

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/340231980>

Haze Disaster Discourses in Local Indonesian Media: Examining Niklas Luhmann's Perspective on Ecological Communication

Article in *Asia-Pacific Social Science Review* · March 2020

CITATIONS

0

READS

164

3 authors:



Arifudin Arifudin

Universitas Riau

12 PUBLICATIONS 22 CITATIONS

SEE PROFILE



Hermin Indah Wahyuni

Universitas Gadjah Mada

36 PUBLICATIONS 51 CITATIONS

SEE PROFILE



Fransiskus Trisakti-Haryadi

Universitas Gadjah Mada

34 PUBLICATIONS 57 CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:



China is Coming!: The Construction and Representation of China in Indonesia [View project](#)



Preferensi Sumber informasi Inovasi Pengolahan Kotoran Ternak Menjadi Kompos pada Kelompok Peternak Sapi Potong di Kabupaten Bantu [View project](#)

RESEARCH ARTICLE

Haze Disaster Discourses in Local Indonesian Media: Examining Niklas Luhmann's Perspective on Ecological Communication

Arifudin,^{1,2} Hermin Indah Wahyuni,² and F. Trisakti Haryadi²

¹University of Riau and ²Gadjah Mada University, Indonesia

¹arif_udin@yahoo.com

Abstract: Haze, driven by peatland fires, has been a dangerous ecological problem in Indonesia that has affected its social system and impacted the air of countries in Southeast Asia. As Niklas Luhmann explained, the social system could be disturbed by ecological problems, but its subsystems can also be seen in media discourses. This study, thus, aims to analyze the discourses presented in two local Indonesian media, *Riau Pos* and *Pontianak Pos*, about the haze disaster. Critical discourse analysis was used to analyze the discourses that are representative of subsystems. We also analyzed the correlation between discourses and peatland fires. The results show that there are nine subsystems affected by the haze disaster: economy, politics, law, science, education, religion, art, public health, and volunteerism. Of these, politics is predominant in the local Indonesian media. In addition, the number of discourses is in line with the fluctuation of hotspots. To conclude, the haze problems can be seen by understanding the discourses in local mass media that have described which subsystem is constructing the social system. Therefore, this study suggests decreasing the domination of politics and increase the role of other subsystems, particularly the subsystem of law, science, and education in the Indonesian social system.

Keywords: ecological communication, haze disaster, local media, Niklas Luhmann, peatland fires

Ecological problems, including haze, are very closely related to the complexities of social systems; as such, there is no instant solution (Alexander & Blum, 2016; Holdschlag & Ratter, 2016; Luhmann, 1989; Lacayo, 2013) the validity of factors said to contribute toward vulnerability is disputed in light of the differing economic success, enormous heterogeneity, divergent paths of development, and varying potential for adaptability displayed by small

islands. Research on uncertainty, vulnerability and resilience of coupled social-ecological systems (SES). The social system consists of at least six subsystems that react to ecological problems: economy, politics, law, science, education, and religion (Fuchs, 1990; Narodny, 1991). Each subsystem has its own complexities and necessitates its own study to parse how it resonates with the disaster using its own codes (Wahyuni, 2019; Wahyuni, Fitrah, Handayani, &

Rob, 2018). Resonance can be interpreted as an echo caused by society's reactions, which can be seen from communication events (Luhmann, 1989). This variety is illustrated by mass media discourse, such as newspapers (Peeples, 2015). Since the 2015 haze disaster in Indonesia, some scholars have investigated the country's media; for example, Kibanov, Stumme, and Jun (2017) analyzed the correlation between social media (Twitter) and hotspots. On the other hand, Christantyawati (2017) had published the use of social media amid government, mass media, and non-government organizations' responsibilities due to the haze disaster. Lin (2018) also compared the traditional media news and new media perspectives in Singapore about transboundary haze pollution. This study, meanwhile, focuses on analyzing the media discourses present in local Indonesian newspapers and their correlation with hotspots.

Newspapers, particularly local newspapers, present the reality of a society and are closer to readers and their local problems (Crowder, 2009). On the other hand, the complex reality of haze is not easy to explain, as each level of society has its own perceptions (Carmenta, Zabala, Daeli, & Phelps, 2017; Medrilzam, Dargusch, Herbohn, & Smith, 2014). It is, therefore, necessary to analyze local media discourse to describe how society reacts to ecological problems (Ekayani, Nurrochmat, & Darusman, 2014; Huang, 2017). This article, meanwhile, provides information about the correlation between hotspots, as a natural scientific data, and the number of media discourses, as well as a description of each subsystem involved in the social system.

Ecological Communication Among Other Communication Theories

Ecological communication is not an uncommon term within ecological science and communication theory (Edwards, 1991). To compare ecological communication with other communication theories, it is necessary to present the related literature, which includes such communication theories as development communication, risk communication, and environmental communication. This literature review will explain why the issue of peatland fires is closest to ecological issues.

The problem of haze, which is caused by peatland fires, can be linked to the failure of development communication. This communication is

used in countries' development, and is implemented to accelerate transformation (e.g., from poverty to economic growth) and to create social equality by realizing greater human potential (Quebral, 2012; Dutta, 2011). Rogers (2003) explained how innovations, mostly in agricultural technology, are diffused with an understanding of the characters of society. For example, farmers can be classified into various types of adopters, networks, and personalities and can be used by local opinions leader and cliques to persuade others about the best agricultural practices. In addition, Dutta (2011) offered a cultural approach to strategic communication for social change in the context of development, or a culture-centered approach for social change communication.

Manyozo criticized the concept of development communication, which is implemented and researched more heavily in developing countries (Bamurtaraki, 2014). Manyozo (2012) stated that development communication could be divided into three categories, which appear separate from each other, especially in projects and initiatives designed and implemented by the government: (1) media that approaches development with an emphasis on content; (2) the media development approach, which emphasizes structure; and (3) a participatory communication approach, which emphasizes process. Moreover, the participatory approach developed by Chambers (1996), with participatory rural appraisal (PRA), places the community as the most important agent in change. The facilitator, or extension agent, is an outsider, a catalyst that precipitates the process. This concept is more widely used by activists from non-governmental organizations (NGOs), which have a different paradigm than governments. Unfortunately, development communications theory is unable to explain why both governments and corporations—rather than farmers at the grassroots level—are accused of being responsible for haze disasters.

Haze can also be examined through a risk communication perspective (Susmayadi, Kanagae, Adiyoso, & Dwi, 2014). Risk communication is utilized by industrial forestry companies and oil palm plantations to tackle negative perceptions of them; after all, when peatland fires occur, most NGOs blame the corporations (Thorburn & Kull, 2015). Risk communication can also be understood as a process of exchanging information between companies/governments and communities. This dialogue must

be a sincere conversation that aims to identify shared solutions in response to problems. They carry out communication as part of their social responsibilities (Breakwell, 2010; Infanti et al., 2013; Wiedemann, Clauberg, & Börner, 2010). It is also an obligation set by the government and, through corporate social responsibility, corporations can avoid (or at least minimize) business risks (Higgins & Walker, 2012).

Environmental communication is one communication theory that is also closely related to haze disasters. It emphasizes how humans interact with nature and was developed with rhetorical theory (Littlejohn & Foss, 2005). In practice, this term was first introduced in the mid-20th century and later used at the 1992 Earth Summit in Rio de Janeiro (Herutomo, 2013). It has also been used in campaigns to save the earth and promote sustainable development. Environmental communication is used by many actors, including governments, companies, and NGOs, because they all feel that they are responsible for saving the environment, in accordance with their respective interests (Anderson, 2015). It can, therefore, be said that environmental communication is a general perspective for looking at environmental issues and raising public awareness of them. However, again, the core of the haze disasters are not only grassroots actors without the capacity to understand environmental problems, but all parties involved in the social system. All parties can be communicators as well as communicants, and every subsystem will react and make self-references

to the problems (Luhmann, 1989). Ecological communication, therefore, is more precisely the conveyance of a holistic understanding of social reality and ecological problems. The position of ecological communication within the constellation of other communication fields, particularly communication development, risk communication, and environmental communication, is illustrated in Figure 1.

Haze and Peatland Fires: From a Natural Science to a Social Science Perspective

Land and forest fires in Indonesia have occurred since the 1980s and peaked—especially in Kalimantan and Sumatra Island—in 1997–1998. In 1997, fires covered an area of 9,745,000 ha; for comparison, in 2015, the fire affected only an area of 2,611,000 ha, despite having a larger economic effect, totaling IDR221 trillion (World Bank, 2016). Massive amounts of peatland drainage caused peatland to be highly vulnerable to fire, especially during the dry season (Dohong, Aziz, & Dargusch, 2017). Canals were made to control water as a form of water table management for this land, which had degraded mostly due to the expansion of oil palm plantations and industrial forestry (Prayoto, Ishihara, Firdaus, & Nakagoshi, 2017). Traditionally, however, fire has been part of the local wisdom of traditional communities, especially when changing cultivation patterns; because this method is easier and cheaper, it remains in common use today (Santín & Doerr, 2016).



Figure 1. Position of ecological communication among communication theories.

The frequent haze disasters in Indonesia have prompted critics and calls from international society to solve the problem. Nonetheless, various studies on the causes, effects, and solutions of land fires have also been widely publicized. For example, Tacconi (2003) identified five causes of peatland fires in Indonesia: livelihoods, environmental conditions, poor governance, limited knowledge, and dry season.

This disaster is part of anthropogenic climate change, meaning that climate change is caused by human activities, which is generally driven by economic interests (Park, 2011; Pidgeon & Leary, 2000). Economic interests can be seen, for example, in the increased demand for crude palm oil (CPO) and pulp and paper, which has resulted in oil palm plantations and industrial forestry taking an ever-increasing amount of land in Indonesia (Gatto, Wollni, & Qaim, 2015; Tacconi, 2003). The companies certified by the Roundtable for Sustainable Palm Oil (RSPO) claimed that they no longer clear land activities with fire, even though data released by the World Bank showed that most peatland fires occur in oil palm plantations and industrial forestry concessions (World Bank, 2016). Gaveau et al. (2014), therefore, are very pessimistic about the possibility of preventing land fires in Indonesia. They write that peatland fires will continue and increase because of the continuous deforestation of Indonesian peatland. Meanwhile, developed countries have implemented economic activities that are low in carbon emissions to take responsibility for climate change (Gidden, 2009).

Indonesia's haze disasters have also received attention from ASEAN countries, especially Singapore and Malaysia because their air is regularly threatened with pollution. This led, for example, in the signing of the ASEAN Agreement of Transboundary Haze Pollution (AATHP) in 2002—without Indonesia (Forsyth, 2014; Jones, 2006). This can be attributed to economic and political forces, both within ASEAN and especially within Indonesia (Quah & Varkkey, 2013), who argue that ASEAN has yet to provide a solution, and instead protected the interests of oil palm companies and strengthened the control of the elites. Fortunately, after the 2014 haze disaster, Indonesia agreed to ratify AATHP, despite remaining sentiments (Heilmann, 2015).

Methods

During data collection, two types of data were collected: data from local newspapers and data on hotspots. The newspapers, *Riau Pos* in Riau Province and *Pontianak Pos* in West Kalimantan Province, were chosen because they represent two local media that have covered highest and most severe haze disasters in Sumatra Island and Kalimantan Island, Indonesia (Arifudin, Nasrul, & Maswadi, 2013; Maswadi, Arifudin, Septiana, & Maulidi, 2018; Stolle & Lambin, 2003). In this research, only six months of data (July–December 2015) were used because peatland fires happened mostly during this period (Fujii et al., 2015; Sloan, Locatelli, Wooster, & Gaveau, 2017). Meanwhile, data on the occurrence of peatland fires was obtained from www.sipongi.menlhk.go.id, a website organized by the Ministry of Environment and Forestry Republic of Indonesia (KLHK RI).

Data were subsequently analyzed using Luhmann's perspective of ecological communication using critical discourse analysis (CDA). CDA was chosen for its ability to explain the construction of reality and useful in explaining power and inequalities in society (Denzin & Lincoln, 2018; Hamad, 2007; Mahmoud, 2014; Sriwimon & Jimarkon, 2017). When analyzing the data, we read news stories with the keywords “haze disaster” (*bencana asap*) and “peatland fires” (*kebakaran lahan gambut*). These stories were then categorized by topic using social system theory. If the news did not include criteria from social systems theory, we created a new category. Both sets of data were analyzed and presented in a graph, generated using Microsoft Excel.

Results

Discourses and Hotspots

Luhmann (1989) identified social systems as having six subsystems. However, in this research, we found more than six subsystems that react to ecological problems. In fact, in responding to haze disasters, other subsystems were affected: art, public health, and volunteerism. Nine subsystems within the social system, thus, reacted to haze disasters: economy, politics, law, science, education, religion, art, public health, and volunteerism.

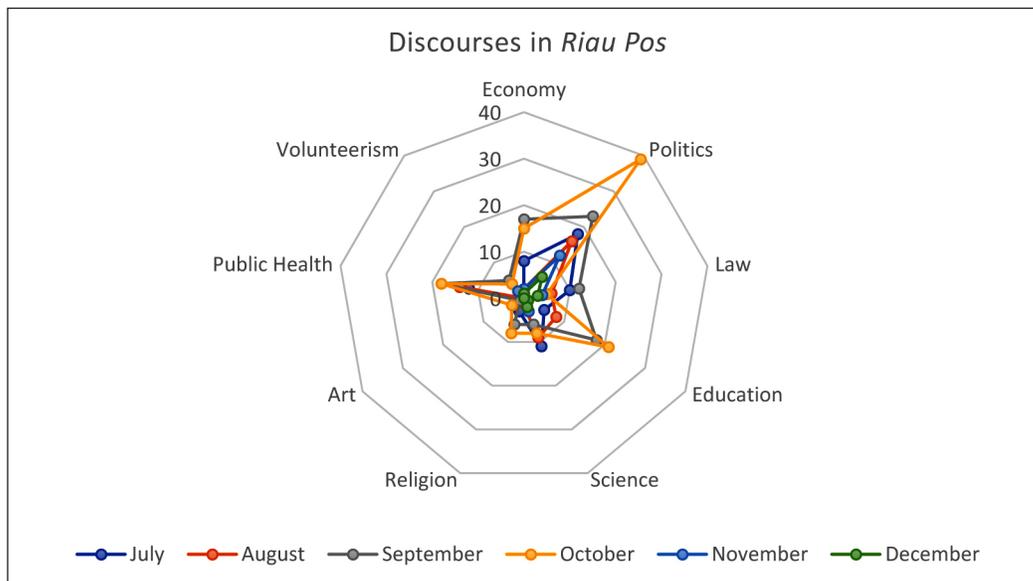


Figure 2. Topics of discourses in *Riau Pos*. (July–December 2015)

Generally, politics is the subsystem that predominantly colors the local media, both in Riau and in West Kalimantan. Meanwhile, the art subsystem is found only in Riau; in West Kalimantan, meanwhile, art has never been used to raise awareness of ecological issues.

In Riau, the number of discourses related to haze was highest in September and October when the number of hotspots was at its peak, and decreased significantly from November to December (Figure 2). The predominant subsystem that reacted to the haze disaster was politics, followed by education and public health. During the haze disaster, most victims were children, pregnant women, and people with respiratory problems (Koplitz et al., 2016). El Niño and positive Indian Ocean Dipole conditions set the stage for massive fires in Sumatra and Kalimantan (Indonesian Borneo).

In West Kalimantan, the number of discourses was also higher in September and October (Figure 3). The politics subsystem was highest in October; however, in September, the law and economy subsystems were of almost equal prominence. In addition, science, education, public health, and religion moderately colored the media during the peak of the haze disaster.

Correlations between discourses and hotspots in Riau and West Kalimantan showed similar tendencies

(Figures 4 and 5). As the number of hotspots rose, the number of discourses also increased significantly; conversely, as the number of hotspots decreased, so did the number of discourses. This means that fluctuations in the number of hotspots (indicating the occurrence of peatland fires) are followed by social reactions, as seen in the local media.

Economy

Economy is an important subsystem in the social system due to humans being *homo economicus*, that is, having actions based on economic reasoning. In economics, there are the codes: “profit” and “not profit.” Researchers, such as Dauvergne (1998) and Purnomo et al. (2017), have also found that the root of many problems is economic. Here we find that economic discourses can be divided into four categories: (1) corporations’ reactions towards peatland fires; (2) decreased societal income; (3) disturbances in transportation, particularly aviation, and; (4) decreased tourism.

Corporations react to the haze by giving villages financial incentives to prevent peatland fires in their area. These activities, which are conducted when the media and NGOs draw attention to their involvement, allows them to show that they “care” about peatland fires. Corporations also have an interest in securing

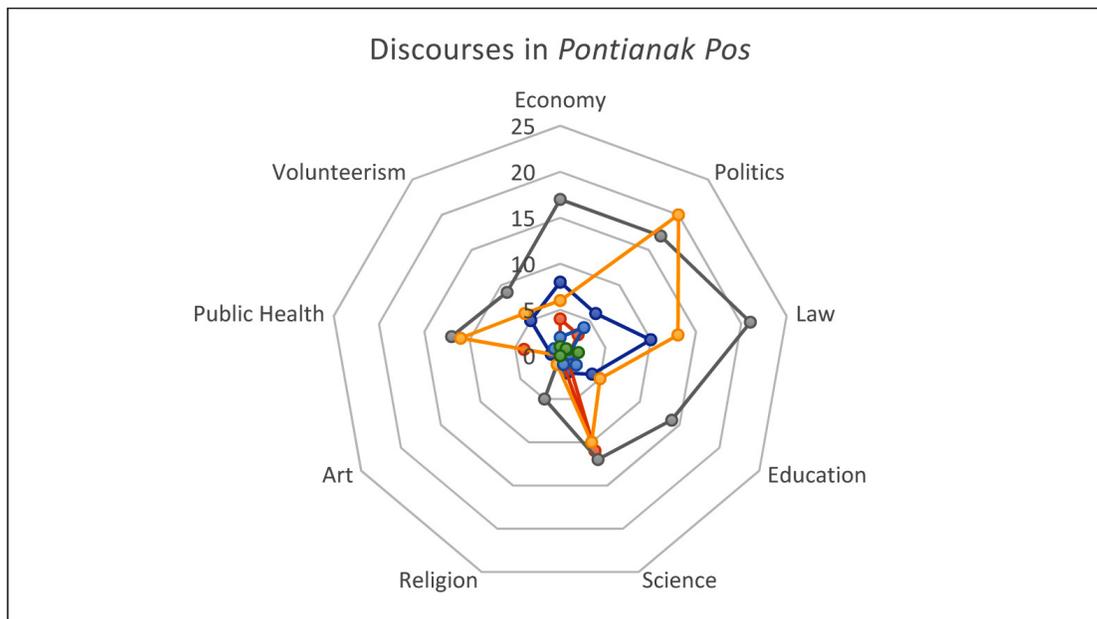


Figure 3. Topics of discourses in Pontianak Pos. (July–December 2015)

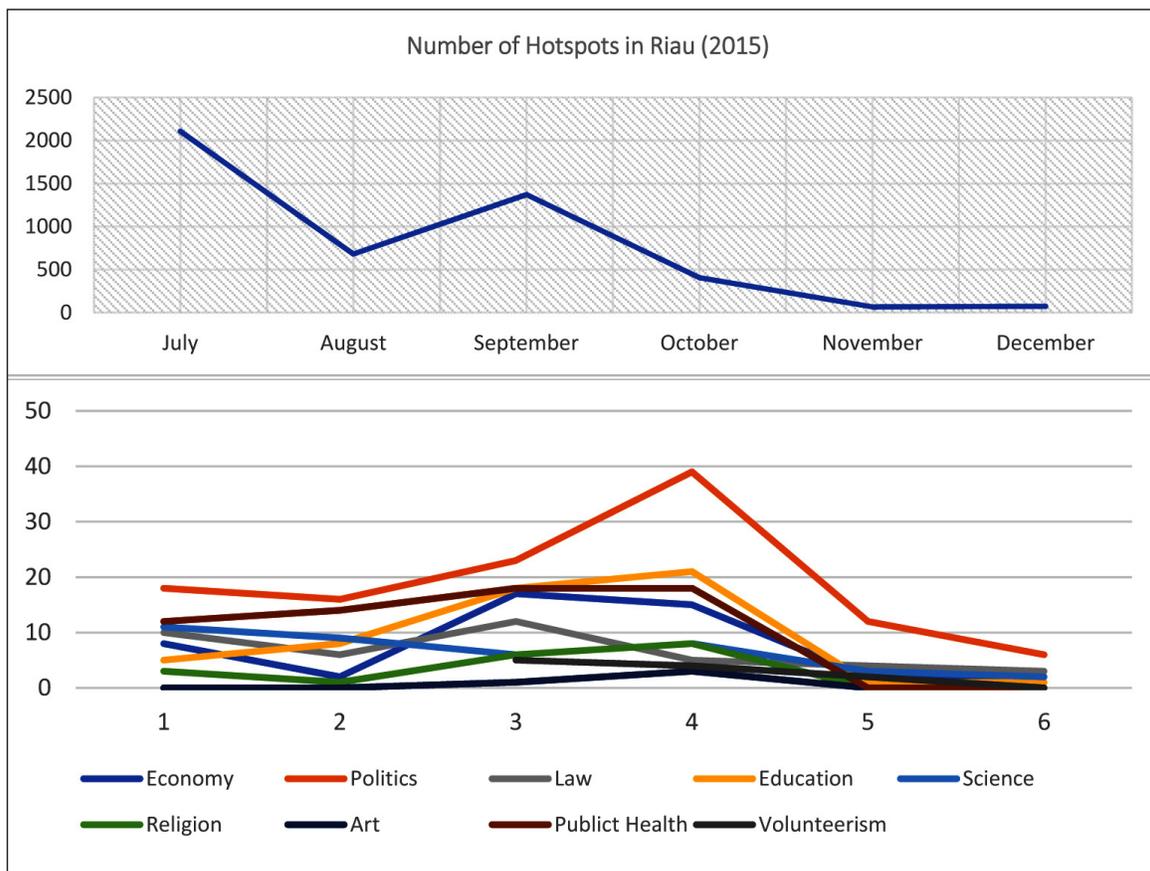


Figure 4. Correlation between the number of hotspots and discourses in Riau.

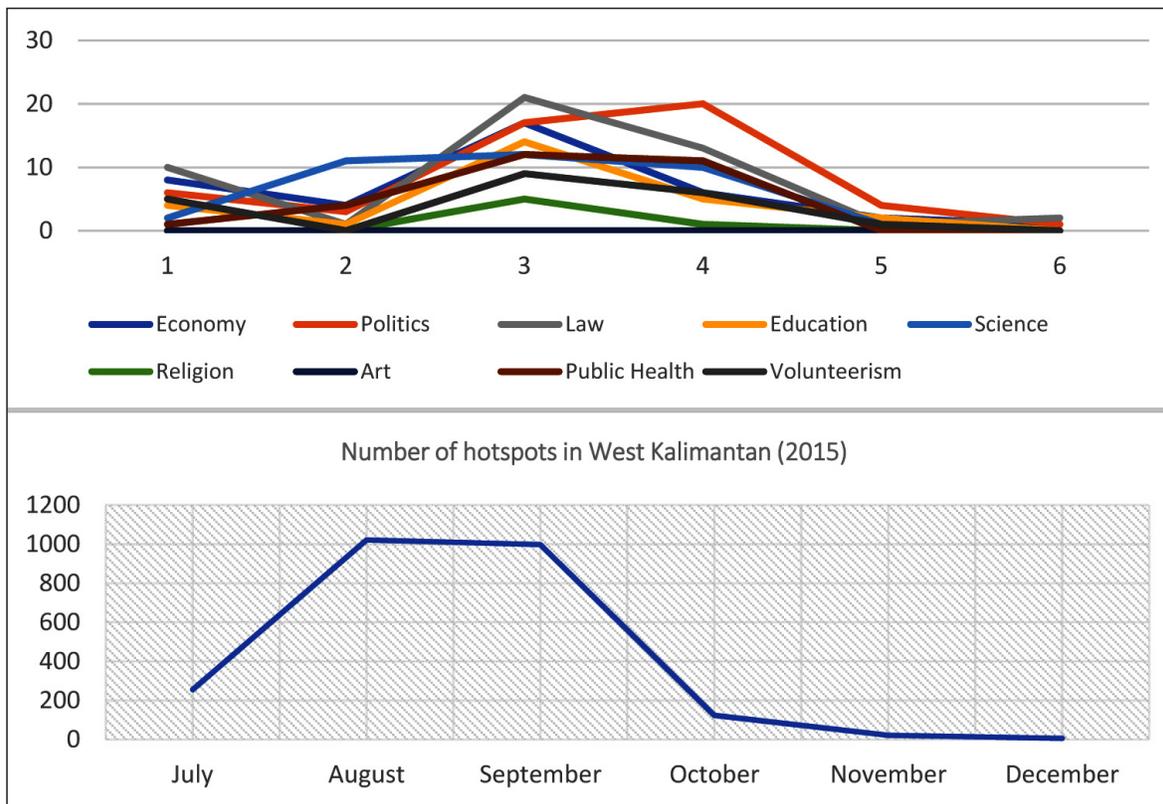


Figure 5. Correlation between the number of hotspots and discourses in West Kalimantan.

their concessions, as they argue that fires come from villagers’ land. Generally, corporations involve and train the residents around their concessions to patrol and to warn people who clear land with fire.

Corporate commitment was done in Karhutla in Riau Province by PT RAPP, which gave the ‘Fire-Free Village’ award in 2015 to nine villages in Pelalawan District... These fire-free villages received one of two awards. First, [fire-free] villages received an incentive of IDR 100 million from RAPP; this reached Kuala Pandu, Petodaan, and Segamai. The second category, [villages] that only burned 20 per cent, received IDR 50 million: Pelalawan, Teluk Binjai, and Kuala Tolam. Another three villages, Kuala Muda, Sering Village, and Teluk Meranti, burned more than 20 per cent of their land but are proposed to receive new incentives next year (“Fire”, 2015, p. 3)

The discourse of decreased societal income appears in relation to a reduced number of flights. This affects all economic activities, such as by causing decreases in hotels’ occupancy rates and harming food imports. In addition, tourism is described as badly affected by haze; articles mentioned, for example, that the number of passengers/visitors to Riau and Pontianak decreased significantly.

The haze disaster has caused economic losses in various sectors, including aviation. Every day, the haze makes a mess of flight schedules to and from Pontianak. The number of passengers dropped by 30 per cent, causing losses in the tens of millions of rupiah. It has been estimated that one delay may cause IDR 200 million in losses... now delays are reaching up to five hours, even though they are usually only 45 minutes to two hours. (“Losing”, 2015, p. 14)

Politics

Politics has its own codes of “power” and “powerless.” Local media tend to frame problems through the lens of politics, as seen in the fact that the number of political discourses in both *Riau Pos* and *Kalimantan Pos* was higher than other discourses. The political system consists of three levels: international politics, national politics, and local politics. Problems at each level are highlighted in their own way. In international relations, affected countries such as Malaysia and Singapore save their citizens by urging them to leave Indonesia; they also seek to help Indonesia tackle this problem by sending helicopters for water bombing. At the national level, stories report that the Indonesian president and his ministers showed the political will to address the problems through short-term and long-term solutions. At the same time, other stories reported that members of parliament were calling on the government to be more serious. At the local level, warnings are targeted at the governors, mayors, and, of course, the central government, urging all of them to take real steps to solve the haze disaster.

A total of 225 Malaysians, consisting of students, workers, and consulate employees, were evacuated. The evacuation process was carried out from the Malaysian Consulate office on Sudirman Street, Pekanbaru. They gathered at the Malaysian Consulate at 1:00 p.m., awaiting the military air force’s permission to evacuate. Only around 4:30 p.m. did they head for SSK II Pekanbaru using a bus that had been prepared. The Malaysians evacuated using a Hercules aircraft belonging to the Malaysian Air Force (TUDM) (“Malaysia”, 2015, pp. 1&2)

Law

Law, which has as its codes “legal” and “illegal,” has an important role in haze disasters. Clearing land with fire is a crime that is regulated in several Indonesian laws and regulations, and local media publicize the illegal acts (crimes) of corporations as well as individuals. Some NGOs believe that farmers or individuals should not be targeted by police for law enforcement, desiring more focus to be given to corporations—especially those whose concessions are burned during the haze season. In addition, the law subsystem also reacts by suggesting the revision of existing law, as there is a legal loophole that can be

utilized by individuals; clearing land with fire may be seen as local knowledge, something that is protected by law.

The West Kalimantan Regional Police are handling 30 cases of forest and land fires that have occurred in this province. This was revealed by AKBP Arianto, the Public Relations Officer of the West Kalimantan Police, yesterday. According to Arianto, of 30 cases, he has identified 22 suspects. When the question was brought up of, in the cases being handled by the West Kalimantan Regional Police, whether the three leaders of the company would be made suspects, Arianto was reluctant to answer. West Kalimantan Regional Police Special Criminal Investigation Director Agus Nugroho said that there were three leaders of the company who would become suspects because they were suspected of clearing the land with fire. (“Examine”, 2015, pp.13&16)

Science

In answering the questions, “What happened?” “Why can’t Indonesia prevent haze disasters?” “How dangerous is the problem?” “When will this be stopped?” among others, one can rely only on science, both the natural and the social sciences. This subsystem has its own codes: “scientific” and “not scientific.” Science has at least three functions: providing information, explaining problems, and solving problems.

Generally, local media only provide information about the Air Pollution Standard Index (ISPU) and the number of hotspots, which are used to consider activities in open spaces. This is also very important information for the government to use in determining the status of the disaster and affects the decision to cease school activities. Unfortunately, only a few news stories seek to explain the root of this disaster in detail. Therefore, people generally lack knowledge of how they can solve the problem; instead, corporations who exploit peatland are accused by environmental activists of causing the haze and told that they must take responsibility for this problem.

Education

Education’s codes are “civilized” and “not civilized.” Discourse on education mostly deals

with how the haze affects school activities, therefore motivating people to find solutions to their problems. In the early years of the haze disaster, the government seemed confused as to how to set its policies. If the school is closed, the quality of education will decrease. On the other hand, schools should be concerned about students' health. As such, recognizing the potential health effects of haze, local governments decided to close schools. Universities also closed their campuses for several weeks. Long-distance learning was one solution used to tackle this problem.

The haze that is still covering Riau Province has forced the government into a dilemma. The reason is not only health; the haze has also disrupted education. For health reasons, 1.2 million students in Riau were forced to leave school. On the other hand, this has caused new problems. The quality of education is threatened if the teaching and learning processes are stopped. The Department of Education and Culture (Disdikbud) has finally been forced to postpone the implementation of the examinations, from the elementary to high school level ("Riau", 2015, pp. 1&2)

Aside from formal education, informal education is also an important way to increase social capacity, mostly for farmers in peatland areas. This is intended to avoid and minimize the effects of fires. The government, through the Department of Agriculture, Plantations, Forestry, and Environment, has implemented several programs to assist farmers living susceptibly. Similar activities have also been organized by corporations and NGOs to teach and train farmers to clear land without using fire.

Religion

Religion has its own codes, "sin" and "sinless." After the haze, with no solution or rain in sight, the Muslims of Riau and West Kalimantan asked for God's assistance through prayer (*sholat istisqa*). This was done not only once, but repeatedly throughout the dry season. The government facilitated these activities by providing space and inviting Muslims to pray together.

The Istisqa prayer was attended by a number of Muslim communities in Pekanbaru, starting from the assembly of Taklim Ibadurrahman,

Aryad Islamic School, Bintang Cendikia School, Syafira Hospital, MZR Autoservice, Gunung Merah Mosque, and a number of orphanages ("Muslim", 2015, pp. 33&39)

Art

Art activities are not held every month. However, they do reveal a refined and polite way to protest, as well as create new public awareness of the haze disaster and its causes. The codes for art are "impressed" and "not impressed." There are two types of art platforms: performance art (poetry and theatre) and visual art (paint and photograph exhibitions). Art, as a subsystem, was only found in Riau. This may be because Riau has a strong cultural tradition of art, especially oral culture, such as poetry.

In order to celebrate Indonesian Poetry Day, in Language Month, poetry readings were held with the title 'Poetry in Smoke that Has Yet to Move.' ... Various expressions of poetry were shed that night in the thick of the haze that once again laid down on the Lancang Kuning Earth. Poetry readings by Riau poets and Pekanbaru high school students were attended by the President of Indonesian Poetry, Sutardji Calzoum Bachri ("Read", 2015, p.26)

Public Health

Public health's codes are "healthy" and "unhealthy." Direct reactions of the public health subsystem were significantly found in Riau and West Kalimantan. For example, media in both provinces published the number of victims of air pollution. The increased prevalence of respiratory illnesses, such as pneumonia and acute respiratory infection (ISPA), was shown as endangering human life. Deaths caused by exposure to the haze in Riau and West Kalimantan were numerous; many richer citizens evacuated family members to cities that were safer than Pekanbaru or Pontianak.

Haze has covered the city of Pontianak and its surroundings in the last two days, even though it had previously experienced a significant decline. However, this haze has affected air quality, killed innocent children. One is Mahir Albar (2), the child of the couple Ahmad Zayadi and Muslimah, from Sungai Rengas, Kakap, Kubu Raya. This two-year-old boy fell ill on

Saturday (10/10) afternoon. This poor boy was gone on Wednesday (10/14) at around 9:15 a.m. after receiving treatment for three days at Saint Vincent Hospital, Singkawang. (“Haze”, 2015, pp.1&7)

Volunteerism

Luhmann (1989) did not believe that movement is the best way to communicate ecological problems. However, in examining haze as an ecological problem, it has been found that people also communicate problems by going to the street. Social media enables citizens to express their aspirations to fight against haze by utilizing the hashtag #melawanasap# (against haze). This can be categorized as a volunteerism subsystem, with the codes “care” and “not care.” Activities are not only done on the Internet, but also in the real world; for example, many members of society help firefighters control the fires.

... protests were carried out by the Riau people through their social media accounts with various hashtags. Not only that; a picture of a tree surrounded by smoke has been used to declare ‘Welcome to Pekanbaru’. There are also memes that read ‘Happy 18th birthday, Riau smoke ... Hopefully ...’. Now, social media like Facebook, Instagram, and Twitter are not just limited to cyberspace. Struggles for justice and unity are also done through social media. This is being done by several social media accounts, such as a public Facebook group administered by Heri Budiman and Dani Permata. Using the hashtag #tetapberjuang on Instagram. Heri said, first they only held discussions about haze at Pekanbaru’s Siku Keluang Cultural House. From the discussion, they decided to form the group Against Haze. Now it has 4,422 members (“Don’t underestimate”, 2015, p. 2)

Discussion

Haze, as a disaster, disrupts the social system as well as its subsystems. This has also been examined by Kibanov et al. (2017), who tried to connect the hotspots and the number of people who sent tweets on Twitter. However, their research provided no information about the topic or discourse most frequently mentioned by residents, as they focused only on people’s awareness

of the haze. This study, on the other hand, explains in detail how each discourse represents a subsystem, which constitutes an element of the social system.

The economy, found to be the most dominant subsystem by Alexander and Blum (2016), is not the most common discourse coloring the newspaper; politics is. This is because haze is a sensitive issue for Indonesia, especially Riau and West Kalimantan. When it reaches Singapore and Malaysia, the citizens of these countries will protest to the Indonesian government—even though some oil palm plantations and forestry companies are owned by Singaporeans or Malaysians. The responsibility for this issue must be borne by both the central and local governments.

Meanwhile, the World Bank (2016) has determined that the 2015 haze caused financial losses of IDR 221 trillion. Unfortunately, local media have not discussed the correlation between peatland fires and past wrongdoings by corporations (i.e., drying the peatland and making it more vulnerable to fire), as revealed by researchers such as Gatto et al. (2015) and Pirker, Mosnier, Kraxner, Havlík, and Obersteiner (2016).

A large amount of time students spend away from school as a result of the haze affects their futures. Their quality of education decreases, and they are unable to compete in national examinations. However, there is no discourse on how to address this problem through the school curriculum. This subsystem only focuses on school activities being disrupted, rather than formal and informal education (Islam, Pei, & Mangharam, 2016) for example, extensive slash-and-burn (S & B). This is similar to discourses on science, despite the fact that some news stories discussed the potential of solving complex problems and addressing their root causes.

Indonesians, as a religious people, will ask God to address their problems, often after involved stakeholders have concluded their activities. However, they are confused about the real problem for which they make special prayers for rain (*sholat istisqa*), particularly during droughts. Society blames the people who burn the peat, whereas the police must work to put criminals into jail. However, more important issues—such as the prevention of peatland degradation by making canals—are ignored.

Public health is a societal concern because everyone has been exposed to haze. Therefore, following politics and economics, public health also colors media discourses. However, there is no scientific data regarding the effects of this haze. Research has been

done primarily by foreign researchers such as Koplitz et al. (2016) El Niño and positive Indian Ocean Dipole conditions set the stage for massive fires in Sumatra and Kalimantan (Indonesian Borneo, who have focused on the long-term effects of haze; the disaster causes physical ailments like lung cancer and is detrimental to the quality of life (Kunii et al., 2002).

Art has a strategic role in communicating problems and sending messages, creating a new awareness in society; however, this has only been found in the local media in Riau. Art, as a media for ecological communication, has been discussed by Curtis, Reid, and Ballard (2012), who argued that the visual and performing arts are more effective in delivering such messages.

Lastly, volunteerism—frequently discussed in the context of natural disasters and human responses—is also an important subsystem in man-made disasters such as haze. Acts of volunteerism, such as distributing face masks, mobilizing people through social media, fighting fires, and protecting land, are activities that must be supported by all stakeholders. Even though Luhmann did not identify this as a subsystem, people seek to voice their aspirations against the haze and gain government/international attention. Unfortunately, such movements only emerge at the peak of the haze season, and they disappear as the number of hotspots decreases. Indeed, haze—as an ecological problem—requires a long-term solution due to its complexity.

Conclusion

Through an ecological communication perspective, it has been revealed that there are nine subsystems (economy, politics, law, science, education, religion, art, public health, and volunteerism) of the social system that react to haze disaster as an ecological problem, with politics that reacts most significantly to ecological problems. In addition, the number of discourses that representative of subsystem fluctuates together with the number of hotspots.

In conclusion, the haze problems as an ecological problem can be understood by studying local mass media. Therefore, this study suggests reducing the domination of politics by increasing other subsystems' roles, particularly the subsystem of law, science, and education in the Indonesian social system. For the next research, in terms of addressing this research limitation, it is suggested to understand society's discourses

by direct interviews with any stakeholders who are involved with the haze disaster problem.

Declaration of ownership

This report is our original work.

Conflict of interest

None.

Ethical clearance

This study was approved by the institution.

References

- Alexander, D., & Blum, V. (2016). Ecological economics: A Luhmannian analysis of integrated reporting. *Ecological Economics*, 129, 241–251. <https://doi.org/10.1016/j.ecolecon.2016.06.020>
- Anderson, A. (2015). Reflections on environmental communication and the challenges of a new research agenda. *Environmental Communication*, 9(3), 379–383. <https://doi.org/10.1080/17524032.2015.1044063>
- Arifudin, Nasrul, B., & Maswadi. (2013). Program of community empowerment prevents forest fires in Indonesian peat land. *Procedia Environmental Sciences*, 17, 129–134. <https://doi.org/10.1016/j.proenv.2013.02.020>
- Bamurtaraki, K. (2014). Review: Media, communication and development: Three approaches. By Linje Manyozo. *International Journal of Communication*, 26(1), 177–180.
- Breakwell, G. M. (2010). Risk communication. In *The Psychology of Risk* (pp. 130–172). <https://doi.org/10.1017/CBO9780511819315.007>
- Carmenta, R., Zabala, A., Daeli, W., & Phelps, J. (2017). Perceptions across scales of governance and the Indonesian peatland fires. *Global Environmental Change*, 46, 50–59. <https://doi.org/10.1016/j.gloenvcha.2017.08.001>
- Chambers, R. 1996. Participatory Rural Appraisal. Kanisius. Yogyakarta
- Christantyawati, N. (2017). The use of social media amid government, mass media, and non government organisations responsibilities due to haze disaster. *Jurnal Kajian Media*. 1(1), 50–59.
- Crowder, S. (2009). *Climate change in the media and public perceptions of it: Investigating the differences between tabloid and broadsheet newspapers* (Unpublished Dissertation). Lancashire: University of Central Lancashire

- Curtis, D. J., Reid, N., & Ballard, G. (2012). Communicating ecology through art: What scientists think. *Ecology and Society*, 17(2).
<https://dx.doi.org/10.5751/ES-04670-170203>
- Dauvergne, P. (1998). The political economy of Indonesia's 1997 forest fires. *Australian Journal of International Affairs*, 52(1), 13–17.
<https://doi.org/10.1080/10357719808445234>
- Denzin, N. K., & Lincoln, Y. S. (Eds.). (2018). *The SAGE handbook of qualitative research* (5th ed.). London, Thousand Oaks, and New Delhi: SAGE Publication.
- Dohong, A., Aziz, A. A., & Dargusch, P. (2017). A review of the drivers of tropical peatland degradation in South-East Asia. *Land Use Policy*, 69, 349–360. <https://doi.org/10.1016/j.landusepol.2017.09.035>
- Don't underestimate the pressure of 70 million social media accounts (2015, October, 13rd), Riau Pos, p. 2
- Dutta, M. J. (2011). *Communicating Social Change Structure, Culture, and Agency* (J. Bryant & D. Zillmann, Eds.). New York and London: Routledge.
- Edwards, C. A. (1991). Book reviews: Ecological communication. *The Quarterly Review of Biology*, 66(2), 222–224.
- Ekayani, M., Nurrochmat, D. R., & Darusman, D. (2014). The role of scientists in forest fire media discourse and its potential influence for policy-agenda setting in Indonesia. *Forest Policy and Economics*, 68, 22–29.
<https://doi.org/10.1016/j.forpol.2015.01.001>
- Examine three company bosses: determine 22 suspects regarding forest and land fires (2015, September 30th). Pontianak Post, pp. 13–16
- Fire free village receive IDR 100 Million (2015, November 19th). Riau Pos, p. 3
- Forsyth, T. (2014). Public concerns about transboundary haze: A comparison of Indonesia, Singapore, and Malaysia. *Global Environmental Change*, 25(1), 76–86.
<https://doi.org/10.1016/j.gloenvcha.2014.01.013>
- Fuchs, S. (1990). Book review: Ecological communication. *American Journal of Sociology*, 96(3), 747–748.
- Fujii, Y., Tohno, S., Amil, N., Latif, M. T., Oda, M., Matsumoto, J., & Mizohata, A. (2015). Annual variations of carbonaceous PM_{2.5} in Malaysia: Influence by Indonesian peatland fires. *Atmospheric Chemistry and Physics Discussions*, 15(16), 22419–22449. <https://doi.org/10.5194/acpd-15-22419-2015>
- Gatto, M., Wollni, M., & Qaim, M. (2015). Oil palm boom and land-use dynamics in Indonesia: The role of policies and socioeconomic factors. *Land Use Policy*, 46, 292–303. <https://doi.org/10.1016/j.landusepol.2015.03.001>
- Gaveau, D. L. A., Salim, M. A., Herguacal, K., Locatelli, B., Sloan, S., Wooster, M., Sheil, D. (2014). Major atmospheric emissions from peat fires in Southeast Asia during non-drought years : evidence from the 2013 Sumatran fires. *Scientific Reports*, 4(6112), 1–7. <https://doi.org/10.1038/srep06112>
- Giddens, A. 2009. *The politics of climate change*. UK and USA: Polity Press.
- Hamad, I. (2007). *Lebih dekat dengan analisis wacana (closser with discoursse analyse) MediaTor (Jurnal Komunikasi)*, 8(2), 325–344. <https://doi.org/10.29313/mediator.v8i2.1252>
- Haze wipes the rights of citizens: two toddlers died due to ARI (2015, October, 19th). Pontianak Post, pp. 1&7
- Heilmann, D. (2015). After Indonesia's ratification: The ASEAN agreement on transboundary haze pollution and its effectiveness as a regional environmental governance tool. *Journal of Current Southeast Asian Affairs*, 34(3), 95–121. doi.org/10.1177/186810341503400304
- Herutomo, C. (2013). Komunikasi lingkungan dalam mengembangkan hutan berkelanjutan (Environmental Communication for sustainable forest). *Acta Diurna*, 9(2), 37–48.
- Higgins, C., & Walker, R. (2012). Ethos, logos, pathos: Strategies of persuasion in social/environmental reports. *Accounting Forum*, 36(3), 194–208. <https://doi.org/10.1016/j.accfor.2012.02.003>
- Holdschlag, A., & Ratter, B. M. W. (2016). Caribbean island states in a social-ecological panarchy? Complexity theory, adaptability and environmental knowledge systems. *Anthropocene*, 13, 80–93. <https://doi.org/10.1016/j.ancene.2016.03.002>
- Huang, S. (2017). *The discourse analysis of haze issue in China: Critical discourse analysis about constructions of people daily and analysis of audiences interaction in terms of haze issue*. Unpublished Thesis. Junkoping: Junkoping University.
- Infanti, J. J., Sixsmith, J., Barry, M. M., Núñez-Córdoba, J. M., Oroviogiochea-Ortega, C., & Guillén-Grima (2013). ECDC Technical Support: *A literature review on effective risk communication for the prevention and control of communicable diseases in Europe*. Stockholm: ECDC. Retrieved from www.ecdd.europa.eu
- Islam, M. S., Pei, Y. H., & Mangharam, S. (2016). Transboundary haze pollution in Southeast Asia: Sustainability through plural environmental governance. *Sustainability*, 8(5), 1–13. <https://doi.org/10.3390/su8050499>
- Jones, D. S. (2006). ASEAN and transboundary haze pollution in Southeast Asia. *Asia Europe Journal*, 4(3), 431–446. <https://doi.org/10.1007/s10308-006-0067-1>
- Kibanov, M., Stumme, G., & Jun, S. I. (2017). Mining social media to inform peatland fire and haze disaster management. *Social Network Analysis and Mining*, 7(1), 30. <https://doi.org/10.1007/s13278-017-0446-1>
- Koplitz, S. N., Mickley, L. J., Marlier, M. E., Buonocore, J. J., Kim, P. S., Liu, T., ... Myers, S. S. (2016). Public health impacts of the severe haze in Equatorial Asia in September-October 2015: Demonstration of a new framework for informing fire management strategies

- to reduce downwind smoke exposure. *Environmental Research Letters*, 11(9). <https://doi.org/10.1088/1748-9326/11/9/094023>
- Kunii, O., Kanagawa, S., Ismail, T. S., Kunii, O., Yajima, I., Hisamatsu, Y., ... Amagai, T. (2002). The 1997 haze disaster in Indonesia: Its air quality and health effects. *Archives of Environmental Health*, 57(1), 16–22. <https://doi.org/10.1080/00039890209602912>
- Lacayo, V. (2013). *Communicating complexity: A complexity science approach to communication for social change*. Ohio: Ohio University.
- Lin, T. T. C. (2019). Communicating haze crisis online: comparing traditional media news and new media perspectives in Singapore. *Environmental Communication*, 13(7), 864–878. <https://doi.org/10.1080/17524032.2018.1488754>
- Littlejohn, S. W., & Foss, K. A. (2005). Environmental communication theories. S. W. Littlejohn & K. A. Foss (Eds.), *Encyclopedia of communication theory* (pp. 344–348). Los Angeles, London, New Delhi, Singapore, Washinton DC: SAGE Publication.
- Luhmann, N. (1989). *Ecological communication*. Chicago and Cambridge: The University of Chicago Press, Polity Press.
- Losing airlines (2015, September 12nd). Pontianak Post, p. 14.
- Mahmoud, M. (2014). Polarized discourse in the news. *Procedia - Social and Behavioral Sciences*, 134, 70–91. <https://doi.org/10.1016/j.sbspro.2014.04.225>
- Maswadi, Arifudin, Septiana, N., & Maulidi. (2018). Socioeconomic factors of smallholder farmers' behavior in biomass burning around palm oil plantation in Indonesia. IOP Conference Series: *Earth and Environmental Science*, 141. <https://doi.org/10.1088/1755-1315/141/1/012020>
- Malaysia evacuates 225 of its citizens (2015, September 19th). Riau Pos, pp. 1&2
- Muslim community not give up requesting rain (2015, October 8th). Riau Pos, pp. 33&39
- Medrilzam, M., Dargusch, P., Herbohn, J., & Smith, C. (2014). The socio-ecological drivers of forest degradation in part of the tropical peatlands of Central Kalimantan, Indonesia. *Forestry*, 87(2), 335–345. <https://doi.org/10.1093/forestry/cpt033>
- Narodny, L. (1991). Review: Ecological communication. *Leonardo*, 24(3), 364–365.
- Park, H. (2011). Man-made disasters: A cross-national analysis. *International Business Review*, 20, 466–476. <https://doi.org/10.1016/j.ibusrev.2010.08.004>
- Peebles, J. (2015). Discourse? Rhetorical analysis approaches to environment, media and communication. Hansen, A and Cox, R (Eds.), *The Routledge handbook of environment and communication* (pp. 39–48). Retrieved from <https://www.routledgehandbooks.com/doi/10.4324/9781315887586.ch3>
- Pidgeon, N., & Leary, M. O. (2000). Man-made disasters: Why technology and organizations (sometimes) fail. *Safety Science*, 34, 4–7.
- Pirker, J., Mosnier, A., Kraxner, F., Havlik, P., & Obersteiner, M. (2016). What are the limits to oil palm expansion?. *Global Environmental Change*, 40, 73–81. <https://doi.org/10.1016/j.gloenvcha.2016.06.007>
- Prayoto, Ishihara, M. I., Firdaus, R., & Nakagoshi, N. (2017). Peatland fires in Riau, Indonesia, in relation to land cover type, land management, landholder, and spatial management. *Journal of Environmental Protection*, 08(11), 1312–1332. <https://doi.org/10.4236/jep.2017.811081>
- 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>
- Quah, E., & Varkkey, H. M. (2013). The political economy of transboundary pollution: Mitigation of forest fires and haze in Southeast Asia. *The Asian Community: Its Concepts and Prospects*, 323–358.
- Quebral, N. C. (2012). *Development communication primer*. Penang: Southbound Sdn. Bhd.
- Read poetry in haze that hasn't moved (2015, October 25th). Riau Pos, p.26
- Rogers, E. 2003. Diffusion of innovation (5th eds). New York: Free Press
- Riau Education in dilemma (2015, October 2nd). Riau Pos, pp. 1&2
- Santin, C., & Doerr, S. H. (2016). Fire effects on soils: The human dimension. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 371(1696), 28–34. <https://doi.org/10.1098/rstb.2015.0171>
- Sloan, S., Locatelli, B., Wooster, M. J., & Gaveau, D. L. A. (2017). Fire activity in Borneo driven by industrial land conversion and drought during El Niño periods, 1982–2010. *Global Environmental Change*, 47, 95–109. <https://doi.org/10.1016/j.gloenvcha.2017.10.001>
- Sriwimon, L., & Jimarkon, P. (2017). Applying critical discourse analysis as a conceptual framework for investigating gender stereotypes in political media discourse. *Kasetsart Journal of Social Sciences*, 38(2), 136–142. <https://doi.org/10.1016/j.kjss.2016.04.004>
- Stolle, F., & Lambin, E. F. (2003). Interprovincial and interannual differences in the causes of land-use fires in Sumatra, Indonesia. *Environmental Conservation*, 30(4), 375–387. <https://doi.org/10.1017/S0376892903000390>
- Susmayadi, I. M., Kanagae, H., Adiyoso, W., & Dwi, E. (2014). Sustainable disaster risk reduction through effective risk communication media in Parangtritis tourism area, Yogyakarta. *Procedia Environmental Sciences*, 20, 684–692. <https://doi.org/10.1016/j.proenv.2014.03.082>

- Tacconi, L. (2003). Fires in Indonesia: causes, costs and policy implications. In *CIFOR Occasional Paper* (No. 38). Bogor: CIFOR
- Thorburn, C. C., & Kull, C. A. (2015). Peatlands and plantations in Sumatra, Indonesia: Complex realities for resource governance, rural development and climate change mitigation. *Asia Pacific Viewpoint*, 56(1), 153–168. <https://doi.org/10.1111/apv.12045>
- Wahyuni, H. I. (2019). Ecological communication in information society: Reflections on Niklas Luhmann's thought in understanding ecological and disaster issues in Indonesia. *Jurnal Komunikasi ISKI*, 04 (01), 9-17
- Wahyuni, H. I., Fitrah, A. A., Handayani, F., & Robie, D. (2018). Ecological communication in Asia-Pacific: A comparative analysis of social adaptation to maritime disaster in Indonesia and Fiji. *Pacific Journalism Review*, 24(1), 12–36.
- Wiedemann, P. M., Clauberg, M., & Börner, F. (2010). *Risk communication for companies: Thriving and surviving on an age of risk*. retrieved from <http://www.wiedemannonline.com/blog/wpcontent/materialien/downloads/Risk%20communication%20for%20companies.pdf>
- World Bank. (2016). *The cost of fire: An economic analysis of Indonesia's 2015 fire crisis*. Jakarta: World Bank