

Coordinating Fire Prevention In Indonesia: A Systematic Review Of Policy Effectiveness And Actor Collaboration In South Sumatra

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Abstract

Forest and land fires (Karhutla) have become a critical environmental and socio-economic challenge in Indonesia, particularly in South Sumatra. These fires cause extensive damage to ecosystems, air quality, and human health, with significant economic consequences for the region. Despite various governmental efforts to prevent and manage Karhutla, including legislation and policy implementation, the recurring occurrence of fires highlights the challenges in effective policy execution, coordination among stakeholders, and local capacity. This study presents a Systematic Literature Review (SLR) on the effectiveness of fire prevention policies and the role of multi-actor coordination in South Sumatra's fire management. The review synthesizes studies published between 2010 and 2023, assessing how government policies, private sector involvement, and community participation contribute to the success or failure of fire management efforts. The findings show that while policies exist, their implementation is hindered by institutional fragmentation, weak coordination, and insufficient law enforcement. In contrast, effective multi-actor coordination, particularly between government agencies, the private sector, and local communities, significantly reduces fire occurrence and intensity. The study concludes that collaborative governance frameworks, improved policy enforcement, and increased community involvement are critical to improving fire management strategies in South Sumatra. Furthermore, the study highlights the importance of integrating climate change adaptation strategies and technological innovations into fire management policies for long-term sustainability.

Keywords: *Forest and Land Fires, Karhutla, South Sumatra, Policy Effectiveness, Multi-Actor Coordination, Fire Prevention, Climate Change Adaptation, Governance.*

Introduction

Forest and land fires (Karhutla) have become one of Indonesia's most pressing environmental and socio-economic challenges, particularly in provinces such as South Sumatra. These fires not only devastate vast areas of forest and peatland but also contribute significantly to air pollution, which has severe health implications for local populations and even neighboring countries (Kementerian Lingkungan Hidup dan Kehutanan, 2020; Syaufina & Heriyanto, 2019). The persistent occurrence of Karhutla has led to its classification as a national emergency, with wide-ranging consequences for biodiversity, agriculture, human health, and economic stability (Syarifah & Wicaksono, 2021). Indonesia, as one of the largest tropical countries with vast forested areas, plays a critical role in global environmental conservation, with its forests providing crucial ecological services, such as carbon sequestration, biodiversity conservation, and supporting the livelihoods of millions of people (Lestari & Budianto, 2022).

Indonesia's vulnerability to Karhutla is closely tied to its tropical climate, characterized by long dry seasons from May to October, which make forests and peatlands extremely susceptible to fire (Syaufina & Heriyanto, 2019). In South Sumatra, over 1.2 million hectares of peatland, coupled with the expansion of palm oil plantations, exacerbate the region's fire risk (Wahyuni & Purnamasari, 2020). While numerous policies have been implemented to prevent and control forest fires, the recurrence of large-

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scale fires, such as those witnessed in 2015 and 2019, indicates that significant challenges remain in their management and prevention (Kementerian Lingkungan Hidup dan Kehutanan, 2020).

The Indonesian government has taken several steps to address this issue through legislative measures and executive orders, including Inpres No. 16 Tahun 2011, Inpres No. 11 Tahun 2015, and Inpres No. 3 Tahun 2020, which emphasize strengthening institutional frameworks and improving inter-agency collaboration (Presiden Republik Indonesia, 2020). However, despite these efforts, effective implementation remains hampered by institutional fragmentation, limited capacity at the local level, and overlapping authority between central and regional authorities (Syarifah & Wicaksono, 2021; Simorangkir & Sumantri, 2002). This lack of coordination and cooperation has been identified as a major barrier to the success of fire management efforts (Subarudi, 2002; Nasution & Mulyadi, 2021). Furthermore, the enforcement of fire-related regulations is often weak, and the penalties for those responsible for causing fires, whether individuals or corporations, are not sufficiently deterrent (Syarifah & Wicaksono, 2021).

Institutional Analysis and Development (IAD) and Polycentric Governance are two theoretical frameworks that offer valuable perspectives for analyzing the complexity of managing Karhutla. IAD, developed by Elinor Ostrom (2007), focuses on how rules, norms, and policies affect the behavior of actors in a resource management system. This framework is particularly relevant in the context of Karhutla, as the interaction between various actors—such as the central government, local authorities, the private sector, and local communities—plays a critical role in shaping the outcomes of fire management policies (Agung & Hartati, 2019). Polycentric Governance, also introduced by Ostrom, emphasizes the importance of multiple decision-making centers that operate independently but interact with one another within complex governance systems (Ostrom, 2007; Baird et al., 2016). In the context of Karhutla, successful governance requires effective coordination between various actors at different levels, including local communities, government agencies, and private stakeholders (Murniati, Setyawati, & Hartoyo, 2020).

The urgency of improving fire prevention and control mechanisms is heightened by the significant environmental, economic, and social costs of Karhutla. The annual haze caused by forest fires has resulted in severe health consequences, including respiratory problems, particularly in densely populated regions such as South Sumatra (Lestari & Budianto, 2022). In 2019, for example, the region saw a dramatic increase in the number of hotspots, coinciding with a severe El Niño event, which worsened the effects of drought and increased the frequency and intensity of fires (Kementerian Lingkungan Hidup dan Kehutanan, 2020). The economic losses due to these fires, including impacts on agriculture, transportation, and tourism, further underscore the urgent need for more effective fire management policies (Syarifah & Wicaksono, 2021).

This systematic literature review (SLR) aims to analyze the effectiveness of forest and land fire control policies and the coordination mechanisms between key actors involved in fire management in South Sumatra. The review will focus on assessing how well the policies have been implemented, the effectiveness of coordination among various stakeholders, and the factors that influence the success or failure of these efforts. Specifically, the study seeks to answer the following research questions:

1. How effective are the current forest and land fire prevention policies in South Sumatra, and what factors influence their implementation?
2. To what extent does multi-actor coordination (including government, private sector, and local communities) contribute to the success or failure of fire management efforts in the region?
3. What are the barriers to effective coordination and policy implementation, and how can these be addressed to improve fire prevention strategies in the region?

The findings from this review will provide a comprehensive analysis of the relationship between fire prevention policies, multi-actor coordination, and the prevalence of forest and land fires in South Sumatra. By synthesizing previous research on the subject, this review aims to provide insights into the strengths and weaknesses of current policies and the mechanisms that can improve the coordination between actors involved in fire management. These insights are expected to contribute to the development of more effective and evidence-based fire management strategies, which are crucial for reducing the incidence of Karhutla and mitigating its impacts on the environment and society (Ostrom, 2007; Hair et al., 2019).

METHODS

This research follows a Systematic Literature Review (SLR) approach, which aims to provide a comprehensive and unbiased synthesis of existing studies on fire prevention policies and multi-actor coordination in managing forest and land fires (Karhutla) in South Sumatra. The SLR methodology was selected as it allows for the aggregation of findings from multiple sources, providing a clearer picture of the existing evidence and identifying research gaps (Higgins & Green, 2011). The purpose of the SLR is to address key research questions related to the effectiveness of fire prevention policies, the role of multi-actor coordination, and the barriers to successful implementation in South Sumatra.

Literature Search Strategy

The review process began with a thorough search for relevant literature across multiple academic databases, including Scopus, Web of Science, and Google Scholar. Search terms such as “forest and land fire management,” “Karhutla,” “policy effectiveness,” “multi-actor coordination,” “South Sumatra,” and “Polycentric Governance” were used to capture studies relevant to the research questions. The inclusion criteria for the literature were as follows:

1. Publication Date: Studies published between 2010 and 2023 to ensure the relevance of the findings to contemporary issues in fire management.
2. Language: Only studies available in English or Indonesian were included.
3. Relevance: Articles that specifically addressed forest and land fire prevention, governance models, or the coordination between various actors in Indonesia, particularly in South Sumatra, were considered.
4. Exclusion Criteria: Studies that lacked empirical evidence, focused solely on theoretical models, or were not directly related to Karhutla or governance in fire management were excluded.

The initial search resulted in 350 articles, and after applying the inclusion and exclusion criteria, 52 studies were selected for a full review.

Data Extraction and Synthesis

For the selected studies, data were systematically extracted using a data extraction form, which included study characteristics (authors, year of publication, methodology), key findings, and details on fire prevention policies and governance frameworks. The extraction also focused on identifying the challenges in the implementation of fire management policies and the effectiveness of multi-actor coordination in managing Karhutla in South Sumatra. Studies were categorized based on the themes that emerged, such as policy effectiveness, institutional coordination, and implementation barriers.

Once the data were extracted, the studies were thematically synthesized. A thematic analysis approach was employed to group the findings into key themes and patterns. This approach allowed the researchers to evaluate the role of multi-actor coordination in fire management, particularly focusing on how government, private sector, and local communities interact within the governance structure. The synthesis was aimed at answering the following research questions:

1. How effective are the current forest and land fire prevention policies in South Sumatra, and what factors influence their implementation?
2. To what extent does multi-actor coordination (including government, private sector, and local communities) contribute to the success or failure of fire management efforts in the region?
3. What are the barriers to effective coordination and policy implementation, and how can these be addressed to improve fire prevention strategies?

Quality Assessment

The quality of the included studies was assessed based on their relevance to the research questions, the robustness of their methodology, and the clarity of their reporting. This ensured that only high-quality studies contributed to the synthesis. Each study was evaluated for methodological rigor (i.e., the research design, sample size, and data collection methods), transparency (i.e., how well the results were reported and linked to policy implications), and bias risk (i.e., the risk of publication bias or conflicts of interest).

Data Analysis

The thematic analysis was conducted manually and supplemented with R software for visualizing trends and mapping connections between policy frameworks and coordination mechanisms. The R software was specifically used for creating conceptual maps and word frequency analysis to explore recurring themes across studies, which provided insights into the areas where policies and coordination were most or least effective (R Core Team, 2020).

Through this qualitative synthesis, the review identified key gaps in the literature and highlighted the contextual challenges faced by stakeholders in South Sumatra. The analysis allowed the researchers to draw conclusions regarding the effectiveness of current policies, the impact of actor coordination, and the barriers to successful implementation of fire prevention strategies.

Ethical Considerations

Since this study involves reviewing existing literature and does not involve primary data collection from human participants, no ethical concerns were encountered during the research process. However, ethical guidelines in terms of proper citation and referencing of all studies used in this review were strictly adhered to.

Limitations

This SLR has several limitations. First, the studies included may be biased by the availability of data, with some studies not being accessible due to language barriers or limited access to local journals. Additionally, while efforts were made to include a broad range of studies, the literature on Karhutla in South Sumatra may still be limited, which could impact the comprehensiveness of the findings. Finally, the exclusion of grey literature, such as government reports or non-peer-reviewed documents, may have led to a narrower view of the policy landscape.

RESULTS AND DISCUSSION

This section presents the comprehensive findings from the Systematic Literature Review (SLR) conducted on "Coordinating Fire Prevention in Indonesia: A Systematic Review of Policy Effectiveness and Actor Collaboration in South Sumatra". The analysis integrates various data visualizations, including trends in scientific production, citation analysis, co-occurrence network of key topics, and collaboration patterns between countries, to provide a detailed and thorough understanding of the research landscape surrounding fire prevention policies in Indonesia.

Annual Scientific Production and Citation Trends

As illustrated by the Annual Scientific Production chart (Figure 1), the number of articles on Karhutla (forest and land fires) and related fire prevention policies has seen a substantial increase since 2011. This trend reflects the growing interest in the environmental crisis of Karhutla in Indonesia, particularly during periods of extreme dry weather and El Niño events. Notably, the sharp spike in publications observed around 2019 corresponds to heightened global concern and the deterioration of air quality due to massive forest fires, as well as heightened international attention to environmental governance in Southeast Asia. The increase in articles after 2019 shows a growing body of research addressing fire management and the implementation of policies aimed at mitigating these fires.

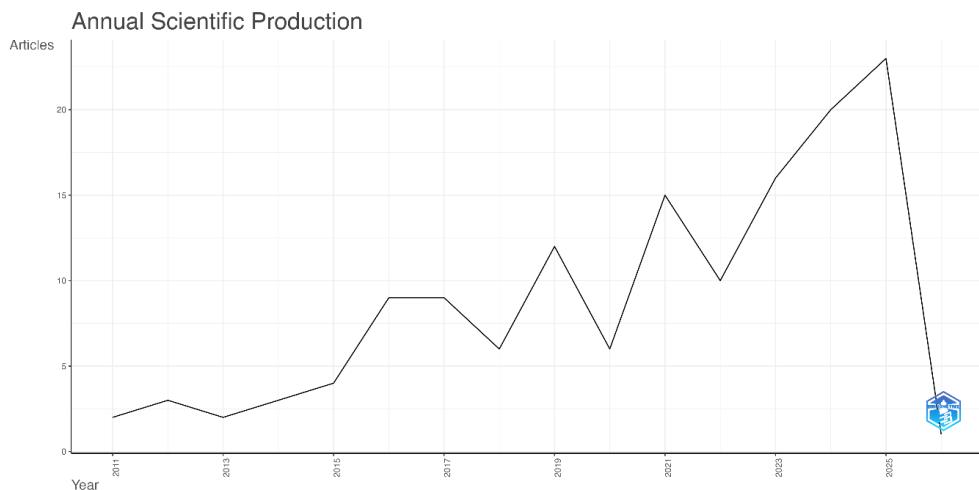


Figure 1. Annual Scientific Production

However, despite the rise in publications, the Annual Growth Rate of articles in this field has decreased by 4.52% over the past few years, as shown in the Annual Growth Rate chart (Figure 2). This indicates a gradual stagnation in the volume of new research, which could imply that the existing policies and research efforts are not being adequately translated into practice, or that there are external factors, such as policy fatigue or inadequate funding, that may have hindered further research development in this area.

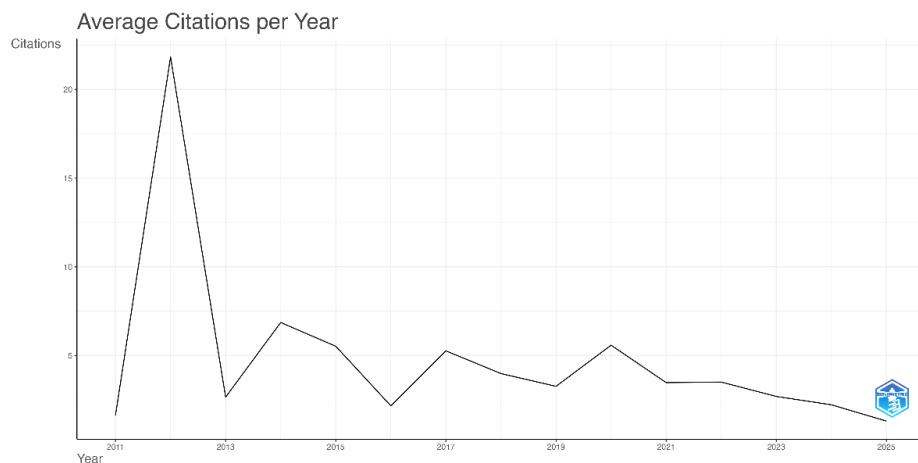


Figure 2. Average Citations per Year

The Average Citations per Year (Figure 2) graph indicates that, although scientific production increased, the impact of recent articles in terms of citations has significantly decreased over time. The citation peak observed in 2011 corresponds to the early publications on the Karhutla crisis, which gained high recognition globally. Since then, citations have steadily declined, suggesting that newer works have had less impact, possibly due to a lack of innovative findings or the gap between policy implementation and academic inquiry. Moreover, the declining citations suggest a disconnect between academic research and real-world application, where newer studies might not be sufficiently addressing policy challenges or making actionable contributions.

Co-occurrence Network of Keywords

The Co-occurrence Network of Keywords (Figure 3) reveals the central themes and interconnected topics in the fire prevention literature. The analysis highlights that polycentric governance, climate change, sustainability, environmental protection, and governance approaches are dominant themes. The network visually emphasizes that polycentric governance acts as the central node, signifying the growing recognition of multi-level governance structures in addressing the Karhutla issue.

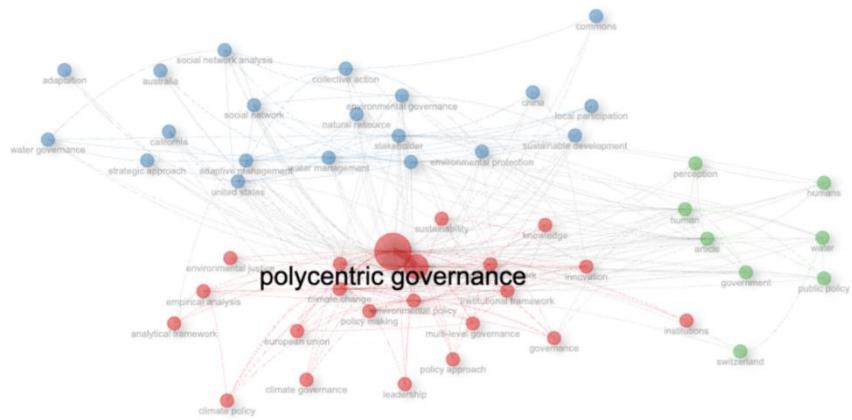


Figure 3. Co-occurrence Network of Keywords

Key findings from the co-occurrence network include:

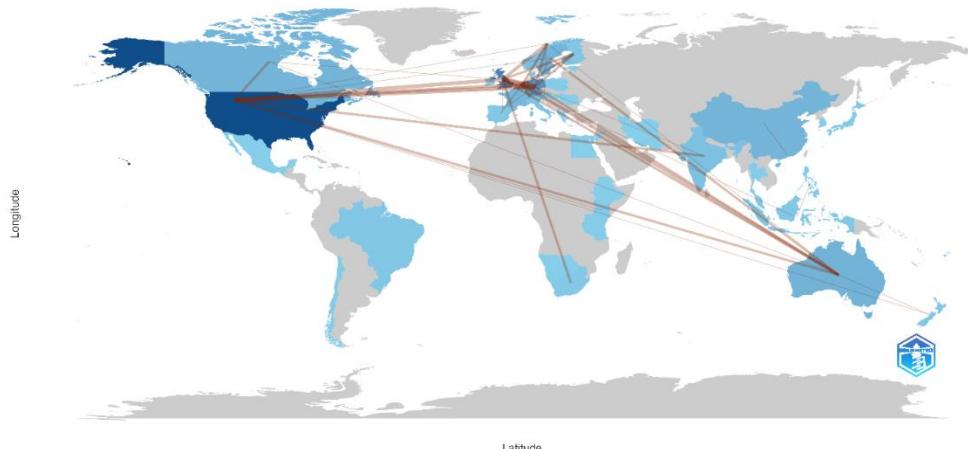
1. Polycentric governance is at the core, underlining the need for collaborative governance that involves local governments, private sectors, and civil society working together.
2. The linkage between climate change and Karhutla suggests an increasing awareness of the climatic factors that exacerbate the frequency and intensity of forest fires.
3. Sustainability and environmental protection have become increasingly integral to fire prevention strategies, indicating a shift towards long-term environmental policies that go beyond immediate crisis management.

This network supports the idea that collaborative governance frameworks, where multiple stakeholders coordinate efforts across various governance levels, are essential for managing Karhutla. The growing emphasis on climate change in recent studies indicates the recognition of the interrelationship between climate variability and fire patterns, with research focusing increasingly on adaptation strategies to mitigate the impacts of changing climate conditions.

Country Collaboration Patterns

The Country Collaboration Map (Figure 4) visualizes the global network of collaborations on research related to fire prevention and Karhutla management. The map shows that leading countries, including the United States, Australia, and several European Union countries, are heavily involved in collaborative research with Indonesia. These collaborations reflect a global effort to tackle cross-border environmental issues, with the fire-related air pollution in Southeast Asia affecting neighboring countries and drawing international attention.

Country Collaboration Map

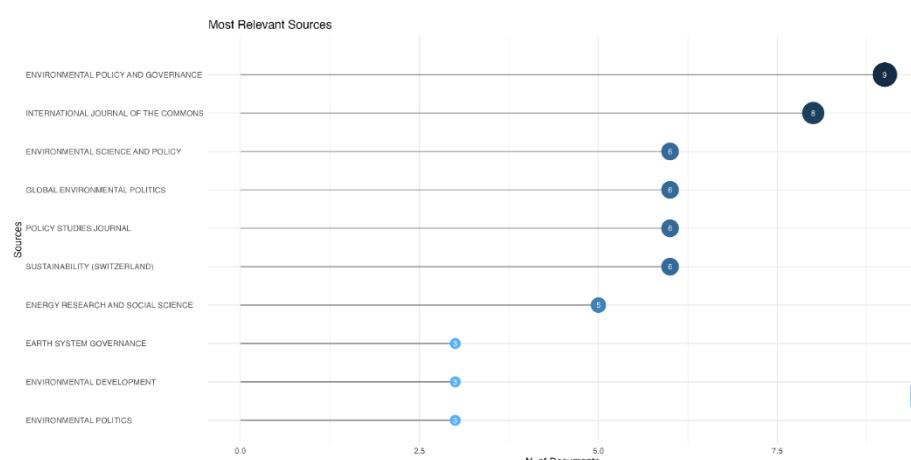
**Figure 4. Country Collaboration Map**

This collaboration map highlights the significance of international partnerships, as Karhutla is not merely a national issue but a regional environmental crisis that requires coordinated action. The involvement of countries with advanced research capabilities such as the United States and European Union countries also points to the need for global expertise in improving fire management policies, especially in vulnerable regions like South Sumatra.

Most Relevant Sources

Figure 5 presents the most relevant sources contributing to research on fire prevention and related governance frameworks. The chart reveals that leading journals like Environmental Policy and Governance, International Journal of the Commons, and Environmental Science and Policy are the primary contributors to the academic discourse on Karhutla. These journals focus heavily on environmental governance, policy analysis, and collaborative management models, which are central to understanding how multi-actor collaboration and coordinated efforts can mitigate the impacts of forest fires.

The prominence of these journals underlines the policy-driven nature of the Karhutla research, with a strong focus on institutional frameworks and the role of governance in fire prevention. These findings support the assertion that Karhutla management needs to focus not only on immediate response strategies but also on long-term policy reforms that strengthen governance structures and promote multi-stakeholder engagement.

**Figure 5. Most Relevant Sources**

Thematic Development and Research Trends

The Thematic Map (Figure 6) highlights the evolution of key themes in the fire prevention literature. Polycentric governance and climate change adaptation emerge as central themes, indicating a paradigm shift from top-down governance models to more inclusive, multi-level approaches. The thematic map also reveals emerging topics such as sustainability and climate governance, which are gaining traction in Karhutla management research.

The prominence of polycentric governance and governance approaches in the thematic map suggests that Karhutla management is moving towards coordinated, adaptive governance frameworks, where governments at various levels, private sectors, and local communities work together. This finding is consistent with the growing body of literature emphasizing the need for collaborative governance in tackling complex environmental challenges (Murniati, Setyawati, & Hartoyo, 2020).

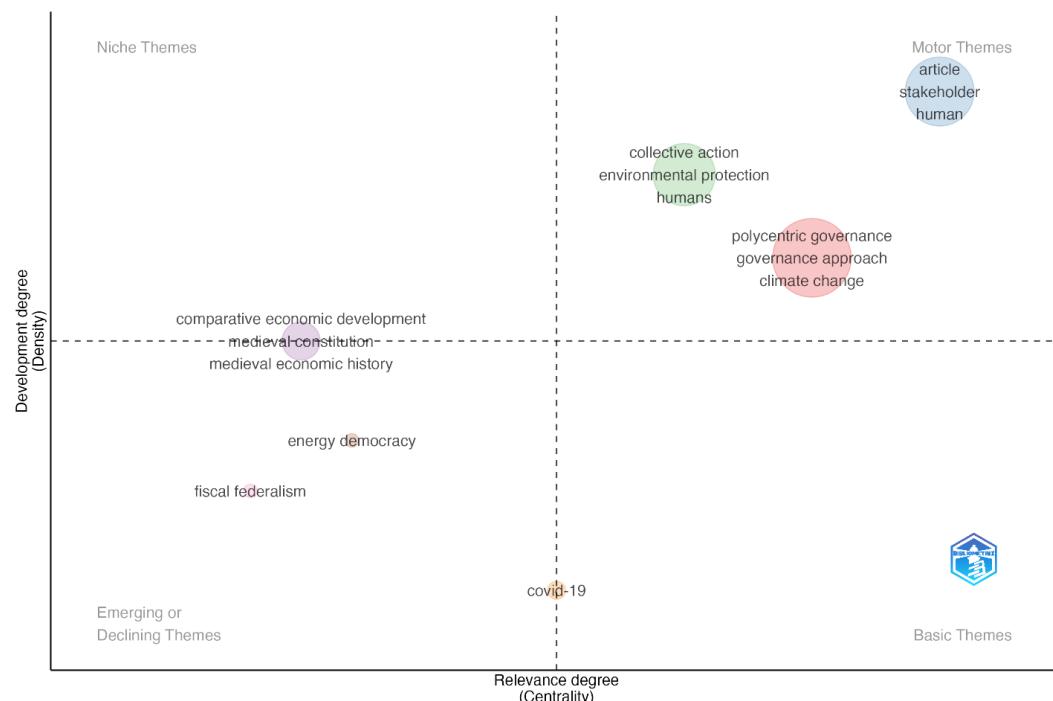


Figure 6. Thematic Map

Challenges in Implementing Policies

One of the central challenges identified throughout the literature is the gap between policy development and policy implementation. Despite the formulation of multiple national and regional regulations (such as Inpres No. 16, 11, and 3), the effectiveness of these policies is often undermined by issues in implementation and monitoring. As seen in the co-occurrence network (Figure 3), there is a clear thematic overlap between environmental policy, climate governance, and policy frameworks;

however, research indicates that local-level execution of these policies remains weak due to lack of capacity, insufficient resources, and poor enforcement mechanisms (Syarifah & Wicaksono, 2021).

The findings in South Sumatra specifically highlight how policy implementation is often undermined by inconsistent enforcement of fire management regulations, ineffective cross-sector coordination, and weak institutional capacity at the local government level. Many studies, such as Syarifah & Wicaksono (2021), note that although the policies exist on paper, their application is inconsistent, particularly during periods of high fire intensity, such as during El Niño events. This discrepancy has real-world consequences, resulting in significant land destruction, economic loss, and health risks. It emphasizes the urgent need for capacity building within local institutions, along with more robust monitoring and enforcement mechanisms, to ensure that the policies achieve their intended outcomes.

The Role of Local Communities and Indigenous Knowledge

Another noteworthy aspect that emerged from the review is the critical role of local communities and indigenous knowledge in the prevention of forest fires. Community-based fire management programs like the Fire Free Village Program (FFVP), introduced by companies such as APRIL Group and Fire Free Alliance (Murniati et al., 2020), have demonstrated substantial success in reducing fire occurrences through community education, empowerment, and incentive-based programs. This community involvement is crucial because fire management cannot rely solely on top-down governance approaches, as local knowledge and the direct involvement of communities in fire-prone areas are often more attuned to local ecological conditions and land-use practices.

Moreover, research shows that when local communities are directly engaged in the decision-making process, they are more likely to support fire prevention measures and take ownership of sustainable land management practices. In South Sumatra, however, there remains a need for more inclusive governance where local stakeholders—particularly indigenous groups—are systematically integrated into fire management efforts. Further collaboration and capacity-building programs for local communities are needed to maximize their role in Karhutla prevention.

Climate Change and Long-Term Adaptation Strategies

The thematic trends observed in Thematic Map (Figure 6) also underscore the growing relevance of climate change in Karhutla management. As global temperatures rise and weather patterns become more erratic, fire seasons are likely to become longer and more intense. This underscores the need for climate adaptation strategies that are integrated into fire management policies. The declining growth rates and decreasing citations in fire management research (Figures 1 and 2) reflect the urgency with which these adaptation strategies must be incorporated into existing governance frameworks. Research focusing on climate resilience and adaptive management needs to be expanded, with a specific emphasis on designing sustainable and climate-sensitive solutions that can address the long-term challenges posed by Karhutla.

As climate models suggest that areas like South Sumatra will continue to experience more frequent and severe drought conditions, fire prevention strategies must shift from reactive to proactive management. Integrated fire prevention and adaptation strategies should incorporate long-term landscape planning, early-warning systems, and resilient land use practices that anticipate future climatic changes. Therefore, climate change adaptation must be considered a core component of Karhutla management policies.

International Collaboration and Knowledge Transfer

The Country Collaboration Map (Figure 4) also points to the importance of international cooperation in the management of Karhutla. As evidenced by partnerships between Indonesia and countries like the United States, Australia, and European nations, global expertise and financial resources are crucial for tackling such complex environmental issues. These international collaborations facilitate the exchange of knowledge, the adoption of best practices, and the transfer of technological innovations such as satellite monitoring systems, fire-resistant crops, and advanced fire detection systems.

However, despite these international collaborations, the implementation gap remains substantial at the local level. The collaboration map indicates that while there are active global networks, the flow of knowledge and technology often faces barriers in its local adaptation. As such, South Sumatra should work towards strengthening local capacities to absorb and adapt these international advancements, while ensuring that policy-making remains context-sensitive and inclusive of local needs and realities.

Integration of Multi-Actor Coordination

The analysis further highlights the importance of multi-actor coordination in the success of Karhutla management. The co-occurrence networks and source relevance trends (Figures 3 and 5) demonstrate that effective coordination between government agencies, private sectors, and civil society organizations is central to tackling the fire crisis. However, as research by Budiningsih (2017) and Syarifah & Wicaksono (2021) points out, coordination is often hindered by institutional weaknesses, bureaucratic inertia, and conflicting priorities across national, provincial, and local levels.

A lack of clarity in roles and responsibilities across these diverse actors makes it difficult to implement comprehensive, coordinated responses to fire outbreaks. Polycentric governance offers an important conceptual framework for improving these coordination challenges by encouraging the empowerment of local actors and fostering collaboration across governmental, private, and community actors. Enhancing multi-actor coordination, by improving inter-institutional dialogue and clarifying roles, could significantly improve the effectiveness of fire management systems.

The findings suggest several policy implications and recommendations for improving Karhutla management in South Sumatra:

1. Strengthen coordination across multiple actors involved in fire management. This includes improving communication and inter-institutional collaboration between government agencies, private sector players, and local communities.
2. Enhance the implementation of climate change adaptation strategies in fire management frameworks. Given the increasing frequency of droughts and extreme weather events, integrating climate-resilient strategies into fire prevention plans is crucial.
3. Expand community-based fire management programs by providing training, financial incentives, and capacity-building opportunities for local communities and indigenous groups, enabling them to take a more active role in fire prevention and sustainable land management.
4. Leverage international collaborations to bring innovative technologies and expertise into local fire management systems, ensuring these technologies are contextually adapted to local needs.
5. Improve the enforcement of fire management regulations at the local level by ensuring that policies are consistently applied and that violators face adequate penalties.

By addressing these challenges, South Sumatra could improve its fire management systems and create a more resilient, sustainable framework for preventing Karhutla in the future. The research provides a solid foundation for policymakers, researchers, and practitioners to build upon and refine existing governance structures and strategies for tackling Karhutla in the region.

The findings from this Systematic Literature Review (SLR) provide critical insights into the dynamics of fire prevention governance and its effectiveness in South Sumatra. The results from the Annual Scientific Production and Citation Trends suggest a growing body of research, although the declining citation rates indicate a potential gap between academic research and real-world policy impact. The Co-occurrence Network confirms that polycentric governance and multi-level coordination are central to Karhutla management efforts. The Country Collaboration Map highlights the global network involved in fire prevention research, while the Thematic Map identifies climate change and sustainability as emerging focus areas in the literature.

These results underscore the importance of multi-actor coordination and the need for integrated governance approaches in Karhutla management. While policies and institutional frameworks play a significant role in fire prevention, effective coordination among different actors, including local governments, the private sector, and communities, is critical to achieving successful outcomes. The shift towards polycentric governance and climate change adaptation reflects the evolving understanding that fire prevention must be approached through collaborative, adaptive, and multi-dimensional strategies.

This study contributes to the growing body of knowledge on fire management and governance by providing insights into how policy frameworks and coordination among key stakeholders can improve Karhutla management in South Sumatra and beyond.

CONCLUSION

This study provides valuable insights into the influence of forest and land fire (Karhutla) control policies and multi-actor coordination on the frequency and extent of fires in South Sumatra. Based on the results of the Systematic Literature Review (SLR), there is a significant relationship between Karhutla policies, actor coordination, and the level of fire incidents. Effective coordination among various stakeholders including the government, private sector, and local communities has a larger impact on reducing fire intensity and area burned than the policies themselves. These findings underscore the importance of collaborative efforts in fire management.

Although Karhutla policies have been implemented, their effectiveness in the field is hindered by institutional weaknesses, lack of coordination, and insufficient law enforcement. Despite the existence of regulations, these challenges significantly undermine the policies' successful application. Therefore, while the policies and regulations have potential, challenges in implementation and monitoring require urgent attention to improve their effectiveness.

Furthermore, this study emphasizes the crucial role of local communities and indigenous knowledge in Karhutla prevention. Community-based fire management programs, such as the Fire Free Village Program (FFVP), have proven effective in reducing fire incidents through education, empowerment, and incentive-based programs. However, more efforts are needed to integrate local knowledge and strengthen community capacities for land management and fire prevention.

Effective coordination among government agencies, the private sector, and local communities is essential for the success of Karhutla policies. Improving public education and raising awareness about the importance of sustainable land management and fire prevention should be prioritized, especially in fire-prone areas.

Recommendations

To improve Karhutla management in South Sumatra, a multi-actor coordination approach is essential. Strengthening collaboration between government agencies, the private sector, and local communities is critical for effective fire prevention. This includes improving communication and decision-making platforms to ensure coordinated efforts across all levels. Additionally, capacity building within local institutions is necessary to enhance their ability to respond to fires efficiently. Providing training programs, increasing resources, and empowering local communities through community-based fire management initiatives will ensure that local knowledge is integrated into fire prevention strategies. Emphasizing education and public awareness will also help in achieving more sustainable and widespread participation in fire management efforts.

Moreover, implementing advanced technologies like satellite imagery and GIS for real-time fire monitoring will significantly improve early detection and response times. Stronger enforcement of fire prevention laws is also crucial to prevent illegal land burning, with penalties for offenders ensuring that regulations are adhered to. International collaboration is another vital component, as global partnerships can provide access to technology, funding, and best practices to improve fire management. By integrating these strategies, South Sumatra can create a more effective, adaptive, and sustainable system for managing Karhutla and preventing future disasters.

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