

Bibliometric Analysis: Forest Fire Controlling Policy in Indonesia

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Abstrak: Penelitian ini bertujuan untuk mengidentifikasi dan menganalisis intensitas perkembangan penelitian dengan topik kebijakan pengendalian kebakaran hutan di Indonesia dalam 5 (lima) tahun terakhir dari tahun 2017 hingga 2021 menggunakan data bibliometrik. Metode penelitian menggunakan studi literatur dengan pengumpulan data melalui software Publish or Perish dari database Google Scholar dengan kata kunci “forest fire Indonesia,” “forest fire management, Indonesia,” forest fire control, Indonesia,” dan “forest fire policy, Indonesia.” Analisis data menggunakan aplikasi VOSviewer. Hasil penelitian menunjukkan terdapat 154 artikel jurnal yang membahas kebijakan pengendalian kebakaran hutan di Indonesia antara tahun 2017 hingga 2021 diakses pada tanggal 18 Desember 2021. Istilah “implementasi” menjadi istilah yang paling sentral dan banyak dibahas dalam penelitian-penelitian sebelumnya. Sebagai perbandingan, pada tahun 2021, istilah “kebijakan koordinasi” dan “kebakaran hutan tahunan” menjadi isu terakhir yang dibahas. Batasan penelitian ini adalah pencarian data menggunakan database Google Scholar ini bersifat terbuka untuk semua tulisan mencakup artikel jurnal, laporan, tugas makalah, dan publikasi lainnya yang telah diupload ke database Google. Selain itu, ketidaklengkapan metadata seperti tahun dan sumber publikasi menjadi tidak terdeteksi saat difilter. Penelitian selanjutnya disarankan untuk menganalisis lebih lanjut menggunakan database pengindeksan lain seperti Scopus atau Web of Science.

Kata Kunci: Bibliometric; Kebakaran Hutan; Kebijakan Kehutanan; Kebijakan Publik.

Abstract: This study aims to identify and analyze the intensity of research developments with the topic of forest fire controlling policy in Indonesia in the last five years from 2017 to 2021 through bibliometric analysis. The research method uses a literature review with data collection through the publish or perish software from the google scholar database with the keywords “forest fire Indonesia,” “forest fire management, Indonesia,” forest fire control, Indonesia,” and “forest fire policy, Indonesia.” Data analysis using the VOSviewer application. The results showed 154 journal articles discussing forest fire controlling policy in Indonesia between 2017 and 2021 accessed on December 18, 2021. The term “implementation” became the most central and widely discussed term in previous studies. As a comparison, in 2021, the terms “coordination policy” and “annual forest fire” will be the last issues to be discussed. The limitation of this study is research using the Google Scholar database. It is open to all articles, including journals, reports, papers assignments, and articles that have been uploaded to the Google database. In addition, incomplete metadata such as year and source of publication become undetectable when filtered. Following research, more analysis will be conducted using other indexing databases like Scopus or Web of Science.

Keywords: Bibliometric; Forest Fire; Forest Policy; Public Policy.

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INTRODUCTION

This study uses a bibliometric analysis of forest fire controlling policy in Indonesia, an important policy to ensure environmental sustainability, the sustainability of tropical forests as the lungs of the world, and forests as a source of livelihood for Indonesian people. Bibliometrics is a measurable data mining process with statistical analysis of previously published studies and the use of publications as knowledge (Agarwal et al., 2016). Since the 1990s, it has emerged as a critical practice tool for assessing research and researchers (Gingras, 2016; Szomszor et al., 2021), can be used to determine the intellectual impact of scholarly activities (Aman, 2018; Bornmann & Marewski, 2019; Fadhlurrohman et al., 2021).

Furthermore, bibliometrics has evolved into a critical tool for assessing and analyzing academic and technological productivity and impact (Moral-Muñoz, Herrera-Viedma, Santisteban-Espejo, & Cobo, 2020). It is used to analyze the number of scientific publications on a particular topic and their citations (Bornmann, 2014; Gingras, 2016; Holden, Rosenberg, Barker, & Weissman, 2013; Polese, 2017; Rousseau, Egghe, & Guns, 2018), several authors who contribute to each publication (Andres, 2009), increasing the ranking of research departments and institutions (Ellegaard & Wallin, 2015), and analyzing information on the authors, keywords, cited references, publication year, source title, publication source, and abstract for thousand of academic articles published in leading journals in the field (Goyal, 2017; Goyal & Howlett, 2018).

Table 1. Applications of Bibliometric Sub-field

Sub-field	Application
Methodology research	<ol style="list-style-type: none"> 1. Concerned with a technique used to conduct bibliometric research 2. Based on the creation or enhancement of bibliometric indicators 3. Bibliometricians will be the primary researchers
Scientific disciplines	<ol style="list-style-type: none"> 1. Researchers from any discipline can conduct these bibliometric studies 2. The goal is to implement bibliometric indicators with a specific field of study 3. metrics are used in these studies to describe science.
Science policy	<ol style="list-style-type: none"> 1. The most crucial subject in the field 2. The study of bibliometric is used to determine various levels of productivity 3. Policymakers conduct this study to determine how to distribute available resources.

Source: processed from Andres, 2009

Various fields have used this bibliometric (table 1), such as a research methodology, scientific disciplines, and scientific policy. Nevertheless, in this study, bibliometric analysis was used as methodology research. It was carried out to see the intensity of the development of writing published using data from Google Scholar with specific keywords. In so doing, this study has focused on finding the most discussed item dealing with forest fire controlling policy in Indonesia. Along with it, the study is also concerned with how updated the terms appear based on the year and item density in the network as well.

Empirically, Forest fires in Indonesia are events that appear every year (Budiningsih, 2017; Kusumaningtyas, Aldrian, Suradi, Ahmad, & Krisnawan, 2021; Rasyid, 2014), most of them are caused by human activities (Adinugroho, Suryadiputra, Saharjo, & Siboro, 2005; Firnando, Septawan, & Ermanovida, 2019; Nugroho, 2016; Saharjo et al., 2018; Sarmiasih & Pratama, 2019). Data on the area of forest fires in Indonesia in 2015-2021 can be seen in Figure 1. This Figure denotes the fluctuation of forest fire area during 2015-2021, with the first broadest area affected in 2015 as of more than 2.6 million hectares followed by the second broadest area affected happening in 2019 as of around 1.6 million hectares. For the other years during 2015-2021, the breadth of forest fire area averaged around 346 thousand hectares. This fact is also concluded in research on forest fires in Indonesia.

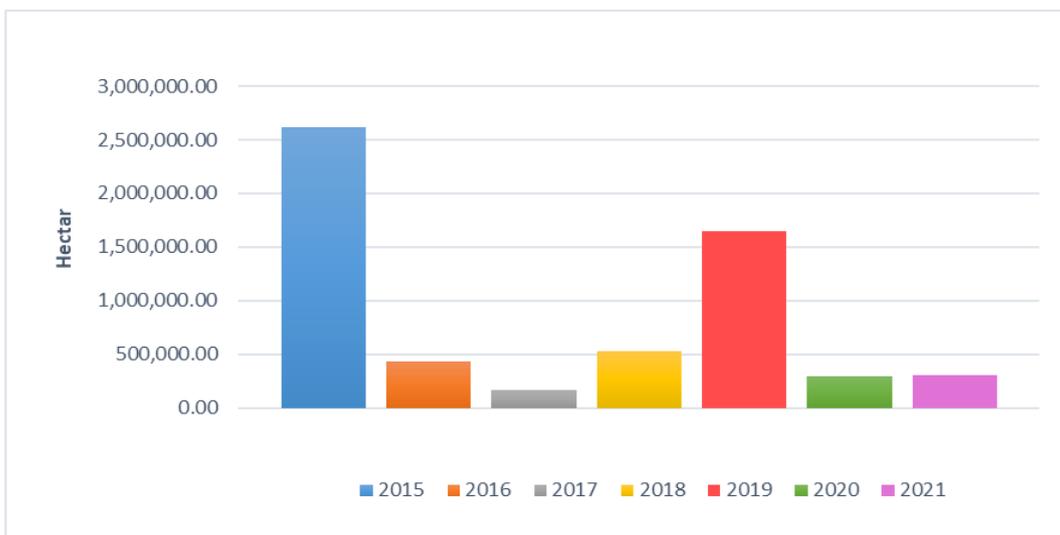


Figure 1. the breadth of forest fire In Indonesia 2015-2021

Source: Sipongi-Karhutla Monitoring System, 2021

Over the past seven years, from 2015 to November 2021, Indonesia has experienced forest fires covering an area of 5,991,336.19 hectares. The forest fire that happened in 2015 and 2019 was the largest in the last seven years (Nurhayati, Hero Saharjo, Sundawati, Syartinillia, & Vetrira, 2020; Yunvi et al., 2021) that is equal to 71.11% out of total forest fire during that period. The distribution of forest fire areas in each province in Indonesia in 2019 can be seen in Figure 2.

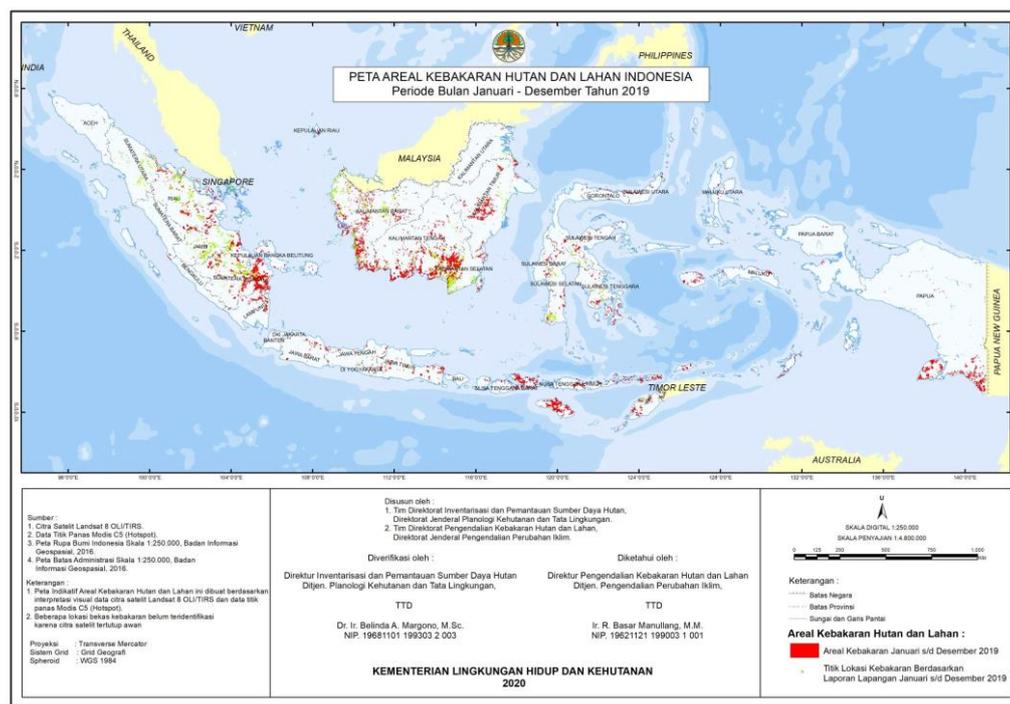


Figure 2. Map of Provincial Forest Fire Areas in Indonesian 2019

Source: Ministry of Environment & Forestry, 2020

Based on Figure 2, most forest fires occur on the islands of Sumatra and Kalimantan. Especially in South Sumatra and Central Kalimantan (Ministry of Environment & Forestry, 2020). The forest fire area, as seen in Figure 2, can also be observed based on the function of the area consisting of conservation forest, protection forest, limited production forest, production forest, conservation production forest, and other use areas as presented in Figure 3.

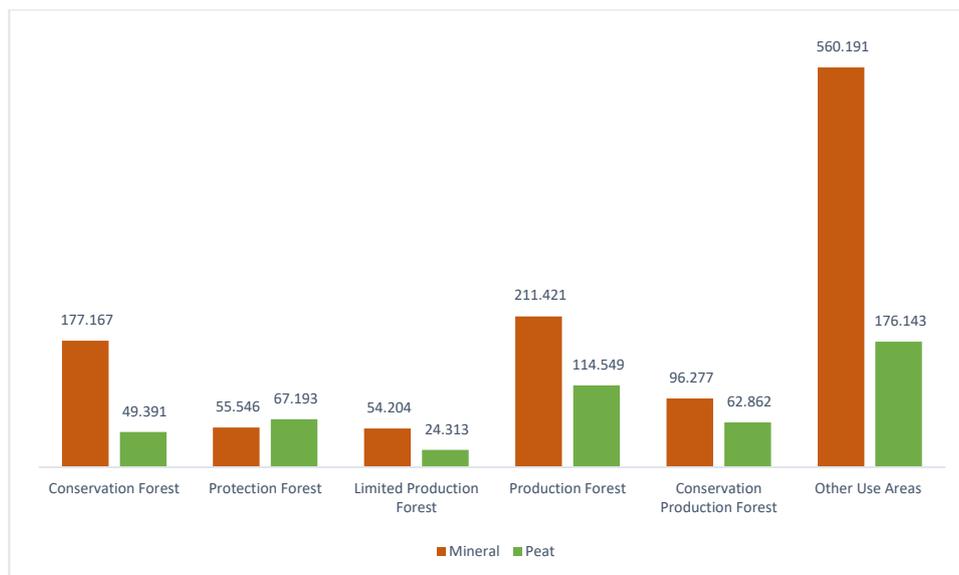


Figure 3. Indonesian Forest Fires in 2019 Based on The Area Function

Source: Ministry of Environment & Forestry, 2020

Figure 3 is the total area of forest fires by area function. As of 70% out of the total forest fire occurred on mineral lands, while the other 30% occurred on peatlands. However, in terms of area function, 45% occurred on the area for other uses that are not determined as forest areas. This fact mentions that in the future the activities to prevent and handle forest fires possibility, of course, will involve many stakeholders including the central, provincial, regency/city governments, as well as the government and people at the village level. In so doing, there is a need to establish an integrated organizational system to ensure coordinated activities among stakeholders. However, in reality so far, coordination between government agencies has occurred only in the context of the emergency stage (Budiningsih, 2017). In fact, forest fire control is all efforts to prevent, emergency, post-forest and land fires, evacuation and rescue, and management support (Medrilzam; et al., 2017). Similarly, Zaenuri also stated that the disaster management cycle consists of prevention, emergency, recovery, and resolution (Zaenuri, 2021).

Forest policies typically approach the issue of forest fires from a reactive standpoint by creating new and expanded policy instruments merely in order to respond to relevant damages of forest fires (Mourao & Martinho, 2020). It has also been conveyed that the government's reaction is more related to the perspective of social appeasement (Mourao & Martinho, 2019). This reactive response has an impact on the implementation of forest fire controlling policy which is still not optimal (Asteriniah & Sutina, 2017; Budiningsih, 2017; Wulantari, Adhyanto, & Handrisal, 2020) even the policy is not appropriate dealing with forest fire control (Nazifah, Yarni, & Nasution, 2020; Umasangaji, 2017).

Several authors have researched on forest fire controlling policy (Alamsyah, Saptawan, Ermanovida, & Yustian, 2019; Asteriniah & Sutina, 2017; Budiningsih, 2017; Fadlillah, Basuni, & Sunarminto, 2017; Fithriyyah, Suwitri, Warella, & Yuliani, 2020; Fitriani., Rianawati, & Maryati, 2018; Kemal Putra, Hero Saharjo, & Wasis, 2019; Khalwani, 2016; Maylani & Mashur, 2019; Purnomo et al., 2017; Rahmah, 2017; Sawerah, Muljono, & Tjitropranoto, 2016; Sayendri, 2016; Setiawan S, 2019; Supriyanto & Syarifudin, 2018). From these researches, each author has a different research focus dealing with forest fire controlling policy covering policy analysis (Supriyanto & Syarifudin, 2018); community participation (Fadlillah et al., 2017; Fitriani. et al., 2018; Sawerah et al., 2016; Sayendri, 2016); policy implementation (Budiningsih, 2017) collaborative governance (Maylani & Mashur, 2019) policy effectiveness (Khalwani, 2016; Rahmah, 2017); institution (Kemal Putra et al., 2019; Suhendri & Purnomo, 2017); actor-network (Alamsyah et al., 2019; Fithriyyah et al., 2020; Purnomo et al., 2017).

Forest fire controlling policy is essential to study because forest fire always occurs every year and has an impact on many things, including loss of benefits from forest potential, reduced forest area, unavailability of clean air, and loss of forest function (Rasyid, 2014), smog, aviation, acute

respiratory infections (Pasai, 2020), loss of ecosystems and biodiversity, degradation, the decline in air quality and air pollution (Sarmiasih & Pratama, 2019). The occurrence of forest fires and the significant losses due to forest fires make the research of forest fires essential to make the relevant policy. Nevertheless, this study aims to identify and analyze the intensity of research developments on forest fire controlling policy in 2017-2021 using bibliometric analysis from the Google Scholar database. The purpose of this research is based on a literature search on bibliometric analysis by mapping research topics that have not been widely studied to formulate research gaps and find novelty from previous studies (Figure 4).

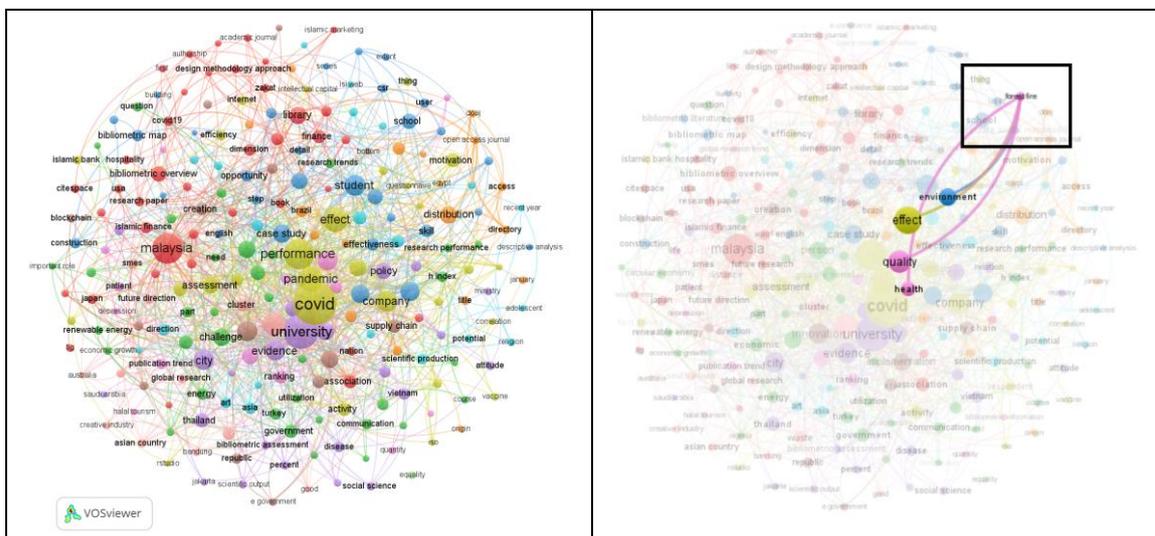


Figure 4. Visualization of Research Topic Position
 Source: VOSviewer, 2021

Based on Figure 4, the topic mapping with the keyword "bibliometric Indonesia" from a scientific journal article through google scholar database shows the research topics using the bibliometric analysis in Indonesia related to forest fires are still rarely done. Hence, this research is focused on forest fire controlling policy in Indonesia with bibliometric analysis.

RESEARCH METHOD

This study uses bibliometric data from Google Scholar to identify and analyze the intensity of research developments on forest fire controlling policy in Indonesia from 2017 to 2021, accessed on December 18, 2021. Google Scholar is a valuable alternative source of citation statistics, particularly in the information and social sciences (Harzing & van der Wal, 2009). The following is a brief overview of Google Scholar which is the essential features: advanced search option, relevance ranking, full-text access, institutional access, library and web search are some of the features available (Mayr & Walter, 2007). The literature search in this study was carried out through Publish or Perish software version 7.30.3280.7752. This software was designed to calculate citation metrics for various purposes, which is very suitable for doing bibliometric research on both authors and journals (Harzing, 2011). From this software, the literature search in this study was set to a maximum limit of 1000 publications originating from journals.

The data collection used the Google Scholar database through Publish or Perish with the keywords which are “forest fire Indonesia,” “forest fire control, Indonesia,” “forest fire policy, Indonesia,” and “forest fire management, Indonesia.” These keywords become important in research in finding titles, texts, abstracts, and others (Siswadi, 2013). The researcher used the google scholar database because it provides a simple way to search for scholarly literature broadly and free accessibility (Bar-Ilan, 2008). It explores many sources such as academic publishers, preprint repositories, and educational institutions (Agarwal et al., 2016). However, after searching, the writer does a filter with the keywords that have been determined. Furthermore, compared to the Web of Science, Google Scholar is considered more inclusive in calculating the h-index (Agarwal et al., 2016).

Data analysis and visualization are made through VOSViewer version 1.6.16, as software in the study, which is a program developed for constructing a bibliometric graph from network data as well as visualizing and exploring these graphs (van Eck & Waltman, 2010; Van Eck & Waltman, 2019). The bibliometric analysis informs about the name of authors, keywords, cited references, publication year, source title, publication source, and abstract for thousands of academic articles published in leading journals in the field (Goyal, 2017; Goyal & Howlett, 2018). The researchers evaluated various bibliometric metrics to view the impact of books, authors, and journals, including several publications, cumulative citations, citations per paper, influential journals, and most significant countries using VOSviewer software. VOSviewer can be used to create a map of keywords from co-occurrence data or a map of authors from co-citation (van Eck & Waltman, 2010). This study limits only the construction of bibliometric data in terms of keywords and the number of articles published. The steps of this research, which are data collection and analysis, are shown in Figure 5.

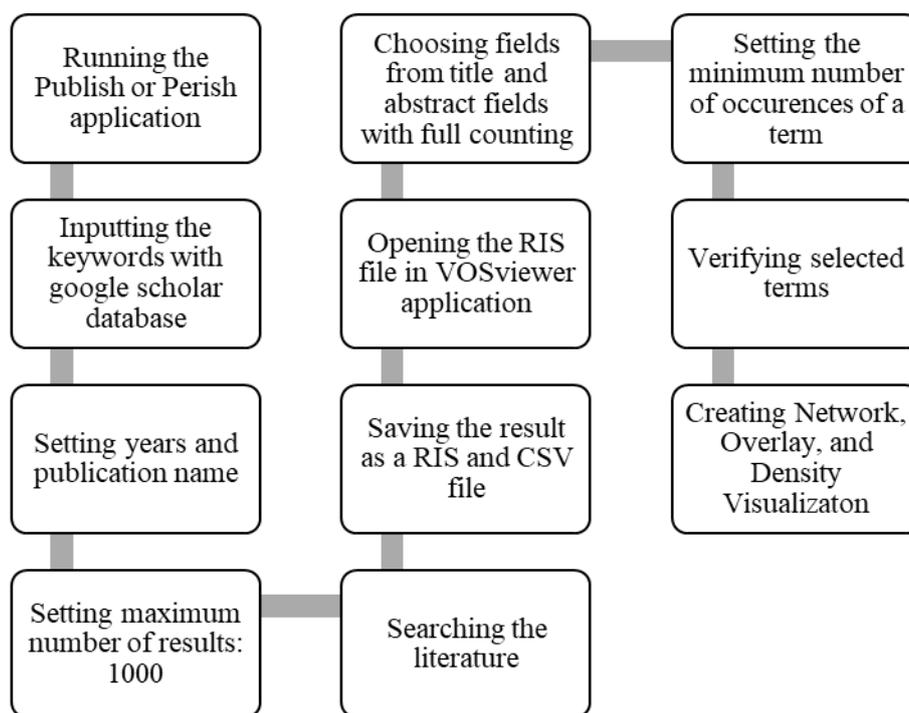


Figure 5. Data Collection and Analyzing Steps

Based on Figure 5, there are two applications used in this study, namely Publish or Perish to search for bibliometric data from the Google Scholar database, and VOSviewer to visualize the network formed from bibliometrics in the form of Research Information Systems (RIS) data containing the number of citations, year, rank, author, title, publication source, publisher, type of document. It is worth to note that not all of RIS data is equipped with metadata.

RESULT AND DISCUSSION

After searching with keywords in the Google Scholar database from 2017 to 2021 accessed on December 18, 2021, by extracting title and abstract fields, the writer found 3.965 papers (Table 2).

Table 2. Number of Publications Before filtered

Search Keywords	Search Result (number of Paper)
Forest fire Indonesia	994
Forest fire management, Indonesia	991
forest fire control, Indonesia	990
Forest fire policy, Indonesia	990
Total	3,965

Source: Google Scholar in Publish or Perish, 2021

Filtering Search Results reduces or filters the initial search results to produce more detailed results dealing with the title more specific focus. From this result, starting from filtering the articles which are published neither in English nor in Bahasa, double papers, and writing outside journals such as researchgate and activity reports (Table 3). By using Google Scholar results in the number of millions of academic documents consisting of abstracts, articles, books, theses, book chapters, technical reports or their drafts, conference papers, preprints, post-prints, patents, and court decisions (Orduna-Malea, Martín-Martín, & López-Cózar, 2017). Hence, it is necessary to filter these publications as the author said before and followed the statement that bibliometrics is a tool for evaluating research and researchers (Gingras, 2016; Szomszor et al., 2021). The review in this study includes the number of articles with specific keywords in a certain time from a certain database. This keyword is one of the requirements to ensure the successful search process that can be searched on the title, text, and abstract (Siswadi, 2013). Having found these keywords (Table 3), the writer interprets the meaning of the available data visualization.

Table 3. Number of Publications after Filtered

Search Keywords	Search Result (Number of journal articles)
Forest fire Indonesia	5
Forest fire management, Indonesia	93
forest fire control, Indonesia	44
Forest fire policy, Indonesia	12
Total	154

Source: Google Scholar in Publish or Perish, 2021

The title "Forest fire controlling policy in Indonesia" with a bibliometric analysis found 154 journal articles out of a total of 3,965 papers from the Google Scholar database. Forest fire controlling policy is one aspect of the public policies in general. Conceptually, public policy implies activities and decisions of the governments to solve public problems and aim to improve people's standard of living (Hagen, Harrison, & Dumas, 2018). It is the final output of government activity, and policy is inevitably political (Peters, 2018). In this case, forest fire controlling policy is one of the government activities to overcome forest fires in Indonesia which occur every year. In fact, for the last five years, namely from 2017 to 2021 accessed on December 18, 2021, there are several publications of articles on forest fires controlling policy in Indonesia, as presented in Figure 5.

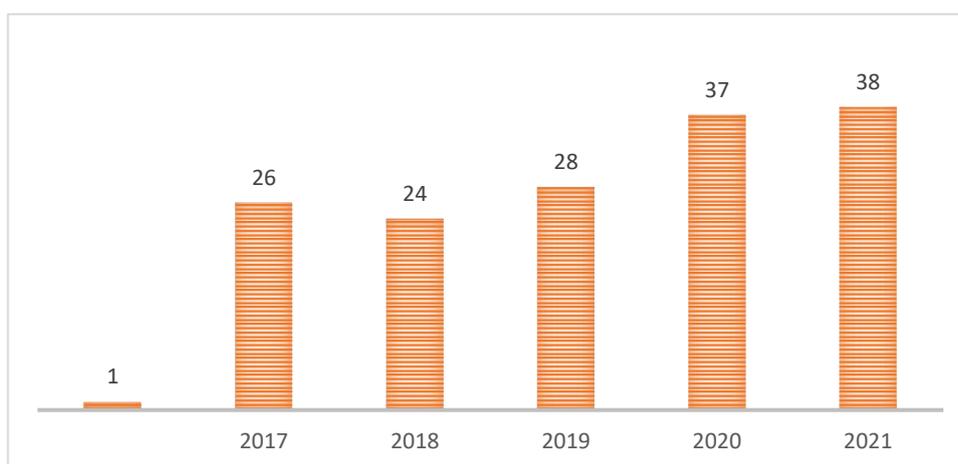


Figure 5. Number of Journal Article in 2017-2021

Source: Google Scholar, 2021

Figure 5 shows 154 publications in journal articles from the Google Scholar database with keywords in table 2. The number of this publication has decreased slightly from 2017 to 2018, but since 2019 it has increased until December 18, 2021, as many as 103 documents. From 154 journal articles, there is one document that has not the year of publication but is entered in the data filter by

using the Publish or Perish application. The average number of articles discussing forest fire controlling policy in Indonesia is 25 journal articles per year. The network visualization of the article by using VOSviewer subject to a minimum number of relationships with three terms. Based on the result of this software, there are 1,452 terms containing 135 thresholds (Figure 6).

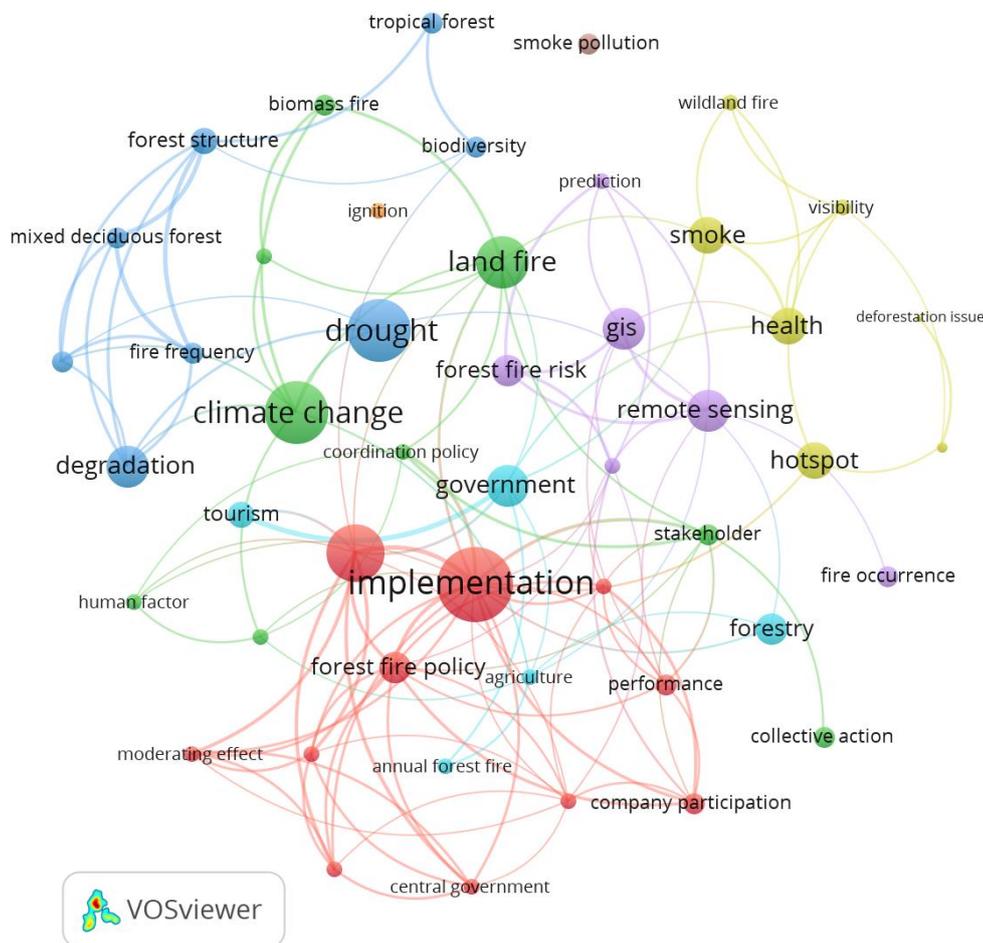


Figure 6. Network Visualization
 Source: VOSviewer, 2021

Figure 6 illustrates the network visualization containing items. The item, which is also called the term or a node, is an object of interest (Van Eck & Waltman, 2019). This node is related to the occurrence found in the title and abstract of an article, the larger the occurrence, the larger the node size. Between node and node, there can be a link which is a relation or a connection among two nodes (Van Eck & Waltman, 2019). This link has a strength, which is characterized by a positive number. The strength of the link is represented by the magnitude of the number. The bigger such number means the stronger the link. Furthermore, a connection between nodes and links made a network (Van Eck & Waltman, 2019). Based on that network, as seen in Figure 6, there are 48 nodes divided into 8 clusters, which totally include 130 links and 348 total link strengths.

The network visualization formed from the keywords of “forest fire Indonesia,” “forest fire control, Indonesia,” “forest fire policy, Indonesia,” and “forest fire management, Indonesia,” which were found in the google scholar database using Publish or Perish software. These keywords create a graph consisting of many clusters respectively having certain colors. Hence, the number of colors in the figure mentions the number of clusters in the network. In addition, the similarity of colors describes the similarity of clusters. A cluster is a group of related nodes in some way (Van Eck & Waltman, 2014). In the figure, there are eight colors in the network, meaning that there are 8 clusters that contain a collection of closely related nodes in each cluster.

Cluster 1 contains 11 red items, namely central government, company participation, forest fire policy, forest fire prevention, good forest fire governance, good governance, implementation, local government, moderating effect, performance, and role. Cluster 2 consists of 9 green items, namely biomass fire, climate change, collective action, coordination policy, human factor, land fire, natural factor, poor air quality, and stakeholders. Cluster 3 contains eight blue items, namely biodiversity, degradation, drought, fire frequency, forest structure, human activity, mixed deciduous forest, and tropical forest. Cluster 4 consists of 7 items, namely deforestation issue, health, hotspot, smoke, sustainable development, visibility, and wildland fire. Cluster 5 contains six items, namely fire occurrence, forest fire risk, forest zone, GIS, prediction, remote sensing. Cluster 6 contains five items, namely agriculture, annual forest fire, forestry, government, and tourism. Cluster 7 only has one item, which is ignition. The last, cluster 8, also has only one item, namely smoke pollution. Cluster 7 and 8 are not connected to other nodes, meaning that the topics are rarely carried out in term of forest fire controlling policy in Indonesia.

Based on the network, the node with the highest occurrence is "implementation," with 14 occurrences. This occurrence indicates the number of documents in which a keyword appears (Van Eck & Waltman, 2019). It means that there are 14 articles that discuss about implementation related to forest fire controlling policy in Indonesia. This node is the most central topic and is the subject of discussion in journal articles, as previous research, which stated that this forest fire controlling policy is still not optimal at the implementation stage (Asteriniah & Sutina, 2017; Budiningsih, 2017; Wulantari et al., 2020). Subsequently, the top five nodes beside "implementation" are "drought" with 12 occurrences, "climate change" with 12 occurrences, "role" with 11 occurrences, and "land fire" with ten occurrences.

The implementation of this forest fire controlling policy also turns out to be still the focus of the National Medium-Term Development Plan (RPJMN) 2020-2024, especially on efforts to prepare, mitigate, and adapt to forest fire disasters which are considered weak. In Indonesia, this forest fire control policy has been regulated in Government Regulation number 4 of 2001 about control of damage and pollution of the environment related to forest and land fires, Presidential Instruction number 3 of 2020 about the handling of forest and land fires, Regulations Minister of Environment and Forestry number P.32/MenLHK/Setjen/Kum.1/3/2016 about Forest and Land Fire Control. The RPJMN also mentions that Indonesia has a history of high disaster events, with most of them (more than 75 percent) being hydrometeorological disasters dealing with climate and its dynamics of change, which forest fire is one of those disasters. Along with the network visualization, forest fire controlling policy in Indonesia also can be presented in overlay visualization as Figure 7.

In contrast to Figure 6, where the color indicates a cluster, in figure 7, the color shows how updated the terms appear based on the year. There are five colors in overlay visualization, which respectively are dark purple, blue-gray, turquoise, green, and yellow. The dark purple indicates the oldest average publication year of the topic. Based on the overlay visualization in Figure 7, these nodes with dark purple color denote the average publication year of the topic in 2017. On the other hand, the yellow color indicates the newest average publication year of the topic during the period. Based on the overlay visualization in Figure 7, these nodes with the yellow color denote the average publication year of the topic in 2021. Recently, the two most frequent terms discussed in journal articles are "coordination policy" and "annual forest fire." Logically, these terms have become a central topic related to many types of research on forest fire controlling policy in Indonesia recently. Dealing with this term, the results of previous research show that coordination among government agencies generally occurs in the emergency stage (Budiningsih, 2017), indicating the need for changes in the context of coordination in all stages of forest fire controlling policy which are prevention, emergency, and rehabilitation. As stated in government regulation number 4 of 2001 that forest fire control efforts consist of efforts to prevent and overcome and restore environmental damage and or pollution related to forest and or land fires. Thus, coordination is required at all these stages.

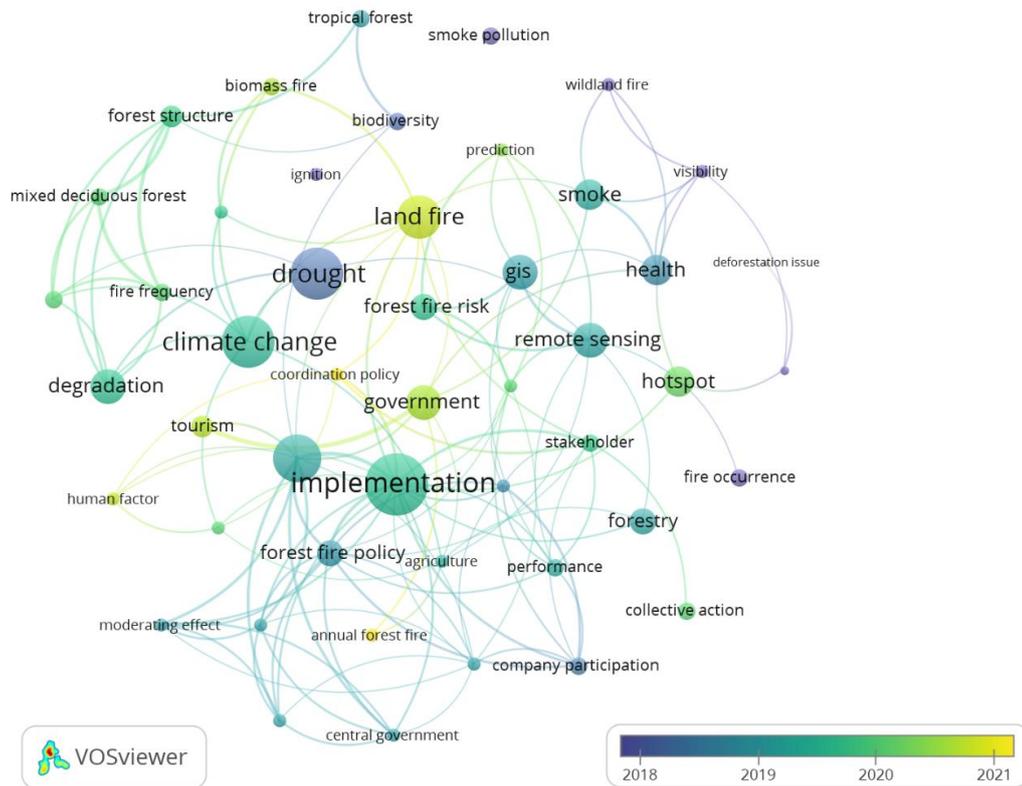


Figure 7. Overlay Visualization
 Source: VOSviewer, 2021

Based on overlay visualization, in 2021, there are two terms that are most often discussed and appear in the article those are coordination policy and annual forest fire. In 2020, the terms that appear in this year slightly varied covering 13 terms which are biomass fire, collective action, human factor, land fire, natural factor, fire frequency, human activity, mixed deciduous forest, hotspot, forest zone, prediction, government, tourism. In 2019, the terms discussed are even more various compared to one in 2020. In this year, there are 20 terms discussed, namely central government, forest fire prevention, good governance, implementation, local government, moderating effect, performance, role, climate change, poor air quality, stakeholders, degradation, forest structure, tropical forest, smoke, forest fire risk, GIS, remote sensing, agriculture, forestry. However, the number of terms discussed in 2018 is less than of in 2019. During this year, the number of the terms that discussed 10 terms, are company participation, forest fire policy, good forest fire governance, biodiversity, drought, health, sustainable development, fire occurrence, ignition, smoke pollution. Even in 2017, that number gets smaller than in 2018. In this year, there are only three terms discussed, namely deforestation issue, visibility, and wildland fire.

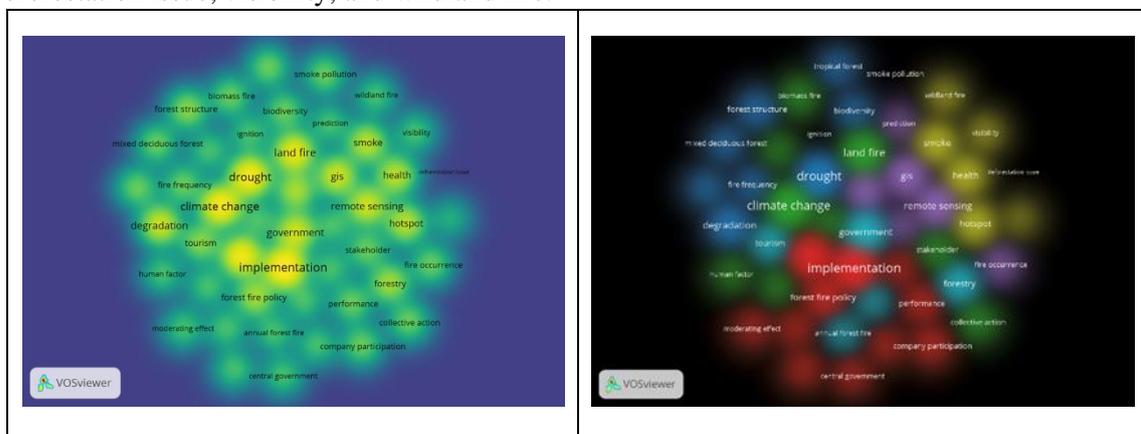


Figure 8. Density Visualization
 Source: VOSviewer, 2021

Figure 8 represents a density visualization consisting of item density and cluster density. Item density mentioned the keywords that frequently appear in the network. The item density visualization consists of three colors, namely blue, green, and yellow. Those colors indicate the weight of neighboring items. The blue one shows the smaller number of items, meaning this item rarely appears in journal articles. On the other hand, the yellow color showing the larger number of items is the trendy topic in a journal article. The visualization of item density is displayed in Figure 8 (left figure).

The next visualization is the cluster density visualization, which is in Figure 8 (right figure) signed by the color of red, dark yellow, green, turquoise, purple. There are also three nodes that are not included in the five colors above, namely "ignition," "smoke pollution," and "deforestation issue." As explained in figure 6 that the node "ignition" included in cluster 7 and the node "smoke pollution" is included in cluster 8. Since the cluster 7 and 8 respectively has only one node means that these nodes are not connected to other nodes, showing that the topics are rarely carried out in term of forest fire controlling policy in Indonesia. However, there is an interesting finding in figure 8 (right figure), the node "deforestation issue" in this application, which was previously included in cluster 4, as explained in figure 6, should has a yellow color, but in reality, it has no color.

Literally, density visualization is how depth the research topic signed by the color of red, dark yellow, green, turquoise, purple. The node "implementation" is the yellow node in item density visualization showing that it is the most frequently appearing keyword; in other words, this is the most researched topic in the journal article. The ten terms with the highest density level in the visualization figure are "implementation," "drought," "climate change," "land fire," "role," "government," "GIS," "remote sensing," "degradation," "hotspot," and "smoke." It means that those terms are discussed more deeply in articles related to forest fire controlling policy in Indonesia from articles published through the filtered google scholar database by using the Publish or Perish application.

CONCLUSION

An emerging bibliometric analysis of forest fire control policy in Indonesia is presented in this study. According to the Google Scholar database, there are 154 articles published in the journal related to forest fire control policy in Indonesia. The keyword "implementation" has the most occurrence of 14. Other popular keywords include "drought" (12), "climate change" (12), "role" (11), and "land fire" (10) which are the main terms in the study of forest fire controlling policy in Indonesia. It means that the term "implementation" became the most central and most widely discussed term in previous studies. As a comparison, in 2021, the two terms, which are "coordination policy" and "annual forest fire," will be the last issues to be discussed.

The limitation of this study is research using the Google Scholar database. It is open to all writings, including journals, reports, papers, and articles that have been uploaded to the Google database. In addition, incomplete metadata such as year and source of publication become undetectable when filtered. Following this research, more analysis in the future ought to be conducted using other indexing databases like Scopus or Web of Science.

REFERENCES

- Adinugroho, W. C., Suryadiputra, I. N. N., Saharjo, B. H., & Siboro, L. (2005). Panduan pengendalian kebakaran hutan pengendalian kebakaran hutan pengendalian kebakaran hutan dan lahan gambut. In *Wetlands International - Indonesia Programme*. Bogor. <https://doi.org/10.26623/jic.v3i1.862>
- Agarwal, A., Durairajanayagam, D., Tatagari, S., Esteves, S. C., Harlev, A., Henkel, R., ... Bashiri, A. (2016). Bibliometrics: tracking research impact by selecting the appropriate metrics. *Asian Journal of Andrology*, 18(2), 296–309. <https://doi.org/10.4103/1008-682X.171582>
- Alamsyah, Saptawan, A., Ermanovida, & Yustian, I. (2019). Actor Networking in Forest Fires Mitigation, Ogan Komering Ilir District, South Sumatra Province, Indonesia. *JKAP (Jurnal Kebijakan Dan Administrasi Publik)*, 23(2), 92–108. <https://doi.org/10.22146/jkap.43707>
- Aman, V. (2018). A new bibliometric approach to measure knowledge transfer of internationally

- mobile scientists. *Scientometrics*, 117(1), 227–247. <https://doi.org/10.1007/s11192-018-2864-x>
- Andres, A. (2009). Measuring Academic Research. *Measuring Academic Research*. <https://doi.org/10.1533/9781780630182>
- Asteriniah, F., & Sutina. (2017). Implementasi kebijakan pengendalian kebakaran hutan dan lahan gambut di Ogan Komering Ilir. *Abdimas Mandiri*, 1(2), 165–186.
- Bar-Ilan, J. (2008). Which h-index? - A comparison of WoS, Scopus and Google Scholar. *Scientometrics*, 74(2), 257–271. <https://doi.org/10.1007/s11192-008-0216-y>
- Bornmann, L. (2014). How are excellent (highly cited) papers defined in bibliometrics? A quantitative analysis of the literature. *Research Evaluation*, 23(2), 166–173. <https://doi.org/10.1093/reseval/rvu002>
- Bornmann, L., & Marewski, J. N. (2019). Heuristics as conceptual lens for understanding and studying the usage of bibliometrics in research evaluation. In *Scientometrics* (Vol. 120). Springer International Publishing. <https://doi.org/10.1007/s11192-019-03018-x>
- Budiningsih, K. (2017). Implementasi kebijakan pengendalian kebakaran hutan dan lahan di Provinsi Sumatera Selatan. *Jurnal Analisis Kebijakan Kehutanan*, 14(2), 165–186. <https://doi.org/10.20886/jakk.2017.14.2.165-186>
- Ellegaard, O., & Wallin, J. A. (2015). The bibliometric analysis of scholarly production: How great is the impact? *Scientometrics*, 105(3), 1809–1831. <https://doi.org/10.1007/s11192-015-1645-z>
- Fadhlorrohman, M., Purnomo, E., Khairina, E., Fathani, A., Salsabila, L., Setiawan, D., & Priyanto, A. (2021). Bibliometrics: Sustainable Clean Water Development And Sanitation Indonesia. *Turkish Online Journal of Qualitative Inquiry*, 12, 2159–2175.
- Fadlillah, N., Basuni, S., & Sunarminto, T. (2017). *Pengendalian kebakaran hutan oleh masyarakat peduli api (MPA) di taman nasional gunung ciremai*. (2013), 216–224.
- Firnando, D., Septawan, A., & Ermanovida, E. (2019). *Evaluasi kebijakan peraturan bupati No. 23 tahun 2016 tentang sistem pengendalian kebakaran hutan dan lahan Kabupaten Ogan Komering Ilir tahun 2017*. Sriwijaya University.
- Fithriyyah, M. U., Suwitri, S., Warella, Y., & Yuliani, F. (2020). *Action-collaborative networks of the regional government on land and forest fire restraint in Pelalawan District, Riau Province*. 2(May), 64–81. <https://doi.org/10.7251/STED2002064U>
- Fitriani., Rianawati, F., & Maryati, T. (2018). Partisipasi masyarakat terhadap kegiatan pengendalian kebakaran hutan dan lahan di Desa Maluka Baulin. *Sylva Scientiae*, 01(2), 263–271.
- Gingras, Y. (2016). *Bibliometrics and research evaluation: Uses and abuses*. Cambridge: The MIT Press.
- Goyal, N. (2017). A “review” of policy sciences: bibliometric analysis of authors, references, and topics during 1970–2017. *Policy Sciences*, 50(4), 527–537. <https://doi.org/10.1007/s11077-017-9300-6>
- Goyal, N., & Howlett, M. (2018). Learning in Public Policy. In *Learning in Public Policy*. Springer International Publishing. <https://doi.org/10.1007/978-3-319-76210-4>
- Hagen, L., Harrison, T. M., & Dumas, C. L. (2018). Data analytics for policy informatics: The case of e-petitioning. In *Policy analytics, modelling, and informatics* (pp. 205–224). Springer.
- Harzing, A.-W. (2011). *The Publish or Perish Book: your guide to effective and responsible citation analysis*. <https://doi.org/10.1002/asi.21535>
- Harzing, A.-W., & van der Wal, R. (2009). A Google Scholar h-Index for Journals: An Alternative Metric to Measure Journal Impact in Economics and Business. *Journal of the American Society for Information Science and Technology*, 60(1), 41–46. <https://doi.org/10.1002/asi>

- Holden, G., Rosenberg, G., Barker, K., & Weissman, A. (2013). Bibliometrics in social work. In *Bibliometrics in Social Work*. <https://doi.org/10.4324/9780203051467>
- Kemal Putra, I., Hero Saharjo, B., & Wasis, B. (2019). Institutional Challenge on Forest and Land Fire Management at the Site Level. *Jurnal Ilmu Pertanian Indonesia*, 24(2), 151–159. <https://doi.org/10.18343/jipi.24.2.151>
- Khalwani, K. M. (2016). *Penilaian Kerugian dan Efektivitas Pencegahan Kebakaran Ekosistem Hutan Gambut: Studi Kasus di Taman Nasional Sebangau*. 52.
- Kusumaningtyas, S. D. A., Aldrian, E., Suradi, Ahmad, M., & Krisnawan, G. D. (2021). Why was the sky red in Jambi during the forest fire? *IOP Conference Series: Earth and Environmental Science*, 893(1), 12052. <https://doi.org/10.1088/1755-1315/893/1/012052>
- Maylani, T., & Mashur, D. (2019). Collaborative Governance Dalam Pencegahan Kebakaran Hutan Dan Lahan Gambut. *Jurnal Kebijakan Publik*, 10(2), 105. <https://doi.org/10.31258/jkp.10.2.p.105-110>
- Mayr, P., & Walter, A. K. (2007). An exploratory study of Google Scholar. *Online Information Review*, 31(6), 814–830. <https://doi.org/10.1108/14684520710841784>
- Medrilzam, Rahayu, N. H., Widiaryanto, P., Rosylin, L., Firdaus, R., Suprpto, U., ... Nugraha, M. (2017). Grand design pencegahan kebakaran hutan, kebun dan lahan 2017 - 2019. *New Civil Engineer*, 108.
- Ministry of Environment & Forestry. (2020). *Analisa Data Luas Areal Kebakaran Hutan dan Lahan Tahun 2019*. Retrieved from <https://geoportal.menlhk.go.id>
- Moral-Muñoz, J. A., Herrera-Viedma, E., Santisteban-Espejo, A., & Cobo, M. J. (2020). Software tools for conducting bibliometric analysis in science: An up-to-date review. *Profesional de La Informacion*, 29(1), 1–20. <https://doi.org/10.3145/epi.2020.ene.03>
- Mourao, P. R., & Martinho, V. D. (2019). Forest fire legislation: Reactive or proactive? *Ecological Indicators*, 104(October 2018), 137–144. <https://doi.org/10.1016/j.ecolind.2019.04.080>
- Mourao, P. R., & Martinho, V. D. (2020). Forest entrepreneurship: A bibliometric analysis and a discussion about the co-authorship networks of an emerging scientific field. *Journal of Cleaner Production*, 256, 120413. <https://doi.org/10.1016/j.jclepro.2020.120413>
- Nazifah, Yarni, M., & Nasution, M. A. (2020). *Indonesian government policy in forest fire handling*. 6(1), 210–218. <https://doi.org/http://dx.doi.org/10.23887/jkh.v6i1.23471>
- Nugroho, A. W. (2016). Manusia dan kebakaran hutan. *Jurnal Lestari*, 1(1), 90–100.
- Nurhayati, A. D., Hero Saharjo, B., Sundawati, L., Syartinillia, & Vetrita, Y. (2020). Perilaku dan persepsi masyarakat terhadap terjadinya kebakaran gambut di Ogan Komeriling Ilir Provinsi Sumatera Selatan (People's behavior and perceptions of the occurrence of peat fires in Ogan Komeriling Ilir, South Sumatra Province). *Jurnal Pengelolaan Sumberdaya Alam Dan Lingkungan (Journal of Natural Resources and Environmental Management)*, 10(4), 568–583.
- Orduna-Malea, E., Martín-Martín, A., & López-Cózar, E. D. (2017). Google Scholar as a source for scholarly evaluation: A bibliographic review of database errors. *Revista Espanola de Documentacion Cientifica*, 40(4), 1–33. <https://doi.org/10.3989/redc.2017.4.1500>
- Pasai, M. (2020). Dampak kebakaran hutan dan penegakan hukum. *Jurnal Pahlawan*, 3(1), 36–46. <https://doi.org/https://doi.org/10.31004/jp.v3i1.609>
- Peters, B. G. (2018). *Policy Capacity in Public Administration*. https://doi.org/10.1007/978-3-319-54675-9_2
- Polese, A. (2017). *The SCOPUS diaries and the (il) logics of academic survival*. (il).
- Purnomo, H., Shantiko, B., Sitorus, S., Gunawan, H., Achdiawan, R., Kartodihardjo, H., & Dewayani, A. A. (2017). Fire economy and actor network of forest and land fires in Indonesia.

- Forest Policy and Economics*, 78, 21–31. <https://doi.org/10.1016/j.forpol.2017.01.001>
- Rahmah, M. (2017). *Efektivitas kebijakan pengendalian kebakaran hutan di Kecamatan Bayung Lencir Kabupaten Musi Banyuasin Provinsi Sumatera Selatan*. IPDN.
- Rasyid, F. (2014). Permasalahan dan dampak kebakaran hutan. *Jurnal Lingkar Widyaiswara*, 1(4), 47–59.
- Rousseau, R., Egghe, L., & Guns, R. (2018). *Becoming metric-wise: A bibliometric guide for researchers*. Chandos Publishing.
- Saharjo, B. H., Syaufina, L., Nurhayati, A. D., Putra, E. I., Walidi, R. D., & Wardana. (2018). Pengendalian kebakaran hutan dan lahan di wilayah komunitas terdampak asap. In *IPB Press* (Vol. 15).
- Sarmiasih, M., & Pratama, P. Y. (2019). The Problematics Mitigation of Forest and Land Fire District Kerhutla in Policy Perspective (A Case Study : Kalimantan and Sumatra in Period 2015-2019). *Journal of Governance and Public Policy*, 6(3). <https://doi.org/10.18196/jgpp.63113>
- Sawerah, S., Muljono, P., & Tjitropranoto, P. (2016). Partisipasi masyarakat dalam pencegahan kebakaran lahan gambut di Kabupaten Mempawah, Provinsi Kalimantan Barat. *Jurnal Penyuluhan*, 12(1). <https://doi.org/10.25015/penyuluhan.v12i1.11323>
- Sayendri, D. (2016). Partisipasi Masyarakat, Kelompok Masyarakat Peduli Api, Kebakaran Lahan dan Hutan. *Jom FISIP*, 3(3).
- Setiawan S, R. (2019). Collaborative Badan Penanggulangan Bencana Daerah Kota Dumai Dalam Menanggulangi Kebakaran Lahan di Kota Dumai. *Wedana*, V(2), 62–68.
- Sipongi-Karhutla Monitoring System. (2021). *Rekapitulasi luas kebakaran hutan dan lahan (ha) per provinsi di Indonesia tahun 2016-2021*.
- Siswadi, I. (2013). Mengenal Konsep Penetapan Kata Kunci. *Jurnal Pustakawan Indonesia*, 12(2), 53–55.
- Suhendri, & Purnomo, E. P. (2017). Penguatan Kelembagaan Dalam Pencegahan dan Pengendalian Kebakaran Hutan dan Lahan di Kabupaten Muaro Jambi Provinsi Jambi. *Journal of Governance and Public Policy*, 4(1), 174–204. <https://doi.org/10.18196/jgpp.4175>
- Supriyanto, & Syarifudin. (2018). Analisis kebijakan pencegahan dan pengendalian kebakaran hutan dan lahan di Provinsi Jambi. *Pembangunan Berkelanjutan*, 1(1), 94–104. <https://doi.org/https://doi.org/10.22437/jpb.v1i2.5413>
- Szomszor, M., Adams, J., Fry, R., Gebert, C., Pendlebury, D. A., Potter, R. W. K., & Rogers, G. (2021). Interpreting Bibliometric Data. *Frontiers in Research Metrics and Analytics*, 5(February), 1–20. <https://doi.org/10.3389/frma.2020.628703>
- Umasangaji, S. (2017). Kebijakan Pengendalian Kebakaran Hutan dan Lahan. *Jurnal Demokrasi Dan Otonomi Daerah*, 15(2), 121–130. Retrieved from <https://jdod.ejournal.unri.ac.id/index.php/JDOD/article/view/5279/4951>
- van Eck, N. J., & Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics*, 84(2), 523–538. <https://doi.org/10.1007/s11192-009-0146-3>
- Van Eck, N. J., & Waltman, L. (2014). Visualizing bibliometric networks. In *Measuring scholarly impact* (pp. 285–320). Springer.
- Van Eck, N. J., & Waltman, L. (2019). Manual for VOSviewer version 1.6.10. *CWTS Meaningful Metrics*, (January), 1–53. Retrieved from https://www.vosviewer.com/documentation/Manual_VOSviewer_1.6.10.pdf
- Wulantari, I., Adhyanto, O., & Handrisal. (2020). Implementasi Kebijakan Pencegahan Dan Penanggulangan Kebakaran Lahan Di Kota Tanjungpinang Tahun 2019. *Soj*, 1, 101–111.

- Yunvi, E. S., Chandra, I., Salam, R. A., Elektro, F. T., Telkom, U., Metter, P., ... Hilir, K. I. (2021). Analisis potensi kebakaran hutan menggunakan data titik Provinsi Riau. *EProceedings of Engineering*, 8(2), 1798–1805.
- Zaenuri, M. (2021). New model for local post disaster tourism governance: Evidence from Indonesia's Merapi Volcano. *JKAP (Jurnal Kebijakan Dan Administrasi Publik)*, 25(2), 185–213. <https://doi.org/https://doi.org/10.22146/jkap.63993>