

Article

# Design for policy strengthening: Analysis of forest fire disaster mitigation governance through ecotourism development integration in Siak Regency

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## CITATION

Syamsuadi A, Yahya MR, Anugerah MF, Farras A. (2024). Design for policy strengthening: Analysis of forest fire disaster mitigation governance through ecotourism development integration in Siak Regency. *Journal of Infrastructure, Policy and Development*. 8(14): 8539.  
<https://doi.org/10.24294/jipd8539>

## ARTICLE INFO

Received: 12 August 2024

Accepted: 29 September 2024

Available online: 26 November 2024

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**Abstract:** This study aims to explain the design of policy strengthening in forest and land fire disaster mitigation governance, through the integration of ecotourism development in Siak Regency. Based on the research topic, this study employs a qualitative approach to describe governance conditions and the design of policy strengthening in ecotourism-based disaster mitigation governance. Data analysis is performed using Nvivo 12 Plus software. The results of this study indicate that forest and land fire disaster mitigation governance based on ecotourism development still has shortcomings that need to be addressed in the principles of conservation, economy, and community involvement. Then, the design of a policy to strengthen ecotourism-based disaster mitigation governance includes three crucial policy recommendations, namely: the need for special regulations related to forest and land fire disaster mitigation prevention based on the integration of ecotourism principle development, the need for a balance of roles between actors in determining and implementing ecotourism-based disaster mitigation policies, and the need for effective and efficient implementation of ecotourism-based disaster mitigation policies through increasing the involvement of strategic actors. Substantially, the handling of forest and land fire disasters in Siak Regency can be combined with ecotourism activities, especially in tourist village areas, by developing policies to strengthen the utilization of village-owned disaster mitigation facilities such as reservoirs, lakes, or ponds that are converted into water supplies during the dry season for forest and land fire disaster prevention activities and local economy-based tourist destinations. Our findings are a strategic effort to raise awareness among actors and highlight the need for policy-strengthening design in ecotourism-based disaster mitigation. These findings can also contribute to the literature that will be useful for all stakeholders in developing future long-term disaster mitigation governance policies. This study relies heavily on information from key informants, who represent only the perspectives and expertise of the stakeholders encountered. However, it still refers to important elements based on the informants' knowledge capabilities in the disaster and tourism sectors. Therefore, we propose to conduct future studies on a comprehensive analysis of sustainable ecotourism-based disaster mitigation governance to promote and accelerate the idea of disaster and tourism in the future.

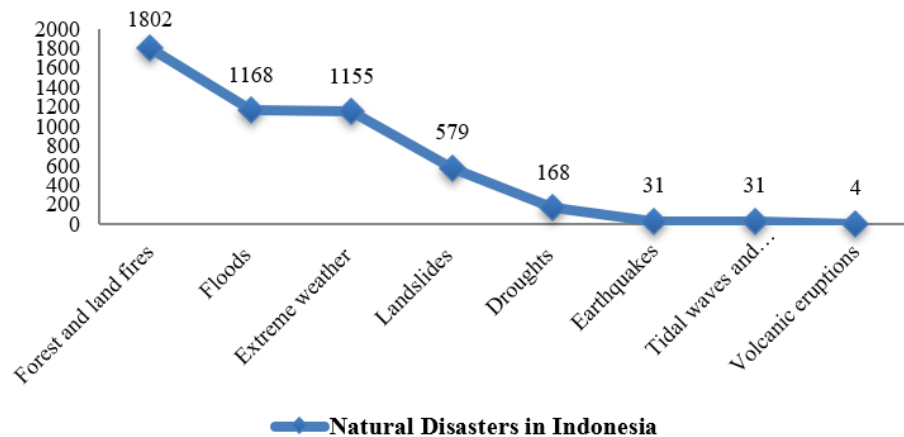
**Keywords:** policy; governance; disaster mitigation; forest fires; ecotourism

## 1. Introduction

Fundamentally, the debate regarding disaster mitigation strategies such as forest and land fires stems from the lack of agreement on the concrete meaning of disaster prevention governance in each region (Canadas et al., 2023; Rozaki et al., 2021). In the process, governments around the world have always realized that forest and land fires are a complex problem and require cross-sector collaboration to overcome them

(Cazzolla Gatti et al., 2019; Purnomo et al., 2018; Purnomo et al., 2021; Rafi et al., 2024; Sundari et al., 2022). In the process, Indonesia has also historically witnessed forest and land fire disasters that have had economic and social impacts on human life (Fadhillah et al., 2023; Rozaki et al., 2021). Essentially, the success of forest and land fire prevention and control efforts is highly dependent on the surrounding community’s emotional involvement, feelings and enthusiasm toward forest sustainability. This requires a forest and land management strategy considering the human element (Rafi et al., 2024; Sundari et al., 2022). Thus, coordination between stakeholders such as the government, community, and business actors are very important in implementing disaster mitigation measures based on the integration of ecotourism development (Dharma et al., 2024; Dharma et al., 2024; Syamsuadi et al., 2022).

Currently, all parties involved in Indonesia, including the central and regional governments, have realized that forest and land fires, if not immediately extinguished, will endanger the survival of wildlife and human life (Ansari et al., 2021; Harrison et al., 2020; Mubarak et al., 2024). Then, one of the causes of forest and land fires in Indonesia, which often occur almost every year, is the clearing of very large areas of land caused by human activities, both by farmers who often clear land by burning and unsustainable forest management practices (Harrison et al., 2020; Indra et al., 2023). **Figure 1** below summarizes the natural disasters that occurred in Indonesia in the period from January 1 to December 31, 2023:



**Figure 1.** Natural disasters in Indonesia in 2023.

Source: (Katadata.co.id, 2024).

Based on **Figure 1**, Indonesia experienced 4938 natural disasters from 1 January to 31 December 2023. Of this number, forest and land fires (karhutla) were the most frequent natural disasters. This figure represents 36.5% of all natural disasters in Indonesia. Then, floods (1168 incidents), bad weather (1155 incidents), landslides (579 incidents), droughts (168 incidents), earthquakes (31 incidents), tidal waves and abrasion (31 incidents), and volcanic eruptions (4 incidents). The National Disaster Management Agency (BNPB) of the Republic of Indonesia reported that 2655 people died, 33 people were missing, 5783 people were injured, and 8.84 million people suffered and were forced to evacuate due to the disaster. This disaster also caused losses of 34,699 people (Katadata.co.id, 2024). Although

the Indonesian Government has made efforts to prevent forest and land fires through disaster management regulations and programs, forest and land fires still occur frequently (Fadhillah et al., 2023; Indra et al., 2024; Susilawati et al., 2022). Various studies have shown challenges in managing forest and land fires, such as the inability of related agencies to coordinate with stakeholders and the lack of division of authority and responsibility between agencies (Canadas et al., 2023; Indra et al., 2023; Safitri, 2021; Sarmiasih and Pratama, 2019), weak law enforcement (Dewi et al., 2022; Indra et al., 2024), and the lack of integration between forest and land fire disaster control policies and the concept of ecotourism (Baloch et al., 2023; Dharma, Marlinda, et al., 2024; Nugraha et al., 2022; Selivanov et al., 2024).

Currently, forest and land fire disasters are frequent in several areas of Riau Province and require adaptive mitigation efforts to deal with disasters responsively (Dharma et al., 2024; Indra et al., 2023). The main problems in handling forest and land fire disasters in Riau Province include the spread of smoke due to forest and land fires, which is difficult to control and can make tourists reluctant to visit Riau Province (Syamsuadi et al., 2022; Yasir et al., 2023), lack of coordination between related parties in handling fires (Dharma, Sujianto, et al., 2024), the complexity of tasks and responsibilities assigned to the central government, provincial government, and district/city government in handling fires (Rizky et al., 2022; Robins et al., 2022), lack of public awareness in protecting the environment and preventing fires (Mustofa et al., 2024; Rafi et al., 2024), limited personnel and equipment to extinguish fires in areas affected by forest and land fires (Bai et al., 2023), and conflicts of interest between land managers and those responsible for handling forest and land fires (Juniyanti et al., 2021; Purnomo et al., 2021).

In this study, Siak Regency is one of the regencies in Riau Province that contributes to areas affected by forest and land fires. Based on data from the Ministry of Environment and Forestry (KLHK), land and forests in Siak Regency have often experienced fire phenomena over the past six years (2018–2024), around 4715 hectares. Every year, from 2015 to 2023, Siak Regency experiences fires that endanger local communities, with the largest fire occurring in 2016, with an area reaching 13,214 hectares. In addition, Siak Regency is also known as a district prone to fires because peatlands cover 57.44% of the administrative area. The condition of peatlands that have high biodiversity and carbon has been impacted by various human activities, both industrial and household economics (Econusantara.org, 2024). The phenomenon of forest and land fires that occur every year in Siak Regency has encouraged the people of Dayun District, Siak Regency, to carry out disaster mitigation efforts integrated with ecotourism. Disaster mitigation not only focuses on disaster prevention but also on other potential aspects, such as community empowerment and increasing the creative economy of rural communities. Disaster mitigation by utilizing ecotourism opens up opportunities for tourists to visit the Dayun District. In the process, Dayun District, Siak Regency is a pioneer area in Riau Province that has launched an ecotourism development program based on the mitigation of forest and land fire disasters and haze (Dharma, Marlinda, et al., 2024; Syamsuadi et al., 2022). Based on this phenomenon, this study focuses on essential concepts in ecotourism development that include 3 (three) dimensions, namely the principle of conservation, the principle of community participation, and the principle

of economy, where the crucial reason underlying the determination of this focus is related to the essential concept of ecotourism that always pays attention to disaster risk parameters, especially in the phenomenon of forest and land fires (Andayani et al., 2022; Nugraha et al., 2022). Therefore, this study aims to explain the existing conditions of disaster mitigation policies and the design of policy strengthening the development of stronger policies.

## **2. Literature review**

### **2.1. Forest fire disaster mitigation governance**

Fundamentally, although forests play an essential role in the social, economic, and environmental sustainability of a country and region, forests are often threatened by natural events, including fires and pests, as well as human activities (Indra et al., 2023; Martinho and Mourao, 2019; Schultz et al., 2019). Destructive fires have shown that controlling forest fires by extinguishing alone is not enough, and planning, preparation, response, and research related to risk reduction must consider the implications of extinguishing limits (Moore, 2019). A study by Panjaitan et al., (2019) explained that the influence of the central and regional governments on controlling forest fires increases along with the increasing level of governance. However, if the role of the central government is high, it will not impact the effectiveness of forest and land fire prevention.

The government needs to make a flexible plan to stop natural disasters in the future (Zamarreño-Aramendia et al., 2020). Some of these plans include communication strategies using social media to educate communities and encourage them to take preventive measures (Rafi et al., 2024; Zamarreño-Aramendia et al., 2020), accelerating disaster hazard education focused on disaster risk reduction (Khaspuria et al., 2024), land use planning focused on forest fire risk reduction (Mockrin et al., 2020; Moore, 2019), developing a meta-framework for fire management and improving performance evaluation (Schultz et al., 2019), encouraging greater integration between land management and fire planning (Friedman et al., 2020; Indra et al., 2023), increasing openness and collaboration (Wunder et al., 2021), and providing agency personnel with the fundamental skills needed to handle challenging fire governance situations (Xiong et al., 2020). Thus, it is crucial to formulate a policy that strengthens forest and land fire disaster mitigation governance and adopts it in disaster management efforts.

### **2.2. Ecotourism development**

Research by Hanyoung Go et al., (2020) explains that interest in ecotourism studies on Google Trends continues to increase over time. Historically, ecotourism has long been believed to be a useful strategy to support sustainable community development and minimize negative environmental impacts on development sites (Baloch et al., 2023; Eshun and Tichaawa, 2020; Stojanović et al., 2021). Several studies have also discussed that ecotourism functions as a form of sustainable tourism to facilitate sustainable community development (Budiyanto et al., 2020; Khaeriah, 2021; Nitivattananon and Thongdejsri, 2019; Salman et al., 2020;

Sukuryadi et al., 2021;). In addition, ecotourism has been promoted to provide a pleasant and relaxing holiday experience while preserving the surrounding ecosystem (Andari, 2023; Saidmamatov et al., 2020; Selivanov et al., 2024).

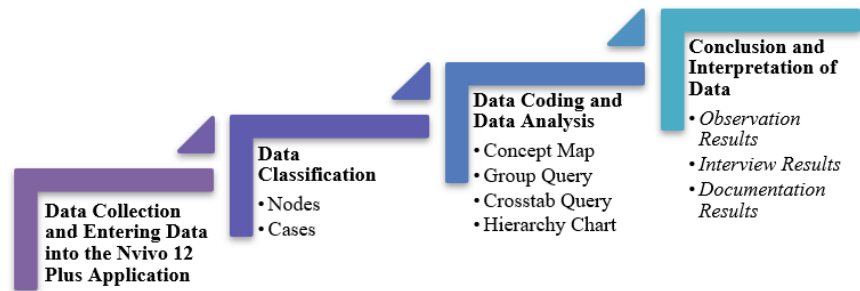
Conceptually, according to research by Nitivattananon and Thongdejsri (2019), the crucial concept of ecotourism development includes 3 (three) dimensions, namely: First, the principle of conservation that demands that ecotourism development must be able to preserve, maintain, and improve natural resources. Second, the concept of community participation emphasizes a development pattern based on concern and respects socio-cultural values and various practices discussed and accepted by the local community. Third, the economic concept emphasizes that in order to achieve balanced development, ecotourism development must be able to support local economic growth and provide benefits to the community in a sustainable manner. In the process, considering that a disaster event cannot be predicted in terms of scale and time, disaster risk parameters can be a standard for the development of relevant ecotourism while still considering disaster mitigation and adaptation management (Andayani et al., 2022; Nugraha et al., 2022; Tiarantika et al., 2024). Therefore, ecotourism development is important in integrating it into disaster mitigation policies, especially in forest and land fires (Jun Zhou et al., 2024; Syamsuadi et al., 2022).

### **3. Methods**

This study uses qualitative research methods to holistically investigate the case studies that occurred (Monique et al., 2020; Wagner et al., 2019). Then, the data in this study consists of primary data and secondary data, where primary data is in the form of observations and interviews with key informants such as the Governor of Riau, Regent of Siak, Head of Dayun District, Head of Dayun Village, Regional Disaster Management Agency of Siak Regency, Commission V of the Riau Provincial DPRD, PT. Bumi Siak Pusako, PT. Berlian Inti Group Siak, Manggala Agni Dayun District and the Dayun District Tourism Awareness Group. Secondary data in this study comes from various sources such as government reports, books, conferences, and relevant research journals. This study will focus on the existing conditions of disaster mitigation governance and the urgency of prevention efforts by designing policy strengthening in disaster mitigation governance based on integrating ecotourism development in Siak Regency using a systematic combination of observation, interview, and documentation data collection techniques.

Furthermore, data analysis was carried out through content analysis using Nvivo 12 Plus software in order to explain the variables and concepts that influence the empirical phenomena of the study by visualizing data based on crucial combinations (Hai-Jew, 2020; Jackson, 2013; Silver and Woolf, 2018; Woods et al., 2015). Data analysis in this study was carried out in several crucial phases: First, the collected data (primary and secondary) were imported into the Nvivo 12 Plus application. Second, data can be classified based on nodes (concepts) and cases (informants). Third, code and analyze data using the concept map analysis feature, group query, crosstab query, and hierarchy chart to visualize concepts (nodes) and informants (cases) based on the results of the research data coding. Fourth, draw

conclusions and interpret primary and secondary data that have been analyzed based on the study context that needs to be answered, as shown in **Figure 2**. Therefore, this article explains the design of policy strengthening in forest and land fire disaster mitigation governance through the integration of ecotourism development in Siak Regency, Riau Province.



**Figure 2.** Research data analysis flow.

Source: Researcher processed data, 2024.

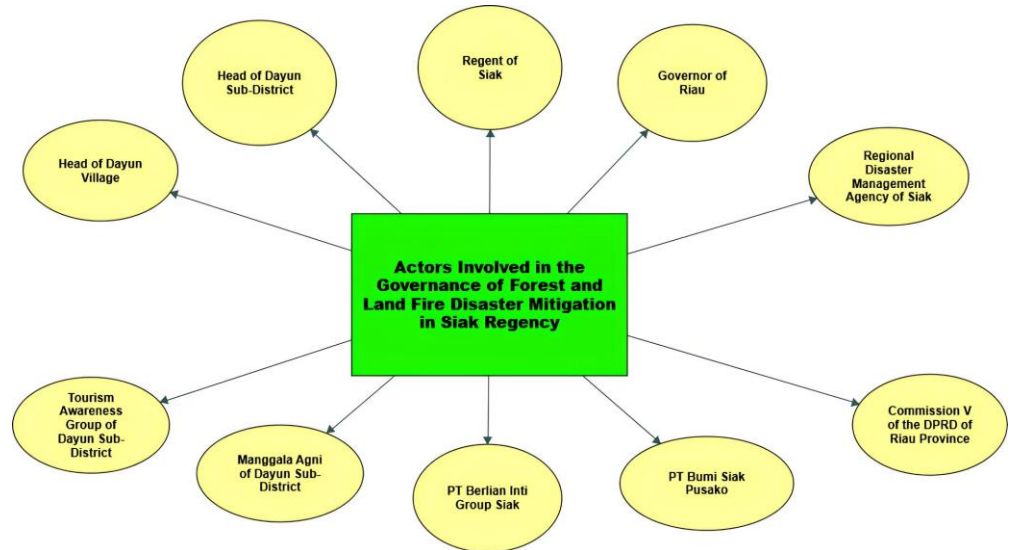
## 4. Results and discussion

### 4.1. Existing condition of ecotourism-based forest and land fire disaster mitigation governance in Siak Regency

Forest and land fires are serious and recurring problems that raise major environmental, economic, and social concerns and are classified as the most challenging problems worldwide (Kathrin, 2019; Xiong et al., 2020). In the context of Siak Regency, Riau Province, this area is also classified as a district prone to fire disasters in Riau Province because its peatlands cover 57.44% and are very vulnerable due to various human activities, including industrial and household economies (Econusantara.org, 2024). Based on the results of observations and interviews conducted with key informants consisting of government, private, and community elements, various actors were found to be involved. They participated in the governance of forest and land fire disaster mitigation in Siak Regency, as seen in (**Figure 3**) which shows the presence of arrow points as variability between actors, including Riau Governor, Siak Regent, Dayun Sub-district Head, Dayun Village Head, Siak Regional Disaster Management Agency, Commission V of the Riau Provincial DPRD, PT. Bumi Siak Pusako, PT. Berlian Inti Group Siak, Manggala Agni Dayun Sub-District and Tourism Awareness Group Dayun Sub-District.

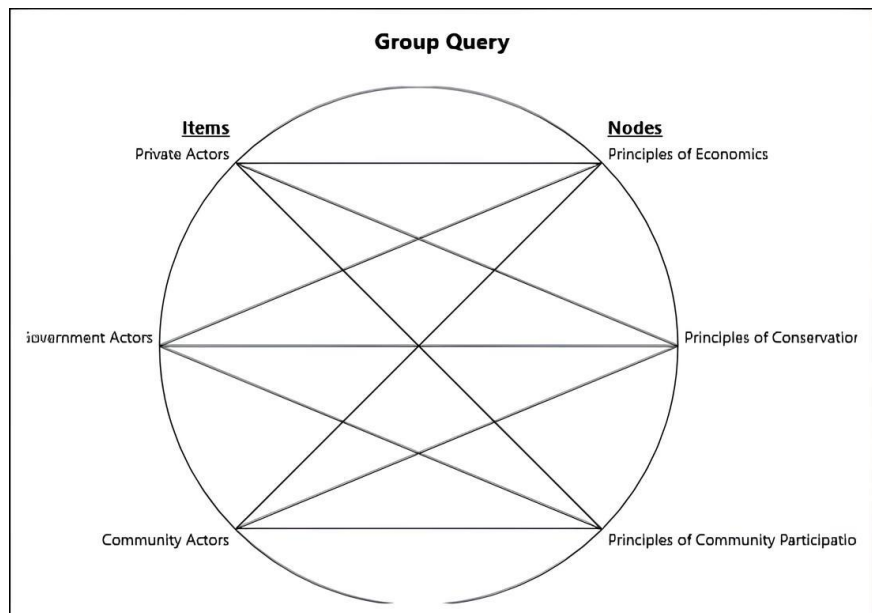
**Figure 3** illustrates the visualization results of the concept map analysis, that explains the diversity of actors (government, private sector, and community) involved in forest and land fire disaster mitigation governance in Siak Regency, Riau Province. In its development, the variability of involvement between actors does not guarantee that all parties have equal access to its realization because there is still complexity related to the position and dominance of power between actors in the disaster mitigation governance process that affects the development of relationships, collaboration, and trust not only for their own organizational goals but also for collective goals. To improve this relationship, all parties must interact systematically and gradually build trust (Aisharya et al., 2022; Nurjanah et al., 2023; Thahir, 2022; Windiani, 2021). Then, based on the results of the group query analysis (**Figure 4**), it

was found that each dimension in the principles of ecotourism development in Siak Regency based on informant perceptions can be seen in each connected line and node, where each informant (government, private sector and community) believes that the principles of conservation, community participation and economic principles have crucial value in their integration into the governance of forest and land fire disaster mitigation in Siak Regency, Riau Province.



**Figure 3.** Actors involved in the governance of forest and land fire disaster mitigation in Siak Regency.

Source: Concept map analysis using NVivo 12 plus, 2024.



**Figure 4.** Informant perceptions in forest and land fire disaster mitigation governance based on ecotourism development in Siak Regency.

Source: Group query analysis using NVivo 12 plus, 2024.

Furthermore, based on the results of further analysis using the crosstab query feature, it was found that each informant had a variety of views explaining the

principles of ecotourism development in forest and land fire disaster mitigation management in Siak Regency as seen in **Table 1** below:

**Table 1.** Existing condition of disaster mitigation governance based on ecotourism development in Siak Regency.

Actors	Principles of Economics	Principles of Conservation	Principles of Community Participation	Total
Community Actors	27,78%	22,22%	50%	100%
Government Actors	33,33%	46,67%	20%	100%
Private Actors	33,33%	26,67%	40%	100%

Source: Crosstab query analysis using NVivo 12 plus, 2024.

**Table 1** shows that each informant, such as the government, private sector, and community, has varying perceptions of the principles of ecotourism development in managing forest and land fire disaster mitigation in Siak Regency. According to the perception of informants (government actors), the principle of conservation is a dominant aspect (46.67%). It must continue to be preserved and prioritized as a step in disaster mitigation management based on ecotourism development. This is because ecotourism can be an effective tool in conservation, especially in the context of Siak Regency, Riau Province, which often faces forest and land fire disaster problems. Currently, ecotourism development in Siak Regency has adopted creative and economical conservation efforts such as disaster mitigation facilities such as reservoirs or water reservoirs, which are then used for ecotourism objects in Tourism Villages, especially Kampung Dayun Village, Siak Regency, which often receives national awards as a tourist village that develops village ecotourism based on forest and land fire disaster prevention. In the process, although the principle of conservation in Siak Regency has been based on the government’s commitment to establishing a policy in the form of Riau Governor Regulation Number 9 of 2020 concerning Permanent Procedures for Criteria for Determining Emergency Status of Disasters and the Command of the Forest and Land Fire Control Task Force in Riau Province, the regulatory aspects related to disaster mitigation prevention through ecotourism development have not been specifically regulated in regional regulations, either governor regulations or regent regulations. Thus, strengthening is still needed in the governance of forest and land fire disaster mitigation in Siak Regency, based on ecotourism development.

Then, according to the perception of informants (private actors), the economic principle in ecotourism development is an important aspect (33.33%) and must be strengthened as a step in its integration into the governance of forest and land fire disaster mitigation in Siak Regency. This is because the existence of ecotourism development based on economic principles can allow all stakeholders to contribute to environmental conservation and ensure that tourism in Siak Regency is in line with ecological conservation efforts. In addition, ecotourism development requires investment in adequate infrastructure such as road access, environmentally friendly facilities, and information centers. This commitment to sustainability is very important, and every policy choice must consider long-term economic, social, and environmental benefits. In this process, Corporate Social Responsibility (CSR) activities through PT. Bumi Siak Pusako and PT. Berlian Inti Group Siak has been used strategically to help develop ecotourism in Siak Regency, emphasizing



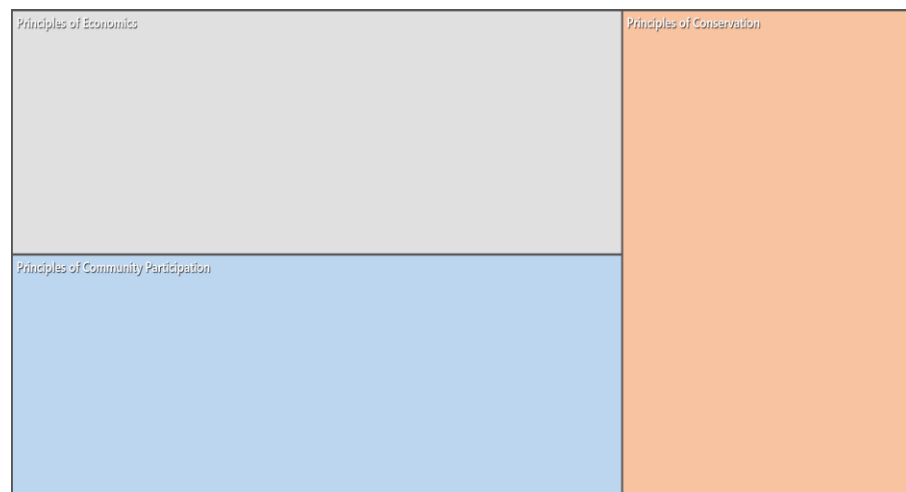
sustainability and community empowerment. Ecotourism development is believed to provide attractive investment prospects for the private sector. Ecotourism projects such as constructing environmentally friendly buildings or managing conservation areas can provide new revenue streams and increase the private sector's investment portfolio. In addition, investing in ecotourism can help a company's reputation. This can demonstrate the private sector's dedication to social and environmental responsibility, which is very important in building strong relationships with stakeholders, including the government and the community. When Siak Regency can manage its ecotourism well, it will certainly be considered a place committed to sustainability, ultimately driving local and national economic growth. However, the governance of forest and land fire disaster mitigation in Siak Regency is still not integrated comprehensively with ecotourism development, especially regarding economic principles.

Furthermore, according to the perception of informants (community actors), the principle of community participation in ecotourism development is the most dominant aspect (50.00%). It must continue to be pushed forward as a crucial step in its integration with forest and land fire disaster mitigation management in Siak Regency. This is based on community belief in the urgency of community involvement in forest and land fire disaster mitigation management, which includes ecotourism integration. By becoming more aware of the impact of fires on the environment and their daily lives, it is believed that the community can take a more proactive approach to maintaining and preserving natural resources to meet daily needs such as agriculture and fisheries and provide profitable alternatives to high-risk tasks such as land relocation and others. Currently, the community feels that the dominance of power by local government elites in policy and its correlation with the existence of financial aspects by the private sector is still a current inhibiting factor in community commitment to be actively involved and tends to create an apathetic attitude by some people in forest and land fire disaster mitigation management based on ecotourism development.

Research by Zakia (2021) explains that community involvement guarantees sustainability in ecotourism development. However, the facts in the findings of this study still show a gap in the involvement of local communities, which is still limited, especially in the availability of information about forest and land fire disasters and ecotourism and the lack of coordination between stakeholders. In addition, this finding is also in line with the study of Koestoer and Prayoga (2021), which explains that the lack of scientific references explaining the physical parameters of peatlands and their relationship to the emergence of hotspots also contributes to the ineffectiveness of government governance and intervention in controlling forest and land fires during the extreme dry season. Therefore, the design of strengthening policies in forest and land fire disaster mitigation governance through integrating ecotourism development in Siak Regency is a crucial instrument that needs to be formulated quickly and precisely.

## 4.2. The importance of strengthening maritime axis policy design in Indonesia

Forest and land fire disaster mitigation management requires a relevant approach to maintain environmental sustainability and its impact on the community's economy (Sidiq and Prawira W, 2019; Unik et al., 2024). Therefore, formulating an appropriate policy-strengthening design will assist the government in disaster mitigation management and environmental preservation and impact community economic growth through ecotourism development (Mulyadi et al., 2021; Nugraha et al., 2022). Based on the results of the analysis through the hierarchy chart feature (**Figure 5**), crucial information was found regarding forest and land fire disaster mitigation management based on ecotourism development in Siak Regency, where the hierarchy chart area on the "economic principle" and "community participation principle" has the widest area which means that the problems and weaknesses of the dimensions of the economic principle and the principle of community participation in forest and land fire disaster mitigation management based on ecotourism development must be accelerated in the resolution process while still paying attention to other dimensions of the problem in the hierarchy chart area, namely the "conservation principle".



**Figure 5.** Recommendations for forest and land fire disaster mitigation governance, based on strengthening the principles of ecotourism development in Siak Regency. Source: Hierarchy chart analysis using NVivo 12 plus, 2024.

Furthermore, **Table 2** below will show in detail the design of policy strengthening in forest and land fire disaster mitigation governance through the integration of ecotourism development in Siak Regency. In the process, the design of policy strengthening based on the analysis of forest and land fire disaster mitigation governance through the integration of ecotourism development (**Table 2**) is the result of the researcher's formulation, which has gone through several crucial stages, such as identifying the parties involved based on their functions and responsibilities in disaster mitigation governance. Then, the main subjects in the policy strengthening design include Government Actors (Governor of Riau, Regent of Siak, Head of Dayun District, Head of Dayun Village, Regional Disaster Management Agency of Siak Regency and Commission V of the Riau Provincial DPRD), Private

Actors (PT. Bumi Siak Pusako and PT. Berlian Inti Group Siak), and Community Actors (Dayun Sub-District Manggala Agni Group and Dayun Sub-District Tourism Awareness Group).

**Table 2.** Design for strengthening policy in forest fire disaster mitigation governance through integration of ecotourism development in Siak Regency.

Number	Policy recommendations	Explanation	Achievement metrics
1	Special regulations related to the prevention and mitigation of forest and land fire disasters are needed based on the integration of the development of the ecotourism principle.	Specific regulations in the regions (governor, regent, and village regulations) related to disaster mitigation prevention through ecotourism development must be issued immediately to strengthen forest and land fire disaster mitigation governance. This is considering that Siak Regency has strategic potential in ecotourism development, especially Dayun Village which received an award as the Top 50 Indonesian Tourism Village Award (ADWI) and an award for the Integrated Reservoir Innovation of Kampung Dayun as the Best Tourism Village in Indonesia for the institutional category in 2022 from the Ministry of Tourism and Creative Economy of the Republic of Indonesia because of its existence in nature tourism, historical tourism, culture, education, culinary tourism, and others. Thus, specific regulations related to disaster mitigation prevention through ecotourism development must be formulated quickly and precisely while still paying attention to its integration with village-owned disaster mitigation facilities in the form of reservoirs, lakes, or reservoirs that are modified as water suppliers in the dry season for forest and land fire disaster prevention activities and also function as a means of local economy-based tourist destinations.	Special regulations exist on the prevention and management of forest and land fire disasters based on the development of more inclusive ecotourism at the Regional Level (Province, Regency, and Village).
2	A balance of roles between actors is needed in determining and implementing ecotourism-based disaster mitigation policies.	The balance of roles between actors must be distributed in determining and implementing ecotourism-based disaster mitigation policies based on accurate and publicly accessible data. In addition, problems in the coordination aspect of various parties such as local governments, private parties, non-governmental organizations, local communities, and ecotourism industry players must be immediately fixed in supporting the acceleration of policy implementation to support environmentally friendly ecotourism and contribute to mitigating forest and land fire disasters in Siak Regency.	Special regulations on forest and land fire disaster prevention and management based on ecotourism development contain concrete articles and explanations about the balanced roles between actors at each level (Province, Regency, and Village).
3	An effective and integrated monitoring system is needed to increase the involvement of strategic actors.	An effective and integrated monitoring system must be implemented to conduct routine evaluations of disaster mitigation policies as an adaptive step in aligning them with ecotourism development in the Siak Regency. The latest technologies, such as early fire detection systems, websites, satellite monitoring applications, and sophisticated communication tools integrated into disaster risk management and ecotourism, can help improve the effectiveness of mitigation and response between actors to forest and land fire disasters. Therefore, in addition to the involvement of government, private and community actors in the context of Siak Regency, the involvement of other actors such as academics and the media who have credible expertise in information and communication technology is still needed for effective supervision of disaster mitigation governance and integration with ecotourism development.	Special regulations on the prevention and handling of forest and land fire disasters based on ecotourism development include explaining budget availability and regulating an effective and integrated monitoring system based on digital technology at all levels (Province, Regency, and Village).

Source: Author elaboration data, 2024.

Based on the illustration in **Table 2**, the policy-strengthening recommendations contain three important aspects. First, special regulations related to the prevention and mitigation of forest and land fire disasters are needed based on the integration of the development of the ecotourism principle. Second, balancing roles between actors is needed to determine and implement ecotourism-based disaster mitigation policies. Third, an effective and integrated monitoring system is needed by increasing strategic actors' involvement. The governance of forest and land fire disaster

mitigation in Siak Regency, Riau Province, can be integrated with ecotourism activities, especially in tourist village areas. The growth of ecotourism in tourist village areas does not have to be focused only on community economic activities. However, it can also be a crucial alternative in forest and land fire mitigation and prevention strategies integrated with digital technology-based ecotourism. Then, policy strengthening needs to be designed by including the use of village-owned disaster mitigation facilities in the form of reservoirs, lakes, or ponds that are modified as water providers during the dry season for forest and land fire disaster prevention activities as well as local economy-based tourist destinations as has been done by the Kampung Dayun Tourism Village, Siak Regency.

Essentially, the way to implement the proposed policy so that it can run effectively (**Table 2**) is to re-identify all stakeholders in the tourism and disaster sectors at the regional (provincial and district), sub-district, and village levels, then formulate and determine policies in the form of specific and detailed regulations (regional-village level) and contain essential aspects such as prevention and management of forest and land fires based on the integration of ecotourism principle development. Then, the regulations that have been issued must regulate and contain crucial points related to the roles of actors in implementing ecotourism-based disaster management policies. In addition, the policies in the regulations issued also need to regulate and establish an effective and integrated monitoring system based on digital technology by partnering and allocating a budget with strategic actors in the field of information technology.

This study's findings substantially align with the findings of Jun Zhou et al., (2024) who explained that ecotourism development is an important concept in efforts to integrate it into disaster mitigation governance in a region. In addition, because a disaster event cannot be predicted in terms of scale and time, disaster risk parameters can be a benchmark for relevant ecotourism development while still paying attention to disaster mitigation and adaptation management that occurs (Nugraha et al., 2022; Tiarantika et al., 2024).

The results of this study confirm that the management of forest and land fire disaster mitigation based on ecotourism development still has weaknesses that need to be strengthened in terms of conservation, economic principles, and community participation. Then, the design of strengthening policies in ecotourism-based disaster mitigation governance includes three crucial policy recommendations, namely requiring special regulations related to the prevention of forest and land fire disaster mitigation based on the integration of ecotourism principle development, requiring a balance of roles between actors in determining and implementing ecotourism-based disaster mitigation policies and the implementation of an effective and integrated monitoring system through increasing the involvement of strategic actors. Substantially, handling forest and land fire disasters in Siak Regency, Riau Province, can be combined with ecotourism activities, especially in tourist villages. The expansion of ecotourism in tourist villages is not always focused on community economic activities alone. However, it can also be a crucial policy in efforts to mitigate and prevent forest and land fires based on digital technology. In addition, policy development in strengthening the utilization of village disaster mitigation facilities such as reservoirs, lakes, or ponds converted into water providers during the

dry season for forest and land fire prevention activities and local economy-based tourism destinations still needs to be developed sustainably.

Our findings are a strategic effort to accelerate awareness building among actors, highlight the need to adopt a policy-strengthening design in ecotourism-based disaster mitigation and contribute to the literature to benefit all stakeholders in developing long-term disaster mitigation policies in the future. However, this study relies heavily on information from several important informants who only represent the perspectives and expertise of stakeholders met by the researcher. Nevertheless, this study still pays attention to important factors such as the knowledge capacity of informants in the disaster and tourism sectors. Therefore, we propose further research on a holistic analysis of sustainable ecotourism-based disaster mitigation governance to promote and accelerate the concept of disaster and tourism in the future.

**Author contributions:** Conceptualization, AS and MRY; methodology, MFA and AF; software, AS and MFA; validation, AS, MRY and AF; formal analysis, MRY; investigation, MFA; resources, AF; data curation, AS and MRY; writing—original draft preparation, AS and MFA; writing—review and editing, AS and MRY; visualization, MFA and AF; supervision, AS; project administration, MFA and AF; funding acquisition, AS. All authors have read and agreed to the published version of the manuscript.

**Funding:** The author would like to thank all parties who have helped and supported the publication of this article, especially the Directorate of Research and Community Service (DRTPM) of the Republic of Indonesia which has funded this research with contract agreement Number 037/LL10/PG.AK/2024, 001/LPPM/KH-DIKTI/PEN/2024. Then, we also express our gratitude to all academicians of the Government Science Study Program, the Faculty of Psychology and Social and Political Sciences, and the Institute for Research and Community Service (LPPM) of Universitas Abdurrah.

**Conflict of interest:** The authors declare no conflict of interest.

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