

## **CHAPTER II**

### **THE DYNAMICS OF SMOKE HAZE DISASTER IN INDONESIA**

The problem of smoke from Indonesian forest fires is not a new problem. Smoke haze has become a disaster that occurs almost every year. It can even be said that Indonesian forest fires are a routine in life because they happen almost every year. Smoke haze disaster in Indonesia is a problem that is difficult to overcome and has an impact on various aspects of life. In this chapter, the author will describe the dynamics of the smoke haze that happened in Indonesia, the factors that cause haze, and the impact of smoke haze in several aspects of life.

#### **A. Dynamics of Smoke Disaster that Happened in Indonesia**

Almost every year, Indonesia suffered forest fires that cause smog disaster. The first worst forest fires occurred in 1997, which caused severe transboundary haze in neighboring countries. The impact was a thick haze that disrupted people's lives in the area of the incident and also disrupted the national transportation system.

Before 1997, a significant fire had occurred in East Kalimantan in 1982-1983. In 1982-1983 fires destroyed about 3.5 million hectares of forest in East Kalimantan. The fire caused a thick haze that also reached neighboring countries Malaysia, Brunei Darussalam and Singapore. Then in 1991 and 1994, a fire broke out again in East Kalimantan which also affected Malaysia, Brunei Darussalam and Singapore (Suryani A. S., 2012). Forest fires in 1991 occurred in Sumatra, Kalimantan, Sulawesi, Java, Bali and Nusa Tenggara. In 1994, there was a long drought that hit Indonesia, and there were large fires on the islands of Sumatra and Kalimantan. BAPPENAS recorded forest

fires in 1991 covering an area of 500,000 hectares and more than 5 million hectares in 1994. The most significant impact happened in 1994, where Indonesia, Malaysia, and Singapore experienced air and sea transportation disruptions. (Peranginangin, 2014).

Forest fires that occurred in 1994 were not as severe as in 1997-1998. In 1997-1998 some fires destroyed 11.7 million hectares of land and forests (Suryani A. S., 2012). In 1997-1998, the Indonesian government estimated that the number of areas affected by fire reached 750,000 hectares. However, various environmental institutions such as the "Wahana Lingkungan Hidup" (WALHI) estimate the number reaches 13 million hectares. Then a study conducted by the National Development Planning Agency together with the Asian Development Bank (ADB) estimates that the amount of land affected by fires reached 9.75 million hectares (BBC, Kebakaran hutan dan lahan Indonesia bisa samai insiden 1997, 2015).

In 1997, it was the largest forest fire that caused the worst haze in Indonesia, and this was because the El Nino phenomenon accompanied the dry season. In 1997-1998, slash and burn agriculture led to fires that were out of control. The forest fires caused smoke and fog that was blown to neighboring countries such as Malaysia, Singapore, Brunei, Thailand, Vietnam and the Philippines (Rawlings, 2011). According to the WWF Indonesia website, forest fires in Indonesia in 1997 produced greenhouse gas emissions of 0.81-2.57 gigatons of carbon. That amount is equivalent to 13% -14% of the total world carbon emissions produced by fossil fuels per year. This contributes significantly to global warming. However, the most significant impact was experienced by neighboring countries in the Southeast Asia region that received smoke shipments from Indonesia. The

effect of this haze was felt by at least 70 million people in six ASEAN countries including Malaysia (Ahmadi, 2008).

From September 2000 to July 2008 in the province of Riau, 57972 hotspots were distributed to 12 regencies/cities. It is known based on the monitoring of Modest satellites (Terra and Aqua) (Raflis & Khunaifi, 2009). Large forest fires also occurred in 2005-2006. Large smoke haze was caused by the 2006 forest fires, where hotspots were increasing in Sumatra and Kalimantan. Smoke fog gets thicker because most of the land burned is peat, so it is difficult to control. From the results of the monitoring of WALHI in Sumatra and Kalimantan, it was shown that until August 18, 2005, in Sumatra there were 4482 hotspots scattered throughout almost Sumatra except for Bengkulu. Most hotspots in Sumatra are on the border of North Sumatra and Riau with the most points in Riau Province (Syumanda).

In July 2000, forest fires occurred in Sumatra. Forest fires are estimated to happen because they were burned by irresponsible parties who carry out illegal logging. The smoke haze caused by this forest fire also affected Malaysia and Singapore. Then in 2003 forest fires occurred in Kalimantan and Sumatra. This year, the smoke disaster was caused by the uncontrolled palm oil business. Indonesia is the world's largest palm oil producer and is a major investment target which is known to be greedy in transforming forests into plantations. After Riau's forests have been exhausted, the entrepreneurs are now targeting peatlands to be converted into oil palm plantations with alternative roads namely burning. Flammable peatland leads to large forest fires and smoke haze effects to the neighboring countries (Geani, 2014).

Forest and land fires in Indonesia have a characteristic because they occur with a clear mode, namely the preparation of land by burning well by the community and forestry and plantation companies. The result is an increasingly severe impact on the lives of humans and other living things. Some fire incidents that can be recorded in this period are fire incidents in 2002, 2004, 2005, 2006, 2007, 2008 and 2009 (Peranginangin, 2014). Forest and land fires in Indonesia repeatedly occur every year in the same place, especially in peat areas. This shows that peatland management has a high risk of fire. This is due to the construction of canal canals as drainage for drying the peatland. So that there is a decrease in the groundwater level in the peat areas which ultimately results in high drought and flammability either intentionally or not (Raflis & Khunaifi, 2009).

Data from reports and observations show that forest fires in Indonesia are increasing every year. In 2012, forest and land fires continued to occur. Not only in the APL area and other agricultural areas, but the forests in the conservation area are also burned. Based on the Ministry of Forestry's hotspot in Indonesia from January to September 2012 it reached 24,663 points. The data was taken from the NOAA-18 satellite detection (Sigit, 2012).

Continuous forest fires have resulted in pollution of transboundary smoke pollution, for example, Forest fires in Riau Province in 2013 were very alarming because they damaged forest vegetation and polluted the environment not only Indonesia but also neighboring countries, especially Malaysia. In early March 2014, forest and peatland fires in the provinces of Riau, Sumatra, Indonesia, soared to a point never found since the Southeast Asian smog crisis in June 2013. According to the Indonesian disaster management agency, nearly 50,000 people

experienced respiratory problems due to smoke haze that (Sizer, et al., 2014).

In September 2015, big fires occurred in forests, degraded land, and peatlands in the provinces of Riau, Central Kalimantan, South Sumatra and other parts of Indonesia. Fires are a routine annual event on Indonesia's peat and forests, their peak occurring around September or October. Deforestation and repeated fires make Indonesian landscapes more vulnerable to fire (Erlangga, 2015).

In 2015, forest fires in Indonesia were believed to be a record as the worst in history. The reason is the El Nino phenomenon that makes weather conditions dry up and prolongs the dry season. Every year Indonesia is hit by forest fires and haze. Air pollution caused by forest fires in Sumatra and Kalimantan set a new record. At the time, the United States Space Agency NASA, also warned that a long dry season made it difficult for blackouts. The fire that hit the two islands was the most severe and longest forest fire. The El Nino phenomenon made the weather conditions drier and prevented the rain from falling (NASA: Kabut Asap Indonesia Terparah Dalam Sejarah, 2015).

In early 2016, the World Bank released data showing that the economic losses due to the 2015 smoke disaster reached 220 trillion Rupiah and caused approximately 47 million people to be exposed to smoke on Kalimantan and Sumatra, and at least 19 people were reported dead. Not only that, but losses due to smog in Indonesia were also suffered by several ASEAN countries such as Singapore and Malaysia (Masalah Kabut Asap Perlu Dianalisa Dalam Perspektif Asia Tenggara, 2016). In 2015, the air index in Singapore was the worst for 15 years. Therefore, this issue is not only a matter of Indonesia alone, but

has become an international issue, especially in the ASEAN region (RistekDikti, 2016).

NASA scientists believe, the situation in 2015 was similar to 1997 which was recorded as the most severe haze disaster in history. This was also believed by the Center for International Forestry Research (CIFOR) Researcher Herry Purnomo, that the impact of forest fires in 2015 was almost the same as 1997, regarding financial losses. Meanwhile, in the 2015 forest fires, the Indonesian government has reduced 20,000 troops, police and firefighters to Sumatra and Kalimantan. And the biggest hope that the fire quickly extinguished is by the arrival of the rainy season (NASA: Kabut Asap Indonesia Terparah Dalam Sejarah, 2015).

The smoke haze caused by forest and land fires in 2015 was among the worst, even creating tensions in relations between Indonesia and neighboring countries in Southeast Asia. Forest fires that caused smog in Indonesia in 2015 approached the situation in 1997. At that time, there was a powerful El Nino phenomenon, causing widespread forest fires with very high levels of air pollution and greenhouse gas release. At that time, some data stated that the fire destroyed 1.5 million hectares of land in Sumatra and 3 million hectares in Kalimantan (S., 2015).

To face 2016, the Government of Indonesia is trying to prevent forest and land fires that have a haze in 2015 again. The Indonesian President, Joko Widodo, asked officials in the area to act quickly and accurately in overcoming the problem. The government has tried to tackle and manage forest and land fires in 2016 more readily. Prevention of fire is a priority (Presiden, 2016). And in 2016, the government has formed a Peat Restoration Agency. The agency has a goal that the problem of forest and

land fires will not occur again like 2015 (Jordan, 2016).

Indonesia's land and forest fires in 2016 dropped dramatically when compared to 2015. This was stated by the Head of the Center for Data and Information for the National Disaster Management Agency (BNPB) Sutopo Purwo Nugroho. Two factors cause the decline in smog and forest fires in Indonesia: forest fires are decreasing due to the government's far better efforts. The government has taken various ways to anticipate catastrophic forest fires. Including the deployment of the Disaster Management Combined Task Force consisting of 7,000 joint military, police, fire-care communities, volunteers, and other relevant agencies. Local governments also have a high awareness in the effort of disaster management of forest and land fires, especially the areas that are the victims of the disaster. And the second is due to natural factors. In 2016, there was no El Nino because it was a wet dry season (Putra, 2016). Wet drought causes Indonesia in dry conditions but with high rainfall. This happened because of the La Nina phenomenon which produced high rainfall. Natural factors are claimed to actively support the government's efforts in overcoming forest and land fires in the country (Suastha, 2016).

In 2016, weather conditions were relatively better than in 2015. This caused the haze to diminish, and the situation was much better compared to the haze in 2015. In 2016, no flights were canceled due to smog, permanent schools enter, normal community activities. This shows a better situation than in 2015, with most of Sumatra and Kalimantan covered by smoke (Bremboo, 2016). The impact of the forest and land fire disaster in 2016 was not as big as 2015.

Some of the main factors that cause fires in Indonesia are dry peatlands, dry season, and people

who are less careful in clearing land. The adverse effects of this fire are health problems and economic losses. Even raised protests from neighboring countries. In 2016, the weather in Indonesia tended to be wet, and this was a factor in the decline in forest fires in Indonesia. In August 2016, forest and land fires dropped significantly by 74% compared to 2015. And to face 2017, the government continues to increase awareness of the possibility of forest and land fires (Bersiap Lebih Dini Menghadapi Karhutla 2017, 2017).

In 2017, the Ministry of Environment and Forestry noted that the amount of land burned in Indonesia is 20 thousand hectares. This figure is down to 99 percent compared to 2016 reaching 438,290 hectares of burned land. The biggest cause of land fires that occurred in Indonesia was due to being burned by certain parties who wanted to clear land with practical means. The behavior of people who like to burn when opening new land or cleaning is very disturbing and tormenting other residents. Land fires in Indonesia in 2017 are low compared to the previous year. Until July, the land burned was 20 thousand hectares. To reduce this figure, the central government and the provincial government and the TNI / Polri have taken precautionary measures (Setyadi, 2017).

The following is a table on the dynamics of smoke haze disaster that occurred in Indonesia.

Table 2.1. The dynamic of the smoke haze disaster in Indonesia from 1982 until 2016

| Years | Countries affected by smoke | Level of |
|-------|-----------------------------|----------|
|-------|-----------------------------|----------|



|           |   |         |
|-----------|---|---------|
| 1982-1983 | Indonesia, Malaysia, Singapore, Brunei Darussalam.                            | Cross-b |
| 1991-1994 | Indonesia, Malaysia, Singapore, Brunei Darussalam.                            | Cross-b |
| 1997-1998 | Indonesia, Singapore, Malaysia, Brunei, Thailand, Vietnam, Philippines.       | Cross-b |
| 2000-2009 | Indonesia, Malaysia, Singapore, Brunei Darussalam.                            | Cross-b |
| 2013-2014 | Indonesia, Malaysia, Singapore, Brunei Darussalam, and Thailand               | Cross-b |
| 2015      | Indonesia, Malaysia, Singapore, Brunei Darussalam, Philippines, and Thailand. | Cross-b |
| 2016      | Indonesia, Malaysia, Singapore  | Cross-b |

Source of the table: from any sources

In 1982, Indonesia experienced forest fires which caused haze which affected neighboring countries. The smoke haze was accompanied by the El Nino climate phenomenon which destroyed 210,000 km<sup>2</sup> from the territory of East Kalimantan Province. Thus causing a thick haze that also reached neighboring Malaysia, Brunei Darussalam and Singapore. And in 1991 and 1994, fires and haze also re-occurred in East Kalimantan which affected Malaysia, Brunei Darussalam and Singapore (Geani, 2014).

In 1997, forest fires in Indonesia included the largest forest fires, because in 1997-1998 the drought in Indonesia was accompanied by the El Nino phenomenon, which affected neighboring countries

such as Malaysia and Singapore. And in 1998, the haze blew to Brunei, Thailand, Vietnam, and the Philippines (Rawlings, 2011).

Some fire incidents that occur in Indonesia occur almost every year and repeatedly happen in the same place, especially peatland areas, such as fire incidents in 2000, 2004, 2005, 2006, 2007, 2008 and 2009 which affected neighboring countries such as Malaysia, Singapore and Brunei Darussalam (Peranginangin, 2014).

In 2013 and 2014, the largest fires and haze occurred again in Indonesia. Thick smoke enveloped Malaysia, Singapore, Brunei Darussalam and other Southeast Asian countries. Malaysia is the biggest country to feel the impact. And in 2015, haze in Indonesia occurred quite severely. In that year, forest fires in Indonesia were believed to be a record as the worst in history. Some Southeast Asian countries that receive haze from Indonesia are Malaysia, Singapore, Brunei Darussalam and also the southern part of Thailand which has recently become the latest area to be affected by smoke pollution from Indonesia, as well as the Philippines (Apriliana, Asap Rambah Thailand, PM Malaysia Desak Indonesia Bertindak, 2015). Loegeng Priyohanisetyo, Indonesian diplomat at the Indonesian Consulate General in Davao City, Mindanao Island, Philippines, said that the haze was visible, but it did not interfere (BBC, Kabut asap kiriman Indonesia sampai ke Filipina, 2015).

Land and forest fires in Indonesia in 2016 dropped dramatically when compared to 2015. In 2015, forests and burned land were 2.6 million hectares. But in 2016, the number fell to 450,000 hectares in 2017, and the area burned decreased to 160,000 hectares (Amindoni, 2018). Malaysia and Singapore, are two countries that are always exposed

to the smoke of forest fires that occur in Indonesia. And in 2016, Malaysia was free from haze, this was conveyed by the Malaysian Prime Minister, Najib Tun Razak, that for the past two years, Malaysia had not experienced a haze. The Malaysian Prime Minister thanked the government of the Republic of Indonesia during a meeting with Jokowi at the Hilton Hotel, Kuching, Malaysia, on Wednesday, November 22, 2017 (VIVA, 2017).

## **B. Factors Cause the Smoke Haze Disaster in Indonesia**

The smoke haze that occurred in Indonesia has happened since 1982, and the worst haze occurred in 2015 which hit most of the island of Sumatra, especially in Riau and Palembang. Smoke haze in Indonesia is caused by forest fires on the islands of Sumatra and Kalimantan. Forest fires can occur by several factors such as natural factors and human factors, also industrial factors.

Smoke haze has a lot of negative impacts on society. Smoke fumes cause daily activities to be disrupted because of unhealthy air, and they have to spend a lot of time at home. Smoke haze also causes various diseases such as a cough and runny nose, shortness of breath, sore eyes and redness, as well as tuberculosis. Also, the haze that caused limited visibility caused many flights to be canceled, and many airlines suffered losses and passengers who had to be willing to delay their trips to allow them to do flights (Lestari, 2015).

Global Forest Watch reports in a series of papers that land clearing for agricultural purposes is

the primary driver of fire in Indonesia. As happened before, about half of the fires took place on land managed by industrial plants, oil palm and timber (Sizer, et al., 2014). Forest and land fires occur every year with a wide range and number of hotspots. This event has been anticipated, but the government is often powerless in taking precautions. According to various studies and analysis results (CIFOR, 2006 and Walhi, 2006), the main factors causing forest and land fires are human behavior/companies who want to accelerate land preparation for the preparation of plantation commodities. The interested parties want to immediately prepare the land at the lowest cost and at the same time expect an increase in the level of acidity (pH) so that plantation crops (palm and acacia, for example) can grow well (Pasaribu & Friyatno, 2006).

According to the Ministry of Environment of the Republic of Indonesia, the source of smog in Indonesia consists of industrial activities, transportation, and forest fires (Sutisna & et.al, 2004). In industrial activities, smoke haze originated from production processes such as in manufacturing, petroleum refining, and steel smelting machines carried out by factories. The plant's activity has produced dangerous chemicals that cause haze that can disrupt human health and cause diseases such as ARI. Transportation activities on land, water and air using fuel as a driving force also produce smoke. Land transportation, especially for motorized vehicles, is a major source of smog in big cities. And forest and land fires in Indonesia are a source of causes of haze that are cross-border. Long dry seasons in Indonesia often cause forest and land fires from dry tree branches, due to heat generated by rocks or other objects that can conduct heat. According to David Glover's research, forest and land fires are often caused by human factors

that open forest land by burning and illegal logging (Glover & Jessup, 1999).

Many factors cause the smoke haze that occurs in Indonesia. However, the most dominant cause of haze in Indonesia is forest, and land fires occurred in Kalimantan and Sumatra. There are some factors cause forest fires that cause haze in Indonesia.

a. Natural Factors

Forest fires caused by natural factors or naturally can occur due to several things, such as the fire that can arise due to lightning, volcanic lava melt, friction between trees in the dry season which then causes sparks. (Webmaster, 2017). But from these factors, forest fires caused by lightning and tree friction are rare in Indonesia, especially in tropical rainforests. Natural factors that cause forest fires can occur if forest conditions allow, such as during long droughts.

According to research from the Ministry of Environment of the Republic of Indonesia, about 10% of forest and land fires that occur in Indonesia are caused by natural factors. This natural factor occurs due to hot weather conditions due to the El Nino phenomenon. The El Nino phenomenon is a natural phenomenon due to rising sea surface temperatures which are estimated to reach 5-6 degrees Celsius, in the equatorial region and northeast of the Pacific Ocean (Analisis Kebijakan Penanggulangan Kebakaran Hutan dan Lahan). This rise in sea surface temperature results in a decrease in air pressure which causes changes in the east to west wind currents. Thus, water vapor or clouds in the Indonesian region, especially Eastern Indonesia, are carried by the wind to the Pacific Ocean region so that almost all of Indonesia's territory

becomes hot. Although initially forest and land fires in Indonesia were caused by human activities, fires were even greater when supported by hot weather conditions.

b. Human Factors

Based on the research of the Ministry of Forestry of the Republic of Indonesia, most of the causes of forest and land fires in Indonesia are human factors. Human factors in the case of forest fires are divided into two, intentional and unintentional. Forest fires caused by the human accident can occur because cigarette butts are discarded in forest areas, bonfires in the forest that forget to be turned off or not completely extinguished when abandoned, burning garbage, and much other negligence. This type of fire often occurs in forests in the mountains that are often visited by nature lovers (mountain climbing) such as forest fires on Mount Sindoro and Mount Muria in 2016 and also forest fires in Gili Lawa, NTT that just happened on August 1, 2018 (Mediani, 2018).

While intentional forest fires usually have a purpose for land clearing. Land clearing by burning forests is often the most frequently done by individuals and companies. Forest burning is the cheapest and easiest option to convert forest land into oil palm plantations, rubber plantations, and another agricultural land while increasing the selling price of land. The great forest fires that occurred in Sumatra and Kalimantan in the past few years were also thought to be caused by this factor.

In general, according to David Glover, forests and land are deliberately burned for farming activities (Glover & Jessup, 1999). As happened on Kalimantan and Sumatra. Burning is carried

out by the community around the forest for the preparation of land for settlement, transmigration, industry, and agriculture which is financed by capital owners with a profit-sharing system. The preparation of the land by burning it has become a tradition of communities around the forests of Kalimantan and Sumatra since 1982 using fire. For communities around the forest, the use of fire in land preparation is sufficient to help improve soil fertility to increase nutrient content and reduce acidity. This activity continues to take place on the islands of Kalimantan and Sumatra, increasing the risk of fire and producing haze (Rusli).

The causes of these forest fires will cause forest fires that are difficult to control when supported by long dry weather conditions. Like the great forest fires that occurred in 2015 which has become one of the natural disasters that caused haze which is very detrimental to Indonesia and neighboring countries.

The method of burning forests used by residents and companies for land conversion is an example of how human factors contribute greatly to forest and land fires that cause smoke pollution. When residents or companies do the land conversion by burning, they do not have an effective method of how to deal with / extinguish the fire, only hoping that the fire can be extinguished due to rain. As a result, when the rain has not come down due to seasonal changes, the fire enlarges and becomes out of control causing forest and land fires that cause smoke pollution (BNPB, 2015).

c. Industrialization Factors

Forest and land burning have also been carried out for the development of Industrial Plantation

Forests since 1996. The development of Industrial Plantation Forests in Indonesia, especially in Kalimantan and Sumatra has increased every year by 10%. Also, forest fires have been carried out to clear oil palm land since 1997 (Glover & Jessup, 1999). Land clearing for oil palm in Indonesia, especially in Kalimantan and Sumatra, has increased every year. This land clearing activity is carried out by oil palm companies because it benefits both in the domestic and international markets.

Since the 1980s, the clearing of oil palm plantations and industrial plantations is thought to be the cause of massive forest fires in Indonesia (JurnalBumi). El Nino weather phenomenon, which causes almost the entire Indonesian archipelago to become dry, is not the main cause of forest fires in Sumatra and Kalimantan. Based on the report of researchers of the Center for International Forestry Research (CIFOR), Herry Purnomo, the factor of industrialization was the cause of forest fires in some provinces. More than 90 percent of forest fires are caused by land clearing for the industry. The burning process was carried out during the dry season, exacerbating and expanding the hotspots in some provinces such as Riau, Jambi, and Pontianak and causing thick haze (Susanto, 2015).

The occurrence of forest fires in Indonesia is often allegedly because of the opening of land for Industry carried out by several unscrupulous companies. In 2015, National Police Chief Gen. Badrodin Haiti stated that as many as 12 companies were used as suspects for forest and land burning. The company operates in various regions, including South Sumatra and West Kalimantan. Companies are operating in the



plantation sector, some in the field of industrial timber plantations. And of the 12 companies, two foreign companies are suspects, namely companies from Malaysia and China (BBC, Polisi tetapkan 12 perusahaan tersangka pembakar hutan dan lahan, 2015).

### **C. Impact of Smoke Haze Disaster**

Forest fires in Indonesia are currently seen as regional and global disasters. Forest fires that often occur in Indonesia cause haze which has a bad impact not only on the territory of Indonesia but also to neighboring countries. The adverse effects of fog smoke occur in several sectors, namely health, environment, economy, and transportation. Smoke haze in Indonesia is cross-border pollution because the impact of smoke haze also extends to neighboring countries. And this also has an impact on Indonesia's relations with neighboring countries such as Malaysia. There are some impacts of the smoke haze disaster.

#### **a. Health and Environment Sector**

According to the Environmental Protection Agency (EPA) USA, the air is in danger because of the haze problem if the haze has exceeded the limit of 80 parts (parts per billion) (ppb) or 0.5 ppm ozone (the main component of smog), or exceeds 53 ppb nitrogen dioxide or 80 ppb particles. Severe haze will cause health problems, especially respiratory problems. Smoke haze can cause emphysema, bronchitis, and asthma (Watson, 2004).

The atmosphere as an environmental medium serves to accommodate oxygen gas, carbon dioxide, sulfur dioxide, nitrogen oxides, methane, ozone, and hydrocarbons. The existence of smoke haze causes the air quality to get worse and make the atmosphere to accommodate and neutralize

the exhaust gas to be reduced in number. So that it results in poor environmental quality, especially in reducing air quality which can pose a danger to health (Ruslan, 2013).

In Indonesia, the impact of the smoke haze is felt in areas adjacent to the location of forest fires. The ingredients contained in the smoke of forest fires can cause various health problems such as irritation and Acute Respiratory Infection (ARI). Problems with health problems caused by smog include irritation of the eyes, nose, and throat, and allergic reactions, inflammation and possibly infection. Smoke haze can also worsen asthma and other chronic lung diseases. The ability of the lung to work is reduced and causes a person to get tired quickly and have difficulty breathing. For those who are elderly and children and who have chronic diseases, with a condition of low body resistance will be more susceptible to health problems.

From this it can be seen that ARI attacks many Riau people, even the physical endurance of the residents also begins to decline due to haze from forest fires.

b. Economy and Transportation Sectors

Smoke haze has a big impact on the economy. In addition to the large allocation of funds needed to overcome the problem of fire and haze, the impact caused to the social and economic conditions of the community is also quite high. From an economic standpoint haze certainly inhibits and reduces community activities outside the home so that it can have an impact on the wheels of the regional economy. This resulted in a decrease in community income, while household expenditure experienced an increase in health costs. Also, the transportation sector also

experienced a decline in revenues, especially transportation services due to the disruption of business activities.

The land, sea, and air transportation sector experienced a significant impact due to this haze. The main transportation disturbance is limited visibility which affects travel safety. Visibility data is also very necessary for landing and taking off aircraft. Thus, smog also caused many flights to be delayed or even canceled.

The haze disaster has a major influence on the Indonesian economy. In the forest fires that occurred in 1997-1998, based on the ASEAN Secretariat's Environment and Disaster Management Center, the economic losses due to forest fires that occurred in 1997-1998 reached 9 billion US dollars. In addition, haze also caused many foreign investors who were afraid to invest in Indonesia, Malaysia and Singapore, because with the smoke haze resulting in the many costs and risks that they must pay (Suryani A. S., 2012).

In 2015, the World Bank called forest fires a big loss for Indonesia in 2015, where the Indonesian government was pursuing economic growth. The World Bank's Chief Economist, Ndiame Diop, said that at least 100 cases of forest fires that caused haze disasters occurred in Indonesia during the period June to October 2015. During this period at least more than 2.6 million hectares of land or four times larger than the island of Bali was burnt burning. The World Bank estimates that the handling of forest fires and haze has caused a loss of US \$ 16.1 million, equivalent to 221 trillion rupiah (Sari E. V., 2015).

This shows that haze disasters cause a lot of losses in the economic field, where haze disasters require large costs in handling them. The smoke haze also inhibits the community in their activities and work, it is very detrimental and hampers the economy of the people and the government.

c. Cross-Border Pollution

Land and forest fires that occur almost every year in Indonesia, especially in the Riau Islands, parts of Sumatra and Kalimantan not only have an impact on the socio-economic of the surrounding community but also often cause transboundary haze pollution to neighboring countries, especially Malaysia and Singapore. The smoke haze that occurs in Indonesia is often blown to Singapore and Malaysia, or even some other Southeast Asian countries. As a long-standing international problem, the usual cross-border pollution mentioned as Transfrontier Pollution can be described as follows (Silalahi, 2001) : “Pollution of which the physical is wholly or in part situated within the territory of one state and which has deleterious effects in the territory of another state”.

The affected country protested because there was a threat to basic human needs because haze polluted the air inhaled. The smoke originating from Indonesia has made the relationship between Indonesia and neighboring countries, especially Malaysia, become conflictual. Smoke haze causes poor air quality and greatly disrupts activity. So it's not uncommon, every year, the Malaysian government declares a state of emergency around Kuala Lumpur and announces emergency measures such as closing schools and

asking residents to wear masks (Suryani A. S., 2012).