

## FOREST FIRE GOVERNANCE AND REGIONAL ENVIRONMENTAL POLITICS IN SOUTHEAST ASIA: A BIBLIOMETRIC ANALYSIS

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**ABSTRACT.** Forest fires remain one of the most persistent environmental governance challenges in Southeast Asia, generating significant ecological, economic, social, and political consequences, including transboundary haze pollution. Despite the growing body of literature on forest fire management, a comprehensive understanding of the intellectual structure and development of forest fire governance research in the region remains limited. This study aims to map and analyze the evolution, thematic structure, collaboration patterns, and intellectual foundations of forest fire governance research in Southeast Asia using a bibliometric approach. Bibliographic data were collected from the Scopus database, resulting in a final dataset of 644 publications after applying systematic screening procedures. The analysis was conducted using VOSviewer, employing keyword co-occurrence, co-authorship, co-citation, and bibliographic coupling techniques. The findings reveal a substantial increase in scholarly attention to forest fire governance over time, reflecting the growing recognition of forest fires as complex socio-ecological and governance challenges. The thematic structure of the literature demonstrates a shift from predominantly ecological and technical perspectives toward governance-oriented approaches emphasizing institutional coordination, stakeholder collaboration, policy implementation, sustainability, and environmental management. Collaboration network analysis indicates that knowledge production remains concentrated among a limited number of countries and institutions, while regional scientific collaboration continues to exhibit fragmented patterns. The study further highlights the importance of state capacity, collaborative governance, and multi-level governance in addressing recurring forest fire crises and transboundary environmental problems. By integrating bibliometric mapping with governance-oriented interpretation, this study contributes to the literature on environmental governance, forest governance, and regional environmental politics in Southeast Asia while providing insights for policymakers seeking more adaptive and collaborative approaches to forest fire governance.

**Keywords:** Forest Fire Governance; Southeast Asia; Bibliometric Analysis; Transboundary Haze; Collaborative Governance.

### INTRODUCTION

Forest and land fires have become one of the most persistent environmental governance challenges in Southeast Asia (Wicaksono, 2023, 2025). Over the last three decades, recurrent fire events have generated severe ecological degradation, biodiversity loss, greenhouse gas emissions, economic disruption, and public health crises across the region (Alisjahbana & Busch, 2017; Astuti, 2020; Dupraw, 2018). Indonesia, Malaysia, and several mainland Southeast Asian countries have repeatedly experienced large-scale fire events that affect not only domestic territories but also neighboring states through transboundary haze pollution (Wicaksono, 2025; Wicaksono & Zainal, 2022a, 2022b). The complexity of forest fires has intensified under conditions of climate change, prolonged drought, and increasing land-use pressures associated with agricultural expansion and natural resource exploitation.

Although forest fires are often discussed as ecological or technical problems, they are equally governance and political issues. The persistence of fire incidents in Southeast Asia reflects challenges in policy implementation, institutional

coordination, law enforcement, decentralization, stakeholder conflicts, and the unequal distribution of environmental responsibilities. Forest fire management, therefore, extends beyond fire suppression and technological monitoring; it requires effective governance arrangements capable of coordinating governments, local communities, private corporations, and international actors. Consequently, forest fire governance has emerged as an important area of inquiry within environmental governance studies (Marlier et al., 2019; Purnomo et al., 2017, 2019).

The political dimension of forest fires becomes particularly evident in the context of transboundary haze pollution. Smoke from large-scale fires frequently crosses national borders, affecting neighboring countries and creating diplomatic tensions, while exposing limitations in regional environmental cooperation. This situation places forest fires within the broader field of regional environmental politics, where issues of state sovereignty, collective action, environmental diplomacy, and regional governance become increasingly relevant. Despite the establishment of regional mechanisms such as the ASEAN Agreement

on Transboundary Haze Pollution, implementation gaps and variations in institutional capacity continue to hinder effective collective responses to forest and land fire crises (Dewi, 2023).

Forest fire governance can be understood through several complementary theoretical perspectives that explain how environmental problems are managed across multiple actors, institutions, and governance levels. Environmental governance scholarship emphasizes that complex environmental challenges cannot be addressed solely through hierarchical government interventions (Adhikari & Baral, 2018; Arnold et al., 2018; Husted, 2017). Instead, effective governance requires coordination among public institutions, private actors, civil society organizations, and local communities. Environmental governance, therefore, focuses on the processes, institutions, and mechanisms that organize collective action to address environmental problems and achieve sustainable resource management.

One influential perspective within environmental governance is collaborative governance (Ansell & Gash, 2008; Westerink et al., 2017; Wicaksono, 2023, 2025). Collaborative governance refers to decision-making arrangements in which public agencies directly engage non-state stakeholders in formal and consensus-oriented processes to formulate and implement public policies (Bradford, 2016; Pierce Colfe & Pfund, 2012; Purdy, 2012; Zadek, 2008). In the context of forest fire management, collaborative governance is particularly relevant because fire prevention and mitigation involve multiple stakeholders, including government agencies, local communities, plantation companies, environmental organizations, and international partners. The effectiveness of forest fire governance, therefore, depends not only on regulatory frameworks but also on the capacity of diverse actors to coordinate actions, share information, and build collective responsibility.

Another important perspective is multi-level governance, which highlights the interaction between governance institutions operating at different territorial and political levels (Enderlein et al., 2010; Faludi, 2012; Gupta, 2007; Piattoni, 2009; Rittberger, 2010). Forest fire governance in Southeast Asia involves local governments responsible for land management, national governments responsible for environmental regulation and law enforcement, and regional institutions such as ASEAN that facilitate cross-border cooperation. The multi-level nature of forest fire governance creates opportunities for policy coordination but also generates challenges

related to institutional fragmentation, overlapping authority, and uneven governance capacity among countries and subnational jurisdictions.

In addition, forest fires in Southeast Asia represent an important issue within regional environmental politics. Recurrent transboundary haze pollution demonstrates how environmental problems frequently transcend national borders and require collective political responses. Regional environmental politics examines how states negotiate environmental responsibilities, manage competing interests, and develop cooperative mechanisms to address shared ecological challenges. Within this perspective, forest fire governance is not merely a technical issue of fire management but also a political process involving environmental diplomacy, regional cooperation, sovereignty concerns, and power relations among states and non-state actors.

Drawing on these perspectives, this study conceptualizes forest fire governance as a multidimensional phenomenon situated at the intersection of environmental governance, collaborative governance, multi-level governance, and regional environmental politics. These theoretical lenses provide a useful foundation for interpreting the evolution of scientific research on forest fire governance and for understanding the broader governance implications emerging from the bibliometric analysis.

Research on forest and land fires has expanded significantly over the past two decades, reflecting growing concerns regarding climate change, biodiversity loss, air pollution, and environmental sustainability. Existing studies have generated substantial knowledge on fire ecology, peatland degradation, carbon emissions, remote sensing technologies, fire detection systems, and climate-related drivers of wildfire occurrence. In parallel, several bibliometric studies have sought to map the broader development of wildfire and fire management research globally.

Despite these advances, several important gaps remain. First, the existing literature is largely dominated by ecological, environmental, and technological perspectives, while governance-related dimensions remain relatively underexplored. Issues such as institutional capacity, policy implementation, collaborative governance, multi-level coordination, environmental diplomacy, and transboundary governance have received considerably less systematic attention despite their importance in shaping forest fire outcomes.

Second, although Southeast Asia is one of the world's most fire-prone regions and experiences

recurring transboundary haze crises, there is still limited bibliometric evidence that specifically maps the development of forest fire governance research within the regional context. Most existing bibliometric studies adopt a global perspective, making it difficult to identify the unique governance challenges, institutional arrangements, and political dynamics that characterize forest fire management in Southeast Asia.

Third, there is a limited understanding of how scientific knowledge on forest fire governance has evolved, how research collaborations are structured, and how emerging governance themes are connected to broader debates on environmental governance and regional environmental politics. As a result, important questions remain about the field's intellectual structure, dominant research themes, collaboration patterns, and future research directions.

To address these gaps, this study employs bibliometric analysis to systematically map the scientific literature on forest fire governance in Southeast Asia. By examining publication trends, thematic structures, collaboration networks, and developments in governance-related research, this study seeks to provide a comprehensive understanding of how the field has evolved and the implications for environmental governance and regional environmental politics.

Based on the identified research gaps, this study addresses the following research questions:

1. RQ1: How has the scientific literature on forest fire governance in Southeast Asia evolved?
2. RQ2: What thematic structures and research clusters dominate the literature on forest fire governance in Southeast Asia?
3. RQ3: How are scholarly collaboration networks structured among authors, institutions, and countries within this field of research?
4. RQ4: What governance and regional environmental politics implications emerge from the evolution of forest fire governance research in Southeast Asia?

## METHODS

This study employs a quantitative bibliometric approach using Vosviewer to analyze the development and intellectual structure of scientific research on forest fire governance in Southeast Asia. Bibliometric analysis was selected because it enables a systematic and objective assessment of a research field by quantitatively examining publication outputs, citation patterns, collaboration networks, and thematic structures (Castañeda et al., 2022; Shi et al., 2024; Wicaksono, 2023; Wulandari et al., 2022).

Compared with conventional narrative literature reviews, bibliometric methods provide greater methodological transparency, reproducibility, and analytical rigor by utilizing structured bibliographic metadata and network analysis techniques.

The study employs a descriptive-exploratory research design to identify publication trends, thematic developments, collaboration patterns, and emerging governance-related issues in the forest fire governance literature. Rather than testing causal relationships, the analysis seeks to map the field's intellectual landscape and reveal the underlying structures of scientific knowledge.

## Data Source and Search Strategy

The bibliographic data were obtained from the Scopus database, which is widely recognized as one of the largest and most comprehensive repositories of peer-reviewed scientific literature. Scopus was selected because it provides high-quality and standardized bibliographic metadata, including author information, institutional affiliations, abstracts, keywords, citation records, and publication sources, which are essential for bibliometric analysis.

Data collection was conducted on January 28, 2026. A structured search strategy was developed using the TITLE-ABS-KEY function in Scopus to retrieve publications related to forest fire governance in Southeast Asia. The search query combined terms related to forest fires, governance dimensions, and Southeast Asian countries using Boolean operators.

The search string used in this study was:

TITLE-ABS-KEY

(

("forest fire\*" OR wildfire\*)

AND

(governance OR management)

AND

(indonesia OR malaysia OR thailand OR vietnam OR philippines OR myanmar OR laos OR cambodia OR brunei OR "timor leste")

)

The search process initially identified 891 records.

## Inclusion and Exclusion Criteria

To ensure the relevance and quality of the dataset, several inclusion criteria were applied:

1. Publications indexed in the Scopus database;
2. Research articles and conference papers;
3. English-language publications;
4. Final publication stage documents;
5. Publications related to forest fire governance, wildfire management, environmental governance, and Southeast Asian contexts.

The exclusion criteria included:

1. Non-English publications;
2. Editorials, notes, letters, book chapters, reviews, errata, and other non-research documents;
3. Duplicate records;
4. Publications that were not directly relevant to forest fire governance in Southeast Asia.

### Literature Screening and Data Cleaning

The retrieved records were subjected to a multi-stage screening and cleaning process to ensure data quality and thematic relevance.

First, document-type filtering was applied, limiting the dataset to articles and conference papers, reducing the dataset from 891 to 754 records. Second, language filtering retained only English-language publications, yielding 702 records. Third, title, abstract, and keyword screening were performed to assess thematic relevance to forest fire governance and Southeast Asian contexts. Publications that did not directly address the study's scope were excluded.

Following the screening process, 58 records were removed due to limited thematic relevance. The final dataset comprised 644 publications included in the bibliometric analysis.

The literature selection process is presented in Figure 1.

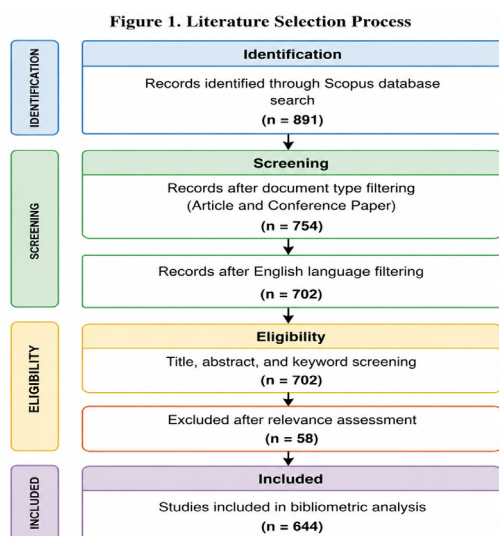


Figure 1. literature selection process

### Bibliometric Analysis Procedures

A bibliometric analysis was conducted using VOSviewer to visualize and analyze bibliographic networks. Four complementary analytical techniques were employed (Eck & Waltman, 2022).

First, keyword co-occurrence analysis was used to identify dominant research themes, thematic clusters, and emerging topics within the literature.

Second, co-authorship analysis was performed to examine collaboration patterns among authors, institutions, and countries involved in forest fire governance research.

Third, a co-citation analysis was conducted to identify influential references, intellectual foundations, and core knowledge sources shaping the field's development.

Fourth, bibliographic coupling analysis was used to identify relationships among publications based on shared cited references and to detect emerging research streams.

The results generated through these techniques were subsequently interpreted qualitatively to provide substantive insights into the evolution of forest fire governance research in Southeast Asia.

### Network Visualization and Threshold Settings

Network visualizations were generated using VOSviewer. To improve analytical clarity and reduce network complexity, threshold criteria were applied during visualization.

For co-authorship analysis, a minimum of 3 publications per author was set, yielding 112 eligible authors.

For the institutional collaboration analysis, organizations were required to have at least 5 publications, resulting in 27 eligible institutions.

In the keyword co-occurrence analysis, VOSviewer identified 642 relevant items distributed across 10 thematic clusters. The application of threshold values enabled the visualization of the most significant relationships while minimizing isolated nodes and enhancing the interpretability of the resulting networks.

### Ethical Considerations

This study utilized publicly available bibliographic metadata obtained from the Scopus database and did not involve human participants, personal data, or direct interaction with research subjects. Therefore, ethical approval was not required.

## RESULTS AND DISCUSSION

### Evolution of Forest Fire Governance Research in Southeast Asia

The analysis of 644 publications indexed in Scopus reveals a significant increase in scholarly attention to forest fire governance in Southeast Asia over the study period. The annual publication trend demonstrates a gradual expansion of academic interest, particularly following major forest fires and transboundary haze episodes that affected several

countries in the region. This growth reflects the increasing recognition of forest fires not merely as environmental disasters but as complex governance challenges requiring multidimensional responses.

The upward trajectory of publications suggests an important transformation in the way forest fires are conceptualized within academic discourse. Earlier studies primarily focused on ecological and environmental dimensions, including biodiversity loss, peatland degradation, carbon emissions, and ecosystem disturbances. However, more recent research increasingly emphasizes governance-related dimensions such as institutional coordination, policy implementation, stakeholder participation, and environmental regulation. This shift indicates the emergence of a governance-oriented perspective that views forest fires as socio-ecological problems shaped by political, institutional, and administrative factors.

The increasing volume of research also reflects broader developments in regional environmental politics. Recurring haze crises have transformed forest fires from localized environmental events into transboundary governance issues affecting multiple Southeast Asian countries. Consequently, the literature increasingly recognizes the need for integrated governance frameworks that combine environmental management, institutional coordination, and regional cooperation.

From an environmental governance perspective, the expansion of scholarly attention demonstrates growing awareness that technological interventions alone cannot adequately address recurrent forest fire crises. Effective fire governance requires strong institutional capacity, policy coherence, regulatory enforcement, and collaboration among governmental and non-governmental actors. Thus, the publication trend illustrates the evolution of forest fire governance into an important area of interdisciplinary inquiry at the intersection of environmental studies, public policy, and governance research.

Table 1. General Characteristics of the Dataset

Indicator	Value
Database	Scopus
Search Date	January 28, 2026
Initial Records Retrieved	891
Records After Document Type Filtering	754
Records After Language Filtering	702
Records After Relevance Screening	644
Final Dataset	644 Publications
Analysis Software	VOSviewer

Number of Authors Analyzed	112
Number of Institutions Analyzed	27
Number of Keywords	642
Number of Clusters	10

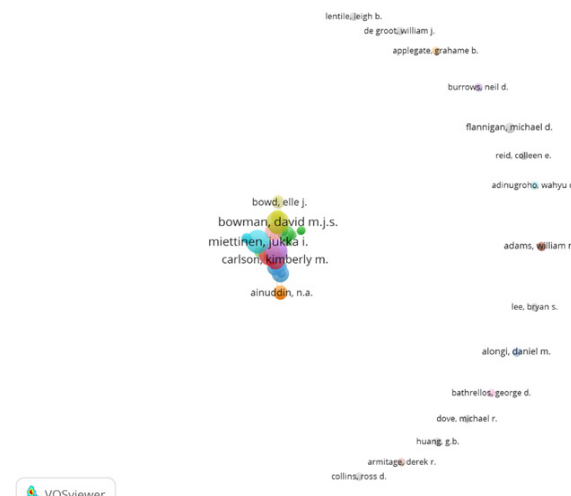


Figure 2. Annual Publication Trends Chart Related to Forest Fire Governance in Southeast Asia

### Thematic Structure of Forest Fire Governance Research

The keyword co-occurrence analysis identified 642 keywords organized into ten thematic clusters, reflecting the multidimensional nature of forest fire governance research in Southeast Asia. The most prominent keywords include *Indonesia*, *forest fire*, *peatland*, *deforestation*, *remote sensing*, *land management*, and *governance*, indicating their central position within the field’s intellectual structure.

The clustering patterns reveal that forest fire governance research extends beyond environmental and ecological concerns to encompass institutional, political, and socio-economic dimensions. Several clusters focus on environmental management and ecological impacts, while others emphasize governance, policy implementation, stakeholder engagement, and sustainability. The coexistence of these themes demonstrates the increasingly interdisciplinary character of the literature.

The prominence of governance-related keywords is particularly noteworthy. Their central position within the network suggests that scholars increasingly recognize forest fires as governance challenges rather than purely ecological phenomena. Contemporary studies frequently examine the effectiveness of institutions, policy instruments, regulatory mechanisms, and collaborative arrangements in preventing and mitigating forest fire risks.

Furthermore, the emergence of keywords associated with collaboration and stakeholder participation indicates a growing interest in



## Collaboration Networks and Knowledge Production

The co-authorship analysis identified 112 authors who met the established threshold criteria, indicating the presence of collaborative research networks in the field of forest fire governance. Although several collaboration clusters are evident, the overall network structure remains relatively fragmented, indicating uneven levels of interaction among researchers and institutions.

The institutional collaboration analysis further identified 27 organizations that met the threshold criteria. These institutions function as important hubs of knowledge production and dissemination within the region. However, collaboration patterns remain concentrated among a limited number of institutions, suggesting that research capacity is not evenly distributed across Southeast Asia.

From a governance perspective, the fragmented structure of the collaboration network mirrors broader challenges in forest fire governance. Just as environmental governance systems often struggle with fragmented authority, overlapping responsibilities, and coordination problems, scientific

knowledge production in this field also appears characterized by uneven connectivity and limited integration. The existence of disconnected research clusters may constrain knowledge exchange and reduce opportunities for interdisciplinary learning. The findings also reveal disparities in research capacity among countries within the region. Institutions from Indonesia and Malaysia occupy particularly prominent positions within the network, reflecting their strong engagement with forest fire-related issues and their comparatively developed research infrastructures. While this concentration contributes to the development of expertise, it may also create imbalances in regional knowledge production and policy influence.

Given the transboundary nature of haze pollution, stronger scientific collaboration across national boundaries is essential. Enhanced collaboration can facilitate knowledge sharing, comparative policy learning, and the development of more integrated governance approaches to address forest fire challenges at both national and regional scales. (Figure 4, Figure 5)

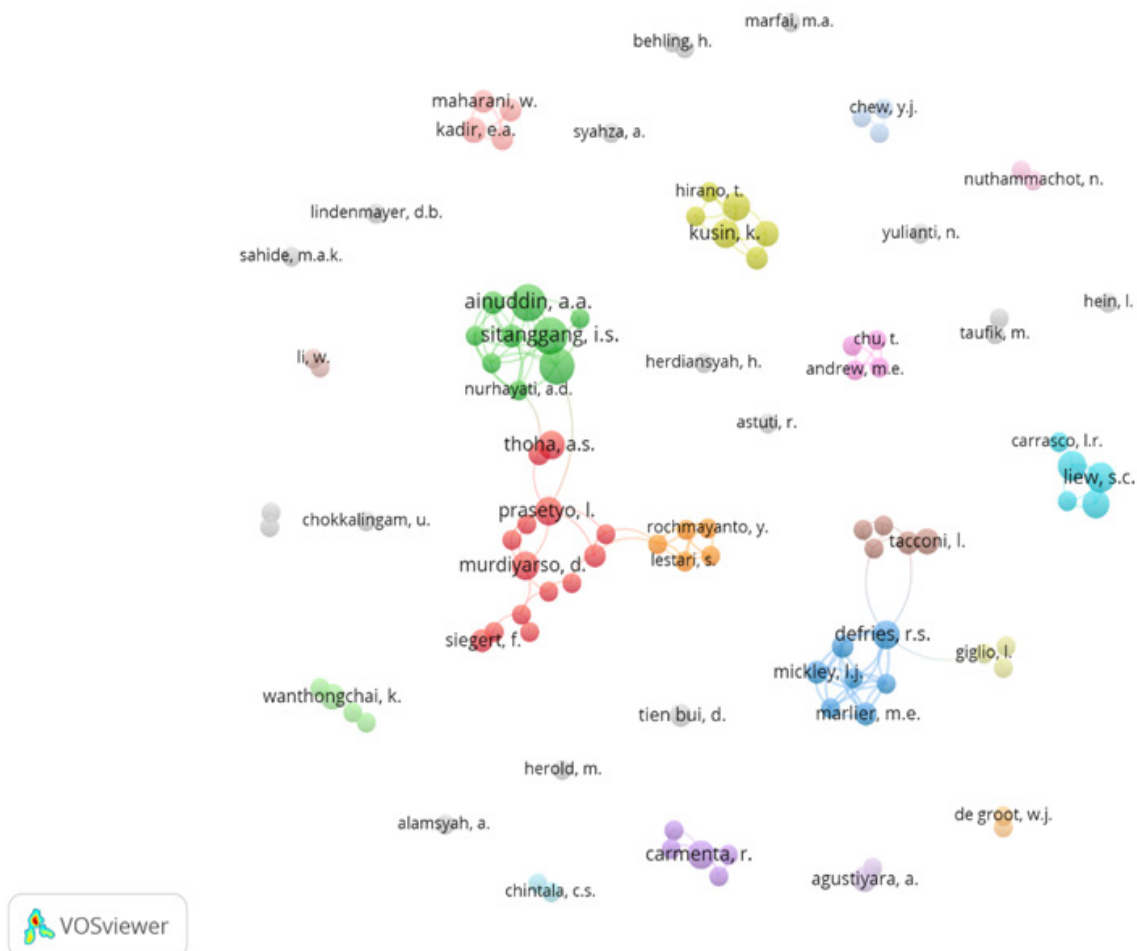


Figure 4. Co-Authorship Network Map – 112 Authors, Minimum 3 Articles. Source: Vosviewer

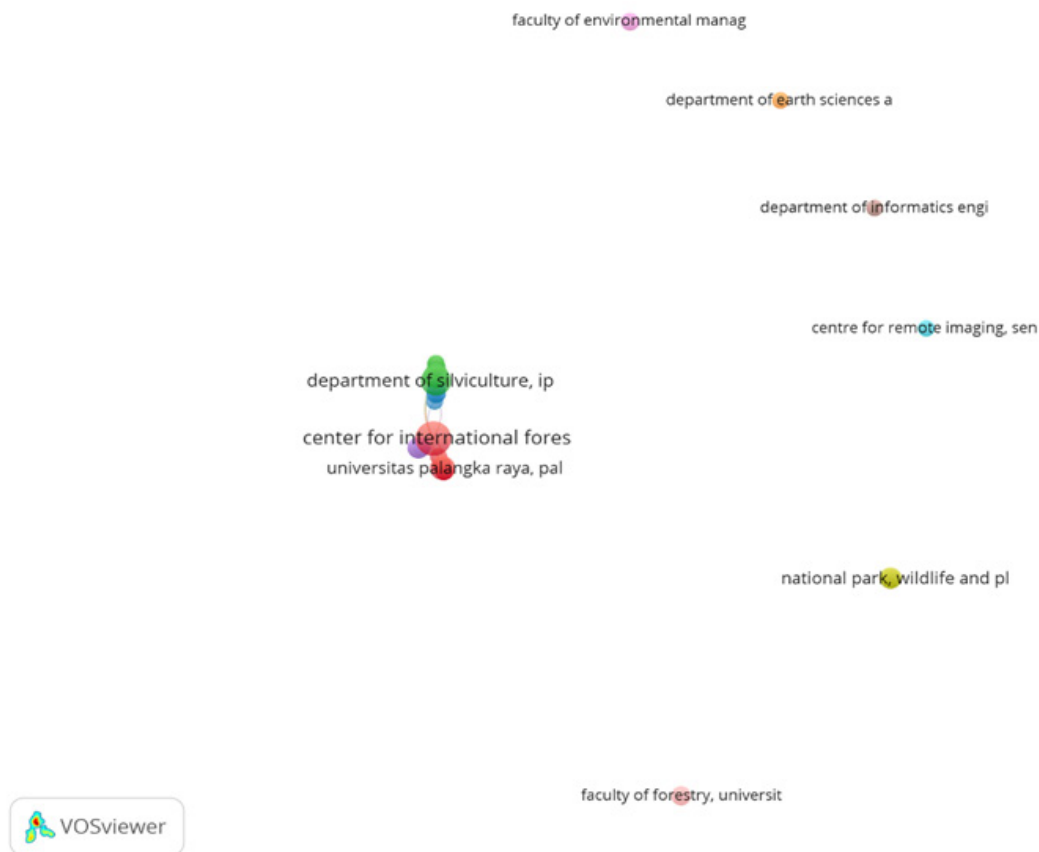


Figure 5. Institutional Co-Authorship Network Map – 27 Institutions, Minimum 5 Articles.

### Forest Fire Governance, State Capacity, and Regional Environmental Politics

One of the most important findings from the bibliometric analysis is the growing attention to governance-related dimensions of forest fire management. The centrality of governance themes suggests that scholars increasingly recognize that recurring forest fire crises cannot be fully explained by environmental and climatic factors alone.

Indonesia's dominant position in the literature reflects not only the frequency and severity of fire events but also the complexity of governance challenges associated with forest and land management. Decentralization reforms, overlapping institutional mandates, land-use conflicts, and uneven regulatory enforcement have created governance environments that significantly influence forest fire outcomes.

These findings indicate that state capacity remains a critical determinant of the effectiveness of forest fire governance. Successful fire prevention and mitigation require governments to coordinate across multiple administrative levels, enforce environmental regulations, monitor land-use practices, and facilitate cooperation among diverse stakeholders. Weak institutional capacity may undermine policy implementation and contribute to recurring fire

incidents despite the existence of formal regulatory frameworks.

The bibliometric evidence therefore supports broader governance scholarship emphasizing the importance of institutional effectiveness, policy coherence, and administrative coordination in addressing complex environmental challenges. Forest fire governance should consequently be understood not only as an environmental management issue but also as a question of governance quality and state effectiveness.

Furthermore, the growing prominence of governance-related themes suggests that future research will likely place greater emphasis on institutional reform, policy integration, and governance innovation as essential components of sustainable forest fire management strategies.

### Implications for ASEAN Environmental Governance

The findings have important implications for regional environmental governance in Southeast Asia. Forest fires and transboundary haze pollution constitute classic collective-action problems in which environmental impacts frequently extend beyond national borders. Consequently, effective governance requires not only domestic policy interventions but also sustained regional cooperation.

The bibliometric analysis reveals that research production remains concentrated in a limited number of countries, particularly Indonesia and Malaysia. While these countries play central roles in regional knowledge production, the uneven distribution of research capacity suggests that opportunities for broader participation in the region remain underdeveloped. Such disparities may influence the effectiveness of collective governance initiatives and regional policy coordination.

The relatively fragmented pattern of international collaboration identified in this study further highlights the need for stronger cross-border scientific partnerships. Given the regional nature of haze pollution, scientific collaboration should ideally reflect the transboundary scale of the problem itself. Enhanced research cooperation can support evidence-based policymaking, facilitate knowledge transfer, and strengthen regional governance mechanisms.

These findings are particularly relevant in the context of the ASEAN Agreement on Transboundary Haze Pollution, the primary institutional framework for addressing regional haze. Despite this agreement, recurring fire and haze episodes persist, suggesting that implementation challenges remain significant. The persistence of these challenges underscores the importance of strengthening institutional coordination, monitoring systems, information-sharing mechanisms, and collaborative governance arrangements across the region.

Ultimately, the findings suggest that future forest fire governance strategies should move beyond reactive fire suppression approaches and embrace adaptive, preventive, and collaborative governance frameworks. Strengthening state capacity, enhancing stakeholder participation, and expanding regional cooperation will be essential for improving the long-term effectiveness of forest fire governance in Southeast Asia.

### **Theoretical Contributions**

The findings of this study advance forest governance scholarship by demonstrating how the intellectual landscape of forest fire research in Southeast Asia has evolved from predominantly ecological and technical perspectives to governance-oriented approaches. While earlier studies largely emphasized biophysical factors such as climate variability, peatland characteristics, land-cover change, and fire behavior, the bibliometric evidence reveals a growing prominence of governance-related themes, including institutional coordination, stakeholder collaboration, policy implementation, sustainability, and environmental management. This shift indicates

that forest fire governance is increasingly understood as a complex socio-ecological phenomenon shaped by interactions between environmental processes and institutional arrangements.

The study further contributes to the development of collaborative governance theory by illustrating its growing relevance in forest fire management. The emergence of keywords associated with collaboration, participation, and multi-stakeholder engagement suggests that scholars are increasingly recognizing the limitations of traditional command-and-control approaches to addressing recurring forest fire crises. Forest fire governance requires the active involvement of governmental agencies, local communities, private sector actors, civil society organizations, and international institutions. Consequently, the findings reinforce the central proposition of collaborative governance theory: complex public problems cannot be effectively resolved through hierarchical governmental action alone but require sustained cooperation among diverse stakeholders.

In addition, the study provides empirical support for multi-level governance perspectives. The bibliometric patterns reveal that contemporary forest fire governance research increasingly addresses interactions among local, national, and regional governance structures. This finding is particularly relevant in Southeast Asia, where forest fires frequently generate transboundary environmental impacts through haze pollution. Effective governance, therefore, depends not only on local fire prevention efforts and national policy interventions, but also on regional cooperation mechanisms that facilitate coordination across jurisdictional boundaries. The findings suggest that multi-level governance has become an increasingly important analytical framework for understanding forest fire governance in the region.

Furthermore, the study contributes to environmental governance literature by highlighting the central role of institutional capacity and governance effectiveness in shaping forest fire outcomes. The prominence of governance-related themes demonstrates growing scholarly recognition that environmental crises cannot be fully explained by ecological variables alone. Instead, institutional quality, regulatory enforcement, policy coherence, and administrative capacity play equally important roles in determining governance effectiveness. This finding supports broader scholarship on environmental governance that emphasizes the importance of institutions in managing complex socio-ecological challenges.

Finally, the study extends existing bibliometric research by integrating quantitative mapping techniques with governance-oriented interpretations. Whereas many bibliometric studies focus primarily on identifying publication trends, influential authors, and thematic clusters, this research advances the discussion by linking bibliometric patterns to broader theoretical debates on collaborative, multi-level, and environmental governance. As a result, the study provides a more comprehensive understanding of how knowledge production in forest fire governance reflects evolving theoretical and policy concerns within Southeast Asia.

### **Contributions to Governance and Political Science**

Beyond its contribution to forest governance scholarship, this study offers several important insights for governance and political science research. The findings demonstrate that forest fires should not be viewed solely as environmental disturbances or natural disasters but rather as governance problems shaped by political institutions, administrative arrangements, and policy choices. The growing prominence of governance-related themes in the literature indicates that scholars are increasingly recognizing the political dimensions of forest fire management, including issues of authority, accountability, coordination, and policy implementation.

The study contributes to governance studies by revealing that state capacity is a critical determinant of the effectiveness of environmental governance. The dominance of Indonesia in the literature reflects not only the country's exposure to recurrent forest fires but also the complexity of governance challenges associated with decentralization, land-use regulation, and intergovernmental coordination. These findings support arguments in governance scholarship that policy effectiveness is strongly influenced by public institutions' ability to coordinate across multiple administrative levels, enforce regulations, and manage competing policy objectives. Consequently, recurring forest fire crises can be interpreted as indicators of broader governance challenges rather than merely environmental failures.

The findings also contribute to the literature on governance fragmentation. The fragmented structure of collaboration networks identified in this study mirrors institutional fragmentation frequently observed in environmental governance systems. The existence of multiple actors operating across different sectors and administrative levels often creates coordination challenges that undermine

policy effectiveness. By highlighting these patterns, the study demonstrates how governance fragmentation influences both knowledge production and environmental management outcomes. This perspective contributes to ongoing debates regarding the relationship between institutional coherence and governance performance.

From a political science perspective, the study underscores the importance of environmental politics as an emerging area of scholarly inquiry in Southeast Asia. Forest fires and transboundary haze pollution are highly political issues that involve conflicts over land use, economic development, environmental protection, and public accountability. The bibliometric evidence suggests that these issues have increasingly attracted scholarly attention because they reveal tensions between competing policy priorities and governance objectives. Consequently, forest fire governance provides a useful lens through which broader questions concerning state-society relations, regulatory politics, and environmental policymaking can be examined.

The study also contributes to the growing field of regional environmental politics. The findings indicate that forest fire governance in Southeast Asia is increasingly transcending national boundaries and requiring collective responses to shared environmental challenges. The recurring nature of transboundary haze pollution demonstrates the limitations of purely national approaches and highlights the importance of regional governance mechanisms. This observation reinforces political science arguments about collective action problems, regional cooperation, and environmental diplomacy. In this context, institutions such as the Association of Southeast Asian Nations (ASEAN) play a critical role in facilitating coordination, information sharing, and policy harmonization among member states.

Ultimately, this study demonstrates that forest fire governance constitutes a valuable empirical arena for examining broader questions in governance and political science. By connecting environmental challenges with issues of state capacity, institutional effectiveness, governance fragmentation, collaborative governance, and regional cooperation, the study broadens understanding of how political and administrative systems respond to complex socio-ecological problems. The findings, therefore, strengthen the relevance of forest fire governance research within contemporary governance and political science scholarship and provide a foundation for future interdisciplinary investigations of environmental governance in Southeast Asia.

## CONCLUSION

This study mapped the intellectual structure and development of forest fire governance research in Southeast Asia through a bibliometric analysis of 644 Scopus-indexed publications. The findings reveal a significant increase in scholarly attention to the topic, reflecting the growing recognition of forest fires as complex socio-ecological challenges that extend beyond environmental management concerns. The thematic analysis demonstrates that contemporary research increasingly emphasizes governance-related issues, including institutional coordination, stakeholder collaboration, policy implementation, sustainability, and environmental management. Furthermore, collaboration network analysis indicates that knowledge production remains concentrated among a limited number of countries and institutions, while regional scientific collaboration continues to exhibit fragmented patterns.

The study highlights an important transformation in the intellectual orientation of forest fire research. While earlier scholarship primarily focused on ecological and technical dimensions, recent studies increasingly conceptualize forest fires as governance challenges shaped by institutional capacity, regulatory effectiveness, and multi-stakeholder interactions. These findings reinforce the relevance of collaborative, multi-level, and environmental governance perspectives for understanding and addressing recurring forest fire crises. The results also demonstrate that governance quality plays a critical role in determining the effectiveness of forest fire prevention and mitigation strategies across Southeast Asia.

From a governance and political science perspective, the study shows that forest fires should be understood not merely as environmental disturbances but as political and institutional problems requiring coordinated responses across administrative and territorial boundaries. The persistence of transboundary haze pollution underscores the importance of regional cooperation and collective action among Southeast Asian countries. Future research may explore the relationships among governance arrangements, policy effectiveness, and environmental outcomes through comparative studies across national and regional contexts. Such efforts will contribute to the development of more adaptive, collaborative, and sustainable approaches to forest fire governance in Southeast Asia.

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