopark
Source: https://belitonggeopark.net/map-2

The Nam Salu Open Pit, as one of the superior geosites in the Belitung Geopark, has international significance because it is the trace of the oldest open pit tin mine in Indonesia and Southeast Asia (Efrianto, 2021). By using an open pit mining system, this mine footprint has enabled the exploitation of tin to a depth that still provides significant economic value. Through these mining traces, rocks from the Kelapa Kampit Formation that are approximately 350 million years old have been revealed, enabling in-depth study of the process of forming Belitung Island, including rising sea levels, intrusion of granite rocks, and the formation of tin deposits (Surya & Efrianto, 2022). The tourism typology at Open Pit Nam Salu is special interest tourism and educational tourism. With the tourist profile of the market segment tending to be a special group (niche market) (Djapani et al, 2021), such as history and culture enthusiasts, researchers and scientists in the field of geology and mining, school and college students, this geosite also provides various attractions or activities that can be enjoyed by relatively more mass segments, such as nature lovers or natural adventure enthusiasts, namely trekking , rock climbing, cave tracing and kayaking (Schwartz & Surjono, 1990).

The Nam Salu Open Pit Geosite, despite its international significance, faces a number of challenges, especially related to the risk of natural disasters. In 2017, BNPB recorded flooding in Kelapa Kampit District, where the Geosite is located (BNPB, 2017). High rainfall causes flooding and waterlogging which disrupts road access and settlements. In addition, illegal mining activities and unsupervised deforestation can damage the environment, potentially triggering natural disasters such as flash floods and landslides (Khoirunnisa et al, 2021). Therefore, mitigating potential natural disasters at the Nam Salu Open Pit Geosite and its surroundings is an issue that needs serious attention.

Potential disaster risks, such as landslides and floods, should be considered as one of the elements that influence tourism attractiveness. This is closely related to safety and comfort factors, especially for visiting tourists (Arfani, 2022). Towards the revalidation of Belitong UGGp status by UNESCO in 2024, the disaster mitigation model in managing the Nam Salu Open Pit Geosite is a very important issue to create security and safety for visitors and ensure the sustainability of tourism and conservation businesses (Suryanti & Setiawan, 2023). Therefore, to increase the attractiveness of the Nam Salu Open Pit Geosite as a safe tourist destination, a disaster mitigation model is needed. This is done to ensure the safety of the tourist area. This reason became the main idea that prompted the preparation of this study.

Tourism is a crucial sector that cannot be separated from the potential threat of disaster. To reduce this potential threat, the government through the National Disaster Management Agency and the Ministry of Tourism is implementing a disaster-safe tourist destination program (Kurniasari, 2017). According to the World Tourism Organization (2003), safety is the main factor taken into consideration by tourists when choosing a tourist destination. The disaster safe tourism program is realized in the form of increasing tourism management preparedness and disaster mitigation. In this preparedness effort, both managers and visitors know the steps that must be taken immediately when a disaster occurs because there are procedures, evacuation maps and early warning instruments installed at tourism locations (Sofyan & Mulyana, 2020). Meanwhile, mitigation efforts are carried out through disaster risk reduction activities that are guided by the principles of sustainable tourist attraction management. This program is to provide a sense of security and comfort so that it will increase the confidence of potential visitors to be interested in coming to tourist locations (Adiyoso, 2018).

The emotional tourism program continues to be developed down to the tourist attraction level at the tourist village level. As one of the leading tourist attractions in the East Belitung Regency region, the Namsalu Open Pit Geosite (OPNS) is located in Senyubuk Village, Bapopnas as the manager of OPNS has the responsibility to create a disaster-safe tourist attraction. To reduce all potential dangers that exist in OPNS, mitigation efforts are one alternative method that can be carried out. Mitigation is understood as an effort to reduce and prevent the risk of loss of life and property through both structural and non-structural approaches (Nursa'ban et al., 2010).

Between these two types of mitigation, several studies show that non-structural mitigation has a higher success rate and good sustainability value (Wibowo et al, 2019). This fact occurs because non-structural mitigation always involves the community directly as the main object and subject in reducing disaster risk. This phenomenon then becomes the background for the interest in knowing community behavior patterns in OPNS as a disaster mitigation model, then analyzing its influence on reducing potential disaster threats in creating a disaster-safe tourist village.

B. METHOD

The research method used in this research is a qualitative research method. What is meant by qualitative research is collecting information about an existing problem or symptom. This means that qualitative research methods can reveal phenomena in the subject that will be studied in depth (Arikunto, 2005). Apart from using qualitative research methods, this research focused more deeply using a case study approach. Case studies are an approach to researching everything related to the research subject (Lincoln & Guba, 1994). In other words, case studies are used to research a problem in more depth and utilize various data sources. The research location was carried out at the Nam Salu Openpit Geosite (OPNS) covering an area of ± 344 Ha located in Senyubuk Village, Kelapa Kampit District, East Belitung Regency with the substance of this research being a disaster mitigation model at the Nam Salu OPNS Openpit Geosite.

The data collection stage is collecting various information needed for the analysis stage. Primary data was obtained through field observations, interviews, visual documentation to obtain a complete and detailed picture of the research area related to potential disasters, including examination of areas that have experienced previous disasters. Literature and policy studies as well as institutional surveys were carried out to collect secondary data which included notes and documentation of various disaster events that had occurred previously from all relevant agencies. The data analysis technique used in this research is the interactive data analysis technique from (Huberman & Miles, 2002). The procedures for data analysis techniques include data condensation, data presentation, and drawing conclusions followed by verification.

C. RESULT AND DISCUSSION

1. Potential Disaster Threats at the Open Pit Nam Salu (OPNS) Geosite

There are interesting tourist attractions in East Belitung, which you must visit if you are in the Bangka Belitung Islands province. It's called the Nam Salu Open Pit Geosite. The Nam Salu Open Pit Geosite is a historical tourist destination for the deepest and largest open pit tin mine in Southeast Asia, which is around 100 meters. The Kelapa Kampit Rock Formation was formed 300 million years ago. This former mine operated commercially from 1980 to 1993 and produced 500 thousand tons of tin ore at a grade of 2 percent. This is the largest primary tin ore deposit in a single deposit ever discovered.

This heritage-based tourism in the Nam Salu Open Pit Geosite area was one of the points in the designation of the Belitung National Geopark as a UNESCO Global Geopark at the 211th session of the Unesco Executive Board in 2021. Apart from that, this geosite is the only archipelagic geosite in Indonesia. Meanwhile, the Minister of

Tourism and Creative Economy (Menparekraf), Sandiaga Salahuddin Uno, assessed that the Nam Salu Open Pit Geosite could be a tourism alternative in the midst of the 2022 G20 event. This could be a momentum for economic revival and opening up job opportunities for the people of Belitung. Belitung is indeed one of the locations for holding side events for the G20 Summit in September 2022.

As a tourist destination (ODTTW), the Open Pit Nam Salu Geosite (OPNS) is inseparable from the potential threat of disaster. The forms of potential disaster threats at the OPNS Geosite include ecosystem damage which has the potential to give rise to drought and landslides, changes in landscape, erosion and sedimentation, disturbance of slope stability, loss of flora and fauna habitat, coastal erosion, changes in land use, decreased water quality, and social unrest. One significant threat is ecosystem damage, which can directly result in drought disasters. Ecosystem damage at the Nam Salu Open Pit Geosite (OPNS) can be caused by mining activities that are not well managed, including excessive deforestation and land destruction for industrial activities. These practices result in land degradation and loss of vegetation, which in turn reduces nature's ability to store and provide water to local communities. The decrease in groundwater and surface water availability can also be caused by unsustainable water use patterns, such as uncontrolled use of water for mining industry purposes.

Meanwhile, the risk of landslides in the OPNS Geosite area is also caused by human activities which disrupt slope stability. Mining practices without proper planning, including excessive land dredging, as well as uncontrolled deforestation, significantly reduce nature's resilience to natural disasters such as landslides. Climate change impacting rainfall and temperature patterns can also exacerbate these risks, increasing the likelihood of landslides that threaten the surrounding environment and the safety of local communities.

Significant landscape changes around the Open Pit Nam Salu (OPNS) Geosite are mainly caused by intensive and poorly managed mining activities. Mining carried out without adequate ecological considerations results in the destruction of soil layers and large-scale removal of natural geological structures. This then has an impact on shifting water flow patterns, especially during the intense rainy season, which increases the risk of erosion and sedimentation. Moreover, the absence of effective handling of mining waste material has the potential to accelerate the rate of erosion and sedimentation, threaten soil quality and reduce land fertility around the OPNS Geosite.

The phenomenon of increasing erosion and sedimentation as a result of changes in the landscape can also be caused by a lack of effective drainage management in the area. Mining activities that change the natural soil structure result in increased surface water flows, which can then damage the topsoil and cause prolonged erosion. Moreover, heavy materials carried by water flows have the

potential to settle in local waters, threatening aquatic ecosystems and reducing overall water quality. Therefore, strict supervision of mining activities and the implementation of an efficient water management system are important to reduce the negative impacts of erosion and sedimentation.

Disturbances in slope stability around the Open Pit Nam Salu (OPNS) Geosite are caused by a number of factors, including uncontrolled human activities such as excessive exploitation of natural resources, including mining without adequate consideration of geotechnical engineering techniques. Mining carried out without careful consideration of geological and hydrological factors can significantly weaken slope integrity, increasing the risk of landslides and land subsidence which can threaten the sustainability of the surrounding environment.

Not only that, disturbances in slope stability can also have a direct impact on the natural habitat of flora and fauna around the OPNS Geosite. Uncontrolled human presence, including poorly planned infrastructure development, can result in damage to natural habitats, causing disruption to established food chains and ecological cycles. This can have a serious impact on the balance of local ecosystems, threatening the sustainability of endemic species and reducing biodiversity.

Beach erosion is also a threat that should not be ignored. Uncontrolled exploitation of natural resources can accelerate the process of coastal erosion, threaten the sustainability of coastal ecosystems and affect the lives of coastal communities who depend on these resources. Uncontrolled changes in land use can result in shifts in the proper function of the environment, disrupting the harmony between humans and their environment. Meanwhile, the decline in water quality is also a serious concern, because human activities that are not well managed can result in water pollution, threatening the sustainability of water resources around the OPNS Geosite.

Finally, the potential for social unrest is also a threat that cannot be ignored. The involvement of various parties in the exploitation of OPNS Geosite resources can give rise to conflicts of interest that have the potential to damage social stability in the region, threatening the continuity of tourism activities and the local community's economy. Thus, appropriate handling and mitigation of potential disaster threats is very important to maintain the sustainability of the Nam Salu Open Pit Geosite as a sustainable tourist destination.

2. Disaster Mitigation Model for the Openpit Nam Salu Geosite Area (OPNS)

The implementation of disaster management includes pre-disaster, emergency response and post-disaster stages. Disaster mitigation is an activity in the pre-disaster stage, which aims to reduce disaster risk. According to Subandono (2007), the concept of disaster risk reduction solutions is adapted to the cycle of disasters, pre-disaster,

during a disaster and post-disaster. The first step taken in disaster mitigation is to change the paradigm from emergency response to mitigation.

In order to create tourism that is safe from the threat of disasters in the former Nam Selu tin open pit, a series of non-structural disaster mitigation steps are needed that can be taken. Here are some modes that can be applied:

a. Early Warning System

The early warning system is a key aspect in realizing tourism that is safe from the threat of disaster at the former Nam Selu tin open pit. This system is an important preventive step in dealing with potential natural disasters such as landslides, floods or other dangers. To implement this system, there needs to be collaboration between related parties, including local disaster authorities, the tourism industry and local communities. Early warning systems must include sophisticated and reliable technology, such as environmental sensors and monitors, as well as efficient and responsive communication systems.

The development of an early warning system must be based on a deep understanding of disaster patterns that have the potential to occur in the area. This requires a comprehensive analysis of the factors that trigger disasters, including geographic conditions, weather and human factors. With a deep understanding of these patterns, early warning systems can be designed in such a way that they provide timely and accurate warnings to the public and tourists.

Apart from that, it is also important to ensure that the information received by the public and tourists from the early warning system is easy to understand and can be accessed by all relevant parties. Education regarding the meaning of different types of warnings and the actions to be taken when receiving a warning should be consistently emphasized. This education can be done through public awareness campaigns, training, and distribution of safety guidelines to tourists and local communities. In this way, an early warning system can not only reduce the risk of disasters, but also give the public and tourists a sense of confidence in exploring the tourism area.

b. Emergency Management Training.

Emergency management training is an important component in efforts to create tourism that is safe from the threat of disasters at the former Nam Selu tin open pit. This training aims to provide practical skills and knowledge to local residents and workers in the tourism sector about appropriate emergency actions in dealing with various natural disaster scenarios that may occur in the area. In the context of this training, it is important to ensure that training materials are adapted to the specific characteristics of the region, including the most likely potential disaster threats. The training must include instructions on evacuation actions, first aid techniques, emergency communication strategies, and how to manage critical situations when a disaster occurs. This can help increase the preparedness of the community and

tourism workers in dealing with emergency situations, thereby minimizing the impacts that may occur.

Apart from that, emergency management training must also be an integral part of efforts to build communities that are resilient and resilient to disasters. This includes developing detailed emergency plans, including identification of safe evacuation routes and reliable evacuation centers. It is important to actively involve the community in developing this plan so that they feel ownership and are directly involved in disaster management efforts.

By providing adequate training, it is hoped that the community and workers in the tourism sector around the former Nam Selu tin open pit will have the knowledge and skills needed to act effectively and timely in dealing with natural disasters. This will not only increase the level of safety and security, but will also provide greater confidence to all parties involved in the tourism industry in the area.

c. Risk Mapping

Regular risk mapping is an important basis in efforts to create tourism that is safe from the threat of disasters in the former Nam Selu tin open pit. This mapping process involves an in-depth analysis of various factors that can trigger disasters in the area, such as geographic conditions, climate, and human factors that can influence disaster risk. In the context of risk mapping, it is important to involve relevant experts, including geologists, environmental experts and natural disaster experts, to ensure that the analysis carried out covers the various possible disaster scenarios that could occur in the area. Risk mapping should provide clear and detailed information about areas vulnerable to disasters, as well as their potential impact on local communities and tourism.

In addition, the results of the risk mapping must form the basis for the development of appropriate and effective mitigation plans. This mitigation plan must include concrete steps to reduce disaster risks, such as appropriate spatial management, development of an effective early warning system, and implementation of resilient disaster management infrastructure. Continuous risk mapping and associated mitigation plans must be updated periodically in accordance with changes in environmental and social conditions around the former Nam Selu tin open pit. Thus, it is hoped that non-structural disaster mitigation efforts will help create a safer and more sustainable tourism environment, while providing better protection for the community and tourists visiting the area.

d. Evacuation Planning

Effective evacuation planning is a crucial element in efforts to create tourism that is safe from the threat of disasters at the former Nam Selu tin open pit. This plan must be prepared taking into account the geographical and demographic characteristics of the region and based on risk mapping that has been carried out previously. Evacuation plans must be designed in such a way that they are easily

understood and accessed by all relevant parties, including local communities, tourism workers and visitors. In the evacuation planning process, it is important to involve active participation from all communities living around the former Nam Selu tin open pit. This can be done through involving them in consultation sessions, evacuation drills, and preparing joint evacuation plans. In addition, the use of modern technology such as mass notification systems and easily accessible evacuation maps can help ensure that evacuation-related information can be disseminated quickly and effectively when needed.

In the evacuation planning process, it is also important to consider the special needs of vulnerable groups such as the elderly, children and people with special needs. The evacuation plan must ensure that special measures are put in place to effectively address their needs and ensure their safety during the evacuation process. With a thorough and well-coordinated evacuation plan, it is hoped that the community and tourists around the former Nam Selu tin open pit will be able to handle the emergency situation better. This plan will also provide a sense of security and confidence for all parties involved, and can minimize the risks and negative impacts of natural disasters.

e. Development of a Disaster Information Center

The development of a disaster information center is an important step in efforts to create tourism that is safe from the threat of disasters in the former Nam Selu tin open pit. This information center must provide easy access to the latest information about potential disaster risks, safety procedures and prepared mitigation measures. In addition, the disaster information center must also function as a coordination center in emergency situations, facilitating the distribution of fast and accurate information to the community and tourists around the tourism area.

In developing a disaster information center, it is important to ensure that this center is equipped with the latest information technology that can guarantee easy and fast access to the latest information. The information presented at this center must be prepared clearly and easily understood, so that it can be accessed by all levels of society and tourists, without exception. In addition, disaster information centers must be active in holding awareness campaigns and training related to disaster management. This can be done through organizing workshops, seminars and educational sessions for the public and tourists. This information center must also function as a platform to foster cooperation between various related parties, including local governments, non-governmental organizations, and the tourism industry, to improve coordination and effectiveness in disaster management.

With the existence of an effective disaster information center, it is hoped that the community and tourists around the former Nam Selu tin open pit will have easy access to the information needed to deal with emergency situations. These information centers can also play an important role in increasing awareness and preparation in the

face of disasters, thereby providing better protection for all parties involved in the tourism industry in the area.

f. Development of Education and Awareness Programs.

Community involvement in the planning and implementation process for disaster mitigation is a key factor in efforts to create tourism that is safe from the threat of disasters in the former Nam Selu tin open pit. This community involvement ensures that the disaster mitigation policies and programs that are prepared can more accurately reflect the needs and interests of the community.

In the community engagement process, it is important to ensure open and participatory communication mechanisms between various relevant parties, including local communities, tourism industry stakeholders, local governments and non-governmental organizations. Discussion forums, meetings and public consultations should be held regularly to facilitate ongoing dialogue and effective collaboration between all parties involved. Apart from that, community involvement must also encourage active community participation in implementing disaster mitigation plans. This can be done through forming local disaster volunteer teams, training emergency response skills, and building community capacity in dealing with disasters. Active community involvement in implementing disaster mitigation plans will strengthen community preparedness and responsiveness to emergency situations.

With strong community involvement, it is hoped that the planning and implementation process for disaster mitigation around the former Nam Selu tin open pit will become more holistic and sustainable. This involvement will also strengthen social ties within the community, increase solidarity, and create an environment that is more responsive and adaptive to changes in the environmental and social conditions around it.

D. CONCLUSION

The Open Pit Nam Salu (OPNS) Geosite in East Belitung is an impressive historical tourist site and is one of the important points in the recognition of the Belitung National Geopark as a UNESCO Global Geopark. However, its existence cannot be separated from the potential for significant disaster threats, such as ecosystem damage, landslides, changes in the landscape, erosion and sedimentation, disturbance of slope stability, and even social unrest. Ecosystem damage is mainly caused by unmanaged mining practices, while slope stability disturbances can be caused by human activities without careful geotechnical considerations. Proper management and implementation of effective disaster mitigation strategies need to be implemented to maintain the sustainability of the Nam Salu Open Pit Geosite as a safe and sustainable tourist destination. In an effort to maintain the safety and sustainability of the Nam Salu Open Pit Geosite, a structured and integrated disaster

mitigation approach is needed. An effective early warning system, emergency management training, regular risk mapping, thorough evacuation planning, development of a disaster information center, and education and public awareness programs are important steps that can be taken. Through this approach, it is hoped that local communities, visitors and related parties can increase awareness of potential disaster threats and prepare appropriate mitigation measures, so that the Nam Salu Open Pit Geosite can remain a valuable and safe cultural heritage for future generations to enjoy.

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