

Advancing Sustainable Tourism Ecosystem Management: The Case of Destination Resilience in Kerora, Rinca & South Padar at Komodo National Park Area, Flores, Indonesia

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ABSTRACT

This research article aims to examine the strengthening of sustainable tourism ecosystem management through the development of community-based destination resilience models, focusing on three main interventions: human-animal conflict mitigation, ecosystem restoration (land reforestation and coral reef restoration), and community empowerment. This study deploys a descriptive qualitative approach with data triangulation techniques through in-depth interviews, field observations, and documentation studies carried out in Kerora Village, Rinca Village, and South Padar, all located within the Komodo archipelago, Indonesia. The findings of the study show that the integration of conservation programs with the specific needs of local communities can encourage adaptive capacity building, strengthening social cohesion, and more efficient management of ecological risks with the number of conflict incidents decreased to about 70 %. The novelty of this study lies in the formulation of a destination resilience cycle model that includes four main stages: participatory planning, implementation of community-based interventions, impact control through visitor management, and adaptive evaluation. This model not only strengthens the effectiveness of conservation area governance, but also opens up opportunities for replication in other destinations with similar socio-ecological characteristics. The results of this study provide a theoretical contribution to the development of sustainable tourism ecosystem management models that are more contextual, regenerative, and collaborative.

Keywords: *Sustainable tourism ecosystem management: Socio-ecological resilience: Community empowerment: Ecosystem restoration: Human-animal conflict mitigation*

INTRODUCTION

Conservation areas are a key element in biodiversity conservation strategies and the provision of ecosystem

services that support the sustainability of human life and nature (MEA, 2005; Berkes, 2009). In the midst of the climate crisis and global environmental degradation, conservation areas such as national parks are not only ecological fortresses, but also spaces for interaction between conservation and development. One of the most prominent dynamics is the development of ecotourism and nature-based tourism, which, although it is generally seen as having economic potential, often conflicts with conservation principles unless it sustainably managed (Buckley, 2012; Eagles et al., 2002).

A clear example of these complexities is found in Komodo National Park (Taman Nasional Komodo, or TNK), a conservation area designated as a Natural World Heritage Site by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 1991 and recognized as a UNESCO Biosphere Reserve since 1990. Despite its global conservation status, TNK has experienced a rapid increase in tourism over the past two decades, particularly through the gateway air and seaport of Labuan Bajo, which serves as the primary entry point to the park. This surge in visitor numbers has intensified pressure on the ecological carrying capacity of the park's ecosystems, wildlife habitats, and the socio-economic structures of surrounding communities (Supriatna, 2020; UNESCO, 2018). Unregulated tourism activities have been associated with coral reef degradation caused by ship anchoring and intensive diving practices (Hasler & Ott, 2008; Roupheal & Inglis, 2010), as well as an increasing frequency of human-wildlife conflicts, particularly between local residents and the Komodo dragon (*Varanus komodoensis*) as natural habitats become increasingly constrained (Nyhus, 2016). These dynamics highlight the persistent tension between conservation objectives and tourism-driven economic

development within globally recognized protected areas. Despite the growing body of literature on sustainable tourism and conservation governance, limited attention has been given to how global conservation frameworks are operationalized in practice within TNK, particularly in relation to tourism pressures and their socio-ecological implications. Addressing this gap is essential for understanding how conservation and development objectives can be more effectively balanced in internationally protected landscapes.

In addition, there is an inequality in the distribution of tourism benefits, where most of the economic value continues to be absorbed by large-scale tourism operators from outside the region, while local communities such as in Kampung Kerora still experience limited access to promotion, training, and independent tourism management (Dhakidae, 2003). The lack of basic infrastructure such as docks, sanitation facilities, and mooring buoys also hinders the professionalization of community-based tourism and increases the risk of environmental damage. The imbalance in power relations between the TNK Center, external investors, and local communities exacerbates the situation, as top-down management approaches often do not accommodate the needs and aspirations of the community (Spenceley et al., 2021).

Revised in 2024 with the aim to achieve better legal protection for wildlife and the environment, the Government of Indonesia Law No. 5 of 1990 concerning Conservation of Living Resources and Their Ecosystems emphasizes the wise management of biological natural resources and their ecosystems, ensuring the sustainability of ecological functions, and paying attention to local social and cultural aspects. The International Union for Conservation of Nature (IUCN) affirms that conservation includes species protection, genetic preservation, and sustainability of ecosystem functions (Allaby, 2010). In TNK, the zoning system has been applied to regulate conservation space through the division of areas such as Core Zones, Marine Protection Zones, and Traditional Utilization Zones (Kepdirjen KSDAE, 2000). However, this system does not fully guarantee the effectiveness of conservation if it is not accompanied by collaborative governance, continuous monitoring, and active involvement of local communities.

Studies have shown that the failure of many conservation and ecotourism projects in developing countries is related to non-participatory management approaches, neglect of local knowledge, and lack of integration between social

needs and ecological goals (Scheyvens, 1999; Berkes, 2012). In the context of TNK, there have not been many studies that explicitly design a conservation destination management model that is able to integrate human-animal conflict mitigation, restoration of terrestrial and marine ecosystems, and community empowerment in one adaptive and contextual framework.

Based on these gaps, within the Indonesian context, this article aims to formulate strengthening sustainable tourism management in conservation areas through the development of an integrated destination resilience model. The study was conducted in three strategic locations in TNK—Kampung Kerora, Kampung Rinca, and South Padar—that represent socio-ecological dynamics, tourism pressure, and vulnerability to human-animal conflict. The main focus of the research includes four key aspects, namely (1) Analysis of socio-ecological resilience conditions and conflict patterns in destinations; (2) Assessment of the suitability of conservation and tourism interventions to the needs of local communities, (3) Module of strategic intervention programs through conflict mitigation, ecosystem restoration, and community empowerment; and (4) Development of destination resilience cycle models as an adaptive and collaborative management framework. The novelty of this research lies in the development of a resilience model of conservation destinations based on community needs and multi-stakeholder participation. The model integrates three key strategies—conflict mitigation, ecosystem restoration, and community empowerment—into a holistic and regenerative management system. With this approach, the study makes a theoretical contribution to the socio-ecological resilience literature (Folke et al., 2010; Walker & Salt, 2006), as well as practical contributions in strengthening tourism impact control strategies through visitor management, sustainable monitoring, and inclusive governance based on socio-ecological justice.

LITERATURE REVIEW

There Sustainable tourism ecosystem management refers to a holistic governance approach that integrates economic growth, environmental conservation, and socio-cultural sustainability. In conservation areas, this approach prioritizes ecological integrity while ensuring equitable benefits for local communities and other stakeholders (Eagles, McCool, & Haynes, 2002; UNWTO, 2013). Tourism development in these sensitive ecosystems must

be guided by regulatory and technical tools, such as spatial zoning (core, buffer, and utilization zones), carrying capacity limits, and visitor education programs to minimize ecological disruption (Buckley, 2012; Millennium Ecosystem Assessment [MEA], 2005). These mechanisms help reduce pressure on habitats, improve conservation legitimacy, and raise ecological awareness.

The concept of sustainability in tourism is based on three interrelated pillars: economic, social, and environmental (Font, 2012; Global Sustainable Tourism Council [GSTC], 2022). Economic goals include income generation and job creation; social objectives involve cultural preservation and equitable benefit-sharing; while environmental goals focus on minimizing ecosystem degradation. Effective implementation requires destination management systems that support institutional coordination, long-term planning, and sustainability monitoring. Stakeholder collaboration is central to this framework, as participation by governments, local communities, NGOs, private sectors, and tourists enables more democratic, inclusive, and contextually appropriate governance (Jamal & Stronza, 2009). In particular, community involvement in planning and monitoring enhances ownership, accountability, and reduces potential conflicts (Berkes, 2012; Spenceley et al., 2021). Given the vulnerability of conservation areas to external pressures like climate change and resource exploitation, adaptive management is essential. Such approaches emphasize policy flexibility, risk mitigation, and the integration of scientific and traditional knowledge (Folke et al., 2010; Simpson et al., 2008).

The theory of socio-ecological resilience provides a valuable framework for understanding the dynamic relationship between human and natural systems. Resilience is defined as the capacity of systems to absorb disturbances while maintaining core functions, adapt to changing conditions, and transform when necessary (Folke et al., 2004; Walker & Salt, 2006). This framework is particularly relevant for conservation areas under pressure from tourism, where ecosystem functions and community well-being are deeply interconnected. Characteristics of resilient systems include institutional flexibility, biodiversity, local innovation, and adaptive capacity. In Komodo National Park (Taman Nasional Komodo, TNK), for example, interactions between tourism, local economies, and vulnerable habitats demand a resilience-based management approach (Berkes, Colding, & Folke, 2003).

Socio-ecological resilience also involves social processes such as participation, access to information, and community empowerment (Riley & Masten, 2005; Tugade & Fredrickson, 2004). In TNK, participatory monitoring, risk reduction strategies, and diversification of tourism products have helped increase resilience to ecological and economic pressures. Visitor management strategies—such as regulating ecological carrying capacity and developing educational tourism—also contribute to this goal. Local initiatives in Kampung Rinca, Kerora, and South Padar demonstrate how community participation in spatial planning and environmental stewardship can strengthen both conservation outcomes and community resilience.

One of the most pressing issues in conservation tourism is human-wildlife conflict, which often arises from competition over space and resources. These conflicts can result in property damage, injuries, and declining support for conservation efforts (Nyhus, 2016; Treves et al., 2006). A comprehensive mitigation model integrates three approaches: technical, participatory, and institutional (Madden, 2004; Dickman, 2010). Technical interventions include safety infrastructure, zoning, and early warning systems. In TNK, the construction of fences and safe routes for schoolchildren in areas frequented by Komodo dragons exemplifies this strategy. The participatory dimension emphasizes community involvement in conflict mitigation design and evaluation, incorporating traditional knowledge and local adaptation strategies (Berkes, 2009; Wisner et al., 2004). Institutional strategies, including SOPs for wildlife encounters, marine traffic regulation, and disaster preparedness, are essential to improving safety and reducing ecological impact (Spenceley et al., 2021). Collaborative and adaptive governance ensures that conflict mitigation not only protects humans and wildlife but also enhances long-term resilience (Simpson et al., 2008).

Assessing the suitability of conservation interventions with local community needs is critical to achieving inclusive and sustainable outcomes. Conservation programs must align with the economic, social, and cultural realities of the communities they affect (Salafsky et al., 2002). Key assessment indicators include access to natural resources, impacts on livelihoods, respect for cultural practices, availability of basic services, and health and safety concerns (Dressler et al., 2010; Chapin, 2004; Nyhus, 2016). This assessment process employs mixed-method approaches such as household surveys, participatory discussions, and case studies to capture diverse

perspectives and inform policy adjustments (Reed, 2008).

Community-based tourism (CBT) offers a model that balances conservation objectives with local empowerment. Unlike top-down tourism development, CBT enables communities to manage tourism operations, such as homestays, cultural tours, and handicraft production (Tosun, 2000; Scheyvens, 2002). This approach fosters cultural integrity, economic autonomy, and environmental stewardship. In TNK, interventions supporting local tour guide training, women's entrepreneurship, and partnership-building with tour operators have enhanced community involvement and benefit distribution (Timothy, 2002; Jamal & Everett, 2005). Such alignment not only enhances the legitimacy of conservation programs but also facilitates conflict resolution and long-term sustainability (Reed, 2008).

To support sustainable tourism in conservation areas, four interconnected program modules are essential: conflict mitigation, ecosystem restoration, community empowerment, and multi-stakeholder collaboration. Conflict mitigation strategies must address both human-animal interactions and socio-political tensions between stakeholders through preventive infrastructure, education, and dialogue (Nyhus, 2016; Upreti, 2004). Ecosystem restoration, both terrestrial and marine, benefits from ethnoecological approaches that incorporate traditional ecological knowledge (Posey, 1999; MEA, 2005). In TNK, reforestation and coral rehabilitation are complemented by regenerative tourism practices that restore rather than exploit ecosystems (Dredge, 2022; Hughes et al., 2017).

Community empowerment involves enhancing capabilities, access to opportunities, and participatory decision-making. Empowerment is not merely the provision of resources, but the expansion of freedoms and choices (Sen, 1999). Training, small enterprise support, and inclusive governance mechanisms are tools for enabling local control and benefit-sharing (Scheyvens, 1999; Berkes, 2012). Lastly, multi-stakeholder collaboration is foundational to sustainable governance. Inclusive partnerships between governments, NGOs, local communities, businesses, and tourists enable resource sharing, knowledge exchange, and conflict mediation (Ansell & Gash, 2008; Ostrom, 2009). In TNK, such collaborations manifest through stakeholder forums, joint zoning planning, and community-involved restoration initiatives (Borrini-Feyerabend et al., 2013). The case of TNK demonstrates the practical application of

these integrated strategies. Zoning regulations, daily monitoring, and SOPs are used to manage visitor behavior and protect habitats (Eagles et al., 2002; Buckley, 2012). Community roles in tourism—such as guiding, lodging, and cultural performance—exemplify successful CBT implementation (Tosun, 2000; Scheyvens, 1999). Meanwhile, interpretive education and local participation enhance conservation awareness and reduce ecological impact. Importantly, TNK's governance reflects a collaborative model where community voice, institutional coordination, and ecological priorities are balanced (Supriatna, 2015). This integrated and adaptive approach offers a valuable model for other tourism-impacted conservation areas facing similar ecological and social challenges.

METHODOLOGY

This study employed a descriptive qualitative approach to provide an in-depth and comprehensive understanding of disaster mitigation, reforestation, coral reef restoration, and community empowerment programs in Kampung Rinca, Kampung Kerora, and South Padar. The qualitative method was selected to capture the social context, meaning, and subjective experiences of stakeholders involved—dimensions that are not readily quantifiable (Yin, 2018). To ensure the validity and reliability of findings, data triangulation was applied, combining multiple data sources and collection methods to cross-verify results, minimize bias, and enhance overall research credibility (Scheyvens, 2002; Pretty et al., 2009). The research was conducted over a seven-month period, from January to July 2025.

Primary data collection involved in-depth interviews, direct observations, and document analysis. Semi-structured interviews were conducted with key stakeholder groups, including program managers from the Komodo National Park and Surrounding Waters Initiative (BPTNKPS), local community members (village heads, customary leaders, and households engaged in homestay and diving guide training), representatives from the Komodo National Park Authority (TNK), local tourism operators, and other relevant agencies such as ITDC Golomori, PLN, and local health and education offices. To improve methodological transparency, the number of participants interviewed in this study is summarized in the following table.

Table 1. Interview Informants Based on Stakeholder Groups

Stakeholder Groups	Roles in the Program	Nbr of Informants
BPTNKPS (Komodo National Park Care Agency & Surrounding Waters)	Management Team	3
Komodo National Park (TNK)	Conservation Area Team	3
Village Government (Rinca, Kerora, South Padar)	Village heads and village officials	3
Indigenous Leaders/Community Leaders	Socio-cultural representation of the community	3
Households of program participants	Homestay trainees and tour guides	8
Local tourism operators	Tour and diving service providers	4
Partner institutions (ITDC Golomori, PLN, health and education office)	Program implementation and support partners	4
Total Informan		28

Source: Researcher, 2025

Observational data were collected from various project sites, including mitigation fence installations, reforestation zones (e.g., kore tree planting in Kerora), coral reef restoration areas in South Padar, and community infrastructure such as trekking paths, guard posts, sanitation facilities, and water and telecommunication networks (Badan Peduli TN Komodo & Perairan Sekitarnya, 2025). Social interactions and daily activities of residents were also observed to better understand environmental behaviors and community responses to conservation efforts (Balai Taman Nasional Komodo, 2023).

Table 2. Location and Focus of Field Observation

Observation Location	Types of Programs/Infrastructure	Observation Focus
Rinca Village	Installation of human-Komodo dragon conflict mitigation fence	Effectiveness of conflict mitigation and community adaptation
Kerora Village	Reforestation program (tree planting)	Community participation and vegetation conditions
South Padar	Coral reef restoration	Marine ecosystem conditions and

		restoration activities
Tourist trekking trails	Nature-based tourism infrastructure	Use of the trail by tourists and the public
Guard posts and conservation facilities	Area surveillance infrastructure	Area supervision and management system
Sanitation and clean water facilities	Community infrastructure	Community access to basic services
Telecommunication infrastructure	Village connectivity	Impact on communication and economic activities
Total Informan		28

Source: Researcher, 2025

Documentary analysis included program proposals, implementation reports, regulatory documents, and memoranda of understanding, notably the MoU between BPTNKPS and the Komodo National Park Authority signed in March 2025 (Badan Peduli TN Komodo & Perairan Sekitarnya & Balai Taman Nasional Komodo, 2025). Additional sources included coral reef survey data, OUV (Outstanding Universal Value) mapping, and records of official field visits by institutions such as BPOLBF and ITDC (Manggarai Barat Regent Office, 2024). Relevant academic literature on community-based tourism, human-wildlife conflict mitigation, ecological restoration, and community resilience in conservation areas was also reviewed (Spalding et al., 2017; Scheyvens, 2002). The integration of these three methods enabled a holistic and well-validated understanding of program outcomes and challenges, reflecting multiple perspectives across ecological, social, and institutional dimensions.

RESULT AND DISCUSSION

4.1. Socio-ecological resilience level

The people of Kampung Kerora demonstrate a strong level of socio-ecological resilience through their ability to integrate tourism-based economic activities with long-standing environmental stewardship practices. Rather than viewing tourism and conservation as competing interests, the community has developed a locally embedded system in which tourism supports environmental protection, cultural continuity, and livelihood diversification. Community members actively participate in guiding visitors, managing natural resources, and maintaining

ecological integrity, while tourism revenues help sustain local livelihoods. This integration reflects an adaptive form of community governance where ecological protection, cultural values, and economic benefits reinforce one another.

A key illustration of this resilience is the cultural role of the “Kore Tree,” which functions as an ethnoecological bridge between traditional knowledge and contemporary conservation practices. The “Kore Tree” refers to a locally named tree recognized in Kampung Kerora’s traditional ecological knowledge, and the term reflects a cultural classification rather than a formally identified botanical species. Within local belief systems, the Kore Tree is regarded as a guardian of the surrounding forest and is associated with ancestral spirits that protect the village and its environment. As a result, cutting or damaging the tree is considered taboo and is believed to bring misfortune or ecological imbalance. These customary beliefs have historically acted as an informal conservation mechanism, ensuring the protection of the tree and its surrounding habitat.

In the context of tourism development, the Kore Tree has also become part of the community’s environmental interpretation and storytelling. Local guides explain its cultural meaning to visitors, emphasizing respect for nature and traditional values. Through this process, the Kore Tree serves not only as a biological resource but also as a symbolic link between indigenous ecological knowledge and sustainable tourism practices. Overall, this example illustrates how local wisdom contributes directly to the community’s socio-ecological resilience. By embedding conservation within cultural narratives and tourism activities, Kampung Kerora is able to maintain ecological balance while simultaneously creating adaptive economic opportunities for local residents.

Through the management of homestays, tour guides, and the preservation of the habitat of rare animals such as yellow-crested cockatoos, the community adapts to local wisdom traditions that regulate the sustainable use of natural resources (Berkes et al., 2003; Lestari & Kusumaningtyas, 2021). However, the increase in the number of tourists poses a risk of environmental degradation, such as coastal erosion and habitat disturbance, which threatens the sustainability of ecosystems (Folke et al., 2010). The challenges of waste management, especially shipments from the sea, require

collaboration between stakeholders to implement integrated conservation actions, such as mangrove planting and coral reef rehabilitation, to strengthen ecological and social resilience (Hughes et al., 2017).

In Rinca Village, the community faces the challenge of human-animal conflict due to interaction with a large population of Komodo dragons. Their socio-ecological resilience is built through ecotourism management that empowers the economy while being conservation-oriented (Nyhus, 2016; Supriatna, 2015). Cultural adaptation involving local knowledge about Komodo dragon behavior and its movement patterns is an important capital in reducing the risk of conflict (Teguh, 2023). The support of national park managers through compensation and mitigation programs strengthens these adaptation mechanisms, reflecting the balance between resource utilization and habitat protection that is essential for socio-ecological resilience (Berkes et al., 2003).

South Padar faces heavier ecological pressure due to the high level of tourist activities such as trekking and snorkeling. Community’s dependence on the tourism sector shows high economic resilience, but limited access to education and conservation facilities is an obstacle to independent resource management (MEA, 2005). Threats to coral reef ecosystems due to uncontrolled anchoring of ships indicate the need for collaborative adaptive management between governments, communities, and tourism business actors (Hughes et al., 2017; Biggs et al., 2015). Habitat restoration programs and sustainable tourism management training need to be prioritized to strengthen socio-ecological resilience while maintaining the ecological function of coral reefs as a buffer for the sustainability of conservation areas.

The demographic and socio-cultural aspects of the community in Komodo National Park also play a significant role in forming socio-ecological resilience. Although the level of formal education is still relatively low, local wisdom that is passed down from generation to generation is a strong social capital in the management of natural resources and the harmonious interaction with wildlife (Cinner & McClanahan, 2015; Teguh, 2022). The ethnic and linguistic diversity in Rinca Village and the cultural traditions that accommodate traditional ecological knowledge enrich the adaptive capacity of the community to face ecological and social pressures. However, inequality in education and employment shows the need for capacity-

building interventions so that communities can optimize their role in managing the area independently and sustainably (Berkes et al., 2003; MEA, 2005).

4.2. Conformity of Community Needs with Conflict Mitigation, Restoration, and Empowerment Programs

Matching community needs with conservation programs in national park areas is a crucial step to ensure that interventions implemented are relevant and effective in complex socio-ecological contexts. A widely adopted approach is a participatory method that integrates local community knowledge with scientific data and conservation policies. Qualitative data collection techniques such as in-depth interviews, focus group discussions, and participatory observation enable an in-depth understanding of people's aspirations, perceptions, and needs—including in the context of human-animal conflict mitigation, ecosystem restoration, and socio-economic empowerment (Chambers, 2008; Reed, 2008). Quantitative surveys are often used as a complement to systematically measure levels of support and need, resulting in more holistic and reliable data (Bryman, 2016).

The active involvement of the community in all stages of the assessment—from problem identification, data collection, to evaluation and solution formulation—is a fundamental aspect of this methodology. This participatory approach is in line with the principles of common resource governance which emphasizes inclusivity, transparency, and the sharing of responsibilities among stakeholders (Ostrom, 1990; Berkes, 2018). In areas such as TNK, this method allows for the adjustment of conservation programs that are responsive to social dynamics and local wisdom, which is very important in managing human-animal conflicts such as those experienced by the people of Rinca Village, while meeting the needs of marine ecosystem restoration in Kerora and South Padar Villages, as well as community empowerment for sustainable tourism management (Timothy, 2002; Lestari & Kusumaningtyas, 2021; Nyhus, 2016).

In addition, this assessment methodology places multi-stakeholder dialogue as a key element, where intense collaboration between governments, NGOs, academics, and local communities results in adaptive and contextual recommendations. This kind of transdisciplinary approach is essential to accommodate a variety of perspectives while reducing potential conflicts of interest that arise in the management of conservation areas (Biggs et al., 2015;

Cinner et al., 2020). The use of technologies such as Geographic Information System (GIS) and participatory mapping also increases the accuracy in spatial data collection, thus being able to determine priority areas for conservation, conflict mitigation, and restoration more precisely (Conrad & Hilchey, 2011).

This participatory and collaboration-based methodology not only increases the legitimacy of conservation policies but also strengthens the socio-ecological resilience of communities. By building social capital and adaptive capabilities, local communities become better able to manage natural resources sustainably, face tourism pressures, and adapt to environmental and social changes (Putnam, 1993; Berkes et al., 2003). Communities' aspirations for effective conflict mitigation, sustainable habitat restoration, and local economic empowerment can be optimally accommodated within this managerial framework, so that conservation programs are not only a conservation project but also a social capacity building that supports the long-term sustainability of national parks (Nyhus, 2016; Hughes et al., 2017).

4.3. Conflict Mitigation, Nature Restoration, Community Empowerment Program Modules including Multistakeholder Collaboration Commitments

4.3.1 Human-Animal Conflict Mitigation and Security Enhancement Programs

Conflicts between humans and wildlife, especially Komodo dragons (*Varanus komodoensis*), are a major issue in Komodo Conservation Areas. This conflict is characterized by a high incidence of Komodo dragons entering settlements, preying on livestock, and in some cases injuring humans, which has implications for economic losses and causes fear (Nyhus et al., 2016). This conflict threatens the sustainability of conservation because it triggers social conflict and the potential for poaching.

The construction of mitigation fences around Rinca Village is designed as a physical barrier to limit the movement of Komodo dragons to settlements. The fence uses materials and designs that pay attention to the natural behavior of Komodo dragons to prevent penetration without causing injury (Supriatna, 2015). A study monitoring the frequency of incidents before and after the construction of the fence showed a significant decrease (>70%) in negative interactions (primary data of the Komodo National Park Office, 2023).

In Kampung Kerora, security interventions also include the construction of a 30-meter bridge with a height of 2-3 meters above the tide to facilitate safe access for school children from Waerebo to Kerora. This infrastructure reduces the risk of accidents and increases community mobility, while reducing social pressures that may arise due to limited access (Fahrig, 2003).

The reduction of human-Komodo dragon conflicts through physical interventions such as mitigation fencing shows that an effective structural approach reduces direct risks, while creating a safe and conducive social environment for economic activities. This approach also reduces community resistance to conservation and opens up space for the development of new livelihoods (Treves & Karanth, 2003).

4.3.2 Nature Restoration Program: Land Reforestation and Coral Reef Restoration

Deforestation and habitat degradation have resulted in a decline in the habitat quality of Komodo dragons and yellow-crested cockatoos (*Cacatua sulphurea*). This condition disrupts the ecological cycle, such as the water cycle and the availability of animal feed (Berkes, 2012). Reforestation efforts help restore vegetation cover that is critical to the water cycle, prevent erosion, and enrich wildlife habitats, including Komodo dragons. In Kerora, the nursery and development plan of the Kore Tree, which is an important habitat for the yellow-crested cockatoo, demonstrates an ethnoecological approach that blends conservation with local wisdom. This reforestation is not only ecological, but also aesthetically pleasing, enhancing the attractiveness of the landscape for tourists seeking nature experiences (Bramwell & Lane, 2011). Reforestation programs prioritize local trees such as the Kore Tree, which is ecologically important as a habitat for cockatoos. Nurseries are carried out in a participatory manner with local communities, who are involved in planting and care (Lamb et al., 2005). The method also adopts an ethnoecological approach taking into account indigenous practices and spiritual values, enhancing social attachment and program sustainability (Pretty & Smith, 2004).

An evaluation of reforested land showed a 40% increase in vegetation cover in the last two years, contributing to the reduction of soil erosion and the improvement of parrot habitat. Community participation has been proven to increase the effectiveness of tree care and project sustainability.

Coral reef restoration. Coral reefs in South Padar are degraded due to uncontrolled ship anchoring activities and excessive tourist pressure (Hawkins & Roberts, 1994). The installation of 10 mooring buoy units out of a total of 30 units planned reduces the need for ships to throw anchors directly onto the reef. This project is supported by a restriction on the number of daily visitors (maximum 400 people) to maintain the capacity of the environment. In addition, coral planting is carried out by the selectively selected coral fragment transplant method and combined with snorkeling tourism education programs to increase visitor awareness (Ballantyne & Packer, 2011).

Monitoring of coral biota showed an improvement in the index of live coral cover and an increase in species diversity after 12 months of intervention. This program emphasizes the importance of marine ecosystem management that is integrated between physical protection (mooring buoy) and the involvement of communities and tourists (Manning, 2007).

4.3.3 Socio-Economic Empowerment and Livelihood Diversification Program

Diving Guide and Homestay Management training module. Diving guide training provides local youth with the technical skills to become competent dive guides, as well as ambassadors for marine conservation. Diving Guide Training: Empowering local youth to become professional dive guides, not only increasing income, but also making them local ambassadors for marine conservation. There are 5 local guides already in Kerora for trekking trails.

The training approach integrates aspects of safety, knowledge of marine ecology, and communication skills (Scheyvens, 1999). This model reduces reliance on extractive activities that damage the environment. Homestay management allows local communities to directly experience the economic benefits of tourism, increase social inclusion and encourage family economic independence (IUCN, 2013). The establishment of MSME tents around the Kerora pier supports women's empowerment through local culinary and handicraft production.

Community-Based Tourism Product Diversification and Sustainable Tourism Marketing Module.

The diversification of tourism products through community-based initiatives plays a pivotal role in enhancing socio ecological resilience and promoting

sustainable destination management. For instance, the development of attractions such as Wae Wako trekking, bird watching, snorkeling, and coral planting exemplifies a strategic approach to product diversification that aligns with local ecological and cultural contexts (Pretty et al., 2009). These nature based and culturally embedded offerings not only create alternative income streams and spread economic benefits among community members but also foster environmental and cultural awareness among visitors and residents. Font (2017, p. 869) emphasizes that sustainable tourism marketing hinges on understanding market needs, designing more sustainable tourism products, and employing persuasive communication strategies to effect behavioural change. By integrating market insights with sustainability objectives, destination planners and operators can enhance positive environmental and cultural outcomes while shifting visitor behaviour toward sustainability. Thus, community based tourism product diversification emerges as a key strategy for balancing conservation and development goals within destination management.

Cultural Engagement and Multistakeholder Collaboration Module. A cultural approach that prioritizes the involvement of indigenous leaders and local rituals in conservation programs strengthens the social capital and legitimacy of the program. This allows for better social adaptation and sustainable management of resources (Berkes, 2012; Pretty, 2003). Multi-stakeholder cooperation involves the Komodo National Park Authority, NGOs, tourism business actors, and local communities in co-management. Although coordination challenges still exist, especially in Kerora and South Padar, the mechanism of the deliberative forum in Rinca has become an example of best practice (Armitage et al., 2009).

Interventions in conflict mitigation, nature restoration, and community empowerment programs in Komodo conservation areas have proven their effectiveness in reducing human-animal conflicts, restoring terrestrial and marine ecosystems, and improving the welfare of local communities in a sustainable manner. An approach that integrates ecological, social, and cultural aspects as well as multi-stakeholder collaboration is key to the program's success. This model offers examples of holistic and regenerative conservation implementation, relevant for similar protected areas in the tropics.

In all three locations, the form of multi-stakeholder

cooperation involves the Komodo National Park Office, the TNK PS Care Agency, conservation NGOs, tourism business actors, and local communities. The highest commitment was seen in Rinca Village, where the coordination and communication mechanism was intensively carried out with village deliberative forums and park managers. Meanwhile, in Kerora and South Padar Villages, coordination challenges still exist, especially related to the division of roles and resources (Supriatna, 2015; Eagles et al., 2002). The program in Rinca, Kerora, and South Padar Villages contains strong regenerative values, where interventions do not only patch up the damage, but improve the socio-ecological structure as a whole. The construction of the fence not only reduces conflict, but also creates a foundation for the development of alternative economies. Reforestation and coral restoration not only plant trees or place buoys, but also restore the spiritual and ecological connection between people and nature. Community empowerment not only provides jobs, but also builds independence and dignity. It is a holistic approach that sees each problem as an opportunity to create better and more sustainable solutions (Dredge, 2022).

4.5. Resilience Model of Conservation-Based Tourism Destinations in the Komodo National Park Area

This model adopts the principles of socio-ecological resilience put forward by Folke et al. (2010) and Walker & Salt (2006), which emphasizes adaptive systems and the interconnectedness between humans and nature as a complex system. This concept is particularly relevant in the context of conservation areas facing pressures from mass tourism, human-wildlife conflicts, and habitat degradation. This model of resilience cycles reinforces the importance of:

- Participatory and transdisciplinary approaches (Berkes et al., 2003; Berkes, 2012), which combines local wisdom, social science, and modern technology for inclusive and adaptive management.
- Adaptive co-management as a responsive and sustainable management strategy, which combines collective learning, conflict management, and stakeholder engagement (Folke et al., 2010).

The structure of the Model and the Sustainable Cycle consists of five main stages that make up the adaptive cycle

including: (1) Identification of problems using participatory methods and socio-ecological data to understand the dynamics of conflict and degradation; (2) Collaborative planning that increases legitimacy and sense of ownership; (3) Implementation of interventions in the form of conflict mitigation, ecosystem restoration, and community empowerment in an integrative manner; (4) Continuous monitoring and evaluation using quantitative and qualitative indicators, supported by technology such as camera traps and digital applications; (5) Adapt flexible policies and practices to respond to changes and uncertainties. This cycle emphasizes that management is not linear, but iterative and responsive, in line with the principle of resilience thinking.

Strategic Intervention and Synergy systemically strengthen the module (1) Conflict Mitigation: For example, the installation of a fence or interaction zone that minimizes negative contact between humans and Komodo dragons, in accordance with the research recommendations of Hasler & Ott (2008) on the importance of setting safe zones; (2) Ecosystem Restoration Module: Includes vegetation rehabilitation and watershed restoration, which plays a role in reducing conflicts by providing sufficient habitat for wildlife (Supriatna, 2015); (3) Community Empowerment: Diversification of the local economy and the development of community-based ecotourism reduce the pressure of resource exploitation, as well as increase the adaptive capacity of the community (Berkes, 2012). This synergy shows that without empowerment, mitigation and restoration will be less effective; Similarly, habitat restoration without conflict mitigation does not solve the root of ecological problems.

Conflict mitigation interventions, ecosystem restoration, and community empowerment function synergistically in the model. Effective conflict mitigation creates safe spaces between humans and wildlife such as Komodo dragons, while adequate habitat restoration reduces conflict intensity by providing healthy ecosystems (Hasler & Ott, 2008; Supriatna, 2015). On the other hand, community empowerment through economic diversification and sustainable ecotourism development reduces people's dependence on destructive exploitation of natural resources (Berkes, 2012). The integration of the three interventions results in adaptive cycles that strengthen the socio-ecological resilience of destinations to change and crisis, in line with the concept of adaptive co-management that emphasizes the reciprocal relationship between humans and

nature (Folke et al., 2010; Berkes et al., 2003).

Regulating the impact of tourism in TNK through a strategy to control the number of visitors and continuous monitoring is a crucial aspect in maintaining a balance between conservation and economic benefits. The implementation of the visitor quota system in various major resorts, such as the capacity of 1,000 people per day at the Loh Buaya Resort and 400 people in South Padar, as well as the restriction of zones and visiting times in Rinca and Kerora Villages, shows the concrete implementation of effective tourism carrying capacity management (Komodo National Park Care Agency & Surrounding Waters, 2025). Digital monitoring technology and the installation of mooring buoys in South Padar also contribute to the reduction of coral reef damage and sustainable regulation of ship traffic (Buckley, 2012). Data on the trend of increasing visits, especially during peak seasons, confirm the need for adaptive policies and responsive management systems to avoid over-capacity that can damage the ecosystem and disrupt the quality of the tourism experience (Fantura in Katong NTT, 2024; Kaha in Antaranews.com, 2025).

Therefore, The Community-Integrated Conservation Resilience Model (CICRM) is a conceptual framework that explains how the integration of ecological conservation interventions, risk mitigation, and community empowerment can build the resilience of conservation-based tourism destinations to anticipate failure scenario. This model departs from a socio-ecological systems approach, where the sustainability of a destination is determined not only by environmental conditions, but also by the adaptive capacity of local communities and the institutions that manage the area.

enhanced local income. As communities become actively engaged in stewardship and decision-making processes, multi-stakeholder partnerships are reinforced and community integration is strengthened, fostering collective responsibility for resource management. This integrated approach creates a positive feedback loop in which ecological conservation, social cohesion, and economic benefits mutually reinforce one another, thereby enhancing the adaptive capacity of destinations to respond to disturbances such as tourism pressures, climate change, and human–wildlife conflicts. In contrast, a silo-based approach addresses only a single dimension of conservation—for example, focusing exclusively on coral reef restoration—without incorporating community participation, institutional coordination, or mechanisms for managing social conflicts. Although such interventions may yield short-term ecological improvements, they often fail to generate broader socio-economic benefits or durable governance structures. Consequently, silo-based strategies tend to produce limited outcomes and lower long-term resilience, thereby increasing the vulnerability of conservation and development initiatives to future disturbances

Thus, the destination resilience model in TNK not only enriches the scientific literature on socio-ecological resilience and adaptive co-management, but also provides a practical foundation that can be replicated in other conservation areas with similar challenges. This integrative approach that combines conflict mitigation, ecosystem restoration, and community empowerment in a sustainable manner is key to preserving the environment while improving the welfare of local communities, as well as ensuring the sustainability of conservation-based tourism in the future.

This research uses a qualitative approach with limited coverage in three locations, so the results cannot be generalized widely. Further research is recommended to use mixed methods with a wider scope of locations, as well as explore the socio-cultural aspects and long-term impacts of the implementation of destination resilience models.

CONCLUSION AND IMPLICATION

5.1. Conclusion

The socio-ecological resilience of communities and destinations in Komodo National Park conservation

COMMUNITY-INTEGRATED CONSERVATION RESILIENCE MODEL (CICRM Framework)

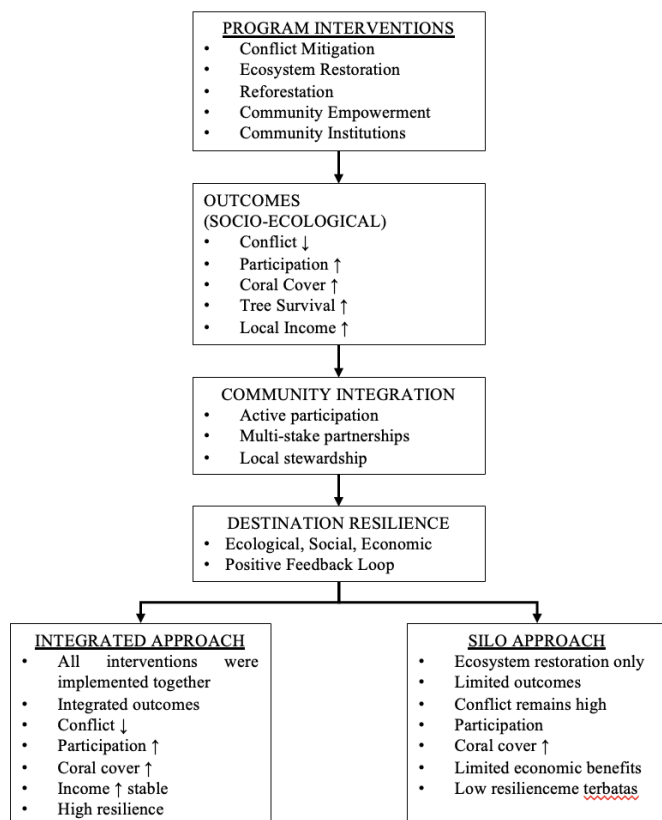


Figure 1. CICRM – Integrated vs Silo Approach

Source : Researcher, 2025

This model conceptualizes destination resilience as an emergent property arising from the dynamic interaction of three interdependent subsystems: ecological systems, social systems, and community economic systems. These subsystems are interconnected through key governance and institutional mechanisms, including community participation, collaborative governance, and the equitable distribution of economic benefits. Within this framework, resilience is strengthened through integrated program interventions that simultaneously address ecological and socio-economic dimensions, such as conflict mitigation, ecosystem restoration, reforestation, community empowerment, and the strengthening of local institutions. The coordinated implementation of these interventions generates a range of socio-ecological outcomes, including reduced conflict, increased community participation, improved coral cover, higher tree survival rates, and

areas—particularly in Kampung Kerora, Kampung Rinca, and South Padar—shows great potential for sustainable tourism ecosystem management. The success of the management is supported by the integration of three main interventions: human-animal conflict mitigation, ecosystem restoration, and community empowerment. The active involvement of local communities and multi-stakeholder collaboration have proven to be key factors in maintaining socio-ecological balance while improving economic well-being. The destination resilience cycle model can be an important reference for the management of other conservation areas with similar challenges.

5.2. Policy Advice

To support the implementation of the destination resilience model and advance sustainable tourism management, several integrated policy directions are necessary. These include strengthening zoning regulations and adaptive visitor quota systems based on ecological carrying capacity, social tolerance, and seasonal environmental conditions, supported by effective monitoring and enforcement to prevent ecosystem degradation. Equally important is capacity development for local communities through training, technical assistance, and improved access to financial and institutional resources, enabling the development of environmentally responsible enterprises such as community-based ecotourism, sustainable fisheries, and conservation-oriented tourism products. Effective multi-stakeholder coordination should also be institutionalized through regular forums involving government agencies, local communities, tourism operators, NGOs, and the private sector, while engaging academic institutions in monitoring and evaluation to support evidence-based and adaptive governance. In addition, the utilization of digital technologies for monitoring and environmental education—including ecosystem monitoring platforms, visitor tracking systems, and digital interpretation tools—can strengthen tourism impact management and promote responsible visitor behavior. Policy support should further include economic incentives that encourage conservation participation, such as conservation-based compensation schemes, payment for ecosystem services, and fair benefit-sharing mechanisms that ensure local communities gain tangible benefits from tourism activities. At the same time, ecosystem restoration initiatives, including mangrove rehabilitation, kore tree as an ethnoecological bridge, coral reef restoration, watershed protection, and habitat conservation, should be integrated

into destination management plans through partnerships with communities, the private sector, and conservation organizations. While the empirical findings of this study are site-specific and cannot be directly generalized due to differing ecological, institutional, and socio-cultural contexts, the study offers a transferable analytical framework through the Destination Resilience Cycle. Rather than replicating specific empirical results, other destinations can adapt this resilience-based framework to assess vulnerabilities, recovery dynamics, and adaptive management strategies. Therefore, the main contribution of this research lies not in proposing a universal model with fixed parameters, but in providing a replicable framework for resilience-oriented tourism planning and evaluation across diverse environmental and governance contexts.

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DECLARATIONS

Ethical Approval

This study was conducted in accordance with ethical research principles involving human participants. Ethical considerations included voluntary participation, confidentiality of respondents' identities, and respect for local socio-cultural values within the research locations in Kerora Village, Rinca Village, and South Padar, Komodo National Park Area, Indonesia. All interview and observation activities were carried out with the permission and cooperation of relevant stakeholders, including local communities, village authorities, and the Komodo National Park Authority.

Informed Consent

Informed consent was obtained from all participants involved in this study prior to data collection. Participants were informed about the objectives of the research, the voluntary nature of their participation, their right to withdraw at any time, and the intended academic use of the collected information. Verbal and/or written consent was secured before conducting interviews, observations, and documentation activities.

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Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request. Certain data, particularly those involving local community information and conservation management documents, are not publicly available due to ethical considerations and confidentiality agreements with stakeholders.

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