

The Impact of Forest Fires in Indonesia Stunting A Literature Review.pdf

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The Impact of Forest Fires in Indonesia Stunting: A Literature Review

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Abstract— Forest is part of the national natural resources which have an important role in various aspects of human life and the state. According to data from Sipongi Karhutla Monitoring System, land and forest fires in Indonesia reached a total area of 510,564.21 hectares in 2018 while in 2019 land and forest fires in Indonesia reached a total area of 135,749.00 hectares. Wildfires are capable of lowering the level of the quality of human health, either directly or indirectly. These impacts have implications for toddlers (under five years) and elderly. Besides the unexpected impact of the fire smoke will affect the child's growth and result in the incidence of stunting. The high risk caused by the smog not only attacks the respiratory tract, but also attack the cardiovascular system. Based on research, carbon monoxide contained by smog from forest fires causing the formation of carboxyhemoglobin, hemoglobin which binds carbon monoxide rather than oxygen. As a result, oxygen levels in the body decreases and anemia. In children who suffer from anemia able to cause growth retardation, due to the reduced supply of oxygen to the body tissues for the long term.

Keywords— forest fires, haze, impacts

I. INTRODUCTION

Forests are part of the national natural resources which have an important role in various aspects of human life and the state. Forest are lungs of the earth. Based on the important function of forests for the life of the world it is necessary to maintain and protected from actions that could result in loss of balance of the ecosystem and habitat of living beings.

Based on data Ministry of Environment and Forest of Indonesia explain that Indonesia is one country that has extensive tropical forests amounted to 133,300,543.98 ha. Include nature reserves, protected forests and production forests. Some islands in Indonesia have considerable forest such as Sumatra and Borneo, which is a region in Indonesia is often experienced forest fires / land every year. Plus, if there are anomalies in the climate, can cause dryness and the increase in the number of forest fires / land.

Forests have quite a lot of problems, forest fires are one of the big problems and gets the attention. Forest fire is a phenomenon that not familiar, especially in some parts of Indonesia such as Sumatra and Borneo. Based on data from the World Wildlife Fund (WWF) Indonesia there are 20 million people who have been exposed to the smoke of forest fires, causing pulmonary disorders and respiratory system [2]. The effects of smoke and dust containing toxic gas generated from forest fire can cause discomfort in breathing and worsen the health of people with allergies and respiratory problems. In addition to human losses, the financial costs such as damage to houses and other infrastructure, power outages and the extinction of flora and fauna endemic to dominate the perception of the impact of fires often highlighted [3].

According to data from Sipongi Karhutla Monitoring System, land and forest fires in Indonesia reached a total area of 510,564.21 hectares in 2018 while in 2019 land and forest fires in Indonesia reached a total area of 135,749.00 hectares [4]. Our Lungs of the earth are in flames, in 2015, Indonesia was able to form the center of world attention for the umpteenth time because of forest fires and land very badly. One indicator used is the concentration of particulate matter (PM10) in Palangkaraya (Central Kalimantan), shows the concentration in 2015 ($> 2,000 \text{ ug / m}^3$) was higher than in 2002 and 2006 ($< 2,000 \text{ ug / m}^3$). Peat fires are a serious problem for Indonesia, providing damaging environmental effects and an estimated 1,748 million metric tons of CO₂ eq. emissions, approximately 5% of the CO₂ emissions of the annual global fossil fuel in 2015. As a result of forest fires and land, Indonesia is considered as an exporter of ASEAN air pollution as well as one of the emitters of greenhouse gases (GHG) world, after the industrialized countries such as China and the United States. Therefore, land and forest fires put in a category disastrous as having an impact in the form of smog that can interfere with the activity and the health of surrounding communities [3].

Land and forest fires are not only damaging to the ecosystem, the environment and may increase global warming, but also have a negative effect on human health, such as Acute Respiratory Infections (ARI), obstruktif chronic

lung disease, and disorders of the eyes and skin. Land and forest fires turned out to be more dangerous than imagined, based on research conducted joint team of Duke University and the National University of Singapore long-term health effects and unexpected that increase the rate of stunting [5].

II. MATERIALS AND METHODS

The design of this paper was a literature review. The literature that is used in this paper mostly was from the journal and previous academic research result. The method used in this research is the method of literature study. First, formulate the problem, determine the problem topic that will be discussed then link it with the solution of the problem that has been created from the existing solution. Second, search literature articles that are relevant to the topic of the problem, namely impact of forest fire and get an overview of the research topic. The source of the article source is very helpful if supported by the knowledge of the topic being studied. The source are provides an overview/summary of the previous research. Third, evaluate data, Look at any contribution to the topic discussed, search and find the right data source as needed to support article writing, data in the form of qualitative data, quantitative data and data derived from a combination of both. Last, Analysis and Interpretation, the last step is to discuss and find and summarize the literature that will be made based on available data.

III. RESULTS AND DISCUSSION

Land and forest fires is not an peculiar phenomenon to some areas in Indonesia especially for Sumatra and Kalimantan. Almost every year in Indonesia, forest fires and land. The central government and the provincial government has made various efforts to mitigate and handle forest fire both preventive and repressive, but the fire still happen over the years. Until this phenomenon evolved into a form of catastrophe that has an impact on various aspects of community life.

1997 ago, in the month of August to November Indonesia suffered the worst forest fires and the longest in the history of the event forest fire. Besides caused by improper forest management, the practice of oil palm land clearing by burning forests, the El-Nino also contribute to forest fire at the time. El Nino is a phenomenon of rising sea surface temperatures around the Pacific Ocean along the equator which would influence the spread of the formation of rain clouds [11]. As a result, extreme long drought in Indonesia, trigger drought Prolonged, crop failure, various diseases, and forest fires, El Nino of 1997 is one of the worst in the 20th century. In these conditions, the burning of peatlands could cause fire that spreads very rapidly through the underground, resulting in severe fires difficult to extinguish. This event is capable of destroying approximately 11 million hectares of land in Indonesia, particularly in Sumatra and Kalimantan, which can transmit thick haze to spread to Thailand and Vietnam [9].

Wildfires are capable of lowering the level of the quality of human health, either directly or indirectly. These impacts have implications for toddlers (under five years) and elderly. The direct impact of forest fire smoke inhalation is an upper respiratory infection, while the indirect impact is the emergence of diseases in muscles and connective tissue system, if the closure of forest fire smoke takes place in a fairly long period [6]. The result is a significant increase in patients with respiratory diseases, bronchial asthma, bronchitis, pneumonia, skin and eye irritation in the various regions affected by forest fires[2].

Various air pollutants caused by forest fires, such as dust with small particle size (PM10 & PM2,5), SOx gas, NOx, COx, etc. can cause negative impacts on human health, including respiratory tract infections, shortness of breath skin irritation, eye irritation, etc. It also can cause interference visibility / sight, can disrupt all forms of outdoor activity [19]. Air pollution is an environmental and health problem throughout the world, especially in developing countries. Air pollution can directly influence one's thoughts and life experiences through visual perception. Air pollution can reduce the subjective well-being of people to a significant degree, such as the case of an increase in ARI is indirectly caused by the entry of smoke particles that contain harmful compounds such as SO2, NO2, CO and O3 disturbing respiratory function and health, especially in the channel respiration top and bottom, and causing infection pare such as bronchitis, edema pare and pneumonia [6].

From previous research, showing that there is strong evidence in early-life exposure to air pollutants are associated with low birthweight and preterm birth [1]. The suspected pathways from air pollutants to birth outcomes are inflammation and direct toxic effects to the placenta and fetus, oxygen supply to the fetus, and DNA expression. With respect to longer-term outcomes, the literature on the "fetal origins" hypothesis suggests that intrauterine health insults can cause lasting and irreversible damage to cardiovascular and respiratory health and that low birthweight is associated with shorter height in adulthood. There are very few studies that specifically make the connection between environmental exposure to air pollutants at early-life and long-term outcomes [20].

More recently, based on the publication previous study stated that to provide a information about the long-term health effects are not unexpected from forest fires, said that exposure to smog caused by forest fire and land give effect to the fetus and children, can result in a significant reduction in height by 3, 4 cm of normal height at the age of 17 years [10].

Based on previous study made an observations on the development of 560 fetuses and infants aged six months in the period from August to October 1997 with the condition affected by smog severe in Indonesia, especially in Sumatra and Kalimantan. The observations made by four periods in 1997, 2000, 2007, and 2014 to determine the high development of these children at the age of 3, 10 and 17

years old. It is certain that the results of these studies are not affected by air pollution levels from previous years, geography, indirect effects severe air pollution on a family's ability to work and earn wages, or reduction in food consumption during forest fires [4].

Based on data from the Ministry of Health of Indonesia towards the end of 2015 against diseases associated with the event forest fire and smog, consisting of 10.133 cases of respiratory infections, 311 cases of pneumonia, a total of 415 cases of asthma, eye irritation as many as 689 cases, and skin irritation as many as 1,850 cases [8]. The adverse effects of the fires to make people in the region are exposed to the smoke haze must bear the consequences. Thousands of people suffering from acute respiratory infection and diarrhea. Even among which there must be dying because there was strong to survive. Data Central Kalimantan Health Office said that the number of patients with ARI and diarrhea due to haze in 3 months (July to October 3, 2015) amounted to 21,085 people for ARI and 6,835 people for diarrhea. Most patients are toddlers (0-5 years old) and the elderly [7].

The smoke contains carbon monoxide (CO), nitrogen dioxide (NO₂), sulfur dioxide (SO₂), ozone (O₃) and particulate matter (PM10). CO is a colorless gas / odorless / tasteless; originating from incomplete combustion; flammable and toxic; that disrupt the blood's ability to bind oxygen blood oxygen deficiency. CO has an affinity to bind with hemoglobin higher than the oxygen (O₂) (240 times) so if exposed to it will be easily absorbed by the blood in the body. As a result, CO replaces O₂ in the blood leading to heart and blood vessel system and innervation. CO at low concentrations (<400 ppmv) can cause dizziness and fatigue, because oxygen in the body decreases and at high concentrations (> 2,000 ppmv) can cause poisoning and even death. NO₂ contribute to particle pollution and ozone precursors to acid deposits and are an essential ingredient of photochemical smog. NO₂ is toxic to living things. SO₂ role in the occurrence of acid rain and pollution particles of sulfate aerosols. SO₂ is a pungent gas that can cause shortness of breath, mucosal irritation and constriction of the bronchial airways, causing wheezing and can damage the lungs. O₃ is a secondary pollutant formed with the help of sunlight causes photochemical reactions oxidants; reactive (destroy / alter molecules); forming smog that is harmful to health; reduce crop production; effects of heat. O₃ can cause irritation to the eyes and respiratory tract as well as asthma, bronchitis and cause headaches [2].

Other evidence also shows that the composition of the forest fire smoke is composed of gases such as carbon monoxide, carbon dioxide, nitrogen oxides, ozone, sulfur oxides. Particles arising from forest fires called particulate matter (PM). More than 10 µm size usually does not enter the lungs but can irritate the eyes, nose and throat. However, particle size of less than 10 µm can be inhaled to the lungs. In the short term (acute) smoke wildfires can cause irritation of the mucous membranes of the eyes, nose, throat, which can cause symptoms of eye irritation and watery, runny nose

and discomfort in the throat, headache, nausea and easy-going ARI [8].

The high risk caused by the smog not only attacks the respiratory tract, but also attack the cardiovascular system. This is evidenced by research conducted by Peters that the increase in the fine particles in the air can increase the risk of myocardial infarction disease [12].

Inhalation of fine particles in the air and ozone in a short time can cause vasoconstriction of the arteries [13]. There is a relationship between air pollution with increased stroke patients admitted to the hospital because of an increase in pollutants PM10 and NO₂ [17]. PM10 can cause lung and cardiovascular disease [14]. PM10 can also increase the incidence of atherosclerosis [16]. Levels of fine particles in the air associated with the risk of death from respiratory and cardiovascular disease [15]. Molecular epidemiological studies show possible biological changes to the effects on birth weight, premature birth, and intrauterine growth retardation (IUGR) and support the view of the relationship between the relationship and outcome of this original birth.

Based on research, said that exposure to smog caused by forest fires great in 1997 in early childhood can significantly influence the physical growth and lung capacity, but does not have a significant effect on cognitive development [9]. In addition, the study explain on the relationship between the haze with physical growth in fetuses and children in the early days of his life. According to that, although their relationship is still uncertain, the carbon monoxide contained by smog causes the formation of carboxyhemoglobin, hemoglobin which binds carbon monoxide rather than oxygen. As a result, oxygen levels in the body decreases and anemia [9]. In another research, in children who suffer from anemia able to cause growth retardation, in the long term can lead to stunting, due to the reduced supply of oxygen to the body tissues [18]. In addition, the relationship between them is also suspected to be due to low weight and respiratory infection [9].

IV. CONCLUSION

The impact of forest fires will affect the various aspects of human life. The high risk caused by the smog not only attacks the respiratory tract, but also attack the cardiovascular system. For long-term and unpredictable impact of forest fires and smoke that will affect the child's growth and result in the incidence of stunting. Based on research that carbon monoxide contained by smog from forest fires causing the formation of carboxyhemoglobin, hemoglobin which binds carbon monoxide rather than oxygen. As a result, oxygen levels in the body decreases and anemia. In children who suffer from anemia able to cause growth retardation, in the long term, due to the reduced supply of oxygen to the body tissues. In addition, the relationship between them is also suspected to be due to low weight and respiratory infections. On the basis of this literature review, we need some future research about the impact of forest fires to cause growth retardation. Need

require further clarification about biologic pathways. By increasing attention to the life course, it would be to examine whether early exposures and impaired outcomes have any long-term consequences in later life.

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