Optimizing disaster communication for future fire mitigation

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Abstract. Forest and land fires are disasters that often occur every dry season in Kalimantan. Fire information often does not reach the public, so disaster communication is urgently needed. Disaster communication is a very important parameter in disaster mitigation so it needs to be improved and requires collaboration and coordination of various stakeholders, such as government, companies, media, scientists, advocacy groups, and the community. There has not been much research on communication with the theme of fire, so more in-depth research is needed. The purpose of this research is to find out how to Optimize Disaster Communication for Future Fires Mitigation". Research on disaster communication was carried out in the location of the new state capital, East Kalimantan. The research used the descriptive-analytic method to identify the research area and collect secondary data. Disaster communication is an activity carried out by several parties, in this case, the authorities in preventing and overcoming the negative impacts that may arise due to fires. The results showed that the disaster management agency in East Kalimantan was the Regional Disaster Management Agency (BPBD). In mitigating fire disasters the community is known to use social media, namely Instagram, Twitter, and Facebook.

1. Introduction

These Fire disasters occur in Indonesia, including East Kalimantan, almost every year, especially during the dry season [1], [2], [3], and become national and international disasters [4], [5]. Fires in Indonesia have received international attention because they cause haze problems for neighboring countries [6] Fires often occur in drained peatlands because drained [6] peat is flammable [7]. Time to clear forest areas in peat ecosystems combined with the use of fire results in uncontrolled fires [8].

Fires can be identified using satellite imagery [9]. Satellites used to detect fires through smoke distribution generally have a high spatial resolution [10]. Satellite imagery is very helpful in fire detection so that the negative impact of fires can be minimized. The province of East Kalimantan is officially designated as the capital city of the State because the area has the least disaster risk, even though it is one of the provinces that cannot be separated from disasters such as forest and land fires [11]. Distribution of the hotspots in East Kalimantan is quite high, especially in New Capital City's locations (see Table 1).

It is very important to identify the distribution of hotspots in each region, including in East Kalimantan, to find out how big the fire threat is and the potential damage caused by fires. Fire

information often does not reach the public, so disaster communication is very necessary. Disaster communication is a very important parameter in disaster mitigation so it needs to be done and requires collaboration and coordination between various stakeholders, such as government, companies, media, scientists, advocacy groups, and the community [12–14]. The form of disaster communication can use social and mass media. It can build public awareness by providing knowledge about disaster events in an area [15]. Media becomes a means of communication and information so that the communicant can understand the meaning contained in the message correctly and then implement the substance contained in the message conveyed [16].

Table 1. Number of Hotspots recorded using SNPP-VIIRS in East Kalimantan in 2012-2022

No.	DISTRICT/CITY	TOTAL
1	Samarinda	771
2	Balikpapan	599
3	Kutai Kartanegara	38694
4	Paser	24579
5	Berau	21190
6	Kutai Timur	36915
7	Bontang	1925
8	Kutai Barat	20828
9	Penajam Paser Utara	4384
10	Mahakam Ulu	4742
	JUMLAH	154627

Source : https://earthdata.nasa.gov/earth-observationdata/near-real-time/firms/viirs-i-band-active-fire-data; Processing and Analysis Results, 2022

Disaster communication is essential in providing accurate information, building public empathy, and encouraging the community to build back better after the disaster[17]. Comprehensive management is needed between the government and the publics [18]. The media itself has a very strategic position in disaster communication. The more often the media report, the more critical the issues reported are. Through social media and existing mass media, we can convey knowledge related to fire disasters and the impact of fires. There is a positive relationship between the media's assessment of a problem and how the audience pays attention to the issues presented by the media [19], in this case, the fire at the New Capital City's location.

Fire disaster information is often transmitted through social media by the National Disaster Management Agency (BNPB). BNBP utilizes several media to convey information and educate the public, including mass media, Facebook, Twitter, Instagram, and YouTube. Seeing this, the role of the media is quite large in disaster communication. There has not been much research on disaster communication with the theme of forest fires[20], so more in-depth research is needed. Based on the above background, it is necessary to conduct research entitled "Optimizing Disaster Communication for Future Fires Mitigation"

2. Methods

The dry season is one of the natural causes of forest and land fires, especially on petland, due to rising temperatures[21,22]. Apart from the dry season, fires are also caused by deforestation in peat ecosystems [23–25]. Fires can be detected from the number of hotspots in each area. Not always existing hotspots can cause fires. Hotspot data can be retrieved from the results of the SNPP-VIIRS remote sensing satellite recording. Hotspot data obtained from SNPP-VIIRS provides information on the location of the hotspot and the location of the fire incident. The point of fire occurrence not only reflects separate fire events but also describes fire events that are still ongoing and/or have not been extinguished [26].

The frequency of fires continues to increase every year so it is necessary to identify the distribution of hotspots and disaster communications. Identify the hotspot distributions to find areas high fire

potential. Disaster communication to increase public knowledge related to fire disasters. Communication is successful when there is mutual understanding between the two parties, and when sender and receiver of information can understand each other [27–29]. Social media and mass media are one of the existing forms of public communication. In the current condition, the positioning of the media is very important, such as an early warning system and education for communities and mitigation measures to save lives[30]. The existing forms of mitigation can be seen from social media and mass media which are communication media although they still rarely adopted. Converting media content into reliable information is not easy [31].

Media to detect disasters that can be used include mass media, Instagram, Facebook, Twitter, and youtube [32–35]. Media is a valuable means of communication because it can be a source of information to increase public awareness, although it is still rarely adopted. The media can be framed as a source of information so that people can trust the messages conveyed through the media [31]. Existing social media and mass media can be used for disaster communication and provide information related to mitigation and early detection of various types of disasters [29,32–37].

Existing media can be a source of information on peatland fires and haze disaster management as well as fire policies, especially the role of central and local governments [38,39] . Through the existing media, people can easily get information about the fire, including strategies for dealing with hotspots and the causes of fires [40]. The more people receive information about the fire disaster, it is hoped the community will be more cautious and stop illegal burning. Relevant media is used as a source to detect wildfires and support policy makers regarding wildfires containment strategies that are implemented. The media contribute to the policy-making process[41].

Fire detection based on social media and mass media is important because it is one of the efforts to mitigate various types of disasters that can be done quickly[42]. Considering that most people access internet-based online media. Seeing this, it is very necessary to research Optimizing Disaster Communication for Future Fires Mitigation at the New Capital City Locations (see Figure 1). This research focuses on looking at the media use of internal media by local governments in mitigating fires, including the official government website, media social such as Twitter, Instagram, and Facebook which is managed by Pusdalops BPBD East Kalimantan Province. The research was conducted to support the smooth planning of the development of the location of the national capital and to prepare the community in the New Capital City location to be resilient to disasters.
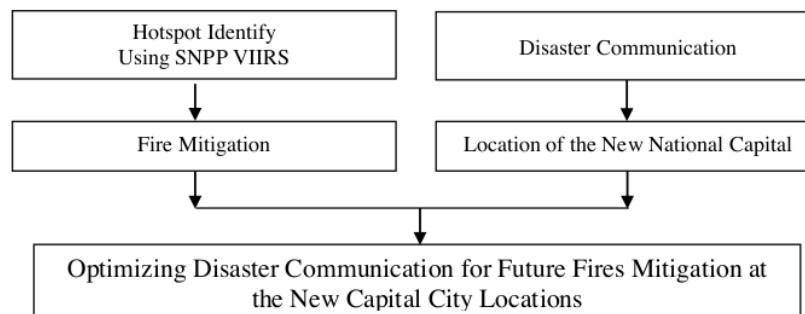

Figure 1. Optimizing Disaster Communication for Future Fires Mitigation at the New Capital City Locations

The research location is the capital city of the New State in the East Kalimantan Province (Fig.2). East Kalimantan is one of the Provinces where forest and land fires are increase almost every year. This research uses an analytical descriptive method to identify the research area and collect secondary data [4,43]. Secondary data collected is hotspot data from 2012-2022 which was recorded from S-NPP VIIRS satellite imagery in East Kalimantan. In addition to hotspot data, disaster communication data is also needed which can be seen from online mass media published by disaster management agencies in East

Kalimantan, namely the Regional Disaster Management Agency (BPBD). The existing online mass media are Instagram, Twitter and Facebook
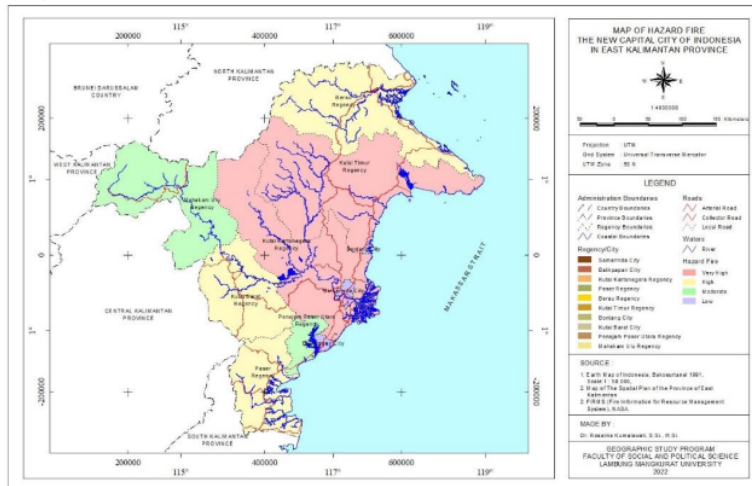

Figure 2. Research Location Map

Disaster communication is an activity carried out by several parties, in this case the authorities in preventing and overcoming the consequences of future disasters. Disaster Communication for Fire Mitigation carried out in this study is to see how far the involvement of the community, government and private parties as well as the mass media in maximum efforts so that all information can reach the target [44]. Disaster communication is needed for mitigation because the impact of losses due to disasters is very large, starting from casualties, infrastructure, materials and others.

Jaelani (in [44]) states that the most common and widely used disaster communication model in Indonesia (Figure 2). Disaster mitigation in Fig. 2 is not only carried out after natural disasters occur, but there are efforts made by the government before a disaster occurs, response to an ongoing disaster, participation in the recovery period after a disaster occurs. The community, the government, the media and the private sector have an important and strategic role in the disaster management system in Indonesia.
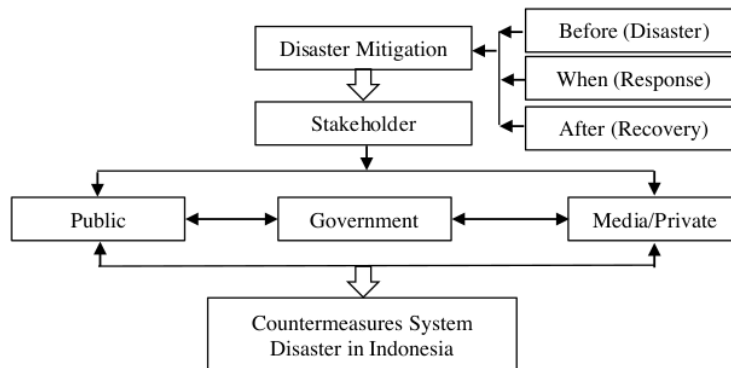

Figure 3. Disaster Communication Model

3. Results and Discussions

3.1 Indentification Hotspot

Hotspots can be used to identify fires in any area [45]. If the distribution of hotspots is known, then the locations with high fire potential can be identified [46–49]. The frequency and distribution of hotspots can be recorded with the satellite imager S-NPP VIIRS. [45]. The number of hotspots obtained from the recording of S-NPP VIIRS satellite imagery from 2012-2022 in East Kalimantan Province was 154,627. Hotspots in East Kalimantan Province from 2012-2022 were mostly found in Kutai Kartanegara Regency as many as 38,694 (see Table 2). The greater the number of hotspots, the greater the potential for fires[50–52] . The high number of hotspots in Kutai Kartanegara Regency as a location designated as the location of the nation's capital is a serious concern and requires intensive handling. The community around the location must know that the location where they live has a high potential for fire to occur so that the community can be better prepared in dealing with disasters. Disaster communication plays an important role here. Successful disaster communication can support success in mitigating fire disasters in order to minimize the negative impacts that may arise. Optimization of disaster communication for future fire mitigation is very important.

Table 2. Number of Hotspots from the Results of Recording Satellite Imagery of S-NPP VIIRS East Kalimantan   Province in 2012-2022

No	District/City	Hotspot	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
1	Samarinda	771	51	23	117	214	118	20	56	125	40	7	0
2	Balikpapan	599	29	52	134	228	42	25	23	46	18	2	0
3	Kutai Kartanegara	38694	3373	2488	5827	13562	4013	846	2030	5106	979	470	0
4	Paser	24579	1661	838	5114	10964	554	359	967	3115	688	319	0
5	Berau	21190	2123	1409	3514	6606	723	627	1345	3567	861	415	0
6	Kutai Timur	36915	2374	1997	4378	11446	5572	953	2542	4795	2185	673	0
7	Bontang	1925	273	164	283	365	249	228	131	73	115	44	0
8	Kutai Barat	20828	1887	1345	3830	9162	391	336	962	2219	484	212	0
9	Penajam Paser Utara	4384	306	165	611	2881	142	36	78	118	39	8	0
10	Mahakam Ulu	4742	493	470	548	1111	323	226	449	518	419	185	0
		154627	12570	8951	24356	56539	12127	3656	8583	19682	5828	2335	0

Source : https://earthdata.nasa.gov/earth-observationdata/near-real-time/firms/viirs-i-band-active-fire-data; Processing and Analysis Results, 2022

3.2. Disaster Communication for Fire Mitigation

Disaster communication for mitigation is an action that must be a top priority to be considered and carried out for people who live in disaster-prone areas [53]. State Capital are a very strategic areas of the country, so it is the duty of the government, society, and other parties to pay great attention to the possibility of disasters in the region. Based on the literature analysis and data results published previously [54] regarding the performance of disaster management agencies in East Kalimantan, namely the Regional Disaster Management Agency (BPBD) in mitigating fire disasters against the community, it is known that social media is used in the communication process in disaster mitigation agencies by these institutions are Instagram, Twitter, and Facebook. Based on the search results, several uploads have been obtained from the East Kalimantan Provincial Government, in this case, the BPBD discusses related to fires in East Kalimantan. Instagram Pusdalops BPBD kaltim Official @bpbdkaltim first released a post on April 1, 2020, until the last post on October 4, 2021.

Fire disaster mitigation communication was carried out by the agency 3 times in posting posts. The first post that contains information on the fire disaster mitigation process is on August 23, 2021, which contains information on hotspots in East Kalimantan Province using the Modis satellite sensor, SNPP VIIRS, and OLI with hotspot values having a low, medium, and high confidence point of zero (0) (Figure

3). Then the day after, BPBD re-released news related to information on hotspots which increased by 13 through the SNPP VIIRS satellite sensor along with news related to fires that occurred in Kutai Kartanegara Regency and Samarinda City (Figure 4). The last news was released the day after on August 25, 2021, with the same number of hotpot points on the previous day, namely 13 with the trust category being captured through the SNPP VIIRS satellite sensor, and the news was followed by news of fires in West Kutai Regency and Balikpapan City (Figure 5).

The official Twitter account @bpbdkaltim first made a tweet on July 26, 2020, and lastly, on September 11, 2021, the dominant news was related to the mitigation efforts of BPBD East Kalimantan related to the COVID-19 disaster and never reported on how to mitigate the fire disaster. While the older social media, namely Facebook, is not much different from Twitter, there is no information related to fire mitigation in East Kalimantan. It can be concluded that there is still a lack of BPBD agencies using internal media as a means of information on fire mitigation in East Kalimantan as the province selected for the New Capital City locations.

Figure 4. News related to hotspot point information dated August 23, 2021
Source: Instagram bpbdkaltim

Figure 5. News related to information on hotspots and fire incidents on August 24, 2021
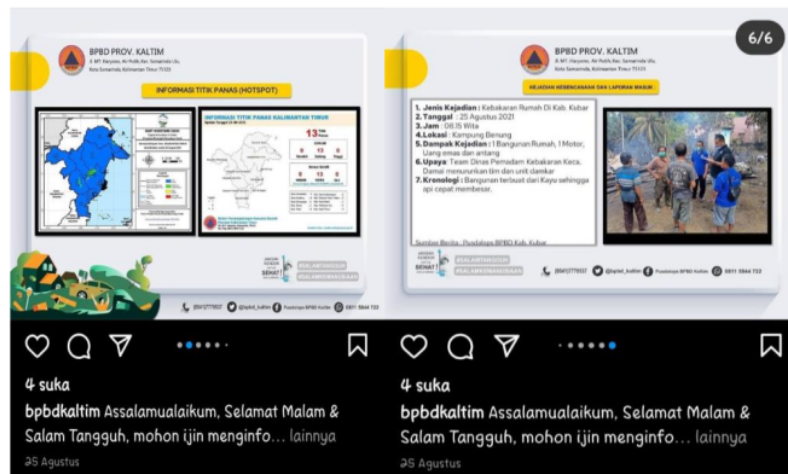Source: Instagram bpbdkaltim

Figure 6. News related to information on hotspots and fire incidents dated August 25, 2021
Source: Instagram bpbdkaltim

Disaster communication was carried out by the East Kalimantan government as an effort to mitigate fire disasters to prepare the East Kalimantan area as the location of the government center in the future. One of the activities conducted by the government through Webinar hosted by the East Kalimantan Provincial Government and the East Kalimantan Regional Council on Climate Change and several development partners of East Kalimantan Province such as the Nusantara Nature Conservation Foundation (YKAN), GIZ Propeat, Planete Urgence, Mangrove Lestari Foundation. , Earth Foundation and Bioma Foundation online with the theme "The Role and Function of Mangrove and Peat Wetland Ecosystems in Water Management Regulations and the Resilience of Surrounding Communities to the Impact of Climate Change", The news is published on the official website https://ddpi.kaltimprov.go.id/

"East Kalimantan Province occupies the 7 position out of 9 provinces that have critical mangrove distribution with a total distribution of critical mangroves inside and outside forested areas of 27,243 Ha. BGRM itself has 6 components of a national acceleration strategy for the rehabilitation and protection of mangroves in Indonesia. And various challenges are also encountered in peat management including drainage for agriculture and plantations as well as peat fire disasters. Achmad Nuriyawan representative of the Mangrove Lestari Foundation as the next speaker in the second session said that there were 3 Empowerment-Based Mangrove Restoration Strategies in the Mahakam Delta, namely Capacity Building, Mangrove Planting & Implementation of Silvofishery Ponds, and Green Microcredit Management. Focusing on the Middle Mahakam, Aang Gunaifi said that in terms of policies, efforts to protect, manage and exploit peatlands already exist in Indonesia, but the important task remains, namely the implementation process and the legal process so that it can run. In addition, the existence of a peatland landscape that is important for community fisheries resources in 6 villages in Middle Mahakam namely Muhuran, Teluk Muda, Sebelimbingan, Genting Tana, Tuana Tuha, and Muara Siran Villages which encourages the Social Forestry Program. (accessed October 7, 2021, at 9:31 pm)."

Disaster mitigation communication is communication carried out in an effort to prevent disasters from occurring [55]. Communication is very closely related to disaster mitigation is very important because it is needed to reduce uncertainty in the community so that effective action can be taken. Disaster prevention, accurate information from stakeholders in this case the government is needed by the community and private institutions that have great concern for the disaster event. Effort to minimize loss of life or property.

The government's efforts to preserve the peatland ecosystem in East Kalimantan as a future conservation plan have involved the media, although not too massively, because researchers are still

difficult to find media reporting on these efforts, especially after the president designated Kutai Kartanegara Regency and North Penajam Paser Regency in East Kalimantan as New Capital City location. The policies owned by the government are contained in Regional Regulation number 5/2009 regarding forest and land fires and strengthened by the East Kalimantan Provincial Regulation Number 8 of 2019 concerning Climate Change Adaptation and Mitigation. The policy in the form of this regulation is a form of preventive action from the government and also preparedness in dealing with it if it occurs in the future.

The community needs education about disasters and their prevention, the media can be a medium used by the government to support this education. Disaster communication through the presentation of disaster news by the media is very important in supporting public education and advocacy so that they can be better prepared in dealing with various environmental problems that occur. The environmental communication approach in presenting messages will form messages that are easier to understand and provide awareness to the public. With media features, both internal media and external media such as print, electronic and online media, it can facilitate the mitigation process carried out by the government so that effective communication is built from the government to the community in building information related to disaster prevention to post-disaster management. Seeing this, it is very important to optimize disaster communication in the mass media as a support for disaster mitigation [56].

4. Conclusions

The conclusion form thi reseach are the number of hotspots in East Kalimantan Province recorded by S-NPP Viirs satellite images from 1012-2022 was 154,627 with the highest number of hotspots is in the location designated as the new state capital, namely in Kutai Kartanegara Regency as many as 38,694. And about the Disaster communication, it carried out by the government of East Kalimantan Province after the determination of the New Capital City location is still very minimal, both through the internal media of institutions/agencies and through external mass media.

Acknowledgments

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