

Analyzing Forest and Land Fire Disaster Prevention Programs in Riau, Indonesia

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Abstract

In Indonesia, forest and land fires are natural disasters that often occur every year, especially during the dry season. To overcome this, the government, non-governmental organizations, business actors and the community are carrying out programs to handle a paradigm shift in the disaster management model from responsive to more preventive in order to reduce it by emphasizing disaster risk reduction efforts and active involvement. The aim of this research is to examine government, company and non-governmental organization intervention programs related to preventing forest and land fire disasters. Qualitative research methods are used to explore sources of information in answering research questions. Data collection uses open interviews and observations as well as Forum Group Discussions regarding strategic intervention designs carried out by local governments, non-governmental organizations, and local communities. The research results show that the forest and land fire prevention model require a sustainable intervention program. The intervention carried out by the provincial government and local government involves all elements of society, including entrepreneurs, non-governmental organizations, fire care communities, farmer groups and the community itself. The results achieved within three years were a reduction in the incidence of forest and land fires.

Keywords: forest and land fires; intervention; disaster; mitigation

1. Introduction

Indonesia is a country with the highest risk of natural disasters (Waloejo, et al., 2021; Priyono, et al., 2021; Misa et al., 2022). The problem of forest and land fires in Indonesia is influenced by natural and human factors (Fahrudin, 2012). A forest and land fire often occurs every year, especially during the dry season, which causes haze and poses a significant threat to human life and the ecological environment. Dayum Village, Dayun District, Siak Sri Indrapura Regency, Riau Province is an area that has the largest peatland and there is an Emerald Lake which is the largest peat lake in the world. Siak Regency is a district with peat land covering almost 50% of its area. The impact of uncontrolled forest fires, especially on peatlands, causes a wide spread of smoke and causes air pollution and environmental damage to ecosystems. Forest and land fires can occur in forest areas, mineral soil and peat (Page & Hooijer, 2016). Fires on peatlands can trigger the process of rapid spread of hotspots through the above-ground biomass and the peat layer beneath the surface. Almost 90% of peatland forest fires occur due to human factors and only 10% due to natural factors (Suyanto, 2013).

The results of the study show the catastrophic impact of forest fires on physical and mental health indicating dangerous pollutants such as land burning contained in smoke and inhaled can cause respiratory, cardiovascular, cerebrovascular diseases (Wettstein, 2015). The level of pollution from smoke also increased to five times higher than the danger limit according to the World Health Organization (Shavit, et al. 2013). Forest fires also have an impact on the contamination of local drinking water sources. In 2020 research, camp-fires caused contamination of drinking water sources

containing Benzene. This is known to increase the risk of cancer and contribute to hematopoietic toxicity in the body. Forest fires also cause depression and anxiety in refugee victims of fire disasters (Proctor, et al., 2020; Laugharne, et al. 2011).

Currently there is a paradigm shift in disaster management to focus more on the pre-disaster stage for disaster risk reduction. Changes in the disaster management model from responsive to more preventive can be reduced by emphasizing efforts to reduce disaster risk and the active involvement of all parties from government, community-based organizations, companies and communities. Effective forest and land fire disaster prevention and preparedness interventions can prevent disasters and the impact of forest and land fires. Prevention efforts through pruning and thinning of dead trees or branches, dry leaves through the management of potentially flammable can significantly reduce the risk and severity of forest fires. An early detection system using remote sensing technology can help control the potential spread of forest and land fires. Various remote sensing techniques are effective for early detection of forest fires (Scott, et al., 2018; Chuvieco, et al., 2018).

Preventing forest and land fires is the responsibility of the Government and all parties must participate in preventing the impact of fires. Fires are not only handled from a technical point of view but also from an organizational and socio-psychological point of view (Knox & Clarke, 2012). Study of a holistic approach in building disaster-resistant institutions, communities and infrastructure through resilience strategies both related to post-disaster recovery and reconstruction, as well as long-term investment in disaster prevention and mitigation. Community education studies can increase awareness of the causes and dangers of forest fires and increase responsible behavior in forest areas and peatlands. The results of the study show the effectiveness of various public education campaigns in increasing forest fire safety behavior (McCaffrey, et al. 2017).

Studies conducted by researchers found that disaster management does not only involve the government, but also community empowerment in disaster-resilient villages through training and disaster experience does not necessarily increase residents' knowledge and preparedness (Paveglio, et al., 2018). The importance of active participation of communities and vulnerable groups in disaster prevention, preparedness and mitigation intervention models in helping identify needs and challenges faced by communities, as well as building local involvement and capacity to deal with disasters through local wisdom (Pollock, et al., 2019). Community-based organizations need to establish relationships and build trust to enhance community resilience and community preparedness through cross-sectoral partnerships and community engagement strategies (Susanto & Ulfa, 2016; Marengo-Escuderos, et al., 2020; Asian Disaster Preparedness Center, 2004). Other research supports community empowerment strategies during disasters that can prevent and reduce impacts and play an important role in disaster risk management (Rajeev, 2014).

The Prevention and Preparedness Program for Emergency Response to Land and Forest Fires through prevention to reduce the occurrence of forest and land fires and minimize their impact has been carried out by the local government, community and non-governmental organizations through empowering community-based mitigation using a local wisdom approach. Land and forest fire disaster prevention and preparedness interventions through active community involvement and vulnerable groups with community empowerment and strengthening community institutions and organizations with local wisdom-based approaches continue to be intensified to reduce disaster risks and prevent disasters. This research aims to evaluate the results of local government, institutional and community interventions related to the role of stakeholders, community involvement and local wisdom-based approaches in preventing and preparing for current forest and land fire disasters.

2. Method

The researchers used a qualitative approach to carry out situation analysis, namely in addition to reviewing literature on qualitative information related to threats and risks, they also identified coping strategies related to forest and land fire prevention interventions. (Creswell & Creswell, 2017). Data from the qualitative approach was carried out by means of in-depth interviews with respondents from stakeholders from local government elements, non-governmental organizations and the community.

Respondents came from informants: local government: Regional Disaster Management Agency, Non-Governmental Organizations, Palm Oil Plantation Entrepreneurs, Village Heads, and the community. The selection of research samples was carried out using purposive sampling with criteria according to position or position and knowing the risk factors, threats and coping strategies that have been carried out (UNESCO/ISDR, 2006; Pandin & Yanto, 2023).

In this case study we only focus on respondents and informants who work in Riau Province, Siak District and Dayun Village. We believe they are able to provide us with a lot of information about their working conditions, enabling us to gain as much knowledge as possible. Due to their widespread, we used a convenience sampling technique to determine their location number of participants. Practical sampling, also known as accidental sampling, is a non-random sampling technique in which participants who meet certain conditions, such as ease of access, proximity to the landscape, and willingness to participate, are included in the study. Convenience sampling involves selecting participants in an ascending manner displaying an order based on their accessibility. For this study, participants were selected based on their desire to be actively involved in forest and land fires.

For data collection, this study used interviews to collect data because it is the most extensive data collection procedure in qualitative research (Sanjani, 2020). In this study we used thematic inquiry and informal interviews with a typical guided interview procedure. We ask participants to discuss and share experiences regarding aspects of forest and land fires conditions that can affect their lives. The entire interview process is carried out in Indonesian and recorded using a voice recorder (Pandin & Yanto, 2022; Pandin & Yanto, 2023)

At research sites, we act ethically to ensure that our presence is a non-intrusive life and work of informants. Throughout the interview, we hope that the participants will feel comfortable and willing to provide all the information we need openly and honestly. To protect their rights, all research participants were asked to provide their personal consent voluntarily participating in this research. We are the sole holder of all personal data (Yanto & Pandin, 2023).

Interview data analysis was carried out by recapitulating and combining information by conducting a phenomenological analysis study. The results of data analysis on informants were processed based on the themes and meanings that arose from the interpretation of the data collected (Yanto & Pandin, 2023).

3. Results and Discussion

Community-based Disaster Prevention activities are part of Community-based disaster management (CBDM). Active community involvement and participation in recognizing threats or risks and participating in reducing disaster risks is the basis for developing Disaster Resilient Villages, namely a government program related to preparing villages with the ability to recognize threats and be able to organize community resources to prevent disasters or overcome and reduce risks.

The Regional Government has the ambition to contribute globally in reducing the temperature increase to below 1.5°C. In the Enhanced National Determined Contribution (NDC) document, the government increases the emission reduction target by 31.89% independently or with international assistance by 43.20% in 2030. One strategy is to make greenhouse gas emissions absorption in Indonesia at least the same. or greater than that issued or generated. Looking back at the output of greenhouse gases in Indonesia, around 40% comes from the forest and land sector. Therefore, in order to achieve the 2030 Forest and other Land Uses Net Sink target, one of which is in terms of preserving peatlands and mangroves, it is necessary to strengthen sustainable forest management, environmental management and carbon management.

The commitment to Indonesia's Forest and other Land Uses Net Sink 2030 has now been implemented by the Siak Regency and Pelalawan Regency Governments, supported by the Non-Governmental Organization "Elang Association". The commitment of the government and local CSOs to collaborate in a national pilot program for landscape restoration of the Kampar-Kerumutan Peninsula ecosystem, was conveyed at COP Egypt 271 in November 2022.

The Kampar Peninsula has an area of almost 700,000 hectares stretching between Siak and Pelalawan Regencies consisting of natural forest cover and peat swamps. Peat in this area has a depth of more than 4 meters, even at some points more than 7 meters. Maintaining the Kampar Peninsula ecosystem will increase the potential for carbon sequestration which is quite large. However, this area is also still very vulnerable to the risk of forest encroachment for land conversion. Therefore, the local government included its restoration and restoration program in the Pelalawan Regency Medium Term Regional Development Plan 2021-2026.

Community involvement, especially for those who live around the forest, is the key to success in preserving the Kampar Peninsula. Unfortunately, until now their involvement is still minimal, so the struggle to protect the area is quite hampered. Efforts to synergize the interests of protecting forest areas and involving communities need to be made to reduce carbon emissions, including taking action to prevent deforestation and carrying out restoration.

Through field study activities to find out more about peat ecosystem restoration initiatives, especially on the Kampar Peninsula, the Elang Association as a local NGO in Riau will facilitate media visits to discuss with the Riau Provincial Government, experts, environmental organizations and communities around the Kampar Peninsula area.

The Dayun Village is one of the villages in Siak District, Riau, where forest and land fires frequently occur during the dry season. This is because the area is surrounded by peatlands, some of which have been converted into plantations and other economic activities. In an effort to extinguish forest and land fires more effectively, the government built a reservoir, or water source in Dayun Village. This reservoir is an easily accessible source of water so that fires can be prevented from spreading. It turns out that by the village government, the embung was transformed into a cultural and creative tourist spot and then in 2022, Dayun Village was selected to be one of 50 villages that won the Indonesian Tourism Village Award from the Ministry of Tourism and Creative. Residents also produce souvenirs and crafts such as Tanjak, processed watermelon food, and Siak souvenirs for additional alternative income.

The Dayun Village community is also proposing 814 hectares of forest area for the Social Forestry program in the Community Partnership Forest scheme. This is a community effort to gain access to forest area management in the hope of generating economic resources without destroying the area. Apart from that, Dayun Village also has the second largest peat swamp lake in the world, namely Lake Emerald which has now become a national park since May 4th, 2016, of Dayun Tourism Village Social Media Platform.

Emerald National Park covers 31,480 hectares. Data from the Riau Natural Resources Conservation Agency recorded 38 species of birds, 12 of which have protected status, as well as fish species such as Arowana and Belida. This National Park is also home to the endangered Sumatran tiger habitat. In the Zamrud National Park buffer zone area of 1,200 hectares, it is currently proposed to be managed collaboratively, consisting of village communities, non-governmental organizations, the Siak government. There has been a demonstration plot of the Mekar Jaya Farmers Group Association covering an area of 2 hectares which will become a pilot project of the Eagle Association collaboration. On this land there is currently a nursery or planting of non-timber annual plants from the category of Non-Timber Forest Products such as 1 hectare of Petai, areca nut, sugar palm while the other 1 hectare is planted with eggplant, corn, citronella, cayenne pepper, pumpkin and water spinach. It is hoped that cultivating fast-harvesting plant species can provide additional income to members of farmer groups while waiting for non-timber forest products. Communities in the buffer zone area also receive training on water level management through water level management. all parties managing this area help each other through the restoration scheme for the restoration of the Zamrud National Park in the landscape of the Kampar Peninsula to achieve Forest and other Land Uses Net Sink 2030.

Government, Entrepreneurs, NGOs and Communities Interventions

At a meeting with the Community Concerned Fire and Bhayangkara the Community Security and Order Advisor found information on fire management in Dayun Village. Informants said that

since 2014, the handling of fires in Dayun has tended to decrease, but there was a spike in 2016. They discussed the innovative steps taken by the MPA to prevent fires. There was also discussion regarding the development of Dayun Village and the participation of community members in the fire management program. Apart from that, this meeting also discussed patrol activities, MPA training, forest fires, and crime handling. The Disaster Program in 14 Districts involving MPA and the Disaster Resilient Village program were also topics of discussion. The use of satellite applications to monitor hotspots and forest fires as well as the need for assistance and support from the government were also discussed. In the context of the budget, the purchase of bicycles and the involvement of outsiders in patrols is also a topic of discussion. Recommendations for a re-meeting and re-reflection of Tangi Village were also put forward at this meeting.

The Fire Care Community discussed the fire management program in Dayun Village. In this program, socialization, training and team formation are carried out. The Fire Care Community is of the view that there has been a reduction in fires in Dayun Village after the implementation of the program. It was conveyed that the community's experiences and responses to the fire management program in 2017, the fire management program in Bobasapi Village were also carried out. Many Fire Care Community activities are carried out at RPP, including integrated patrols and training. The Fire Care Society is also involved in fighting fires and petty crime in Dayun. This is in line with what has been reported in research by Blaustein and friends in Australia (Blaustein et al., 2023).

The phenomenon is that the majority of Dayun residents are Malay, Minang and Javanese people who live in harmony. Social conflict in Dayun is largely caused by petty crime and drug abuse. The Regional Disaster Management Agency program involves Fire Care Communities in socializing disaster resilient villages. The Fire Care Community feels the importance of cooperation between MPA and Manggala Agni in fighting fires. Apart from that, the establishment of an integrated post in Dayun to help monitor fires. The limitations of applications that can monitor fires in forest areas are overcome with a budget of 100 million used to buy bicycles for conservation in the Putong and Danau Jambud areas. The best access to Putong is via Pelawan, there is a budget for the Pelawan area but it has not been involved in patrol activities. There is a task to explore the causes of forest fires and accidents in certain areas every year.

According to one of the coordinators of the Fire Care Community in Dayun Village, which is a form of intervention to reduce forest fires, programs from MPI, tourism planning in one location, forming village meetings, conflicts with DSI, and the strength of animist practices in Kalimantan. They use socialization, education and legal approaches in MPA Dayun which has 6 members who guard and extinguish fires. There is also collaboration with companies and environmentally conscious groups in Dayun Village to overcome forest fires. Apart from that, the embung development program was also discussed as an effort to improve agriculture in fire-prone areas. This is in line with Burnett's research on flood risk mitigation after wildfire (Burnett & Edgeley, 2023).

Based on the results of interviews, it was found that people in Dayun began to become aware of the dangers of fire after the impact it caused. As a result of the fire, disease and transportation disruption occurred in Dayun. After the 2015-2016 fires, the Fire Care Community and environmental awareness groups carried out various socialization activities such as patrols, socialization through social media, and direct counseling to the community, a village consultation program that invites the community to participate in various activities, such as environmental management and agriculture. In reality, the presence of Non-Governmental Organizations in villages can have a positive or negative impact in resolving conflicts. Research by Forbes-Mewett and colleagues and Newnham also shows that there are programs in place to control the consequences of forest and land fires (Forbes-Mewett & Schermuly, 2023; Newnham et al., 2023).

In meetings with farmer groups, various aspects of agriculture were discovered such as the PKH program, experience as a farmer, price and processing of palm oil, as well as the concept of drilled wells for irrigation. Farmer groups feel the role of humans in Micro, Small and Medium Enterprises and pineapple dodol production. Farmer groups feel that the Family Hope Program comes from government funds for people who cannot afford it. People who receive funds from the Family Hope

Program are considered incapable. Of course, being a farmer has risks, such as if the plants are not cared for properly, the price of agricultural products can fluctuate, but farmers must continue to farm even if agricultural prices are not good. When cultivating peat soil, farmers can plant short-lived crops with the help of dolomite. In addition, farmer groups can plant pineapples and process them into pineapple lunkhead and watermelon growers.

The Dayun village head added information that the success of the village in preventing large fires was by forming a Fire Care Community, coaching and training programs for members of the Fire Care Community, making village regulations prohibiting burning, as well as community empowerment programs to reduce fire risk. In addition, the village head added that the potential for regional development, sustainable development, issues of education and health in the regions, the role of youth in village development, the need for facilities and infrastructure, the importance of community participation in development, economic interests, the role of youth in the economy, youth involvement in organizations local government, as well as the importance of education and health in the regions are program priorities that must be addressed. This was stated and supported by research conducted by Oliveira, Park and Zembe (Park et al., 2023; Zembe et al., 2022; Oliveira et al., 2023).

Furthermore, the Head of Dayun Village stated that the guidance and training program for the Dayun Fire Care Community was carried out by BPD Ekawana and other companies. Dayun Village also allocates a budget for community empowerment through programs for cattle cultivation and horticultural crops. Attention to fire prevention is still needed in the form of patrols, agreements with companies, and community economic empowerment. The cork culture program is also implemented by planting horticulture in the middle of an oil palm plantation.

The biggest problem at the moment is the lack of funding for village development. The development of oil palm farming is a potential income. Challenges in managing AS-PTSL and improving the quality of education. There needs to be cooperation with other villages for environmental development. Education and health in the village still need to be improved because there are still several older generations that prevent the younger generation from getting an education and hinder village development. Therefore, a leader who is responsive and committed to advancing the village is needed. Agricultural development and improving the quality of life in the village are the focus of the village government. In addition, there is a need for good support and assistance in the development of Community Social Programs.

In a meeting with the Tourism Awareness Group, it discussed efforts to socialize and prevent forest and land fires. The people in Dayun realize that forest fires are a common threat, and they work together to overcome this problem. Penggulu and the Community Fire Care for Dayun play an important role in coordinating and inviting the community to join. There have been attempts to solve the burning problem by planting crops such as watermelons between the oil palms. The Fire Care Society is also involved in fire monitoring and prevention. There are challenges in the socialization process, such as societal skepticism and cultural differences. However, with a collaborative approach and firm law enforcement, they have succeeded in increasing community awareness and involvement in preventing forest fires. They also maintain relations between villages in a coordinated manner and share knowledge in dealing with forest fires. There is an Early Warning System that uses flags to indicate the level of fire. It can be seen that the rowing model in managing forest fires is very effective in increasing community participation and building collective awareness.

At a meeting with the Alam Siak Lestari business, they discussed the company's business development plans, which operate in the processing of snakehead fish and related products. They also discussed challenges in business development, such as underdeveloped markets and the availability of raw materials. Currently, the company is still trying to achieve positive cash flow and continue to expand the market. They also want to involve village communities as shareholders in the company. This company's products have not yet been launched commercially, but there are several products that have been tried and are still in the testing phase.

In the meeting it was stated that their main product is called *albugo*, which is the product that completes all operations. They also have by-products such as albumin, protein balls, collagen, skin

flour, calcium flour, and others. This company focuses on making products from fish waste. They have collaborated with Village-Owned Enterprises and villages that have the potential for forest fires. The prices of their products are adjusted to the market. Currently they are still in the periphery stage and are focused on increasing the market and supply of raw materials. They want to build a sustainable company with positive cash flow. Their products have obtained distribution permits and are locally based.

The results of the Group Discussion Forum with the Regional Disaster Management Agency of Siak Regency, Riau Province discussed fire management and evacuation in disaster-affected areas. They discuss their experiences in fighting fires, how to deal with emergency situations, and strategies used to control fires. They expressed the need for more resources and government attention in fighting fires. They also discussed the important role of the community in helping to fight fires and rescuing endangered animals. This is in line with the research of Ahmed and Ledger and Zohar and friends (Ahmed & Ledger, 2023; Zohar et al., 2023).

4. Conclusion

The Forest and Land Fire Disaster Prevention Program in Riau, Indonesia is one of the best practices for preventing fire disasters through sustainable programs. The intervention carried out by the provincial government and local government involves all elements of society, including entrepreneurs, non-governmental organizations, fire care communities, farmer groups and the community itself.

Evaluation of successful intervention models in preventing forest and land fires in Riau shows the continuity of the program with community economic activities that can support their survival. By involving various parties and connecting community livelihood activities, the community indirectly realizes the importance of preventing forest and land fires. Apart from that, the internalization of this awareness is included in their daily lives so that it can be passed on from one generation to the next.

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