

Adaptation and mitigation in agrotourism development

Sugihardjo¹, Eksa Rusdiyana^{1*}, Eny Lestari¹, Widiyanto¹, Retno Setyowati¹, and Nur Kholiq Birr Samsita²

¹Agricultural Extension and Communication Study Program, Faculty of Agriculture, Universitas Sebelas Maret, Jl. Ir Sutami 36 A, Kentingan, Jebres, Surakarta, Jawa Tengah, Indonesia

²Dept. Of Undergraduate Agricultural Extension and Communication Study Program, Faculty of Agriculture, Universitas Sebelas Maret, Jl. Ir Sutami 36 A, Kentingan, Jebres, Surakarta, Jawa Tengah, Indonesia

Abstract. Climate change and global warming have an impact on the development of the tourism sector. Tourism village development programs must align with ecological interests and politics to align with tourism and environmental sustainability. This study aims to analyze adaptation and mitigation in efforts to develop agro-tourism. This study uses a qualitative descriptive approach. Data was collected through interviews, involved observation, and FGD. The location was chosen purposively, namely agro-tourism Ngargoyoso, Karanganyar, Indonesia. Research informants were obtained through purposive and snowball sampling of village heads, youth leaders, tourism awareness groups, and community groups. Data validity was determined using source triangulation and method triangulation. Data were analyzed using the interactive Milles and Huberman data analysis model. The analysis results show that the community has adapted to maintain the sustainability of tourism objects by managing irrigation water, selecting plant varieties, planting annual crops to prevent landslides, and marketing and processing crops. Mitigation includes making appropriate infrastructure easy to reach for visitors to tourist attractions.

1 Introduction

The impact of climate change on national development results in an increase and change in temperature and reduces natural resources [1]. A handful of parties need help to solve the problem of climate change. However, all individuals must participate and become actors in development who care for the environment and are sustainable. Communities must create attitudes and behaviors that care for the environment and play an active role in the success of development that maintains environmental balance and is sustainable. In one of the efforts to deal with climate change, all parties, including the community, need to have knowledge and skills and be able to support environmental preservation programs.

Development in the tourism sector is one of the efforts to improve the economy of local communities and globally. One of these developments is carrying out tourism-based village

* Corresponding author: eksarusdiyana@staff.uns.ac.id

development. The development of a tourist village is a form of tourism that creates a relationship between tourists and rural components (norms, values, beliefs, and customs) [2]. The development of tourist villages is an alternative form of tourism that can contribute to the Sustainable Development Goals (SDGs) by facilitating development at the local level. Tourism contributes directly and indirectly to rural development. The management of tourist villages is one of the village development efforts in an integrated manner which aims to encourage the socio-cultural and economic aspects of the village. Tourism villages encourage regional economic development and growth, tourism destinations which are a priority to achieve economic, socio-cultural, and environmental sustainability goals [3]. However, village development must also pay attention to aspects that can support the sustainability of village development, such as adaptation and mitigation.

Ngargoyoso District is one of the sub-districts in Karanganyar Regency, Central Java, consisting of 7 villages that have very beautiful natural scenery because they are located to the west of Mount Lawu, which makes Ngargoyoso District located on the slopes of Mount Lawu. With this natural landscape, 23 tourist destinations developed in the form of natural and historical tourism in Ngargoyoso District, one of which is a tourism-based village. The existence of this tourism-based village offers an opportunity for tourists to experience the lifestyle of rural communities. Tourism-based villages in Ngargoyoso District are managed by Village-Owned Enterprises (BUMDes) and the private sector. Institutions in tourism are a component to support tourism sustainability because tourism institutions play a role in facilitating and mobilizing community participation in tourism [4].

One of the problems in developing tourist villages in Ngargoyoso District is adaptation and mitigation of climate change and weather. This study aims to analyze the impact of climate change adaptation and mitigation on the development of tourist villages. Climate change is a climate change that is influenced directly or indirectly by human activities that change the atmosphere's composition, increasing the variability of the observed climate over a long period [5]. Climate change can be anticipated with mitigation and adaptation. Mitigation means prevention efforts that need to be done. At the same time, adaptation is adjustment activities that need to be done to live and survive, increase resilience and flexibility, and lead to migration due to different climatic conditions [6]. Based on this background, this research aims to describe adaptation and mitigation to climate change in tourism management, especially in the field of agrotourism in rural areas.

2 Material and method

This study examines community involvement in the tourism-based village development process. The research method used descriptive qualitative approach. Collection techniques with triangulation (combined), data analysis is inductive/qualitative, and the results of qualitative research emphasize meaning rather than generalization [7] with data collection techniques through focus group discussion (FGD), direct interviews, documentation, and field observations, the data collection process took approximately 3 months. Qualitative research methods will be suitable for understanding social processes or interactions [8–10]. Several indicators must be considered, including destinations and attractions, facilities and marketing, the potential for partnerships, enthusiasm from the community, and the availability of public facilities. Tourism-based villages also have principles, namely paying attention to environmental characteristics, having a positive impact on the area, materials according to the local environment, environmentally friendly materials, and involving local communities in developing tourism-based villages. The data sources used in this research are books, scientific journals, theses, and other documents relevant to climate change adaptation and mitigation impacts on tourism-based village development in Ngargoyoso District.

3 Results and discussion

Ngargoyoso District, Karanganyar Regency, Central Java Province (Indonesia), has beautiful natural scenery because it is located west of Mount Lawu. With these natural views, 23 tourist destinations have developed in Ngargoyoso District, one of which is a tourism-based village. The existence of this tourism-based village offers an opportunity for tourists to experience the lifestyle of rural communities. Tourism-based villages in Ngargoyoso District are managed by Village-Owned Enterprises (BUMDes) and the private sector. A tourist spot cannot be separated from disasters, whether in the form of natural disasters, artificial disasters, or both. A disaster is a series of events that threaten, disrupt, and damage people's lives and livelihoods caused by natural, non-natural, and human factors [11]. One form of disaster that people need to understand is the climate change disaster. Climate change (*climate change*) is unavoidable due to global warming (*global warming*) and is believed to broadly impact various aspects of life, including the tourism sector. Changes in rainfall patterns, an increase in the frequency of extreme climate events, and increases in air and sea level temperatures are serious impacts of climate change that Indonesia faces [12]. Tourism is one of the sectors experiencing the most serious impacts due to climate change, especially agriculture-based tourism (agro-tourism) and tourism that utilizes natural resources directly. It is necessary to make an effort to preserve nature; the efforts made can be in the form of adaptation and mitigation.

3.1 Adaptation to agrotourism management

Adaptation is an action taken to reduce vulnerability and increase resilience. Emphasis on adaptation is necessary because even though the climate change impact scenario is so worrying, in several places in various parts of the world, the impacts of climate change can be overcome. In the local context (Indonesia), adaptation is needed immediately to reduce the impact of climate change that is already underway [13]. Adaptation, as stated in Article 57 of Law Number 32 of 2009 mentioned efforts to maintain the environment are carried out in three ways, namely natural resource conservation, natural resource reserves, and or preservation of the function of the atmosphere. Adaptation can also be referred to as an effort to conserve natural resources and prevent changes in natural conditions that can lead to natural disasters. Implementation of adaptation in the development of a tourist village in Ngargoyoso includes the practice of conserving natural resources and protecting the natural resources themselves.

3.1.1 Conservation of flora and fauna

The community conserves natural resources by planting ornamental plants and woody plants that follow the region's geographical conditions, not logging plants indiscriminately, and carrying out plant propagation at tourist village location points. So, apart from being part of the adaptation effort, it also provides aesthetic value in tourism objects. In addition, conservation is also carried out by preserving the fauna in protected tourism areas.

3.1.2 Protecting natural resources

Efforts to protect natural resources include making the best possible use of water resources, utilizing abundant water to store it as water to support the tourism sector, such as bathing pools and for community needs, and channeling the remainder for irrigation purposes on agricultural land, livestock, and fisheries.

3.1.3 Preservation of atmospheric functions

The cold Ngargoyoso area encourages tourism managers and accommodation service providers to minimize the use of air conditioning so that apart from reducing electricity

consumption costs, it also reduces carbon consumption. Cold regional conditions also encourage people and tourists to adapt to wearing thicker and warmer clothing.

3.2 Mitigation in tourism object management

Disaster Mitigation is an effort to reduce the risks and impacts caused by disasters on communities in disaster-prone areas, whether natural disasters, manufactured disasters, or a combination of the two within a country or community [14]. Mitigation efforts can be carried out in structural mitigation by strengthening buildings and infrastructure potentially exposed to hazards, for example, creating building codes, engineering designs, and construction to delay and strengthen structures or buildings to protect against landslides, coastal walls, and others. In addition, mitigation efforts can be carried out in non-structural forms, including avoiding disaster-prone areas by building away from disaster locations, which can be identified through spatial and regional planning and by empowering communities and local governments.

Tourism in the Ngargoyoso subdistrict is very diverse, including guava-picking agrotourism in Jatirejo Village. In maintaining environmental sustainability, agrotourism managers also carry out several forms of adaptation and mitigation. One form of mitigation to address climate change is related to irrigation; the handling is in the form of irrigation using pumps (wells) when the dry season arrives. In addition, increasing special access to guava picking agro-tourism so that larger vehicles can access the vehicle space when something happens. The form of adaptation carried out is adjusting the conditions of changing weather and climate related to the irrigation of guava plants. Water is the source of life and determines plant growth. The availability of water and the response of plants to water also influence the growth process and crop yields [15]. During the dry season, irrigation canals are opened from above to irrigate guava trees in agro-tourism areas, while during the rainy season, irrigation canals are closed to keep the trees from drying out. This irrigation is very influential on the yield of guava fruit. Irrigation volume affects the growth of guava plants, as it is reported that increasing water availability can increase the area and number of leaves and the weight of plant biomass [16]. The less water, the guava produced will be sweeter but difficult to grow, while the more water, the fruit will quickly grow and mature but less sweet. Another form of mitigation is protecting the guava fruit, which is still small and young, by wrapping the fruit in a special plastic. This packaging aims to protect the fruit from the influence of external plant conditions such as pests and rain water. Agrotourism managers and farmers in Jatirejo have never received special training related to adaptation and mitigation. However, groups of guava farmers receive counseling at least once every 3 months from the local Agricultural Advisory Office (BPP).

Other tourist attractions in Ngargoyoso District include tea plantations, Pucung river tubing, and paragliding in the village of Kemuning. Kemuning Village is one of the popular tourist villages in Karanganyar Regency, so many visitors spend weekends and holidays in Kemuning Village. Mitigation in Kali pucung tourism is also given less attention, only paying attention to river flow, especially during the rainy season, when the flow is too heavy (floods). The tubing is temporarily closed, and if the river flow is normal, it will be reopened.

Tourism also greatly impacts the surrounding conditions, especially for people whose homes are close to tourism sites, both positive and negative impacts [17]. The surrounding community tourism spot feels both positive and negative impacts. Like wise, the people of Kemuning village, Ngargoyoso. It positively impacts the local economy because many visitors come, but it has other negative impacts, such as poor hygiene. Environmental awareness and concern cannot grow without internal desire and encouragement. Movement with the community is needed to achieve behavior and environmental changes. That is why it is necessary to form an empowerment community where the community is active and

empowered to solve social problems that exist in the community [18]. The Kemuning people, aware of this, have formed a community of volunteers to preserve nature in Kemuning Village called the Kemuning Care Community (KPK), founded 3 years ago to preserve nature and tourist attractions. The Kemuning Caring Community consists of members ranging from youth to adults; in addition to keeping the environment clean at the Kemuning tour, this community also works with the Regional Disaster Management Agency (BPBD Karanganyar) to learn about natural disaster mitigation. The Kemuning Caring Community conducts cleaning activities in the tourist area in Kemuning every weekend. This activity began by picking up trash from the Bale Rante restaurant, the Kemuning terminal, and the tea garden.

Berjo village is a tourist village with tourist destinations for Jumog Waterfalls and Telaga Madirda. Tourism in Berjo Village is managed directly by BUMDes by appointing managers who are selected through village meetings. All parties involved in the tourist sites in Berjo Village, from managers to parking attendants, are only filled by the people of Berjo Village, and BUMDes also prohibits the involvement of parties outside Berjo Village. The Berjo village youth organization is also directly involved in managing Jumog Waterfall and Madirda Lake tourism to become volunteers when a disaster occurs. Youth in Berjo Village were trained directly by the Indonesian Navy for mitigation at Telaga Madirda. In addition, BUMDes and the surrounding community also work together to preserve Jumog Waterfall. One of the ways is to always replant (reforestation) trees around the cliffs that are getting old and collapsing. Reforestation is an activity to replant bare forests. It is useful for improving the quality of human life by absorbing pollution and dust from the air, rebuilding natural habitats and ecosystems, preventing global warming by capturing carbon dioxide from the air and utilizing the results [19]. Reforestation has had a major impact on reducing abrasion and preventing floods and landslides in the Jumog Waterfall area, surrounded by high cliffs. As well as access to Jumog Waterfall, special road access was developed for persons with disabilities so that access to the waterfall's location can be carried out by anyone, regardless of the physical condition of other people. People with disabilities in their mobility will indirectly experience difficulties in carrying out activities. Compared to physically normal people, people with disabilities experience weaknesses in moving their bodies optimally [20].

Based on field observations, the mitigation carried out by the agro-tourism manager in Ngargoyoso structurally is by strengthening the structure of buildings or tourist objects, including :

1. Building wide roads to facilitate access for vehicle mobility to and from tourist sites to minimize damage,
2. Wise use of water for tubing tourism,
3. Utilizing waste and paying attention to the cleanliness of tourism objects to prevent environmental pollution and
4. Reforestation activities around waterfalls and on cliffs to prevent landslides during the rainy season.

Meanwhile, non-structurally, climate change mitigation activities in supporting agrotourism development are carried out in 2 ways, namely: (1) forming a tourism-oriented community that cares about the environment, (2) Avoiding outside investors by involving the younger generation and the local community as managers of tourism objects. It is feared that foreign investors will not practice adaptation and mitigation values for natural preservation and sustainability (only for profit) and (3) Avoid expanding tourist areas identified as prone to landslides.

4 Conclusion

Climate change affects tourism development regarding the arrangement and development of tourism objects and supporting facilities. Rainfall, water discharge, temperature, and weather require adaptation and mitigation to develop tourist villages to align with climate change, nature conservation, and business sustainability. In order to realize this goal, adaptations carried out by tourism managers in Ngargoyoso include (1) the conservation of flora and fauna, (2) the preservation of natural resources, and (3) the preservation of the function of the atmosphere. Meanwhile, mitigation is implemented in the form of (1) structural mitigation, (a) building road access for vehicle mobility to and from tourist attractions, (b) wise use of water, (c) keeping waste clean, and (d) reforestation. (2) Non-structural mitigation is carried out by (a) forming a tourism awareness community that cares about the environment, (b) avoiding outside investors, and (c) avoiding expanding tourist attraction areas identified as being prone to natural disasters.

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