Journal of Natural Resources and Environmental Management
12(4): 669–678. http://dx.doi.org/10.29244/jpsl.12.4.669–678
E-ISSN: 2460-5824
http://journal.ipb.ac.id/index.php/jpsl

Civil society participation model: forest and land fire prevention policy in Jambi Province

Cici Sundari, Eko Priyo Purnomo, Aqil Teguh Fathani

Department of Government Affairs and Administration, Jusuf Kalla School of Government, Muhammadiyah Yogyakarta University, Bantul, Daerah Istimewa Yogyakarta, 55183, Indonesia

Article Info:
Received: 18 - 07 - 2022
Accepted: 17 - 09 - 2022

Keywords:
Community participation, cooperation, fire management

Corresponding Author:
Cici Sundari
Student of Master's Program of Government Affairs and Administrasion, Universitas Muhammadiyah Yogyakarta;
Tel. +6285267309461
Email: cicisundari06@gmail.com

Abstract. *This study analyses the factors influencing community participation in forest and land fire prevention. The focus of this research is on Jambi Province. This study uses a qualitative descriptive method to describe, record, analyze and interpret the current or existing conditions. The informants in this study were the people of Jambi Province, consisting of the Jambi Provincial Forestry Service and ordinary people. Data analysis used the NVivo 12 plus data processing application, a qualitative document analysis tool with computer assistance. They are easy to use and can process words and explore word frequency, attributes, and cases from big data, generating factor categories in journalistic and research applications related to the research topic. The results showed that the government made a strategy to encourage community participation in environmental management cooperation, especially in overcoming the problem of forest and land fires in Jambi Province. Informal reactions from the community can be seen through the government's policy to create a Fire Care Group Program that is motivated by community aspirations for forest and land fires. The government formed a Fire Care Group to reduce the number of forest and land fires.*

How to cite (CSE Style 8th Edition):
Sundari C, Purnomo EP, Fathani AT. 2022. Civil society participation model: forest and land fire prevention policy in Jambi Province. JPSL **12**(4): 669–678. http://dx.doi.org/10.29244/jpsl.12.4.669–678.

INTRODUCTION

Community participation in overcoming forest and land fires in Jambi Province; forest and land fires often occur in every dry season in Indonesia (Rauf *et al.* 2020). The case of forest fires is an annual disaster that regularly happens in Indonesia, including one in Jambi Province (Suhendri and Purnomo 2017). The government has carried out various prevention efforts, and the achievement of prevention is inseparable from the participation of the surrounding community. Community participation is essential because it is the implementer of multiple activities pursued by the Government (Schultz *et al.* 2019). This study was conducted because forest fires have an important impact on evaluating government efforts to strengthen local institutions that deal with forest fire incidents (Purnomo *et al.* 2021a). This research was conducted because forest fires have an important impact on evaluating the government's efforts to strengthen local institutions that deal with forest fire incidents (Purnomo *et al.* 2021b).

In modern times like now, the use of forests in tourism has intensified both by local communities and governments (Tan *et al.* 2020). This forest is utilized to support the economic region, as well as a tangible form of the community and local government in synergy always to protect and preserve forests for the sake of survival in the future (Molina-Terrén *et al.* 2019). Forests are one part of the environment. Forests are also a

national development capital that has real benefits for the life and livelihood of the Indonesian people, both ecologically, socio-cultural, and economically. Forests play a significant role in human life, evident with the protection, shade, and products needed by humans for their survival (Abdulsahib and Khalaf 2018). The problem of forest fires often occurs in Indonesia, whether human activities cause it or are caused by a long dry season (Nisa and Suharno 2020). So that it has negative impacts caused by forest fires, such as ecological damage, decreased forest economic value and land productivity, micro and global climate change, and human health (Zhang *et al.* 2019). This is because the handling of forest and land fires is more focused on repressive efforts, namely efforts that individuals can make, groups, or the government to control the community. For this reason, forest and land fire management policies must be re-evaluated to find the best solution to avoid forest and land fires (Saharjo and Nurjanah 2021).

Figure 1 explains data on forest fires that occurred in the last five years in Jambi Province in 2017–2021, fire data has increased and decreased in forest areas and areas where fires occurred in Jambi Province. The highest fire area data occurred in 2019, namely the area of forest fires reaching 56.592,00 hectares. Furthermore, data on forest fires decreased until 2021, reaching 540,00 hectares. In solving forestry problems, it is necessary to involve stakeholders (government, private, and non-governmental institutions) because forestry problems are increasingly complex and essential. There is a need for strategies and efforts to overcome current and future forestry problems (Zainuddin *et al.* 2019).

Law enforcement efforts continue to be carried out by implementing several instruments ranging from prevention, security, and administrative sanctions to civil and criminal law enforcement (Bentley and Penman 2017). The purpose of this study is to analyze the factors that influence community participation in forest and land fire prevention in Jambi Province and to assist the government in forest protection efforts for the balance of the surrounding environment and the sustainability of living things in the future (Solekhan and Febriharini 2022). Based on this, it is essential to study and analyze the factors influencing community participation in forest and land fire prevention in Jambi Province. This research will assist the government in increasing law enforcement efforts, monitoring forest fires, and community participation in protecting forests, especially in Jambi Province (Musri *et al.* 2020).

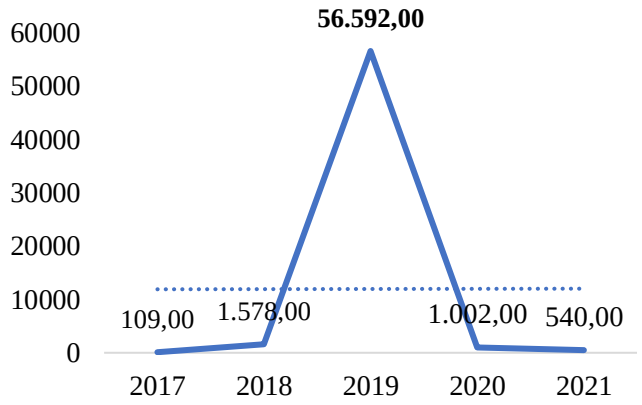

Figure 1 Forest fire data in Jambi Province

The Role of Local Governments in Forest Management

The government's role is critical in realizing forest conservation and development for the government's policies to preserve customary law communities (Nikolakis and Roberts 2020). Effective forest management is based on the multipurpose use of existing forest resources and their ecological functions. The multifunctional principle focuses on sustainable forest management by considering environmental, economic, and social factors (Teguh *et al.* 2021). The intended government policies are those relating to protecting the rights of indigenous peoples and the empowerment of indigenous peoples, which are expected not to overlap with

customary law. In this regard, the Department of Culture and Tourism makes road infrastructure in tight areas a work priority to facilitate the community. Forest status is not recognized separately from state and private forests (Wantu *et al.* 2021).

This, of course, invites conflict between the state and indigenous peoples. For example, with forest conditions that fall within the scope of state forest status, the state may issue the granting rights to cultivate forest areas controlled by legal communities (Siombo 2021). On the other hand, the damage to the forestry sector is caused by government regulations that are not pro-environmental. The facts show that the Indonesian Government 2008 issued Government Regulation No. 2 in 2008. Rules govern non-tax state revenues from using forest areas for development outside forestry activities. This approach to forest management is based on ecosystems, forest management by society does not entirely depend on legal formalities (Aprianto 2021).

Community Participation

In community participation in development, it can be concluded that the needs largely determine community participation, community interests, customs, and characteristics that bind each community member to one another (Yang *et al.* 2019). In a straightforward form, it is a form of contact and providing information with the authorities regarding forest fires and timber theft, explaining the structure of participation in the form of communication and providing information (Sekulic *et al.* 2019). Therefore, what is needed is not an approach that emphasizes capital formation, but what is more important is studying the workforce and providing job opportunities. And this requires priority on the issue of participation; participation can be directed at four goals (Palaiologou *et al.* 2021).

First participation in decision-making. Second, participation in implementation. Third, participation in utilizing, and fourth, participation in evaluation (Laschi *et al.* 2019). Involvement in decision-making is mainly related to determining alternatives with the community regarding ideas or ideas that concern common interests (Andriani *et al.* 2018). Participation in implementation includes mobilization of funding sources, administrative activities, coordination, and program elaboration; participation in benefit-taking and participation in benefit-taking cannot be separated from the implementation results that have been achieved in terms of quality and quantity. Participation is shown by the community in efforts to make forests sustainable and prevent forest fires (Rauf *et al.* 2020).

METHODS

Time and Location

This research was conducted from April 2022 to July 2022 in Jambi Province, covering all areas in Jambi Province to see community participation in forest and land fire prevention. Because the success of forest and

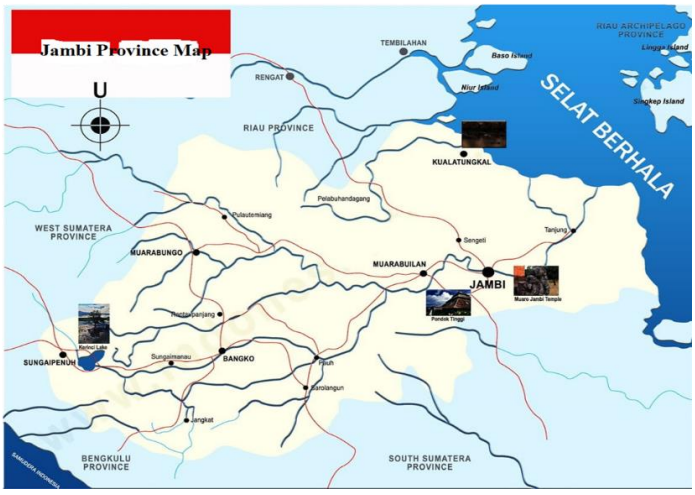

Figure 2 Area of forest fires in Jambi Province

land fire prevention and control activities is very dependent on the success of uniting local communities in emotions, feelings and enthusiasm to preserve forests and requires a forest and land management approach that understands human aspects, as shown in Figure 2.

Data Collection

This qualitative descriptive study was conducted to analyze Community Participation in preventing forest and land fires in Jambi Province. This descriptive research describes, records, analyses and interprets current or existing conditions (Rauf *et al.* 2020). The informants in this study were the people of Jambi Province, consisting of the Jambi Provincial Forestry Service and ordinary people. This research data consists of primary data from research subjects using in-depth interviews and secondary data from the Jambi Provincial Forestry Service.

Data Analysis

The analysis of this study uses Nvivo 12 plus as a qualitative analysis tool (Sundari *et al.* 2022). The qualitative approach explores and describes the efforts to deal with forest fires in Jambi Province. Next, analyze how management collaborates in making new policy strategies for handling forest fires in Jambi Province so that the results of this study can determine the role and contribution of each actor in the government's efforts to influence community participation in forest and land fire prevention in Jambi Province (Purnomo *et al.* 2021b). The Nvivo 12 Plus analysis tool makes it easier for researchers to process and display the data that the researcher narrates. Figure 3 describes the framework illustrating the coordination used by network forms. The coordination network model will show the values of actors who play a role and contribute to the forest fire prevention sector and government programs in increasing community participation in preventing forest and land fires in Jambi Province.

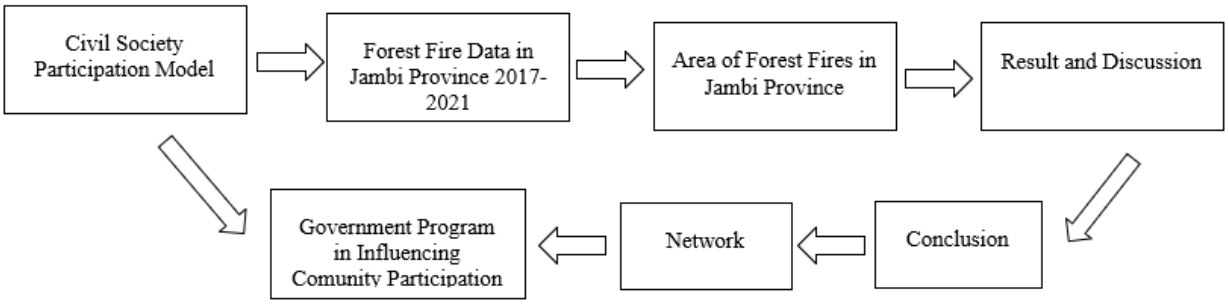

Figure 3 Area of forest fires in Jambi Province

RESULT AND DISCUSSION

Community participation is no longer a matter of whether they want to participate but rather the extent to which they will benefit from their socioeconomic life through this participation. Informal reactions from the community can be seen through the government's policy of making the Fire Care Group program which is motivated by community aspirations for forest and land fire incidents (Zainuddin *et al.* 2019). The government created the Fire Care Group to reduce the number of forest and land fires (Suhendri and Purnomo 2017). The government also routinely conducts socialization to the community in Jambi Province so as not to burn land indiscriminately and also provides socialization after forest and land fires.

With the formation of fire-aware communities, the community helps build water storage points and provides technical training to prevent forest and land fires (*karhutla*). Through the socialization of the Fire Care Community (MPA/*Masyarakat Peduli Api*) group, the Jambi Provincial Government collaborates with the community by always caring, maintaining communication and embracing the community through village

officials. With the implementation of the program for the formation of the Fire Care Group initiated by the government to prevent and control forest and land fires, cooperation between the community and firefighters has been well established (Syarifah *et al.* 2020). This is proven when a fire occurs; the community immediately reports the incident to the officers. The community also helps extinguish the fire by dousing the fire spot with water. The following are government policy factors to influence public participation (Figure 4).

Figure 4 describes the government's efforts to influence community participation in forest and land fire prevention and strategies developed by the government to encourage community participation in cooperation in environmental management, especially in overcoming the problem of forest and land fires in Jambi Province:

1. Opportunity: Providing Land Processing Opportunities, with the opportunity for local communities to cultivate the land around the forest, the community will participate in protecting the forest and land from fires because they are worried that fires will also damage the land they cultivate;
2. Incentives: with the provision of incentives, the community will benefit from their active participation in preventing and overcoming fires and improving their socioeconomic life (Rauf *et al.* 2020). Incentives can be given by developing alternative products that the community can produce that function as a firebreak;
3. Stimulus and Encouragement: stimulation and encouragement will stimulate their emotions and feelings to be involved in fire prevention and control. This stimulation and encouragement can be carried out through public awareness activities such as: raising awareness from an early age, efforts to increase public awareness of forest functions, measures to prevent or reduce the occurrence of fire sources created by communities around the area, and facilitating community access in vulnerable areas fire;
4. Improving Community Capacity: Community capacity building can be done through training or counseling activities such as applying alternative techniques to reduce the use of fire in land preparation and training on fire control;
5. Guidance: activities involving the community will run well if guidance is from related parties. Its duties include forming public awareness, assisting the community in preventing and controlling forest fires, and supervising and providing understanding to local communities.

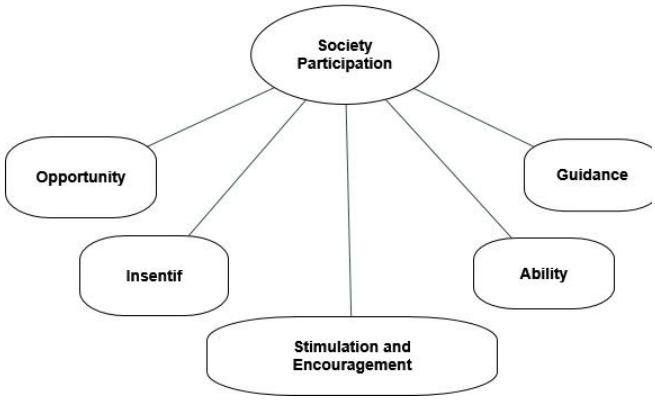

Figure 4 Factors affecting community participation

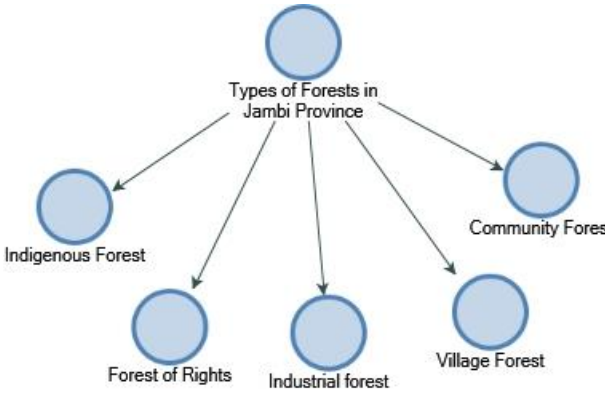

Figure 5 Types of forests in Jambi Province

The government is also preparing a strategy to influence community participation in forest and land fire prevention in Jambi Province. So far, the government has carried out socialization to the community both directly, such as conducting disaster management training, making water storage points and by distributing browsers, banners and billboards. Figure 5 describes the existing forest types throughout the Jambi Province and have different potentials: (1) Community forestry is a form of social forestry scheme given by the government to the community to manage and utilize forest areas to improve welfare and environmental sustainability and empower the community; (2) A village forest is a state forest managed by village institutions to help the community's economy and prosper the village; (3) A private forest is a forest located on land

encumbered with certain land rights outside the state forest area as a state forest. The private forest is evidenced by certificates of ownership, business, and use rights; (4) A customary forest is a forest located within customary law communities' territory that aims to improve their welfare; (5) Industrial plantation forest is managed based on the principle of optimal utilization by considering the preservation of the environment and natural resources and applying economic principles in their exploitation to obtain the maximum benefit.

Figure 6 describing the inhibiting factors in handling forest and land fires faced by the Jambi Provincial Government, several indicators often become obstacles to a forest and land handling when fire incidents occur (Madsen *et al.* 2018): (1) Obstacles faced by the Government and the Regional Disaster Management Agency are remote locations and steep terrain; the location of the fire is difficult to reach, making it difficult for firefighting to reach the location, which results in delays in extinguishing the fire; (2) Limited water sources from the fire location so that fires that have been burned will rekindle and access roads that cannot be passed by vehicles, making it difficult for the task force (task) to deal with forest and land fire disasters; (3) Limited equipment and equipment available at the location must be able to be used in an emergency by disaster officers, such as transportation equipment (transportation) for the evacuation of victims both on land (trucks), water (rubber boats), and air (helicopters) (Ertugrul *et al.* 2021).

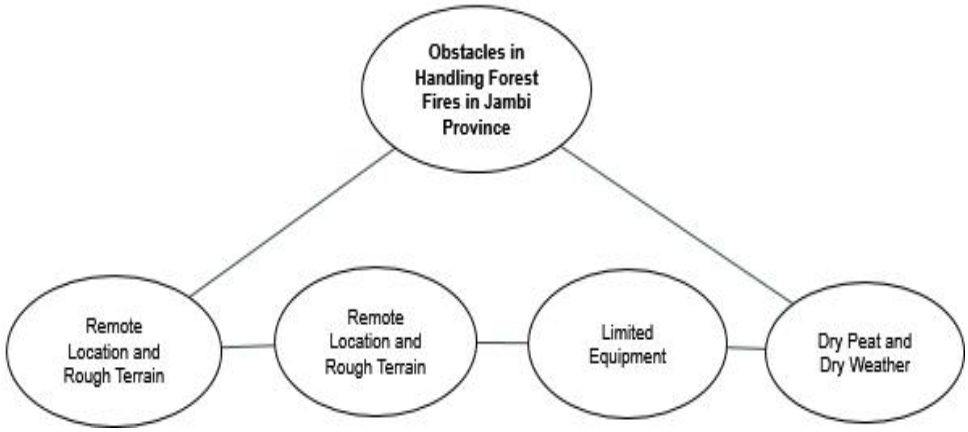

Figure 6 Inhibiting factors in forest fire handling

Likewise, other equipment includes telecommunications equipment, electricity generators, rescue equipment, early taxi equipment, bulldozers, forklifts, and others. In disaster management, officers face many obstacles regarding equipment, such as being unusable, not good quality, or even not having information on where to place the equipment. good condition and easy to find (Maghari *et al.* 2021). When the task force is about to be dispatched to the location, it often does not have information about where the equipment is readily available, so they are slow to take definite and appropriate action; (4) Dry peat soil and dry weather make fires easy to spread and difficult to extinguish by the task force, which makes fire suppression obstacles (Collins *et al.* 2019).

Figure 7 describe the government's efforts in overcoming obstacles in handling forest and land fires in Jambi Province, starting from routinely conducting government patrols in collaboration with communities concerned with fires and establishing command posts at every forest border; Forest patrols are essential to maintain forest security, especially from the possibility of forest fires and illegal logging (Fernandes 2020). Rife forest fires require that forest patrols and surveillance be carried out more routinely and strictly. Especially if the long dry season arrives, forest patrols must be carried out more often (Izumi *et al.* 2021). Furthermore, conducting socialization to fire-aware communities by adding facilities and infrastructure, conducting training and simulations on forest and land fire prevention, installing warning signs for the prohibition of forest and land burning, and making campaigns in print and electronic media. And finally, the addition of human resources, such as being given sufficient funds, facilities, and infrastructure so that they can control forest and land forest fires in Jambi Province (Bhuvaneshwari *et al.* 2019).

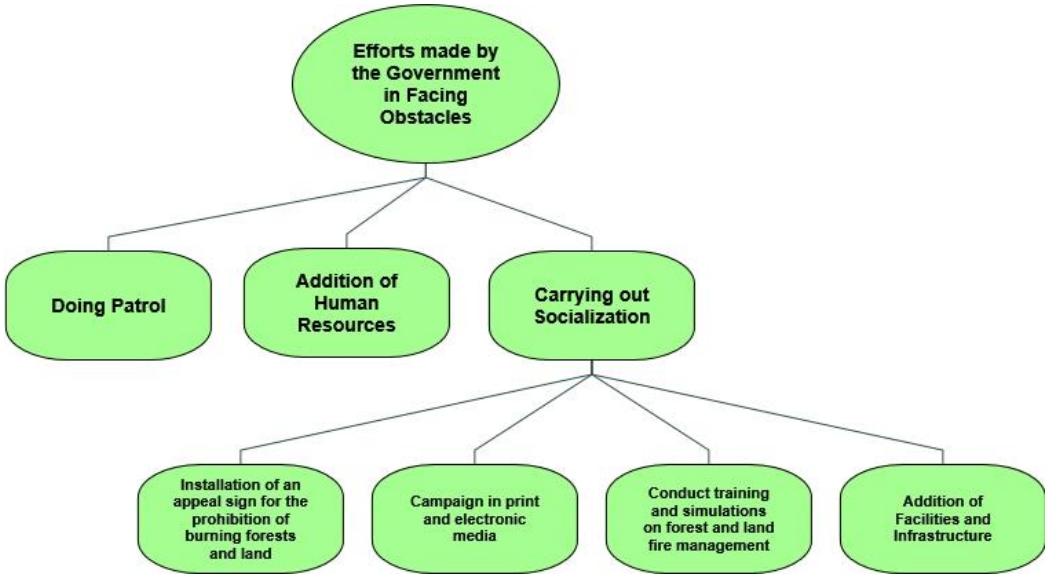

Figure 7 Government efforts in facing obstacles

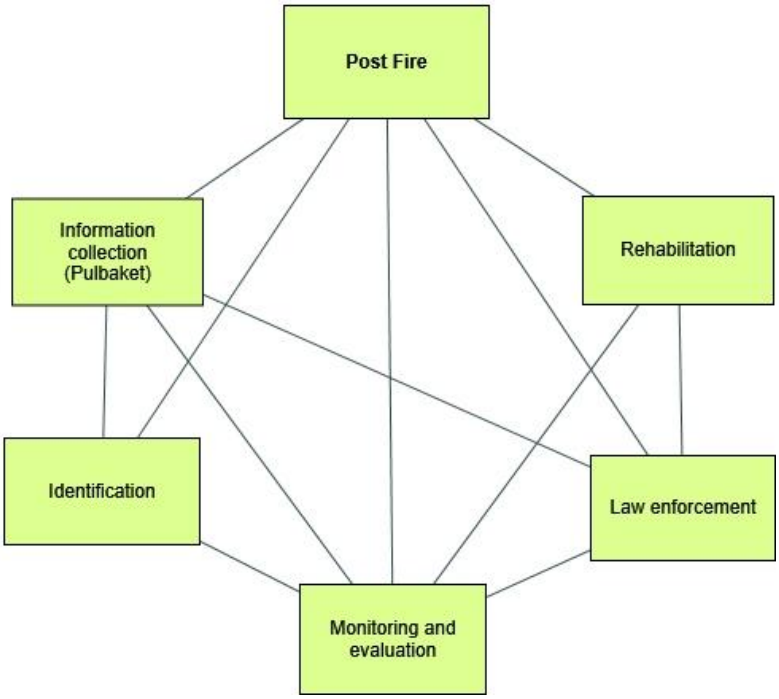

Figure 8 Handling factors after forest and land fires

Figure 8 describes handling activities after forest and land fires in Jambi Province, all efforts, actions, or activities that include inventory, monitoring and evaluation, and coordination to address locations after the forest and land fires occur (Aminah *et al.* 2020). After the forest and land fires are handled through activities: (1) Collecting information material (collection of materials and information) through field checks on burned areas using monitored hotspot data and collecting soil samples, plants, and hills in the fire area; (2) Identification is made to find out the cause, the area of the fire, the type of vegetation burned, and the effect on the environment and ecosystem; (3) Monitoring and evaluation are carried out to monitor the fire control activities that have been carried out and the development of the former fire area (Arisanty *et al.* 2021); (4)

Rehabilitation is carried out in the context of rehabilitating ex-fire areas by considering recommendations or inputs based on data and information obtained from identification results; (5) Law enforcement is carried out in the context of efforts to take legal action in the field of forest fires by starting with the collection of materials and information relating to the occurrence of violations as investigation material (Musri *et al.* 2020).

CONCLUSION

Participation is essential to a policy's success in achieving an expected goal. So far, the performance of the Fire Care Community in tackling forest and land fires is constrained by the facilities and infrastructure to carry out their duties, one of which is the lack of supporting tools. In extinguishing the fire. Collaborating with the Emergency Task Force for Forest Fire Management in Jambi Province and seeing community participation is no longer a matter of whether they want to participate. Still, to what extent will they get their socioeconomic benefits through involvement in life. The success of forest and land fire prevention and control (extinguishing) activities depends on bringing local communities into their emotions, feelings, and enthusiasm to conserve forests. This requires a forest and land management approach that understands the human aspect. Informal reactions from the community can be seen through the government's policy to create a Fire Care Group program that is motivated by community aspirations for forest and land fires. The government formed the Fire Care Group to reduce the number of forest and land fires.

ACKNOWLEDGEMENTS

This research work is supported by the Master of Government Science study program at the University of Muhammadiyah. In addition, the authors would like to thank Budi Effendi Manalu and Melati Anissa, who have assisted in the data collection.

REFERENCES

Abdulsahib GM, Khalaf OI. 2018. An improved algorithm for fire detection in a forest using wireless sensor networks. *International Journal of Civil Engineering and Technology*. 9(11):369–377.

Aminah, Krah CY, Perdinan, Perdinan. 2020. Forest fires and management efforts in Indonesia (a review). *IOP Conference Series: Earth and Environmental Science*. 504(1):1–7.

Andriani Y, Rosnita, Yulida R. 2018. Penanggulangan kebakaran lahan di Desa Tanjung Peranap Kecamatan Tebing Tinggi Timur Kabupaten Kepulauan Meranti. *Indonesian Journal of Agricultural Economics (IJAE)*. 9(2):244–250.

Aprianto A. 2021. Strengthening global governance: Indonesia's court and the Central Kalimantan forest fire case. *Lampung Journal of International Law*. 3(1):1–18.

Arisanty D, Muhaimin M, Rosadi D, Saputra AN, Hastuti KP, Rajiani I. 2021. Spatiotemporal patterns of burned areas based on the Geographic Information System for fire risk monitoring. *International Journal of Forestry Research*. 2021:1–10.

Bentley PD, Penman TD. 2017. Fire risk management trade-offs for koalas and people. *International Journal of Wildland Fire*. 26:455–468.

Bhuvaneshwari S, Hettiarachchi H, Meegoda JN. 2019. Crop residue burning in India: policy challenges and potential solutions. *International Journal of Environmental Research and Public Health*. 16(5):1–19.

Collins BM, Miller JD, Knapp EE, Sapsis DB. 2019. A quantitative comparison of forest fires in central and northern California under early (1911-1924) and contemporary (2002-2015) fire suppression. *International Journal of Wildland Fire*. 28(2):138–148.

Ertugrul M, Varol T, Ozel HB, Cetin M, Sevik H. 2021. Influence of climatic factor on changes in forest fire danger and fire season length in Turkey. *Environmental Monitoring and Assessment*. 193(1):1–7.

Fernandes PM. 2020. Fire country: how indigenous fire management could help save Australia. *International Journal of Wildland Fire*. 29(11):1–11.

Izumi T, Sukhwani V, Surjan A, Shaw R. 2021. Managing and responding to pandemics in higher educational institutions: initial learning from COVID-19. *International Journal of Disaster Resilience in the Built Environment*. 12(1):51–66.

Laschi A, Foderi C, Fabiano F, Neri F, Cambi M, Mariotti B, Marchi E. 2019. Forest road planning, construction and maintenance to improve forest fire fighting: a review. *Croatian Journal of Forest Engineering*. 40(1):207–219.

Madsen RS, Haynes HJG, McCaffrey SM. 2018. Wildfire risk reduction in the United States: leadership staff perceptions of local fire department roles and responsibilities. *International Journal of Disaster Risk Reduction*. 27:451–458.

Maghari AM, Al-najjar IA, Al-laqtah SJ. 2021. *Books' Rating Prediction Using Just NN*. 5(3):43–48.

Molina-Terrén DM, Xanthopoulos G, Diakasis M, Ribeiro L, Cballero D, Delogu GM, Viegas DX, Silva CA, Cardil A. 2019. Analysis of forest fire fatalities in Southern Europe: Spain, Portugal, Greece and Sardinia (Italy). *International Journal of Wildland*. 28:85–98.

Musri I, Musri I, Ainuddin AN, Ainuddin AN, Hyrul MHI, Hazandy AH, Hazandy AH, Azani AM, Mitra U 2020. Post forest fire management at tropical peat swamp forest: A review of Malaysian experience on rehabilitation and risk mitigation. *IOP Conference Series: Earth and Environmental Science*. 504(1): 1–7.

Nikolakis W, Roberts E. 2020. Indigenous fire management: a conceptual model from literature. *Ecology and Society*. 25(4):11.

Nisa AN, Suharno S. 2020. Penegakan hukum terhadap permasalahan lingkungan hidup untuk mewujudkan pembangunan berkelanjutan. *Jurnal Bina Mulia Hukum*. 4(2):259–312.

Palaiologou P, Kalabokidis K, Troumbis A, Day MA, Nielsen-Pincus M, Ager AA. 2021. Socio-ecological perceptions of wildfire management and effects in Greece. *Fire*. 4(2):1–20.

Purnomo EP, Ramdani R, Agustiyara, Nurmandi A, Trisnawati DW, Fathani AT. 2021a. Bureaucratic inertia in dealing with annual forest fires in Indonesia. *International Journal of Wildland Fire*. 30(10):733–744.

Purnomo EP, Zahra AA, Malawani AD, Anand P. 2021b. The Kalimantan forest fires: an actor analysis based on supreme court documents in Indonesia. *Sustainability (Switzerland)*. 13(4):1–12.

Rauf R, Zainal, Prayuda R, Rahman K, Yuza AF. 2020. Civil society's participatory models: a policy of preventing land and forest fire in Indonesia. *International Journal of Innovation, Creativity and Change.* 8(1):64–73.

Saharjo BH, Nurjanah YE. 2021. Peran masyarakat dalam pengendalian kebakaran hutan di Bkph Slarang Kph Pemalang. *Jurnal Sivikultur Tropika*. 12(2):78–85.

Schultz CA, Thompson MP, McCaffrey SM. 2019. Forest Service fire management and the elusiveness of change. *Fire Ecology*. 15(1):1–15.

Sekulic MT, Boskovic N, Milanovic M, Letic NG, Gligoric E, Pap S. 2019. An insight into the adsorption of three emerging pharmaceutical contaminants on multifunctional carbonous adsorbent: Mechanisms, modelling and metal coadsorption. *Journal of Molecular Liquids*. 284:372–382. doi: https://doi.org/10.1016/j.molliq.2019.04.020.

Siombo MR. 2021. Local wisdom is essential material for drafting local government regulations. *Linguistics and Culture Review*. 5(S3):1067–1075. https://doi.org/10.21744/lingcure.v5ns3.1690.

Solekhan M, Febriharini MP. 2022. Forest and land fire management strategies: prevention and law enforcement. *International Journal of Educational Research and Social Sciences*. 3(1):567–580.

Suhendri, Purnomo. 2017. Penguatan kelembagaan dalam pencegahan dan pengendalian kebakaran hutan dan lahan di Kabupaten Muaro Jambi Provinsi Jambi. *Journal of Governance and Public Policy*. 4(1):174–204. doi:https://doi.org/10.18196/jgpp.4175.

Sundari C, Nurmandi A, Muallidin I, Kurniawan D, Salahudin. 2022. Analysis of secondary education services during the COVID-19 Pandemic. In: Ahram T, Taiar R, editors. Human interaction, emerging technologies and future systems V. Proceedings of the 5th International Virtual Conference on Human Interaction and Emerging Technologies (IHIET); 2021 Aug 27–29; Cham, Switzerland. Cham: Springer Nature Switzerland AG.

Syarifah H, Poli DT, Ali M, Rahmat HK, Widana IDKK. 2020. Kapabilitas badan penanggulangan bencana daerah Kota Balikpapan dalam penanggulangan bencana kebakaran hutan dan lahan. *Nusantara: Jurnal Ilmu Pengetahuan Sosial*. 7(2):408–420.

Tan ZD, Carrasco LR, Taylor D. 2020. Spatial correlates of forest and land fires in Indonesia. *International Journal of Wildland Fire*. 29(12):1088–1099. doi:https://doi.org/10.1071/WF20036.

Teguh R, Lestari A, Louhenapessy BJ, Hayasaka H, Wibowo RE. 2021. Peatland fire photo geotagging using smartphones as an investigative tool. *International Journal of Technology*. 12(2):422–431. doi:https://doi.org/10.14716/ijtech.v12i2.4348.

Wantu PM, Mahdi I, Purba AS, Haris I, Amal BK. 2021. The law on plant protection, an effort to save Indonesia's earth: a review of international publications. *International Journal of Modern Agriculture*. 10(1):867–879.

Yang Z, Guo L, Yang Z. 2019. Emergency logistics for wildfire suppression based on forecasted disaster evolution. *Annals of Operations Research*. 283(1–2):917–937. doi:https://doi.org/10.1007/s10479-017-2598-9.

Zainuddin, Rosyani, Haryadi B. 2019. Partisipasi masyarakat dalam pencegahan dan pengendalian kebakaran lahan gambut di Hutan Lindung Gambut (HGL) Londerang Provinsi Jambi. *Jurnal Pembangunan Berkelanjutan*. 1(1):16–39. doi:https://doi.org/10.22437/jpb.v21i1.5101.

Zhang G, Wang M, Liu K. 2019. Forest fire susceptibility modeling using a convolutional neural network for Yunnan Province of China. *International Journal of Disaster Risk Science*. 10(3):386–403. doi:https://doi.org/10.1007/s13753-019-00233-1.