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RESEARCH ARTICLE

Community Conduct and Its Influence on Forest Fires in the Sebangau Watershed: Spatial Analysis Utilizing Remote Sensing and Community Observation

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Abstract

The frequent forest fires along the Sebangau River in Central Kalimantan, particularly during the dry season, have emerged as a significant environmental issue, driven by human activities such as the burning of wild pandanus on the riverbanks to facilitate the deployment of fishing equipment. This study examines the correlation between community behavior, particularly among fishermen, and the occurrence of forest fires in the Sebangau watershed, while also investigating the causes of these fires. The research methodology employs a combined approach, using remote sensing analysis (MODIS) to map forest fire patterns spatially, alongside observations from local groups to gather qualitative data on land-burning practices. The study's findings indicated that forest fires along the Sebangau River were predominantly caused by fishermen burning wild pandanus, often leading to uncontrolled spread. The El Niño phenomenon exacerbates drought conditions that instigate fires. This study underscores the significance of a community-oriented strategy for forest fire mitigation and the necessity of sustainable management practices that foster collaboration between governmental entities and communities to reduce the likelihood of future forest fires.

Keywords: Sebangau Watershed; Peat Swamp Forest Fires; How People Act and Fire; Community-Based Fire Safety

1. Introduction

Forest fires near the Sebangau River in Central Kalimantan, particularly during the dry season, have become a progressively alarming phenomenon. The Sebangau River delineates the external perimeter of the Sebangau National Park conservation zone. It constitutes a vital component of a peat swamp forest ecosystem, essential for biodiversity, carbon sequestration, and hydrological management. This ecosystem encounters significant challenges from recurrent forest fires. Many of these are instigated by human activities, particularly the practice of igniting river pandanus, known in the Dayak language as Rasau (Pandanus Helicopus), by fishermen to facilitate the deployment of traditional fishing apparatus such as rawai (Nurseptiani et al., 2021). This conflagration is frequently unmanageable, harming flora that functions as a water retention and environmental quality regulator.

This study seeks to detect and examine the correlation between burning river pandanus and the occurrence of forest fires in the Sebangau watershed. This study employed a mixed-methods approach, integrating remote sensing analysis to delineate fire patterns with qualitative observations to investigate perceptions, motivations, and the socio-economic effects of forest fires (Priya and Vani, 2024). The findings are anticipated to yield profound insights into the determinants of forest fires and their impact on communities and peat swamp forest ecosystems (Prasetyo et al., 2022).

The examination of MODIS data indicated that forest fires along the Sebangau River predominantly occurred near fishing villages (Perkasa et al., 2023). While forest fires are influenced by the El Niño phenomenon, which reduces precipitation, the practice of community burning significantly contributes to increased fire severity. The research identified two primary fire areas using spatial data, which can serve as a foundation for establishing priority fire management zones (Pratamasari et al., 2020).

The study revealed that local communities, despite possessing ecological expertise, frequently lack comprehension of the long-term effects of fires on their ecosystems. The socio-economic ramifications of the fires are considerable, particularly for fishers, who are the most adversely affected group due to the depletion of the fishing supplies upon which they depend (Suandy and Harahap, 2025). This illustrates the significance of a community-oriented strategy for forest fire mitigation, which necessitates cooperation between governmental entities and local communities (Yulianti et al., 2020).

Wildfires are frequently linked to climate change and El Niño events; however, human activities, notably land burning, are a primary triggering factor (Nurdiati et al., 2022). This research underscores the importance of data-

driven mitigation measures that balance environmental conservation with residents' socio-economic welfare. An enhanced participative and data-driven methodology is anticipated to yield more efficient and sustainable forest management solutions (M. Harry Mulya Zein and Sisca Septiani, 2021).

This study suggests the need to formulate forest management policies that incorporate both nature-based conservation measures and community welfare considerations (Bos et al., 2020). This research significantly contributes to the integrated and sustainable management of natural resources. It may serve as a foundation for forest fire control in fire-prone regions such as the Sebangau watershed (Kuswandi et al., 2020).

2. Methods

2.1 Research Methodology

This research adopts a descriptive mixed-methods design that integrates quantitative geographical analysis with qualitative field observations (Brown et al., 2017). The study addresses key research questions concerning the spatial distribution of community land-burning practices within the Sebangau watershed, the spatial and temporal relationship between these practices—particularly those conducted by fishermen—and the occurrence of forest fires, as well as the social and behavioral factors that influence fishermen's reliance on fire for land management activities. Figure 1 illustrates the geographical location of the study area.

Accordingly, the objectives of this study are to identify and map forest fire hotspots using remote sensing data, to analyze the spatial relationship between community land-burning activities and forest fire incidents, and to examine community practices and perceptions related to land burning through direct observation. By integrating spatial analysis with sociological insights, this research provides a comprehensive understanding of the drivers of forest fires in the Sebangau watershed (Akbar et al., 2021).

2.1.1 Qualitative Data Collection and Analysis

The qualitative component of this study focuses on behavioral, social, and perceptual characteristics related to land-burning practices among fishing communities in the Sebangau watershed. Qualitative data were collected from 25 fishermen selected through purposive sampling, based on their direct involvement in land-burning activities and their long-term experience in fishing along the Sebangau River. Data collection was conducted through non-participant field observations and semi-structured interviews, allowing respondents to describe their motivations, perceptions of fire use, and awareness of its environmental impacts.

The qualitative data were analyzed using a thematic analysis approach. Interview transcripts and observation notes were systematically coded to identify recurring patterns related to land-burning behavior, perceived benefits of burning, risk awareness, and community-based fire management practices. These themes were then interpreted in conjunction with spatial fire data derived from remote sensing analysis to provide an integrated understanding of the relationship between community behavior and forest fire occurrence.

2.1.2 Demographics and Subset

The research population comprises the community that relies on the Sebangau watershed, primarily consisting of fishermen residing in its vicinity. The research sample comprised fishermen living in the Sebangau watershed, who actively participated in land burning actions to enhance fishing opportunities. Samples were selected based on criteria, including experience with land burning and knowledge relevant to forest fires in the region. Figure 2 below provides an overview of the incineration of river pandanus and of fishermen's operations.

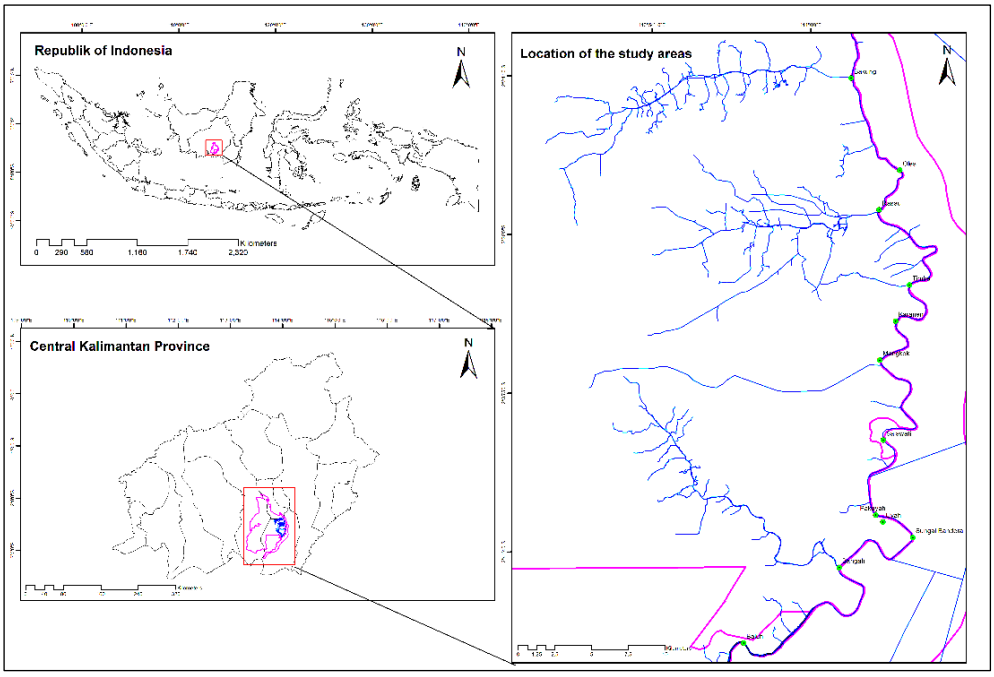


Fig. 1. Location of the study area within the Sebangau watershed, Central Kalimantan, Indonesia. The map shows the boundary of Sebangau National Park, the Sebangau River network, and the distribution of fishing communities along the riverbanks where land-burning activities were observed.

2.2 Methods of Data Acquisition

Data collection is conducted using two primary methodologies:

2.2.1 Acquisition of Remote Sensing Data from MODIS

Forest fire data is sourced from MODIS (Moderate Resolution Imaging Spectroradiometer), which provides satellite imagery for identifying fire hotspots in the Sebangau watershed region. The downloaded data encompasses the years 2014 to 2024, concentrating on the peak months of the fires, specifically during the dry season (Schreven et al., 2018). This data will illustrate the spatial distribution and frequency of forest fires occurring along the Sebangau River (Xu et al., 2024).

Insights regarding the community surrounding the Sebangau watershed:

Observation of fisherman residing in the Sebangau watershed to acquire qualitative data concerning the combustion patterns of river pandanus and their correlation with forest fires. Observations were conducted on local anglers at the research site, in addition to fishermen (Sofia, 2023).

2.2.2 Remote Sensing Data and Hotspot Criteria

Forest fire hotspot data were obtained from the MODIS (Moderate Resolution Imaging Spectroradiometer) active fire product, with a 1 km spatial resolution, which is commonly used for regional-scale fire detection and temporal analysis. The MODIS data were utilized to identify the spatial and temporal distribution of fire occurrences within the Sebangau watershed during the study period.

The hotspot dataset includes fire detections across all confidence levels provided in the MODIS active fire product. This approach was adopted to capture the overall pattern and frequency of fire occurrences in the study area, particularly in peatland environments where low-intensity fires may not always be detected at higher confidence thresholds. The selected data were then processed and analyzed using GIS techniques to examine fire distribution patterns and their association with community land-burning practices.

2.3 Methods of Data Analysis

The data gathered from both approaches will be analyzed using GIS (Geographic Information System) software to assess the spatial distribution of forest fires. Overlay techniques will be used to integrate MODIS data with additional datasets, including land-use maps, fire distribution, and the impact of El Niño on fire patterns (Muhindo Bahavira et al., 2025). This analysis seeks to delineate the spatial patterns of wildfires and identify regions most susceptible to fires due to human activity (Alonazi and Alnfiai, 2023). Furthermore, qualitative observational data will undergo thematic analysis to discern patterns of community behavior, the socio-economic repercussions of forest fires, and the mitigation techniques communities employ to reduce the risk of such fires (Nardi et al., 2025). This geographical and qualitative analysis aims to provide a more thorough understanding of the correlation between land-burning practices and the occurrence of forest fires in the Sebangau watershed.

This study employs a methodology that integrates remote sensing analysis with community observation, thereby facilitating a comprehensive understanding of the determinants of forest fires and their effects on communities surrounding the Sebangau watershed. This study aims to offer data-driven recommendations for enhanced forest fire management and mitigation measures by integrating geographical and qualitative data.

Fig 2. Field observations of community activities in the Sebangau watershed: (a) burning of river pandanus (Pandanus helicopus) along the riverbank to facilitate fishing gear installation, and (b) traditional fishing activities conducted by local fishermen in the Sebangau tributary.

3. Results

According to an 11-year analysis of geographic data, the study location recorded a total of 889 hotspot attacks, peaking in 2015 with 483, followed by 2014 with 214, and 2023 with 138. Wildfire patterns exhibit a pronounced tendency during the dry season, with peak fire occurrences linked to the El Niño phenomenon, which intensifies drought (Hein et al., 2022). Figure 3 below summarizes hotspot assaults and average precipitation over 11 years at the research site. Data from MODIS indicates that forest fires are more prevalent in regions with low rainfall, especially in the years 2014, 2015, 2018, 2019, and 2020, which experienced an average annual rainfall of 88.128 mm, significantly lower than in other years.

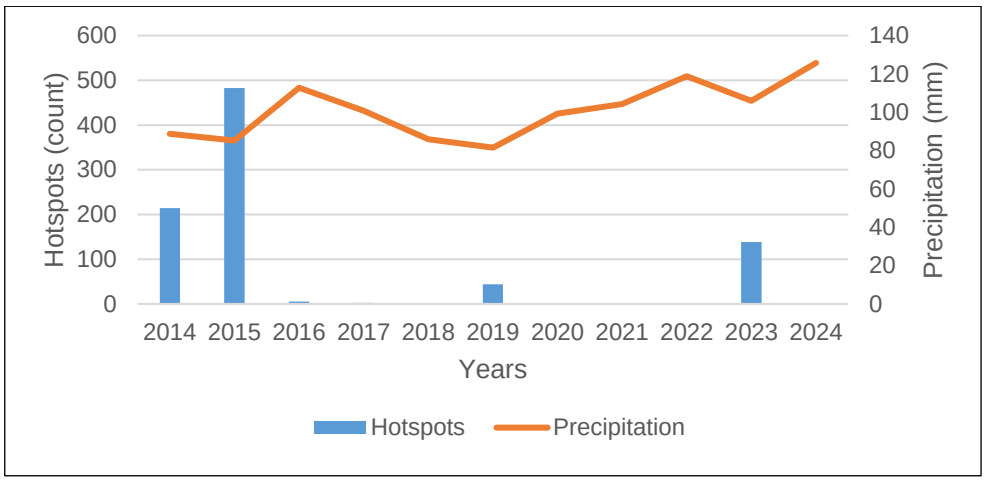
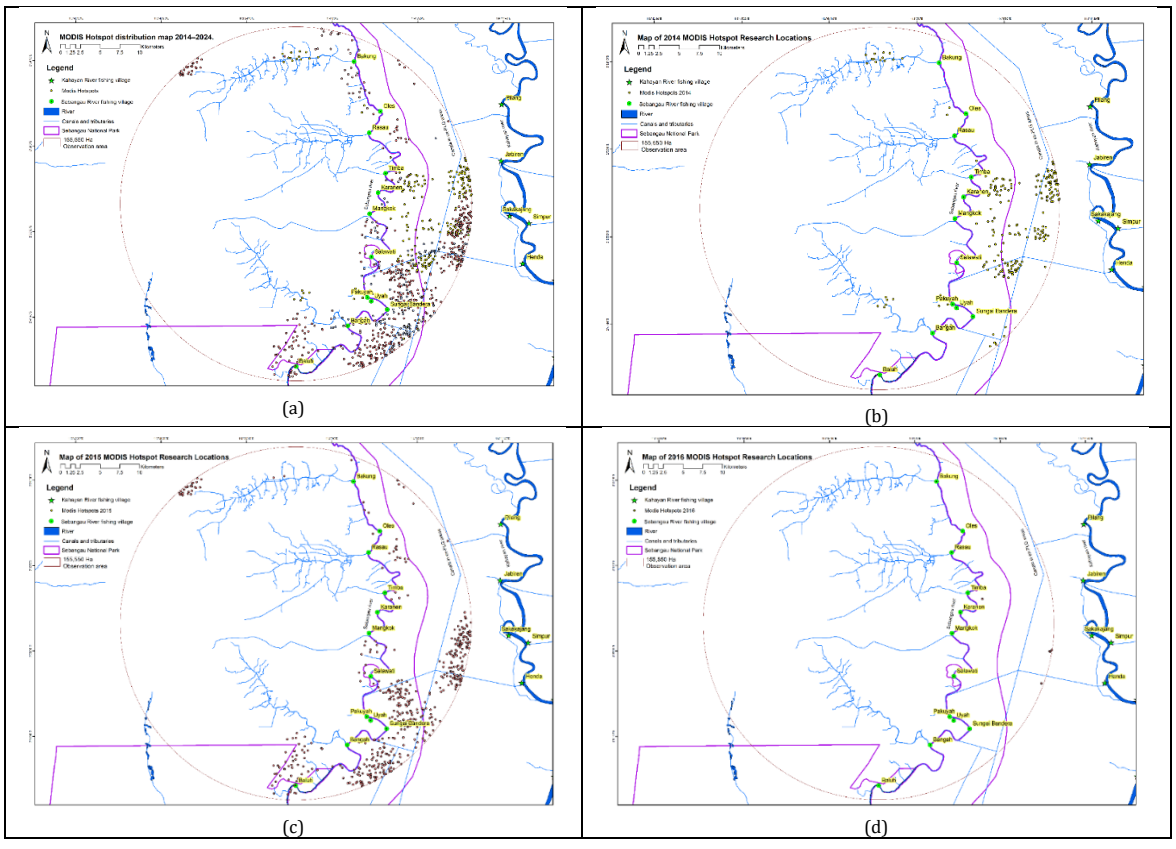


Fig 3. Temporal relationship between forest fire hotspots and average annual precipitation in the Sebangau watershed from 2014 to 2024. The left vertical axis represents the number of MODIS fire hotspots. In contrast, the right vertical axis represents average annual precipitation, highlighting the inverse relationship between fire occurrence and rainfall during dry years influenced by El Niño events.

Local community observations indicated that forest fires along the Sebangau River are frequently initiated by the combustion of river pandanus (Pandanus helicopus) that desiccates during the dry season (Suwito et al., 2020). Fishermen perform this procedure to facilitate the installation of fishing apparatus, such as rawai, which require an unobstructed space (Ndiba and Lampe, 2024). Fishermen said that the fires along the riverbank cleaned the region where fish congregated, resulting in increased catches. Nevertheless, they recognize that fires resulting from these techniques frequently exacerbate environmental conditions and pose a risk of spreading to broader areas, harming vegetation and other habitats (Ohkubo et al., 2021).

Moreover, several fishermen perceive the advantages of the fires, noting that after combustion, nascent flora such as grasses will proliferate, creating an optimal environment for fish foraging, particularly in anticipation of the flood season. The fire improves access to the swamp forest, allowing fishing equipment to be positioned farther away. Nonetheless, despite many perceived advantages, uncontrolled wildfires continue to exert a lasting influence on ecosystem sustainability and human livelihoods (Santika et al., 2020). The GIS overlay study of fire point distribution along the Sebangau River reveals two significant fire-affected regions, located to the north and south of the river, with the most often impacted areas occurring near canals and degraded terrain (Yuana et al., 2023). Figure 4 below illustrates the distribution of hotspots over 11 years at the research site. These data elucidate the intricate interplay between anthropogenic activities, climatic factors, and the occurrence of forest fires in the Sebangau watershed.



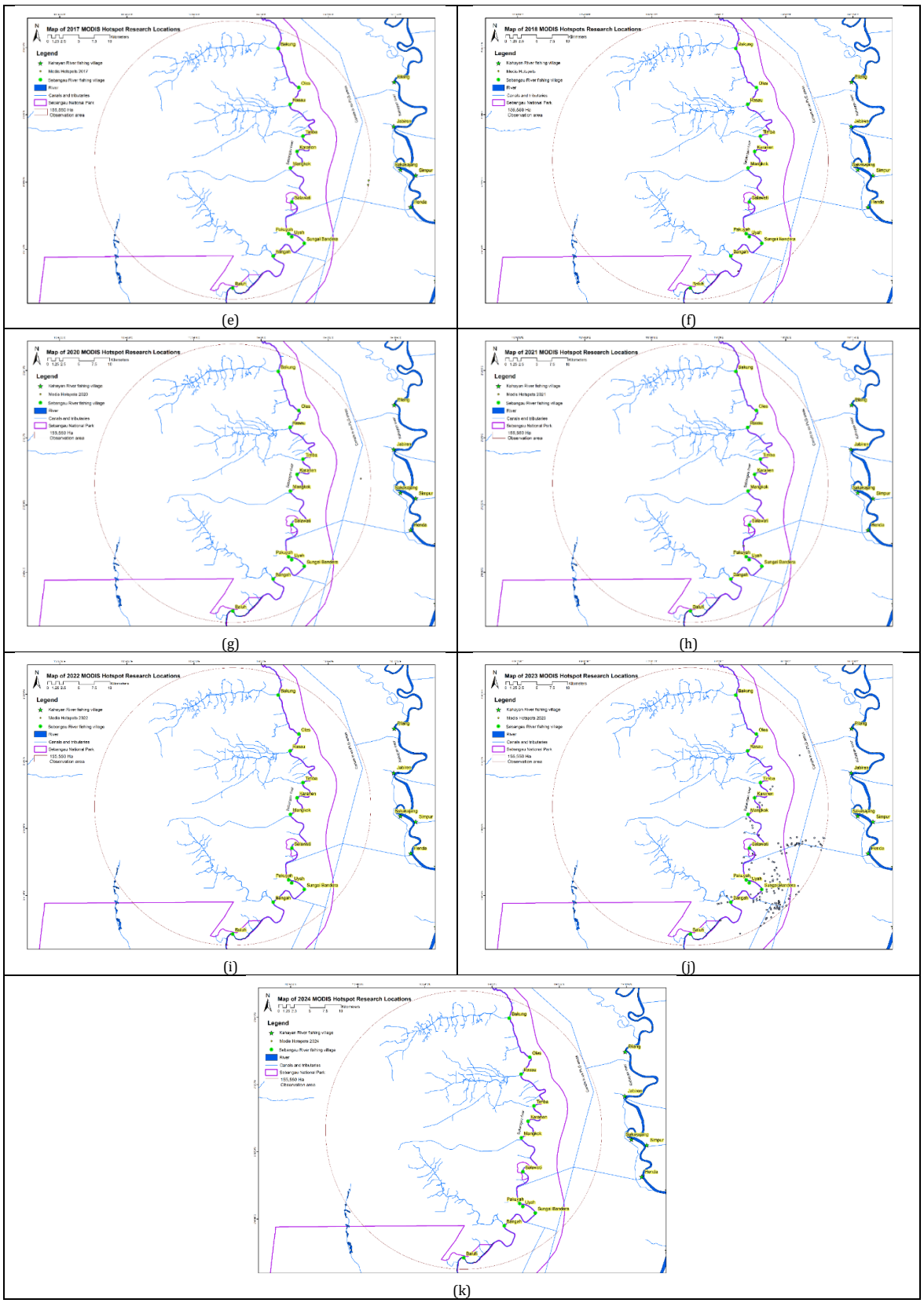


Fig 4. Map depicting the location of MODIS hotspots from 2014 to 2024. (a) Year 2014. (b) The year 2015. Year 2016. (d) The year 2017. Year 2018. Year 2019. Year 2020. Year 2021. Year 2022. (j) Year 2023. (k) The year 2024.

4. Discussion

The study's findings indicate that forest fires in the Sebangau watershed exhibit a distinct pattern linked to anthropogenic activities, particularly the incineration practices of river pandans along the riverbanks by local groups, notably fishermen. These findings align with prior research indicating that wildfires are frequently initiated by human activities in the vicinity of peat swamp forests (Harrison et al., 2020). The practice of land incineration to enable the deployment of fishing apparatus, such as rawai, has emerged as a primary catalyst for forest fires in this

area. Pandanus helicopus, prevalent along the Sebangau River banks, desiccates during the dry season, rendering it especially susceptible to fires. When ignited by sparks, whether from carelessly discarded cigarette butts by anglers or inadequately extinguished campfires, they can rapidly propagate to a broader region (Viegas et al., 2021).

This phenomenon highlights the significance of understanding how local behavior affects the occurrence of forest fires in peat swamp forests, which has historically been examined primarily through the lens of external influences such as temperature change or global climate change. This research introduces a novel sociological perspective on forest fires, demonstrating that while fires are frequently perceived as an environmental issue, human engagement with the environment significantly exacerbates them. Spatial analysis utilizing remote sensing data (MODIS) and GIS overlays revealed two primary regions of fire propagation along the Sebangau River, predominantly occurring in proximity to fishing communities, frequently serving as ignition locations for the fires (Edwards et al., 2020). These data corroborate the conclusion that geographic area and human activity in the vicinity significantly influence the intensity and frequency of forest fires (Akbar et al., 2024).

These findings further validate the importance of a community-oriented strategy for forest fire mitigation in fire-prone regions. Consequently, practical strategies for mitigating forest fires in the Sebangau watershed must encompass not only nature-based conservation regulations but also the enhancement of public understanding and awareness of the consequences of unregulated land-burning practices (30). An inclusive mitigation plan that requires strong community engagement is urgently needed to achieve sustainable forest management in the future.

5. Conclusions

This study demonstrates a strong relationship between forest fires in the Sebangau watershed and human activities, particularly the practice of burning river pandanus by fishing communities along the riverbanks. Although climatic factors such as reduced precipitation and El Niño events contribute to fire susceptibility, community land-burning practices play a decisive role in triggering fire occurrences. Spatial analysis using MODIS hotspot data identified major fire-prone areas located near fishing settlements, indicating that human activity significantly influences fire distribution patterns.

These findings highlight the importance of adopting a community-based and data-driven approach to forest fire mitigation in peatland ecosystems. Strengthening local awareness, integrating indigenous knowledge with fire management policies, and fostering collaboration between local communities and governmental institutions are essential to achieving sustainable forest management and reducing future fire risks in the Sebangau watershed.

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References

Akbar, A., Adriani, S., Priyanto, E., 2021. The potential for peatland villages to prevent fire: Case study of Tumbang Nusa Village Central Kalimantan. IOP Conf. Ser. Earth Environ. Sci. 758. https://doi.org/10.1088/1755-1315/758/1/012017

Akbar, A., Applegate, G.B., Kurniawan, A., Hadi, E.E.W., Idrus, N.I., Arifanti, V., 2024. Tropical peatland village communities' self-perceived attitude and behaviour changes regarding fire usage. Mires Peat 30. https://doi.org/10.19189/MaP.2023.OMB.Sc.2326030

Alonazi, M., Alnfiai, M.M., 2023. Fire Hawk Optimizer with Deep Learning Enabled Human Activity Recognition. Comput. Syst. Sci. Eng. 45, 3135–3150. https://doi.org/10.32604/csse.2023.034124

Bos, A.B., De Sy, V., Duchelle, A.E., Atmadja, S., de Bruin, S., Wunder, S., Herold, M., 2020. Integrated assessment of deforestation drivers and their alignment with subnational climate change mitigation efforts. Environ. Sci. Policy. https://doi.org/10.1016/j.envsci.2020.08.002

Brown, G., Strickland-Munro, J., Kobryn, H., Moore, S.A., 2017. Mixed methods participatory GIS: An evaluation of the validity of qualitative and quantitative mapping methods. Appl. Geogr. 79, 153–166. https://doi.org/10.1016/j.apgeog.2016.12.015

Edwards, R.B., Naylor, R.L., Higgins, M.M., Falcon, W.P., 2020. Causes of Indonesia's forest fires. World Dev. 127. https://doi.org/10.1016/j.worlddev.2019.104717

Harrison, M.E., Ottay, J.B., D'Arcy, L.J., Cheyne, S.M., Anggodo, Belcher, C., Cole, L., Dohong, A., Ermiasi, Y., Feldpausch, T., Gallego-Sala, A., Gunawan, A., Höing, A., Husson, S.J., Kulu, I.P., Soebagio, S.M., Mang, S., Mercado, L., Morrogh-Bernard, H.C., Page, S.E., Priyanto, R., Ripoll Capilla, B., Rowland, L., Santos, E.M., Schreer, V., Sudyana, I.N., Taman, S.B.B., Thornton, S.A., Upton, C., Wich, S.A., van Veen, F.J.F., 2020. Tropical forest and peatland conservation in Indonesia: Challenges and directions. People Nat. https://doi.org/10.1002/pan3.10060

Hein, L., Spadaro, J. V., Ostro, B., Hammer, M., Sumarga, E., Salmayenti, R., Boer, R., Tata, H., Atmoko, D., Castañeda, J.P., 2022. The health impacts of Indonesian peatland fires. Environ. Heal. A Glob. Access Sci. Source 21, 62. https://doi.org/10.1186/s12940-022-00872-w

Kuswandi, Y., Erwindi, J., Dwi Hadian, M.S., Muslim, D., 2020. Disaster Mitigation for Palu City Residents in Dealing with Liquefaction Disasters in Accordance of Spatial Patterns of Palu City, Central Sulawesi Province, Indonesia. J. Geosci. Eng. Environ. Technol. 5, 219–226. https://doi.org/10.25299/jgeet.2020.5.4.5653

M. Harry Mulya Zein, Sisca Septiani, 2021. Manajemen Partisipatif: Sebuah Pendekatan Meningkatkan Peran Masyarakat Dalam Pembangunan Desa. J. Adm. Soc. Sci. https://doi.org/10.55606/jass.v2i1.1023

Muhindo Bahavira, J., Lukoo Mitsindo, J., Paluku Lukumbi, M., Zenga Anselme, A., 2025. Impacts of Land Use/Land Cover Change and Climate Change on Natural Hazards in Tropical Regions: Synthesis Review and Relevance to the Kinshasa (DRC) Context. J. Geosci. Eng. Environ. Technol. 10, 344–355. https://doi.org/10.25299/jgeet.2025.10.3.22912

Nardi, D., Geppert, C., Thorn, M.J., Ward, S.F., Brown, R.L., Gordon, J.S., Riggins, J.J., 2025. Burning questions: how human behaviors and firewood characteristics influence the transport of wood-boring insects. Biol. Invasions 27. https://doi.org/10.1007/s10530-024-03518-9

Ndiba, A.S., Lampe, M., 2024. Bubu Fishing Gear: A Study of Traditional Fishermen's Fishing Technology on Bangkurung Island, Banggai Laut Regency. Egypt. J. Aquat. Biol. Fish. 28, 1013–1027. https://doi.org/10.21608/ejabf.2024.395134

Nurdiati, S., Bukhari, F., Julianto, M.T., Sopaheluwakan, A., Aprilia, M., Fajar, I., Septiawan, P., Najib, M.K., 2022. The impact of El Niño southern oscillation and Indian Ocean Dipole on the burned area in Indonesia. Terr. Atmos. Ocean. Sci. 33. https://doi.org/10.1007/S44195-022-00016-0

Nurseptiani, S., Kamal, M.M., Taryono, T., 2021. Status Perikanan Tangkap di Sungai Sebangau dan Sungai Katingan, Taman Nasional Sebangau Kalimantan Tengah. Trop. Fish. Manag. J. 5, 1–10. https://doi.org/10.29244/jppt.v5i1.33767

Ohkubo, S., Hirano, T., Kusin, K., 2021. Influence of fire and drainage on evapotranspiration in a degraded peat swamp forest in Central Kalimantan, Indonesia. J. Hydrol. 603. https://doi.org/10.1016/j.jhydrol.2021.126906

Perkasa, P., Gumiri, S., Wahyudi, W., Permana, I., 2023. Analysis of Canal Blocking Distribution to Reduce Sabangau Tropical Peat Swamp Forest Fires. J. Stud. Sci. Eng. 3, 85–102. https://doi.org/10.53898/josse2023327

Prasetyo, L.B., Setiawan, Y., Condro, A.A., Kustiyo, K., Putra, E.I., Hayati, N., Wijayanto, A.K., Ramadhi, A., Murdiyarso, D., 2022. Assessing Sumatran Peat Vulnerability to Fire under Various Condition of ENSO Phases Using Machine Learning Approaches. Forests 13. https://doi.org/10.3390/f13060828

Pratamasari, A., Permatasari, N.K.F., Pramudiyasari, T., Manessa, M.D.M., Supriatna, S., 2020. Spatial Distribution Patterns Analysis of Hotspot in Central Kalimantan using FIMRS MODIS Data. J. Geogr. Lingkung. Trop. https://doi.org/10.7454/jglitrop.v4i1.74

Priya, R.S., Vani, K., 2024. Vegetation change detection and recovery assessment based on post-fire satellite imagery using deep learning. Sci. Rep. 14. https://doi.org/10.1038/s41598-024-63047-2

Santika, T., Budiharta, S., Law, E.A., Dennis, R.A., Dohong, A., Struebig, M.J., Medrilzam, Gunawan, H., Meijaard, E., Wilson, K.A., 2020. Interannual climate variation, land type and village livelihood effects on fires in Kalimantan, Indonesia. Glob. Environ. Chang. 64. https://doi.org/10.1016/j.gloenvcha.2020.102129

Schreven, S.J.J., Perlett, E.D., Jarrett, B.J.M., Marchant, N.C., Harsanto, F.A., Purwanto, A., Sýkora, K. V., Harrison, M.E., 2018. Forest gaps, edge, and interior support different ant communities in a tropical peat-swamp forest in Borneo. Asian Myrmecology 10. https://doi.org/10.20362/am.010010

Sofia, L.A., 2023. Fisherman's Perception on the advancement of Eco-Conscious Bagan Tancap Fisheries Tourism in Kotabaru Regency, South Kalimantan. Pakistan J. Life Soc. Sci. 21, 462–477. https://doi.org/10.57239/PJLSS-2023-21.1.0035

Suandy, I., Harahap, S.R., 2025. Modeling Land Use Change Dynamics in the Buffer Zone of Bukit Rimbang Bukit Baling Wildlife Reserve: A Business-as-Usual Simulation-Based Approach. J. Geosci. Eng. Environ. Technol. 10, 134–144. https://doi.org/10.25299/jgeet.2025.10.02.21726

Suwito, D., Suratman, Poejirahajoe, E., 2020. Peat swamp forest-firesimpacts on local livelihoods: A case study in Kapuas Kahayan Protected Forest Management Unit, Central Kalimantan, Indonesia. IOP Conf. Ser. Earth Environ. Sci. https://doi.org/10.1088/1755-1315/451/1/012097

Viegas, D.X., Oliveira, R., Almeida, M., Kim, D., 2021. Ignition of fuel beds by cigarettes: A conceptual model to assess fuel bed moisture content and wind velocity effect on the ignition time and probability. Fire 4. https://doi.org/10.3390/fire4030035

Xu, H., Chen, H.W., Chen, D., Wang, Y., Yue, X., He, B., Guo, L., Yuan, W., Zhong, Z., Huang, L., Zheng, F., Li, T., He, X., 2024. Global patterns and drivers of post-fire vegetation productivity recovery. Nat. Geosci. 17, 874–881. https://doi.org/10.1038/s41561-024-01520-3

Yuana, K.A., Kusrini, K., Setyanto, A., Laksito, A.D., Maruf, Z.R., Johari, M.Z.F., Adninda, G.B., Kartikakirana, R.A., Nucifera, F., Widayani, W., Orphanoudakis, T., 2023. GIS data support technique for forest fire management and decision support system: A Sebangau National Park, Kalimantan case, in: 2023 6th International Conference on Information and Communications Technology, ICOIACT 2023. pp. 286–291. https://doi.org/10.1109/ICOIACT59844.2023.10455935

Yulianti, N., Kusin, K., Jagau, Y., Naito, D., Naito, D., Susetyo, K.E., 2020. A proposal of community-based firefighting in peat hydrological unit of Kahayan - Sebangau River: Methods and approaches. IOP Conf. Ser. Earth Environ. Sci. 504. https://doi.org/10.1088/1755-1315/504/1/012025