

# Environmental Impact of Fire Forest and Land, Lole of Government in Land Control of West Sumatra Province



Susi Erianti, Indang Dewata, Dedi Hermon

**Abstract:** Forest is a natural resource that has a very important and strategic role in national development. Forest and land fires in Indonesia are considered regional and global disasters. This is due to the impact of forest fires on neighbouring countries. Forest and land fires in Indonesia that occur every year since 1997. This condition occurs in El Nino conditions during the dry season and biophysical conditions of degraded land. Forest and land fires are rotting on socio-cultural, economic and political aspects. Therefore, the Indonesian government was involved in multi-government control of Forest and land fires. Thus, improving between bodies is needed in the control of Karhutla. This paper will provide an integrated concept in an effort to control forest fires. The method of making is by studying literature, added by searching from the author. The method of analysis of this paper is a literature study of several results, both the author's research and the research of various parties. Literature Study, this analysis is also supported by secondary data released from the parties who violate. Furthermore, the data is analyzed and can be analyzed freely which can be supported by theories and concepts that will be built in various operational steps, and results, and some results from several literature and event analysis. Can be used for fire control carried out through 3 (three) stages, namely prevention of events, blackouts, and post-fire handling. This process is carried out on all components in the system.

**Index Terms:** Land Cover, Land Cover, Fire Forest

## I. INTRODUCTION

Forest is a natural resource that has a very important and strategic role in national development. Forest and land fires in Indonesia are seen as regional and global disaster events. In 2015, six provinces experienced forest and land fires, namely South Sumatra, Jambi, Riau, West Kalimantan, Central Kalimantan, and South Kalimantan [1] [2] [3] [4]. The impact of this haze was felt in North Sumatra Province, West Sumatra, as well as neighboring Malaysia, Singapore, Thailand and the Philippines.

The haze disaster that hit Indonesia in 2015 was a very severe haze disaster. Robert Field, a Columbia University researcher who conducted a study at the Space Agency's Goddard Institute for Space Studies said, "If estimates of dry season weather last longer, it can be considered that 2015 will be recorded as the worst event in a record."

Head of the Data Information and Public Relations Center for the National Disaster Management Agency (BNPB), Sutopo Purwo Nugroho, based on the number of areas affected and the severity of the smog this year, estimates the number of losses this time will be greater. In 2014, for Riau Province alone, losses caused by smog reached IDR 20 trillion. However, this financial loss rate has not included elements of loss in terms of expenditure or health impacts, loss of biodiversity, and calculation of greenhouse gas emissions [5] [6] [7] [8]. Forest and land fires in Indonesia occur almost every year since 1997. These forest fires are the cause of forest destruction and the most detrimental because in a short time it can cause losses, both economically, ecologically, aesthetically, and politically. Forests and land are related to human activities, and are supported by extreme climatic conditions that are affected by El Nino during the dry season and biophysical conditions of degraded land [9] [10] [11] [12]. Factors affecting forest fires such as: Fuel (size, arrangement, volume, type, water content/ chemistry), Weather (wind, air temperature, rainfall, soil, relative humidity), Time (21.00-06.00 slow).

Another disadvantage in the form of ecological losses is the reduction in forest area, the unavailability of clean air produced by forest vegetation and the loss of the function of the forest as a regulator of the water system and preventing erosion [13] [14] [15] [16]. The global impact of forest and land fires that is directly felt is that air pollution from the smoke generated results in respiratory problems and disrupts daily activities [17] [18] [19] [20]. The events of forest fires that occurred in Indonesia in 1997 - 1998 and 2002 - 2005 produced smoke which was also felt by the people of Malaysia, Singapore and Brunei Darussalam and threatened the disruption of the relationship between air transportation between countries. The area of forest in West Sumatra based on Minister of Forestry Decree Number 35/Menhut-II/2013 dated January 15, 2013 is approximately 55.39% while 44.61% is used for other activities in the form of Other Use Areas (APL) covering an area of 1,886,837 hectares of the total area of West Sumatra Province which is an area of 4,229,730 Ha). Beginning in 2014, almost all districts cities in West Sumatra Province experienced haze disasters. The phenomenon of smog experienced was from Riau Province due to forest and land fires get worse.

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## II. RESEARCH METHODS

The method of writing this paper is a literature review of several research results, both the author's research and various parties' research. Literature Study, Analysis of the problem is also supported by primary data from field observations and secondary data released from the authorities. Furthermore, the data are presented descriptively which can support the theoretical and conceptual foundation that will be built in preparing operational steps for controlling forest and land fires, especially in West Sumatra Province. To obtain strategic steps in formulating policies on efforts to prevent and combat forest and land fires, the Provincial Government of West Sumatra should be able to make Operational Standards for Forest and Land Fire Levels by taking into account the following criteria: Determination of standard technical criteria for provincial scale environmental damage related to forest and land fires and Coordination of management of forest fires and Forest Protection.

## III. RESULTS AND DISCUSSION

Based on primary data from field observations and secondary data as well as some sources and literature collected in the preparation of this paper, the occurrence of forest fires can be caused by several natural good things: very hot weather for long periods of time in the dry season, lightning strikes, lava from volcanic eruptions and the results of human actions, whether intentional or unintentional, such as land clearing for plantations and cultivation of communities around forests and hunting that can cause damage to the economic, social, cultural aspects of society and impact on the environment and public health. The direct effects of forest fires are as follows: First, the emergence of acute respiratory infections for the community. Second, socially and economically the community is disadvantaged because of reduced work efficiency, offices and schools are closed and the transportation network is disrupted. Third, material and material losses for local residents even cause cross-border haze pollution to neighboring countries such as Singapore, Malaysia and Brunei Darussalam [7] [21] [22] [23] [24].

### *Factors that influence the occurrence of forest and land fires*

Topography, namely slope, slope direction, terrain is very influential on the occurrence of forest fires. The topographic conditions in the West Sumatra region are mountainous or longitudinal hills, with a long coastline. [3]. Weather and climate are one of the factors that support the occurrence of forest and land fires. The characteristics of the West Sumatra region are located in the equatorial area. In addition, the West Sumatra region bordering the Indian Ocean causes most of the West Sumatra region to have an equatorial rain pattern with 2 (two) high rain peaks and 2 (two) low rain peaks namely western West Sumatra Region have higher rainfall than the eastern part. Annual rainfall also varies greatly. West Sumatra has a Normal Temperature (Maximum 32°C, Minimum 21 °C) with 60% humidity. Fire Processes that play a role in it such as: air, fuel and heat (high temperature) cause a flame to spread. Spread of fire and heat that occurs through conduction, radiation, and convection. Climate factors in the form of temperature, humidity, wind and rainfall also determine fire hazard. High

temperatures due to direct solar radiation cause the fuel to dry up and become flammable, high humidity (in forests with heavy vegetation) reduces the chance of forest fires, wind also influences the drying process of fuel and the speed of spread of fire while rainfall affects the size water contained in fuel [3] [25] [26] [27] [28] [29].

The socio-cultural factors of the community have the biggest contribution to the presence of forest fires. Some factors that cause forest fires include: (1) Use of fire in land preparation activities. Communities around forest areas often use fire for land preparation, both to make agricultural land and plantations such as coffee and cocoa. The high difference in production costs is one factor driving the use of fire in land preparation activities. The method of using fire in land preparation activities is carried out because it is cheap in terms of cost and effective in terms of time and the results achieved are quite satisfactory, (2) Disappointment with the forest management system. Various social conflicts often appear in the community around the forest area. Conflict experienced especially the problem of conflict over forest management systems that did not provide economic benefits to the community. The existence of some people's dissatisfaction with forest management can trigger the community to act anarchistically without taking into account conservation or legal principles. The limited education of the community and the lack of knowledge of the community about the functions and benefits of forests greatly influence their actions in managing forests that tend to be destructive, (3) Illegal logging or illegal logging. The activities of illegal logging or illegal logging produce more critical lands with a high level of fire vulnerability. Often, uncontrolled fire easily spreads to the area of critical forests. The activities of illegal logging or illegal logging often leave fuel (leaves, branches, and twigs) that are increasingly increasing and accumulating in forest areas which in the dry season will dry up and be very potential as a cause of forest fires, (4) Need for Forage (HMT). The life of the people around the forest area cannot be separated from livestock and grazing. Livestock (especially cows) is a form of side business to fulfill family needs. The need for HMT and grazing areas is one of the things that must be fulfilled. To get good quality grass and high levels of palatability, people usually burn pasture areas that are already unproductive. After the burning grassland area will grow new grass with better quality and high nutritional content, (5) Forest encroachment. Another factor that is not less important as the agent that causes forest fires is population migration in forest areas (forest encroachers). Whether or not it is realized that the longer, the life needs of the community will increase along with the increasing number of families and increasingly complex needs of life. This requires residents to increase their cultivated land so that their agricultural products can meet their daily needs, and (6) Other reasons. Other reasons that can trigger fires are a lack of public awareness of the dangers of fire. Usually the form of activity that is the cause is the accident of the perpetrator. For example the community has a high interaction with the forest. One form of interaction is the habit of residents taking rattan which usually while working they light cigarettes.

Unconsciously they throw cigarette butts in a forest area that has the potential of abundant fuel so that it can cause a fire [4] [30] [31] [32].

The causes of forest and land fires are mostly due to human activities, including land clearing activities [5]. The results of studies in the field there are six things that cause fires always occur [6]. First, due to damage to the forest canopy structure so that forests are easily warmed up. Second, forests are resources that are open to the public so everyone is easy to enter, while the ability of the forestry apparatus in the field to secure the forest is so lacking that everyone can take forest products without prioritizing their sustainability Thirdly, the fire control system has not maximally included the surrounding community Fourth, forest fires are caused by increasing negligence in using fire for farming [4]. Fifth, fire control technology thanot yet in the community, and sixth, due to the inappropriate silvicultural system [8]. But recently in 2015 there were symptoms showing that the land was intentionally burned by business people or individuals. According to PNPB (2015) land and forest fires that occur in Sumatra are 99.9% due to human activity. Even recently it was discovered that several companies were opened to burn the land, and there were tones of some people who were ordered to burn the forest. Other hypotheses also need to be examined for possible fire being used as commodity goods. Because with a forest fire the project will enter. Opportunities to search for climate change proposal funds due to forest fires can be obtained from donor countries. Therefore a comprehensive audit of all existing systems is also needed. Even fire control institutions must be audited.

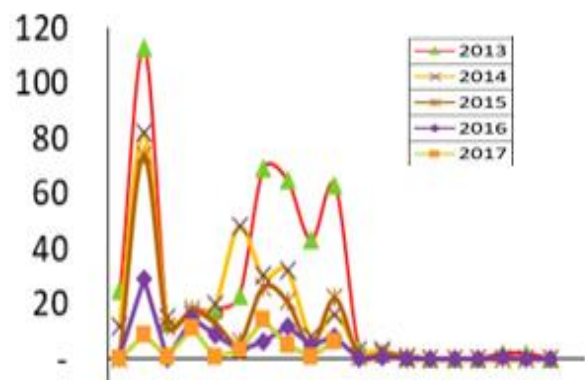
**The negative impacts of Forest and Land Fires include negative impacts on biophysics, negative impacts on socio-economics and negative impacts on the environment.**

Impact on Ecology and Environmental Damage. Forest fires provide direct impacts on ecology and the environment which include:

- The loss of a number of species; besides burning various flora, forest fires also threaten the survival of a number of animals. Various endemic species (plants and animals) are threatened with extinction due to forest fires.
- Erosion; Forests with plants function as a barrier to erosion. When plants are destroyed due to forest fires, there will be forest land which is easily eroded by rain water and even wind.
- Forest function change; The area of burning forest requires a long time to return to being a forest. In fact, often forests experience changes in designation into plantations or grasslands.
- Declining water quality; One of the ecological functions of the forest is in the hydrological cycle. Forest fires have the effect of losing the ability of forests to absorb and store rainwater.
- Global warming; Forest fires produce smoke and other CO<sub>2</sub> and gas gases. In addition, the burning of forests will reduce the ability of forests to store carbon. Both of them have a big influence on climate change and global warming. The smoke caused also becomes air pollution which can cause respiratory tract diseases such as Upper Respiratory Tract Infection (ISPA), asthma, chronic obstructive pulmonary disease.

- River sedimentation; dust and residual combustion brought on by erosion will settle in the river and cause siltation.
- Increased natural disasters; The disruption of the function of the forest ecology due to forestfires has increased the intensity of natural disasters (floods, landslides and droughts).
- Besides being able to cause material losses, forest and land fires also cause a large accumulation of smoke. Forest and land fires in the last few years have attracted the world's attention, due to a certain weather condition that is smoke from forest fires and land trapped under a layer of cold air atmosphere above the territory of Indonesia and neighboring countries, causing a decrease in visibility and disturbing smooth transportation of land, sea and air.

**The Role of the Government of the Province of West Sumatra in the Efforts to Combat Forest and Land**



**Figure 3. Distribution of hotspots in the province of West Sumatra in the last five years**

Based on the graph of the West Sumatra Province hotspot distribution, the largest distribution of hotspot points in the West Sumatra region is found in the Other Use Areas (OUA), which were the most in 2013 and 2014. And from year to year the number of hotspots in the Sumatra region The West is decreasing, this is because the beginning of the community understands the impact caused by forest and land fires.

The above is the largest area of forest and land fires that occurred in 2015 with an area of ± 746 Ha, for the last year 2017 the area of land burned in West Sumatra Province ± 148.5 Ha. This means there is a decrease in hotspots and extensive forest and land fires in Sumatra Barat Province.

The task of the West Sumatra Province in overcoming forest and land fires is in accordance with the Republic of Indonesia Government Regulation PP. 38 of 2007 and Presidential Instruction No. 16 of 2011 are as follows: Determination of standard technical criteria for Living environment damage at provincial scale related to forest and land fires and coordination of forest and land fires; Living environment damage / pollution and carrying out control of forest and land fires; on Production forest, Protected forest, Custom, and Highway forest park that are not burdened by Rights;

Facilitation of Bimwas in forest protection activities in forest areas encumbered with customary rights and Forests; Provincial Forestry Information (including forest and land fires); provincial forestry technical and functional training; Compilation of Regulations for the Governor of West Sumatra; Control of forest and land fires; Increased Role of Regional Disaster Management Agency; Regional Expenditure Budget Allocation and Facilitation of collaboration between districts / cities; Obliging agricultural businesses to have sarpras dalkar and carrying out forestry controls; Sanctions for agricultural businesses. The Strategic Measures for Mitigating the Forestry by the West Sumatra Provincial Government, especially the West Sumatra Provincial Forestry Service are as follows: Coordination, Synchronization and facilitation of cooperative relations between district/city agencies/ agencies in charge of forestry and land and forest fire control as well as neighboring provinces; and facilitating community participation in forest and land fire prevention; Budget Sanctioning and Improvement of Energy and Mineral Resources; Fulfillment of infrastructure facilities for forest and land fires; Establishing forest and land fire suppression task force; Making work operational standards (SOP) for forest and land fire suppression; Pergub Making Forest and land fire control.

To reduce the danger of forest and land fires, the West Sumatra provincial government has taken measures:

- Prevention of forest and land fires: creation of hazard maps for forest fires, making maps of distribution of hotspots, Dissemination of Hotspot Information through [dishut.sumbarprov.go.id](http://dishut.sumbarprov.go.id), Increasing the Role of control of forest and land fires Posts and Making work operational standards (SOP).
- Extinguishing Forest and Land Fires: Initial outages by monitoring hotspots (hotspots), Forest fire patrols, Continuing blackouts coordinating with Regional Disaster Management Agency s or firefighting teams from relevant agencies.
- Increasing human resources through: Forestry Management Training for Officers / Forestry Officers, Forestry Simulation, establishment of forest and land fire brigades
- Community Empowerment: Formation of community cares about fire and increasing role of Nagari-Based Forest Security Officer (PPHBN) to help control forestfires, Training community cares about fire members, Include community cares about fire members in Forest Fire Extinguishing, provide manual tools, Community Awareness / Awareness and Billboards Installation, Include other security members in Forest Fire Outages.
- Providing and completing infrastructure facilities for forest fires, both manual, semi-mechanical, mechanical and navigation / GPS equipment and support

Things that have not yet materialized and will be implemented are post-fire handling that has not yet been carried out in relation to human resource capabilities, formation of provincial level forest and land fire control brigades that need coordination, MOU between West Sumatra Provincial Forestry Office, Central UPT Forestry Agency in Sumatra West, Forestry Service / Institutions in the District / City, forest management holders and related parties in the effort to Control Forest and Land Fires. Information systems for forest and land fires have not been

completed in the West Sumatra Province. Need to encourage district / city governments to provide budgets, HR as well as forest fire control infrastructure facilities for the Establishment of the Governor of Forest Fire Control.

## II. CONCLUSIONS

Factors that affect the extent of natural forest fires such as: Fuel (size, arrangement, volume, type, water content / chemical) Weather (wind, air temperature, rainfall, soil, relative humidity), Time (9:00 to 6:00 a.m. slow ), Topography (slope, slope direction, terrain) Fire Process which plays a role in it such as: air, fuel and heat (high temperature) causing a flame to spread. Spread of fire and heat that occurs through conduction, radiation, and convection. Whereas another factor in the occurrence of forest fires is human participation in the burning process both directly and indirectly, such as clearing land for agriculture, settlements. The impact of forest and land fires can be categorized in general, namely: 1. Physical-soil-water-climate (air) environment 2. Biotic environment-flora / fauna 3. Social, economic and health. For forest and land fire prevention, a forest fire prevention strategy needs to be made rather than extinguishing forest fires because it is economically more efficient at preventing forest fires than fires, such as: Making maps of fire hazard, Monitoring (weather accumulation of fuel) Symptoms of fire hazard forest and land firefighting teams, building watch towers, making bulkhead lines, educating people about awareness, the danger of the forest and land fires, the formation of forest firefighting organizations from relevant agencies such as the Forest and Land Fire Brigades and with involving the community such as the formation of the MPA (Community of Fire Care). Analysis of the impact of forest fires is still in the initial development stage, knowledge of complex ecosystems has not been well developed and information in the form of a critical threshold of ecological changes related to fires is very limited, so the impact of real forest fires on biodiversity is difficult to calculate precisely.

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