

LITERATURE REVIEWS: HYDROMETEOROLOGICAL DISASTERS AND CLIMATE CHANGE ADAPTATION EFFORTS

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ABSTRACT: Climate change has had an impact on increasing hydrometeorological disasters in Indonesia. The Meteorology, Climatology and Geophysics Agency (BMKG) estimates, until mid-May 2020 Indonesia is threatened with a hydrometeorological disaster. Most of the Indonesian people are in areas prone to hydrometeorological disasters. To reduce its impact, the government needs to make adaptation efforts to climate change, which are carried out holistically and integrated by involving all elements of society and the government by referring to the National Action Plan for Climate Change Adaptation in Indonesia that has been prepared by the government of Indonesia.

Keywords: Disasters, Hydrometeorological, Adaptation, Government



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1. INTRODUCTION

Hydrometeorological disasters (meteorological natural disasters) are natural disasters related to climate. Hydrometeorological disasters include floods, landslides, tornadoes, tidal waves, and drought [1-5]. The frequency of climate and weather-related disasters in Indonesia has continued to increase in the last 10 years. Based on data from the National Disaster Management Agency (BNPB), during 2019–2020, if you look at the previous year's data, the trend of disaster incidence in early January 2020 has decreased by 29.6 percent compared to the data per 2019. However, the number of decreases is not too significant, namely 290 events in 2019 and 207 in 2020 [6].

Then regarding the data on the number of dead and missing victims as of January 20, 2020, it has increased to 583.3 percent when compared to data as of January 20, 2019. In 2019 there were 12 dead and missing victims and in 2020 the death toll reached 82 on the same date and month. Furthermore, the increase in the number of injured victims also increased to 7.8 percent as of January 20, 2019 compared to January 20, 2020, with details of 77 to 83. Furthermore, data on refugees has increased very significantly, reaching 1,552 percent from 48,668 people as of January 20, 2019 to 803,996 people as of January 20, 2020. Then for damaged houses, it has increased to 303.9 percent from 2,799 per January 2019 to 11,305 per January

2020. as many as 92.1% of disasters in Indonesia were caused by hydrometeorological factors. Even in 2013, this percentage increased to 97%. Environmental damage and global climate change are suspected of being the triggers [6].

Forecasts by the Meteorology, Climatology and Geophysics Agency (BMKG), the hydrometeorological disaster will continue until mid-May 2020, due to anomaly of warming sea surface temperature in Indonesian waters which causes abundant supply of water vapor so that highly integrated rainfall occurs in various parts of Indonesia. As a result, floods, and landslides will still occur until mid-February 2020.

According to the Report Global Humanitarian Forum (The Anatomy of Silent Crisis, 2009), Hydrometeorological disasters will be humanity's greatest threat in the coming years, because when global warming has an impact on the melting of polar ice, temperatures in snow mountains warm-up, and countries in the world, especially Asia, including Indonesia, are increasingly threatened by increasing hydrometeorological disasters [7, 8]. The vulnerability of the community will also increase because millions of Indonesians live in high disaster-prone areas in terms of hydrometeorological disasters [9-11]. [12-17] explain based on the BNPB study, in Indonesia 124 million people are living in danger areas with moderate to high categories due to the threat of landslides, and 61 million people living in flood hazard areas with moderate to high categories.

2. LITERATURE REVIEWS

2.1 Anthropogenic Factors Dominant Causes of Hydrometeorological Disasters

Report Global Humanitarian Forum blames climate change as the cause of increasing hydrometeorological disasters because it has significantly affected changes like rain and weather. Is it true that the increase in hydrometeorological disasters is only caused by a changing climate? The Intergovernmental Panel on Climate Change (IPCC) 2000 report shows that the global climate has changed. The effects of climate change cause rainfall patterns to change [18]. Not only did the thickness of rain change, the intensity, duration, and distribution of rainfall also changed. Global climate change also greatly affects changes in flow patterns, such as decreasing trends in annual rainfall. Globally, the annual rainfall continues to increase in the middle and high latitudes in the northern hemisphere, namely 0.5–1% per decade, except in East Asia [19-22]. In the subtropics, the average rainfall decreased by about 0.3% per decade, while in the tropics it increased 0.2–0.3% per decade during the 20th century [23-28]. Most of these occur in the northern hemisphere. The changes in rainfall in the southern hemisphere are not comprehensively known.

Several studies have shown that climate change in Indonesia has brought about changes in local seasonal patterns. The average amount of rain during the rainy season (October-March for the Indonesia region) is 80% of the total annual rainfall [2-5, 24]. Changes in seasonal patterns occur with an increase in the length of the dry season and an increase in the ratio of the amount of rain in the rainy season to the dry season which increases above 80%. This condition has been exacerbated by a persistent decrease in the total accumulation of annual rainfall in almost all regions of Indonesia in the last five decades, so that the potential for gushing water has diminished [15, 21, 24].

Increasing hydrometeorological disasters are not only caused by global climate change, but also due to environmental mismanagement [29]. The IPCC 4th Study Report 2007 proves that the global climate continues to change due to human activities. Environmental degradation due to human activities leads to increased hydrometeorological disasters. In Indonesia, it can be seen from the rate of forest destruction that is higher than the government's ability to rehabilitate land. For example, during 2003–2006, the rate of forest destruction was 1.17 million hectares per year. Meanwhile, the government's ability to rehabilitate forests and land every year is only around 450,000 hectares and the success rate of tree planting in forest and land rehabilitation does

not reach 100% so that forest and land degradation is greater [30-33].

Efforts to curb the rate of forest destruction are also carried out through a moratorium on the granting of new permits in forest areas (Presidential Instruction No. 6 of 2013 concerning Postponement of Granting New Permits and Improving Management of Primary Natural Forests and Peatlands). However, this has not been able to reduce the rate of forest destruction even though the moratorium policy for new permits has been extended for the next 2 years [34, 35].

2.2 Adaptation to climate change

The IPCC 4th Assessment Report (2007) [36] shows that the global climate is constantly changing because of human activities. However, prominent international reactions such as the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol are activities that are more in the form of mitigation_ (efforts to reduce the build-up of greenhouse gases in the atmosphere) than adaptation activities_ (efforts to reduce the vulnerability of people and ecosystems to climate change). [37] adds in fact, climate change cannot be completely avoided, while mitigation policies need time before they become effective. For this reason, adaptation is essential to reduce the high risk that must be borne due to climate change, including for Indonesia which is very vulnerable to the impacts of climate change.

[38] explains adaptation is a process that occurs naturally by humans and other living things in their habitats and ecosystems as a reaction to the changes that occur. According to the UNDP definition cited by UNEP (2008) [40], climate change adaptation is “a process by which strategies aiming to moderate, cope with, and take advantage of the consequences of climate events are enhanced, developed and implemented. ”The report also includes four principles in the process of climate change adaptation, namely placing adaptation in the context of development, building adaptation experiences to anticipate climate change variability, understanding that adaptation takes place at different levels, especially at the local level and understanding that. adaptation is an ongoing process.

According to [41, 42], to achieve the goals of adaptation, strategic steps are needed that are right on target and minimize losses from climate change, these steps include: 1) Getting the right people and parties to be involved in the participatory process, because climate change adaptation must be carried out in an integrated manner in development plans and programs; 2) Identifying vulnerabilities, including current risks and potential risks that may arise; 3) Assessing

adaptation capacity; 4) Identifying adaptation options; 4) Evaluating options; 5) Implementation; and 5) Monitor and evaluate adaptation. In the

context of Indonesia, World The bank provides adaptation options to climate change as shown in Table 1 above.

Table 1 Adaptation Efforts to Climate Change

	Reactive/Responsive	Proactive/Anticipatory
Water Resources	<ul style="list-style-type: none"> -Protection of groundwater resources -Improved management and maintenance of existing water supply systems -Protection of water catchments -Improved water supply -Groundwater, rainwater storage and desalination more 	<ul style="list-style-type: none"> -use both from recycled water -Conservation of catchment areas Water -policy reforms including pricing and irrigation policies -Development of flood control and drought
Agriculture	<ul style="list-style-type: none"> -Erosion control -Dam construction for irrigation -Changes in fertilizer use and application -Introduction of new crop types -Maintenance of soil fertility -Changes in planting and harvesting times -Transition to different crops -Educational programs and information dissemination on soil and water conservation and management 	<ul style="list-style-type: none"> -Development of tolerant /crop species resistant (to drought, salt, insects/pests) -R&D -Soil and water management -Diversification and intensive si food crops and plantations -Policy, tax/subsidy incentives, free market -Development of early warning systems.
Forestry	<ul style="list-style-type: none"> -Improved systems management, including regulating deforestation, reforestation and afforestation -Promotion of agroforestry to enhance forestry products and services -Development/improvement of forest fire management plans -Improved storage carbonby forests 	<ul style="list-style-type: none"> -Creation of parks/reservations, nature reserves and biodiversity corridors -Identification/development of species that are Resistant to climate change -Better assessment of ecosystem vulnerability -Species monitoring -Development and maintenance of plant seed banks -Early warning systems fires
Coastal/Marine	<ul style="list-style-type: none"> -Protection of economic infrastructure -Public awareness to improve protection of coastal and marine ecosystems Seawall development -and strengthening of beaches -Coral reef protection and conservation, mangroves, seaweed and seashore vegetation 	<ul style="list-style-type: none"> -Integrated coastal zone management -Better coastal zoning and planning -Development of regulations for coastal protection -Research and monitoring coastal and coastal ecosystems
Health	<ul style="list-style-type: none"> -Sanitation public health management reform -Improved housing and living conditions -Improved emergency response 	<ul style="list-style-type: none"> -Development of early warning systems -Better disease surveillance -Improved environmental quality -Changes in urban and residential design.

NB: Options in bold are options already contained in the Indonesian National Action Plan.

Source: Policy Brief, World Bank [41-43].

The Indonesian government compiles a National Action Plan for Climate Change Adaptation (RAN-API). RAN-API will be prioritized in 4 main sectors, namely: 1) Agriculture sector; 2) the coastal, marine, fishery, and small islands sectors; 3) Health sector; and 4) Public works sector which includes water resources, creative works, roads and bridges, and spatial planning [44]. Adaptation efforts in the RAN-API document serve as the basis for preparing anticipatory plans for the impacts of climate change, starting from disseminating information, actions, and handling, to community involvement. Adaptation efforts are directed at

developing development patterns that are resistant to the impacts of climate change and disruption of variability climate (climate anomalies) that occur and anticipating future impacts, as well as implementing an environmentally friendly economic development system to inhibit the rate of systemic damage from the biosphere environment and the social system. the earth's economy.

3 CONCLUSION

Adapting to climate change is an urgent priority for society. Each adaptation step needs to be adjusted to existing and ongoing development

programs such as poverty alleviation programs, community empowerment, food security, disease control, urban planning, and disaster management. This is important because climate change impacts all sectors so that the handling must be carried out in a holistic and integrated manner by involving all elements of society and the government. The government needs to continue to supervise the implementation of adaptation efforts according to the RAN-API. In addition to supervising various climate change adaptation efforts, the government with its function can include the issue of climate change adaptation in various draft laws to be discussed. By carrying out various climate change adaptation efforts by various parties, the risk of climate change impacts can be reduced. Material Losses and non-material that must be borne by the state and society can be minimized.

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