

## COMMUNITY CENTERED MITIGATION BASED ON SCIENCE LITERATURE TO REDUCE THE RISK OF DISASTER IN INDONESIA

**Basuki Supartono<sup>1</sup>, Muhamad Djazuli Ambari<sup>2</sup>, Muhamad Rudi<sup>2</sup>**

<sup>1</sup>Fakultas Kedokteran UPN Veteran Jakarta, Jakarta, Indonesia

<sup>23</sup>Perhimpunan Bulan Sabit Merah Indonesia, Jakarta, Indonesia

**Abstract.** Disasters are a potential threat to the lives of the Indonesian people. The trend of disasters in Indonesia is increasing regarding the number, type, impact, and complexity of the problem. All of that burdens individuals, communities, nations, and countries. Reducing this burden remains a common challenge. A simple activity to reduce the burden is to carry out risk reduction and disaster mitigation activities involving various stakeholders. Community-based mitigation activities utilizing science literacy can be an alternative model of solutions to overcome this.

**Keywords:** mitigation, community, science literature, disaster

### INTRODUCTION

Disaster is a human problem in the world and Indonesia. Various types of disasters cause various kinds of impacts on individuals, families, communities, nations, and countries. The disaster changed a person's life regardless of his profession, no matter how high his position and many assets he had.

Change can happen in a matter of minutes. Changing or even negating something that we had before. The disaster took away life, health, activities of daily living, friends, relatives, home, residence, work, communication, school, infrastructure, and other life affairs. Not just one but tens, thousands, even tens of thousands of people became victims of the impact of the disaster.

After a disaster occurs, the community must rebuild their lives (Wishanto, 2011). The activity may or may not succeed. It might take a month, a year, or maybe decades. Many of our brothers and sisters, many years after the disaster, do not live in their original homes as before the disaster (Maulana, 2019).

The tsunami disaster in Aceh, the earthquake in Jogjakarta, floods in Jakarta, Merapi in Jogjakarta, the earthquake in Padang, the earthquake in Bengkulu, the earthquake in Nabire, liquefaction in Palu, the earthquake in Lombok, the Semeru lava and finally the corona pandemic. All of this brings deep sorrow and concern to all of us.

Disasters cause many difficulties for the people who are directly affected and, at the same time, also raise sympathy and concern for all of us Indonesian citizens.

The axiom indeed states that humans cannot predict the exact time of a disaster. However, does that mean we do not care about disasters? What if the disaster happened

to our family? Disasters may not be entirely avoidable, but we can reduce them. Our concern for disasters should be channeled through disaster management activities.

## RESULT AND DISCUSSION

### Disaster Situation in Indonesia

We are grateful to live in Indonesia. A beautiful island nation decorated with charming high mountain ranges, exotic dense tropical forests, and stunning deep oceans. We are grateful to live in an area inhabited by dozens of ethnic groups with a sublime cultural diversity. We are grateful to live in Indonesia. Indonesia's natural conditions provide an abundance of natural resources of incalculable value. The territory of Indonesia is a meeting place for the world's major volcanic routes. The Asia Pacific series of volcanoes or the Asia Pacific circum series (Ring of fire) traverses the territory of Indonesia. However, this condition holds the potential for disaster. The risk of natural disasters such as volcanic eruptions, earthquakes, tsunamis, and landslides is very high, threatening people's lives (Figure 1).

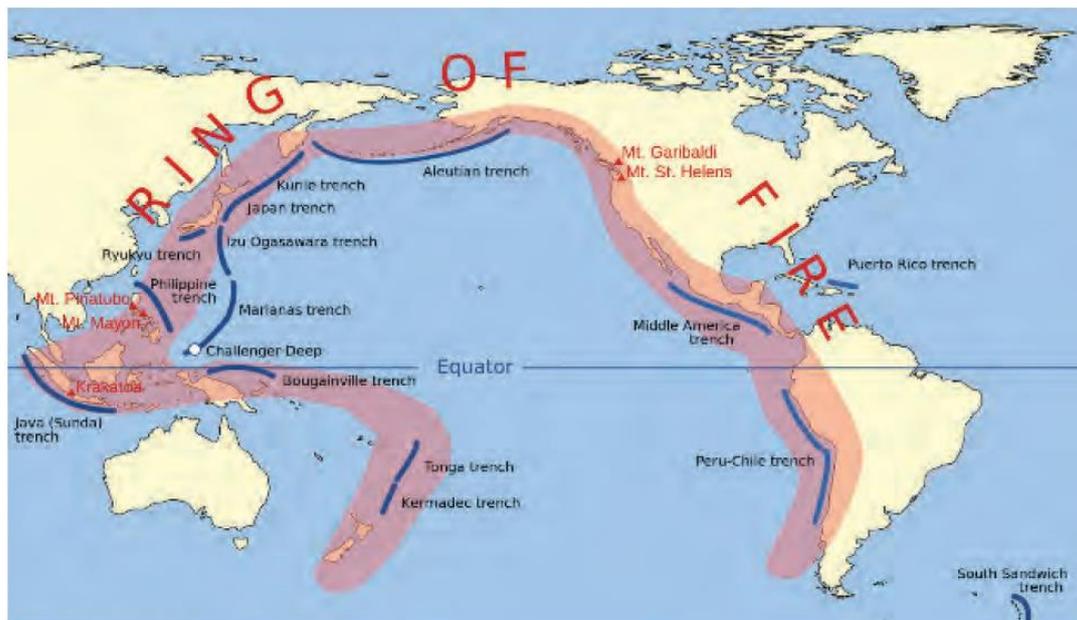


Figure 1. Map of the distribution of the Asia-Pacific volcanic pathway (ring of fire)

Source: (Mohd. Robi Amri, 2016)

Various natural disasters occur in Indonesia, including earthquakes, tsunamis, and volcanic eruptions. This volcanic eruption poses a great danger, namely hot clouds and avalanche of ash whose temperature reaches  $950^{\circ}\text{C}$  with a flow speed of 30-40 m per second. An extraordinary threat to human life. This volcanic eruption also causes volcanic avalanches, lava flows, and lahars. In addition, there are other natural disasters, namely landslides, floods, droughts, forest fires, extreme weather, high waves, coastal abrasion, flash floods, and tornados.

In addition to the potential for natural disasters, there is still the potential for social disasters, namely social, physical, economic, and environmental vulnerabilities. Various ethnic groups inhabit Indonesia with their characteristics. These social conditions provide

a treasure trove of the cultural diversity of high value. However, this can cause social conflicts, as has happened in the past (Mohd. Robi Amri, 2016). All praises are to Allah. The social conflict has recovered.

The number of disasters in Indonesia showed an increasing trend from 1815 to 2018. A steep increase occurred from 2000 to 2018, as shown in Figure 2 below (Fitriyani et al., 2021).

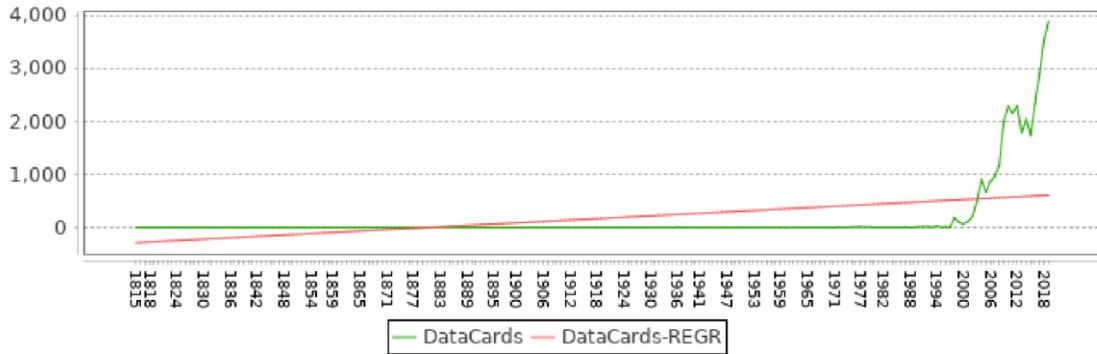


Figure 2: Disaster Incidence Rate in Indonesia in the Period 1815 – 2018  
Source: (Fitriyani et al., 2021).

The highest number of disasters occurred in Central Java Province, with 7113 disasters, and the lowest in West Papua Province, with 59 disasters (Fitriyani et al., 2021).

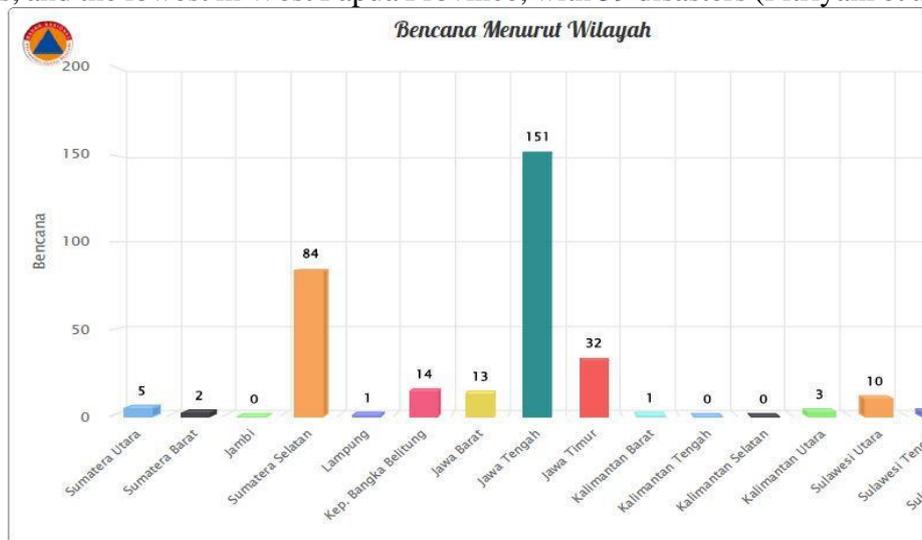


Figure 3: Number of Disasters in Indonesia by Province  
Source: (BNPB, 2022)

The disaster destroyed buildings and constructions, and other infrastructure. The type of disaster in Indonesia that severely destroys infrastructure is an earthquake. Most of the damage to houses (49%) caused by disasters in Indonesia was caused by earthquakes. As far as records exist, the earthquake has caused damage to 623,901 houses and buildings. The highest number of damage to houses occurred during the earthquake-tsunami disaster in 2004, with around 223,162 buildings. Besides earthquakes, other types of disasters that are very destructive are earthquakes - tsunamis, and floods (Figure 4).

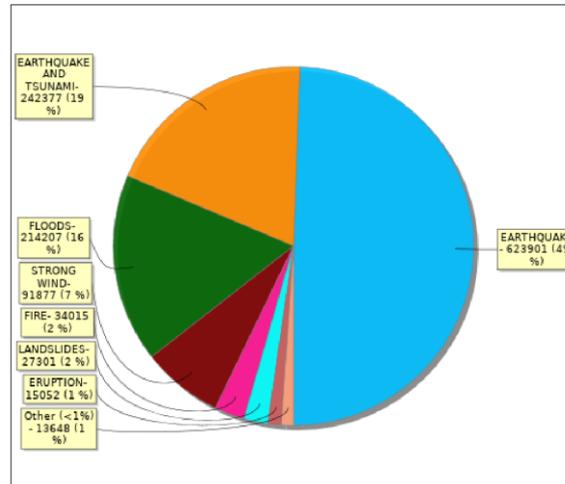


Figure 4: Infrastructure Damage by Type of Disaster in Indonesia  
Source: (Fitriyani et al., 2021)

Damage to infrastructure due to the disaster has increased, especially from 2000 to 2018 (Figure 5).

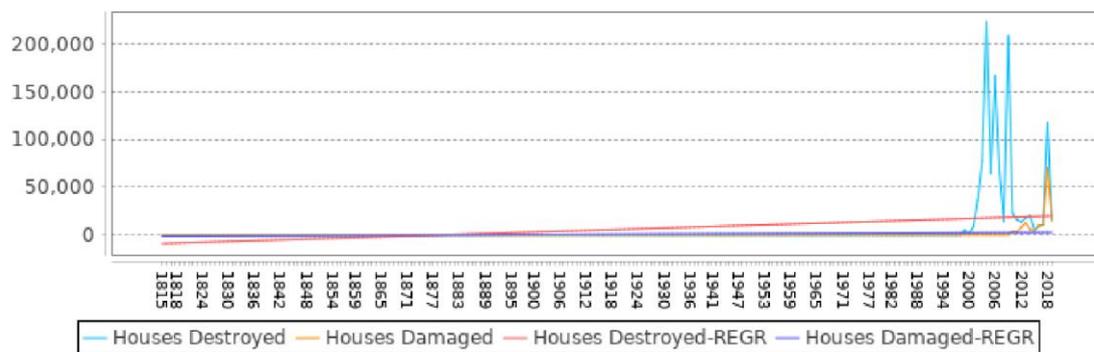


Figure 5: Trends in Infrastructure Damage due to Disasters in 1815 – 2018  
Source: Fitriyani, 2019

However, recently there have been more types of disasters in Indonesia, namely the emergence of biological disasters in the form of a coronavirus pandemic which has caused many problems in society. According to the Covid home page of the government of R.I., coronavirus has affected 6,048,685 people and caused the death of 156,396 people (the Republic of Indonesia, 2022).

The coronavirus exposure rate is not as high as the flood disaster, which reached 32,034,250 people. However, the death rate due to the coronavirus exceeded the death rate for the tsunami earthquake in Aceh Province, which amounted to 132,093 people (Fitriyani et al., 2021). The highest number of deaths due to disasters in Indonesia in the pre-pandemic period was due to the earthquake and tsunami disaster, which was 132,999 (49%), and then sequentially, volcanic eruptions, 78,634 people (29%), flood disaster, 21,932 people (8%), earthquake 16,317 people (6%), conflict 6,059 people (2%), tsunami 5,064 people (1%), landslide 2,888 people (1%), other disasters 3,875 people (Fitriyani et al., 2021).

Disasters always exist and have the potential to threaten the lives of Indonesian people. Therefore, it is necessary to carry out disaster risk reduction and disaster

mitigation activities to protect people's lives, both in disaster-prone areas and in the community.

### The Role of Mitigation in Disaster Management

Disasters cause grief and burden for the people of Indonesia in various parts of the region, both in the west and east. We should all make efforts to reduce these risks and burdens.

On December 26, 2004, the earthquake and tsunami disaster that hit Indonesia and ten other countries in the Indian Ocean region gave great lessons. The disaster made the government and society aware of the severity of the impact of a disaster. Soon after that, in January 2005, the World Conference on Disaster Reduction (WCDR) was held in Kobe, Japan. The trial approved the Hyogo Declaration and Hyogo Framework of Action 2005-2015.

The Declaration is a global commitment and cooperation of the world community to reduce disaster risk. The Declaration emphasizes the importance of the link between disaster reduction, development, and poverty. The Declaration calls on each country to give top priority to disaster risk reduction in order to reduce disaster losses.

There are five priority agendas: 1) Legal basis; 2) identification, assessment, monitoring, and early warning of disaster risk; 3) development of a culture of safety and disaster resilience based on science and technology, innovation, and education; 4) reduction of disaster risk factors; 5) strengthen preparedness and effective response to disasters.

As part of the world community, Indonesia is called to make these efforts and follow up on them. The government issued (together with the DPR) Law Number 24 of 2007 concerning Disaster Management (Undang Undang Nomor 24 Tahun 2007 tentang Penanggulangan Bencana, 2007). Subsequently, the government issued Presidential Regulation Number 8 of 2008 and established the National Disaster Management Agency (BNPB) as a national disaster management agency directly under the President (the Government of Indonesia, 2008).

Subsequently, several regulatory documents and government action plans related to disaster management were issued. All the results of this work are reported by the Indonesian government to the United Nations (UN) through the United Nations International Strategic for Disaster Reduction (UN-ISDR) agency (Mohd. Robi Amri, 2016).

Disaster Management Act; Article 16 and Article 33 state that disaster management is carried out during the pre-disaster period, emergency response, and post-disaster period. Furthermore, Article 34 states that pre-disaster activities are carried out in two situations, namely a situation of no disaster and a potential disaster situation.

Activities in **non-disaster situations** include disaster management planning, **disaster risk reduction**, prevention, integration in development planning, disaster risk analysis requirements, implementation and enforcement of spatial plans, education, training, and technical standard requirements for disaster management.

Disaster risk reduction activities aim to reduce the adverse effects of disasters. The activities include:

1. disaster risk recognition and monitoring
2. participatory disaster management planning;
3. development of disaster awareness culture;
4. increased commitment to disaster management actors



5. implementation of physical, non-physical efforts, and disaster management arrangements.

Pre-disaster activities in **potential disaster** situations include preparedness, early warnings, and **disaster mitigation**. Disaster preparedness activities aim to ensure prompt and appropriate efforts in dealing with disaster events. Meanwhile, early warning activities aim to take quick and appropriate action to reduce disaster risk and prepare emergency response actions.

Mitigation activities aim to reduce disaster risk for people living in disaster-prone areas. Several types of mitigation activities are mentioned in Law Number 24 of 2007 (Undang Undang Nomor 24 Tahun 2007 tentang Penanggulangan Bencana, 2007):

1. Implementation of spatial planning;
2. Development arrangements, infrastructure development, building planning
3. Implementation of education, counseling, and training. This activity can be done conventionally or modernly.

### Scientific Literacy Model in Disaster Mitigation

According to article 1, paragraph 9 of the Disaster Management Act, mitigation is a series of efforts to reduce disaster risk, both through physical development and awareness and capacity building to face disaster threats. The ultimate goal of disaster mitigation activities is public safety in potential disaster areas. Disaster mitigation activities aim to prepare the physical environment and raise public awareness. Types of public awareness activities are education, training, and counseling.

This disaster mitigation activity must involve various stakeholders, the government, the business world, non-governmental organizations, and the community. Communities must be empowered, and all mitigation activities must be community-oriented. Communities must be less vulnerable to disasters and must be protected from disasters. Several things must be the main concern: exposure to hazards, community vulnerability, socio-economic and cultural characteristics, infrastructure accessibility, and community response capacity (Aprilyanto, 2021).

Several parameters for the success of mitigation activities can be used, namely mortality rate, disability rate, public health, poverty level, employment, education, socio-economic life, and healthy living environment.

Based on the explanation above, it can be concluded that the thirteen characteristics of community-based disaster mitigation models are:

1. Mitigation activities are carried out during pre-disaster
2. Mitigation activities are carried out in situations where a potential disaster arises
3. Activities are specific according to the type of disaster in the disaster area
4. The target of mitigation activities in disaster-prone communities in disaster areas
5. Mitigation activities utilize scientific literacy, namely science, technology, and innovation.
6. Mitigation activities utilize local wisdom
7. Mitigation activities take into account the economic capacity of the local community
8. Mitigation activities involve the participation of policymakers.
9. Mitigation activities involve the community, community leaders, and traditional institutions.
10. Mitigation activities are oriented towards vulnerable communities in disaster areas.
11. Mitigation activities adapt to local culture and avoid social friction with the community.

12. Mitigation activities can involve social fund institutions such as zakat and other community organizations.
13. The forms of mitigation activities are applicable, practical, and easy for the community to implement.

The results of this disaster mitigation model can be maximized by utilizing scientific literacy. Scientific literacy can be defined as scientific knowledge and skills to be able to identify questions, acquire new knowledge, explain scientific phenomena, draw conclusions based on facts, understand the characteristics of science, awareness of how science and technology shape the natural, intellectual and cultural environment; and a willingness to be involved and concerned with issues related to science (Narut & Supradi, 2019).

Mastery of scientific literacy can increase understanding of environmental, health, economic and other problems faced by modern society today. Mastery of scientific literacy can improve life skills, decision-making, adaptability, and community productivity (Sanjaya et al., 2017). This ability is needed by the community in anticipating and responding to disasters that may occur.

In principle, scientific literacy aims to humanize humans. Communities in disaster areas are the subject of disaster protection. All activities are oriented to the community (community-centered mitigation) to lead to active participation and independence of the community in dealing with possible disasters in their homes.

The concept of a scientific literacy-based disaster mitigation model is not an easy endeavor. However, it should be tried as much as possible. One of the obstacles is the condition of education in Indonesia. According to Narut, the Indonesian education system has not been able to facilitate the empowerment of scientific literacy for education personnel (Narut & Supradi, 2019). Therefore, further research is needed to involve domestic and foreign experts, experts, and stakeholders in disaster mitigation activities.

As with its duties and functions, the National Disaster Management Agency (BNPB) needs to provide legal protection and support these activities. BNPB can coordinate community-based disaster mitigation activities and scientific literacy by involving all stakeholders, including the government, the business world, and the community.

## CONCLUSION

Thus, the concepts, types, and impacts of disasters in Indonesia have been described as the basis for making disaster mitigation models. Furthermore, the initial ideas of community-based disaster mitigation models and scientific literacy have also been described. Includes understanding, goals, objectives, targets, and limitations of the concept of community-based and science-based disaster mitigation models. Hereinafter, research on applying the above model can be carried out in certain disaster-prone communities.

Disasters are a threat to the lives of the Indonesian people and can pose a heavy burden to society, nation, and state. Therefore, efforts to reduce the burden are a joint obligation of the government and the community. Community-based mitigation activities utilizing scientific literacy can be an alternative solution model to overcome this.



## REFERENCES

- BNPB. (2022). *Jumlah bencana berdasarkan provinsi di Indonesia*. <https://dibi.bnpb.go.id/>
- Fitriyani, J., Khoirudin Apriyadi, R., Winugroho, T., Hartono, D., Dewa Ketut Kerta Widana, et al. (2021). Karakteristik Histori Bencana Indonesia Periode 1815 – 2019 Berdasarkan Jumlah Bencana, Kematian, Keterpaparan dan Kerusakan Rumah Akibat Bencana. *PENDIPA Journal of Science Education*, 5(3), 322–327. <https://doi.org/10.33369/pendipa.5.3.322-327>
- Maulana, M. (2019). Penyebab terlantar dan rusaknya rumah bantuan korban tsunami Aceh dan tinjauannya dalam hukum Islam. *Ar-Raniry*, 6(2), 129–142. <https://doi.org/http://dx.doi.org/10.22373/jar.v6i2.10281>
- Mohd. Robi Amri. (2016). *Risiko Bencana Indonesia, BNPB Indonesia (M. R. A. Raditya Jati (ed.); 1st ed., Vol. 1)*. Badan Nasional Penanggulangan Bencana. <https://bnpb.go.id/kajian-bencana/risiko-bencana-indonesia>
- Narut, Y. F., & Supradi, K. (2019). Literasi sains peserta didik dalam pembelajaran ipa di indonesia. *Jurnal Inovasi Pendidikan Dasar*, 3(1), 61–69. <https://jurnal.unikastpaulus.ac.id/index.php/jipd/article/view/214>
- Undang Undang Nomor 24 Tahun 2007 tentang Penanggulangan Bencana, (2007). [https://bnpb.go.id/ppid/file/UU\\_24\\_2007.pdf](https://bnpb.go.id/ppid/file/UU_24_2007.pdf)
- Republik Indonesia. (2022). Penanganan Covid-19 Situasi COVID-19 di Indonesia, May 10th 2022.
- Sanjaya, R. W. K., Maridi, & Sucianti. (2017). Pengembangan modul berbasis Bounded Inquiry Lab untuk Sistem Pencernaan Kelas XI. *Jurnal Penelitian Pendidikan Biologi*, 6(3), 1–16. <https://jurnal.um-palembang.ac.id/index.php/dikbio>
- the Government of Indonesia. (2008). Peraturan Presiden Republik Indonesia Tentang Badan Nasional Penanggulangan Bencana. 1, 1–24.
- Wisyanto. (2011). Tsunami Aceh 2004 Sebagai Dasar Penataan. *Jurnal Sains Dan Teknologi Indonesia*, 3 (12), 137–143.