

Berkala Ilmu Perpustakaan dan Informasi, Vol. 19, No. 2, Desember 2023, Hal. 301-313
<https://doi.org/10.22146/bip.v19i1.6830>
ISSN 1693-7740 (Print), ISSN 2477-0361 (Online)
Tersedia online di <https://journal.ugm.ac.id/v3/BIP>

Indigenous literacy of local knowledge about the signs of natural disaster A case of Way Ela Natural Dam - Maluku

Edwin Rizal¹, Rizki Nurislaminingsih²

^{1,2}Fakultas Ilmu Komunikasi Universitas Padjadjaran
Jalan Raya Bandung-Sumedang Jatinangor KM 21 Jatinangor
Email: edwin.rizal@unpad.ac.id

Submitted: January 30, 2023, Revised: June 20, 2023, Accepted: September 1, 2023

ABSTRAK

Pendahuluan. Berbagai bencana alam terjadi di Maluku, yang salah satu dampaknya dapat mengubah permukaan tanah, contohnya hutan menjadi bukit atau sungai menjadi bendungan alam. Di Maluku, bendungan alam Way Ela yang terbentuk karena bencana pada 2012 dan dihancurkan lagi oleh bencana juga pada 2013. Peristiwa alam yang terjadi dalam waktu yang berdekatan ini masih terekam dalam ingatan masyarakat. Penelitian ini bertujuan untuk mengetahui jenis-jenis pengetahuan lokal tentang bencana bendungan yang disadari oleh masyarakat.

Metode pengumpulan data. Pengumpulan data dilakukan dengan cara wawancara.

Metode analisis. Data dianalisis dengan cara mengelompokan tema tanda alam terbentuknya sekaligus jebolnya bendungan.

Hasil dan pembahasan. Terbentuknya bendungan diawali dengan adanya gempa, tanah longsor, sungai tiba-tiba kering, dan perilaku aneh hewan. Tanda alam sebelum bendungan jebol adalah gempa, hujan deras, tanah retak, perilaku aneh hewan, dan perubahan suhu udara menjadi lebih dingin.

Kesimpulan. Penelitian ini menyimpulkan bahwa tanda-tanda bencana yang disadari oleh masyarakat terdiri dari tiga tema yakni terbentuknya bendungan, sebelum bendungan jebol, dan saat bendungan jebol.

Kata kunci: indigenous literacy; pengetahuan lokal; bencana bendungan; Maluku

ABSTRACT

Introduction. Various natural disasters occurred in Maluku, with one of the impacts is changing the land surface. One example is a forest has changed into a hill or a river has changed into a natural dam. In Maluku, Way Ela natural dam was formed as a result of the disaster in 2012 and was destroyed again by the disaster in 2013. This natural event that occurred in a relatively short period of time is still remembered by the community. This study aims to explore the types of local knowledge about dam disasters based on their memories.

Data Collection Method. Data collection in this study was conducted by the interviews.

Data Analysis. Data were analyzed by grouping the themes on natural signs of the formation and of the broken of the dam.

Results and Discussion. The formation of dams begins with earthquakes, landslides, dry rivers, and strange animal behavior. Natural signs before a broken-down dam are earthquakes, heavy rain, cracked ground, strange behavior of animals, and changes in cooler air temperature.

Conclusion. This study concludes that the community is aware of three types of disaster signs including the formation of a dam, before the dam breaks, and when the dam breaks.

Keywords: indigenous literacy; local knowledge; dam disaster; Maluku

A. INTRODUCTION

The Maluku Islands have long been known as the Indonesian region most vulnerable to natural disasters, including plate tectonic disasters. This disaster formed the surface of the Moluccan land as diverse as mountains, lakes, and dams. For instance, Negeri Lima (one of the villages in the Leihitu sub-district of Central Maluku) had a natural dam on July 13, 2012. The community named it the Way Ela Natural Dam because it was formed due to the blocking of the Way Ela River's water flow by the collapse of Ulakhatu mountain material. Based on the data we obtained from Balai Wilayah Sungai Maluku (river territory office of Maluku), this dam had a height of 200 meters, a width of 300 meters, a length of 1000 meters, and a volume of water of 87 million m³.

A more scientific explanation of the formation of the Way Ela dam is in the research of Wisyanto & Naryanto (2022) that, the Negeri Lima region was composed based on volcanic soil and Pliocene rock formations which were the result of young volcanoes. Arrangements like this are generally still in the form of very sharp hills and canyons (steep topography). Observations of the rocks in the area of the former Way Ela Natural Dam, Ulakhatu Mount, have shown that the area was dominated by breccia, tuff, and andesite. This condition caused it to be very prone to landslides due to earthquake shocks. Landslides get worse after the earthquake was followed by heavy rain. An earthquake with a magnitude of 5.6 Mb was followed by heavy rain with an intensity of 360 mm for two days happened on July 12 to 13 July, 2012. These two natural events caused rocks on the Ulakhatu mount to slide, blocking the Way Ela River.

One year later, on July 25, 2013, the dam broke. The water flow hit the hills, destroyed the village, and swept away the houses to the sea. Two days of heavy rain followed by the earthquake had affected the destruction of the natural embankment holding the dam. This situation is also described by Ishizuka et al. (2017) that the dam broke about a year after its formation due to large-scale flooding. It started with an overflow of rainwater on July 24, 2013,

which shook the dam's spillway. The rain intensified until July 25, 2013, causing the spillway walls to fall off one by one. When all the spillways were released, there was no longer any barrier to the dam, so it broke.

The time range of this natural event, which was only one year, is still clearly recorded in the residents' memories. Direct experience of dealing with two disasters in close time, one year, made them aware of the characteristics of disasters. They feel natural signs that initiate the formation and collapse of the dam. This awareness is known as indigenous literacy because it is carried out by indigenous people about events that occur in their area. This literacy adds to knowledge about disasters because they do not have experience with the process of forming and breaking dam.

McLeod (2016) provides an understanding that indigenous literacy is a lifelong learning process about the native world, gained from years of experience with the environment, and not at all book-based formal learning. Indigenous literacy is an individual step to acquiring local knowledge from events around them. Sarkhel (2016) explains that indigenous knowledge is knowledge gained from experience or direct involvement with the environment, accepted by local communities, and applied to them. Widuri et al. (2022) argue that knowledge and information about disasters are useful for community preparedness in self-rescue actions when facing disasters.

Rizal et al.' (2020) research provides an example of the local knowledge of the people in Ambon Island, residents of Hutumuri village, about the characteristics of disasters based on natural signs. They saw agitated birds a few days before the tsunami. They flew here and there aimlessly. The residents also saw thousands of dead fish washed ashore several hours before the big sea waves hit the village. These two phenomena made residents aware that something would happen in their environment. Now they are more careful when there are other natural signs than usual, especially when there are lots of fish washed up on the beach. They will automatically be disaster alert.

Based on this finding, we argue that

communities in another area on Ambon Island also have local knowledge about disasters. We chose the people of Negeri Lima because they were affected by the disaster. They are witnesses to the creation and breakdown of the natural dam. Even though the dam broke, only one person died. They are aware of natural signs as an indication of impending disaster so they can save themselves before the disaster occur. Thus, the purpose of this research is to explore the types of dam disaster signs based on the events experienced by informants.

B. LITERATURE REVIEW

This study uses a phenomenological approach. Thus, it does not start with a particular theory, because the core of phenomenological research is to analyze the experiences of several people with the same phenomenon. The limitation of this research is to explore the types of local knowledge about dam disasters based on indigenous literacy (awareness of locals) who had experience disasters. According to Browning (2016), indigenous literacy is a practice carried out by people to recognize everything unique in certain communities.

McLeod (2016) gave an example of the characteristics of indigenous literacy, namely descriptive systems, critical thinking, oral traditions, prioritizing values and morals, family and community involvement, and the original views of the community (before colonization or receiving influence from foreigners). Furthermore, McLeod (2016) provides an overview of indigenous learning principles. This type of learning is centered on individuals, families, and people in a particular community. Learning is holistic, reflexive, reflective, and relational from generation to generation. They gain knowledge from the experience of interacting with the environment, from stories about the history of the community, and social interaction.

Chung & Yen (2016) provide an example of the link between indigenous literacy and indigenous knowledge about disasters. Stakeholders provide children with disaster mitigation training so that the community will understand the characteristics of and know how

to save themselves from an early age. Trainers and students learn together to recognize potential disasters based on phenomena in their environment, practice how to find a place to save themselves and practice how to survive by utilizing local resources (plants, animals, and other natural potentials). This learning process is known as how to produce indigenous knowledge using indigenous literacy, namely, competencies related to the environment in a community and developed by community members from time to time.

Based on the explanations by Browning, McLeod, Chung, and Yen, it can be understood that indigenous literacy is a way for people to acquire local knowledge because it comes from events in their environment. Indigenous literacy about local knowledge of disasters around them is useful for making people aware of the characteristics of disasters, which one day will be useful for self-rescue actions.

C. RESEARCH METHODS

This study aims to determine local knowledge about disasters obtained from the personal experience of the community in dealing with disasters. Wati & Rahmi (2021) recognize the importance of community-owned local knowledge. Communities have the right to ownership of knowledge (intellectual rights) which is characteristic of them. We use a phenomenological approach to gain knowledge about disasters from the people's experiences in Negeri Lima – Maluku. They sensed the natural signs of disaster and witnessed the disaster occur. What they saw and felt became local knowledge about the disaster.

Creswell (2015) explains that qualitative research explores problems or issues in certain populations or communities to obtain detailed information. The phenomenological approach is useful for understanding and describing the core of the experiences of several individuals about the same phenomenon. This type of approach does not stick to any particular theory. Researchers come to the location with concepts related to the research theme. Data collection is carried out by interviews, document studies, and observations. Data analysis is done by grouping

important statements and descriptions of the core of the informant's statements.

Data collection in this study was conducted by interviewing residents of Negeri Lima, former village head, village secretary, volunteers, and employees at the *Balai Wilayah Sungai Maluku* (river territory office of Maluku). Residents of Negeri Lima who agreed to be interviewed were only six people; WT-01, MK-02, SA-03, SM-04, SP-05, and IS-06. SP-05 (village head and IS-06 (village secretary) were the people who took care of disaster issues and Way Ela. They received reports from residents about the dryness of the Way Ela River, participated in checking the causes of dry river water, monitored the construction of a spillway dam, and witnessed the dam breaking. Other residents refused to be interviewed because they were still traumatized. We also interviewed one of the volunteers, WD-07, who monitored the dam until it burst and helped evacuate residents. The demographic data of them can be seen in Table 1.

We did data validity by member checking, and by that we clarify the answers of informants on their knowledge of the signs of a disaster which was carried out between interviews. We did data analysis by grouping the signs of the formation and breakdown of the dam based on the explanations from the informants. The description of the data was clarified with citations from other similar studies. Hence, we will get the types of natural signs that characterize the disaster, scientific explanations, and examples from other studies that have already been published.

The data from the community regarding the process of the dam bursting to employee at the *Balai Wilayah Sungai Maluku* (river territory office of Maluku), JS-08 had been validated. He also suggested that we analyze the video recording of the dam breaking, which is on YouTube with the keywords "*Jebolnya Bendungan Alam Way Ela Maluku 2013*" which was uploaded on the YouTube channel of the National Agency for Disaster Countermeasure of Indonesia (Badan Nasional Penanggulangan Bencana Indonesia).

D. RESULTS AND DISCUSSION

This research resulted in three themes regarding the natural signs of a dam disaster, namely the dam's formation before the dam break, and when the dam break. The signs of the dam's and the signs before the dam breaks are written in Table 1 while the signs when the dam breaks can be seen in Table 2. Information about the dam breaks does not answer the research objective. It is part of the informants' stories during the interview process. Thus, we consider it as research findings so it is written separately in Table 2.

1. Signs of Nature of The Formation of Dam

The former head of the village, SP-05, explained that the Ulakhatu mountain had been cracked for dozens of years. Earthquakes have frequently hit Negeri Lima for tens of years, so it is natural for mountains to crack.. The earthquake that occurred on the night of July 13, 2012, made the cracks wider, and then landslides buried the Way Ela River so that the flow of water stopped instantly, and completely drying up. According to the village secretary, IS-06, the Way Ela dam was formed due to the landslide of part of Mount Ulakhatu. It was due to an earthquake in the early hours of July 13, 2012. In simple terms, S-06 analogized that an earthquake shakes the ground, then causes the movement of mountains. The strong movement caused parts of the mountain body to collapse and cover up the Way Ela River. Then, he giant pile was called the Way Ela Natural Dam. IS-06 also explained that village officials were aware of the existence of this natural dam, starting with reports of residents who felt strange that the river water, which was usually swift, had suddenly dried up. Then, village elders, along with several residents, followed the river bank from end to base to find the cause. It was known that there were heaps of soil and rocks that were massive that blocked the flow of the river.

Based on their explanations, a natural sign of the creation of the Way Ela dam was a landslide that occurred due to an earthquake. This occurrence is in accordance with Badawi's statement (2020) that the Way Ela natural reservoir was formed as a result of an avalanche of Mount Ulakhatu (Negeri Lima Village -

Ambon Island) on 13 July 2012. The landslide covered the Way Ela River, forming a natural reservoir that dammed the river valley. Yunita & Puspitosari (2014) said that the landslide on 13 July 2012 had formed a natural dam. The landslide was triggered by an intensity of 360 mm of rainfall bringing breccia, tuff, and andesite. The landslide material gathered at one point (in the middle of the Way Ela River) and then formed a natural dam. It was approximately 1000 m long, 200 m wide, 210 m high, and 10 million m³ volume.

A natural dam can be created due to the collapse of soil and rocks in the mountains. Landslides and rocky mountains occurred because of the earthquakes. This also happened in Wenchuan in 2008, as exemplified in the research by Li et al. (2019), where an earthquake moved rocks in the ground and eroded mountains, causing landslides. Similar phenomena also occurred in Negeri Lima, Ambon. The results of research by Yakti et al. (2018) explained that the Way Ela Natural Dam was formed due to an avalanche of soil and rock materials that blocked the Way Ela River in 2012. Thus, this dam is called a natural dam. The name of the Way Ela dam comes from the name of the dammed river.

MK-02 is one of the witnesses to the Way Ela River suddenly drying up. Every dawn, she routinely went to the river to fetch water. She was confused that the river had no water even though yesterday the water was still flowing as usual. She remembered that the natural phenomenon before the river water drying up was an earthquake at night. She said "*Katong gempa, dengar suara gemuruh malam sebelum gunung runtuh. Suara gemuruh mirip guntur. Karena malam katong seng curiga suara apa. Paginya ada yang aneh, sungai mengering*" (I remember there was an earthquake and heard howling wind on the mountain at midnight. The sound was like thunder. I was not suspicious of the sound. I continued to sleep. When I woke up, I went to the river, and found no water there).

The river water that suddenly dried up needs to be watched out for because it indicates that something very large is burying the river flow. In the case of the Way Ela River, what piled

up was chunks of soil and mountain rocks due to the earthquake. Dugar & Dahal (2014) explained the earthquake's impact on the surrounding area. The earthquake caused landslides and rocks to fall, burying roads or rivers. The degree of damage varies depending on the magnitude and frequency of the earthquake. Damage from landslides is even worse if rainstorms accompany the earthquake.

SA-03 admitted into witnessing strange natural phenomenon, such as changes in animal behavior before the mountain split and filled the Way Ela River. She remembered many birds that usually live in the forest were perching on the trees near the residents' houses. She had time to think about what happened on the mountain so that the birds fled to the village. Her suspicions grew when she saw the birds flying as if they were restless. After the avalanche of Mount Ulakhatu covered the river, she realized that the birds had a feeling that their habitat (trees, forests, and mountains) would collapse. Therefore, they fled to the trees in the village.

Unusual animal behavior is also an indicator from nature that a disaster is about to occur. Animals will leave places they perceive as dangerous. In this case, the birds that usually live on Ulakhatu mountain took refuge in the trees near the village. Respondents in the research by Fadilah et al. (2021) also acknowledged unusual animal behavior prior to the disaster. They witnessed dogs, pigs, cats, cows, and birds that looked nervous, panicked, and agitated just before the earthquake.

Kariyanna (2020) states that animal behavior is a reaction to changes in nature because they have strong receptors to detect changes in the environment around them. They have special sensory organs to sense changes in the earth's magnetic field, infrasound, and ultrasound. Earthquakes, volcanic eruptions, tornadoes, tsunamis, and landslides are all examples of disasters that produce pneuma and infrasound. Therefore, the signs can be detected by animals. For instance, birds in Peru's Yanachaga National Park seemed to be less active than usual. After a week of birds acting strangely, an earthquake hit Peru in 2011. So did the behavior of animals on Haiyuan. Sparrows

flew in unusual ways, wolves scurried about, and dogs barked in strange voices before the Haiyuan earthquake in 1920.

2. Signs of Nature Before the Dam Broke

As an employee at the disaster management office, JS-08 confidently explained that the cause of a mountain collapsing (then bursting up a river) and the cause of a dam breaking were the same; an earthquake. WT-01 gave another elaboration on the cause. She explained that the natural sign she remembered before the dam broke was heavy rain without stopping for two days. She didn't see any sunlight. It was dark because of the black clouds and rain. Water pooled around the house. Another thing she remembered was the shaking of the ground near the resident's houses. She suspected it came from the surge of water in the dam before it broke. IS-06 also recognizes signs of changes in nature. A few days before the dam broke, he and several volunteers visited the dam. They talked with researchers from Japan to examine the progress of making spillway dams. At that time, IS-06 saw the ground around the dam cracked.

Earthquakes and rain are examples of natural events that directly impact land contour and construction. Earthquake shocks have a huge effect on ground cracks, while heavy rain affects the loose soil. This matter also happened to the land around the Way Ela Dam. The earthquake and heavy rain affected the soil around the dam to become brittle and easily cracked. This crack had an impact on the spillway plug. Spillways that stand on cracked ground will become unsteady and eventually no longer able to hold the dam's water.

The relationship between earthquakes and dam damage is explained by Abbas & Al-Hadidi (2021), who define earthquakes simply as vibrations of the earth's surface due to the sudden release of energy in the crust and upper coat. This phenomenon occurs due to the rupture of the underground rock energy layers, causing movement and vibration of the earth. Earthquakes do not only result in the splitting of the ground but can also threaten the stability of dams and the collapse of bridges. According to Adamo et al. (2020), earthquakes can cause

major dam damage. The severity of the dam failure depends on the size of the Richter scale, the duration of time, the distance from the epicenter, and the nature of the rocks and soil at the base of the dam. Natural dams (earthfill) are usually less tolerant of earthquake shocks than artificial dams (concrete).

The collapse of the Way Ela dam after heavy rain was also confirmed by one of the volunteers, WD-07. According to him, the only sign of nature he felt was continuous rain for two days. It is feared that the rain, which he called without sunshine, will cause the water discharge in the dam to overflow. Rainwater can no longer be accommodated by the dam bowl, which can then cause landslides. Natural dam materials that are only made from piles of landslides also tend to be brittle because they are less dense than naturally formed soils. This logic was derived from his experience when the Mamua dam (in Mamua village) burst, which also broke after heavy rains in 2011. The volume of rainfall in Negeri Lima at that time was explained in the research by Osok & Puturuhi (2015), namely 5.4 billion liters of water or the equivalent of 281.7 million gallons of water. This amount is enough to cause dam overflow, landslide, dan flood.

Estimates from the volunteer regarding heavy rain that risk the embankment breaking are in accordance with the statements of Ge et al. (2019) that the easiest conventional method to analyze a dam break is by calculating the amount of water. The amount of water that continues to increase will exceed the capacity of the bowl so that the dam breaks. According to Lin et al. (2021), dam flooding can occur due to rainstorms. The breakdown of the dam is greatly influenced by the amount of rainfall which increases the water discharge. The amount of rainwater that exceeds the reservoir's capacity will break the dam. The heavier the rain, the bigger the chance of the dam to burst.

Kawajiri et al. (2019) exemplify the disaster in Hokkaido in 2016. It started with three successive typhoons that brought torrential rain. This heavy rain has a very significant impact on the destruction of lands and rivers. The embankment broke and was eroded by the

overflow of water. The results of the research by Psomiadis et al. (2021) showed that the rapid flow of water in a collapsed dam highly dependent on the volume of water stored in the reservoir. However, according to Koto & Negara (2017), the absorption of water into the soil depends on the contour of the soil. The water will be absorbed quickly if the soil is granular and porous like sand. Conversely, if the soil is muddy, it is not easily absorbed into the soil.

Signs of nature before the dam disaster also came from the behavior of animals. WT-01 realized it when she saw the anxiety of the cats and chickens. She said "*Kucing menangis terus, ayam laki-laki berkokok terus, hewan seng tenang berhari-hari. Katong sampai merinding. Katong kira ada orang mau meninggal. Katong percaya tidak percaya tapi itu terjadi*". (The cats made a sound like they were crying and the roosters kept crowing. They were not calm for days. I got goosebumps because I thought someone would die. Believe it or not, before news of someone died, we usually hear signs from animals).

Other natural signs are animal behavior because animals can also feel the danger signals given by nature. Animals will show anxiety, worry, and confusion. Animals will avoid places of danger. Just like the birds from Ulakhatu Mountain who took refuge in the trees in the village to save themselves from the effects of the earthquake on their homes (the tree where they perched fell). In the case of a broken dam, this time, the animals sought refuge in the forest. SA-03 described the change in the behavior of the animals in the days before the dam burst. The cats that used to roam the village were nowhere to be seen.

SM-04 also acknowledged the disappearance of cats from residential areas. According to her, she had not seen any cats since the morning before the dam broke. Most livestock, such as cows and chickens, were also mostly not in the village. People saw animals running to the mountains. They believe that animals have their own sensitivity to changes in nature. They seemed to know that floods would sweep away the village so they took shelter in the forest.

Animals in residential areas are also sensitive to changes in nature. They will exhibit unusual behavior before the disaster occurs. Dogs and cats take their children outside the house. Goats and chickens come out of their cages. Pigs scream and fish move quickly (Kariyanna, 2020). The result of Ha's (2015) research also showed a similar thing, that some animals (which are usually located around settlements) ran towards the mountains just before the big earthquake and tsunami occurred in the Indian Ocean in 2004. This behavior happened because animals communicate through various actions, including when they feel a sign of danger; they will fly away and let out alarming sounds. For example, snakes, rats, ferrets, catfish, and chickens will show expressions of anxiety or fear by hiding or acting panic.

Air temperature can also be an indicator of natural changes that has the potential to be disastrous, as experienced by the informant. The temperature had gotten colder in the days before the dam's collapse. SA-03 felt there was something different in the environment. Three weeks before the dam broke, the air was colder and the wind blew stronger. People use multiple blankets while sleeping. They suspected the cold was coming from the water in the dam. A strong blow of wind brought cold water from the dam to the village. Shabbir et al. (2023) explain that climate change can also trigger disasters. In the study of Fadilah et al. (2021), it was explained that temperature changes are also indicators of disaster. The people of Padang Pariaman experienced natural anomalies, such as rising temperatures and the appearance of vertical clouds like tornadoes, before the earthquake.

3. Findings: Phenomena When the Dam Broke

The results of our conversations with informants not only answered research questions, namely types of natural signs about the process of the formation and breakdown of the giant Way Ela embankment, but also received additional information about natural phenomena when the dam broke. We consider

these findings to be the characteristics of a dam disaster when this disaster occurred. The details are in Table 3.

According to JS-08, government employees from *Balai Wilayah Sungai Maluku* (river territory office of Maluku) visited the mountain at 4 am on July 25th, 2013 to monitor the dam. They watched it from the top of a mountain next to the dam. The dam burst as if it had exploded. All informants described the event of a burst dam as a flash flood that hit residents' settlements. A scene that still traumatizes WT-01 is the house that looks like it's walking. She saw the foundation of the house uprooted from the ground. The house (from foundation to roof) goes with water flow to the sea. SP-05 compared the flash floods at the Way Ela Dam with an onshore tsunami caused by a powerful water strike.

One of the residents, SA-03, admitted that she had heard information from the government team regarding the results of research that estimated the time the dam broke, but she responded casually without thinking about preparing herself to evacuate. She and her family left their house after volunteers said that the Way Ela dam is likely to break because it has the similarity in characteristics with the Mamua dam (Mamua village) which had already collapsed in 2011. Both formed due to a landslide. Dams made from landslides are prone to collapse because the soil is not solid. If the dam breaks, the village will be flooded. Volunteers also reminded the strange signs of nature in the village, such as changes in air temperature and ground shaking. This story made SA-03 finally willing to be evacuated. While in evacuation, she witnessed water level was almost the same as the coconut tree, and all the houses were washed away.

The informant's statement about the high flooding of the Way Ela Dam was reinforced by a videotape entitled "*Jebolnya Bendungan Alam Way Ela Maluku 2013*" which was uploaded on the YouTube channel of the National Agency for Disaster Countermeasure of Indonesia (*Badan Nasional Penanggulangan Bencana Indonesia*). In the video, the flow of water is half a hill high. Shortly before arriving at the

residential area, the water from the dam hit the trees in the forest; the height of the water looked the same as the height of the trees, just like what the informant had told. The video also shows houses being submerged in water and rifting into the sea. In the study by Ishizuka et al. (2017), it is also explained that the current height of the dam is around 140 meters. After flowing, the height is getting lower at around 63 m. The lowering of the water level continues as the water reaches settlements; flow depths range between 0.5 m and 3.5 m.

The awareness to save herself is recognized by SM-04, who believes that the cats running from the village to the forest has a special meaning. Cats are considered sacred animals that represent the side of the people's spiritual belief in nature. If the cat acts strangely, then bad things will happen in society. Although SM-04 cannot predict what bad events will happen, she and her family immediately agree when advised to evacuate. The attitude of Negeri Lima residents who are aware of the signs of disaster is also written in Suneth et al.'s (2016) that people had predicted the Way Ela Dam would burst due to continuous rain. Rainwater will increase the volume of dam water and overflow it.

Dam explosions, floods, and water levels as high as coconut trees were also recognized by SP-05. He was one of the village officials who checked the condition of the dam for the last two months before it broke. He communicated intensely with researchers from Japan who were examining the state of the dam. Japanese researchers say that if the dam breaks, the flood water level will reach 20 meters. The researcher also provided predictions for when the dam would break and a map of the extent of the flood flow. Two weeks before the dam breaks, researchers concluded that the dam would be destroyed on July 25, 2013, and about 400 houses would be wiped out. Thus, village officials know which areas will be affected by flooding.

An overview of the Way Ela Dam disaster was written by a journalist from the online newspaper; news.republika.co.id. Floodwaters as high as 6-7 meters hit the village, and all

houses and other buildings were destroyed and washed away. Even though the big flood destroyed the village, only one person died because the residents were willing to evacuate after realizing the dam would soon burst.

We got confirmation about the person who died from SP-05. He explained that the victim did not want to evacuate even though village officials and volunteers had picked him up. The victim said he did not want to leave his house and possessions. WD-07 as a volunteer, also confirmed the SP-05's statement that several times volunteers picked up victim to be willing to be evacuated, but he refused. His family and volunteers finally left him at home alone.

E. CONCLUSION

Indigenous people in Negeri Lima recognize the signs of the Way Ela natural dam disaster. The types of disaster signs they are aware of are the formation of the dam, before the dam breaks, and when the dam breaks. The formation of the dam begins with earthquakes, howling wind, landslides, river suddenly drying up, and strange animal behavior. Natural signs before a dam break are earthquakes, dark clouds, heavy rain, strong wind, cracked ground, strange behavior of animals, and changes in air temperature (colder). This research found natural signs when the dam had broken namely the sound of explosion, flooding, and water as high as a coconut tree. The results of this study can be a reference source for researchers in other social fields regarding knowledge on natural disaster. An example of a further research theme is the level of community literacy about local disaster knowledge or the benefits of local knowledge about disasters for the community.

REFERENCES

- Abbas, I. H., & Al-hadidi, M. T. (2021). Effect of halabjah earthquake on Al-Wand earth dam: Numerical analysis. *E3S Web of Conferences*, 318, 1–8. <https://doi.org/10.1051/e3sconf/202131801016>
- Adamo, N., Al-Ansari, N., Sissakian, V., Laue, J., & Knutsson, S. (2020). Dam safety and earthquakes. *Journal of Earth Sciences and Geotechnical Engineering*, 10(6), 79–132. https://www.scienpress.com/journal_focus.asp?main_id=59&Sub_id=IV&Issue=1849919
- Badawi, A. (2020). Analisis banjir rancangan daerah aliran sungai wai ela [Unpublished Teknik Sipil. Skripsi]. Universitas Hasanuddin.
- Browning, P. C. (2016). The problem of defining “indigenous literacy:” Lessons from the Andes. *Ikala*, 21(3), 301–312. <https://doi.org/10.17533/udea.ikala.v21n03a04>
- Chung, S.-C., & Yen, C.-J. (2016). Disaster prevention literacy among school administrators and teachers: A study on the plan for disaster prevention and campus network deployment and experiment in Taiwan. *Journal of Life Sciences*, 10, 203–214. <https://doi.org/10.17265/1934-7391/2016.04.006>
- Creswell, J. W. (2015). *Penelitian kualitatif & desain riset*. Pustaka Pelajar.
- Dugar, S., & Dahal, V. (2014). Impact of earthquakes on mountain roads. *International Symposium Geohazards: Science, Engineering and Management*, 153–164. <https://doi.org/10.13140/RG.2.1.4416.2965>
- Fadilah, M., Maryani, E., Permanasari, A., & Riandi, R. (2021). Disaster-vulnerable community perception related to pre-earthquake natural phenomena in west sumatera as part of disaster preparedness. *IOP Conference Series: Earth and Environmental Science*, 683(1), 1–10. <https://doi.org/10.1088/1755-1315/683/1/012075>
- Ge, W., Jiao, Y., Sun, H., Li, Z., Zhang, H., Zheng, Y., Guo, X., Zhang, Z., & van Gelder, P. H. A. J. M. (2019). A method for fast evaluation of potential consequences of dam breach. *Water*, 11(11), 1-12. <https://doi.org/10.3390/w11112224>
- Ha, K. M. (2015). Animals as valuable instinctive and 'learned' beings in the field of disaster management: a comparative perspective. *Natural Hazards*, 75(2), 1047–1056. <https://doi.org/10.1007/s11069-014-1359-1>

- Ishizuka, T., Kaji, A., Morita, K., Mori, T., Chiba, M., Kashiwabara, Y., Yoshino, K., Uchida, T., & Mizuyama, T. (2017). Analysis for a landslide dam outburst flood in Ambon Island, Indonesia. *International Journal of Erosion Control Engineering*, 10(1), 32–38. <https://doi.org/10.13101/ijece.10.32>
- Kariyanna, B. (2020). Role of insects and other animals in prediction of natural calamities. . *Indian Entomologist*, 1(2), 58–64. <https://doi.org/10.7748/phc.3.3.3.s7>
- Kawajiri, S., Kawaguchi, T., Watanabe, Y., Hayakawa, H., Miyamori, Y., Nakamura, D., & Yamashita, S. (2019). Investigation report of geotechnical disaster on river area due to typhoon landfall three times on Okhotsk region, Hokkaido, Japan. *Soils and Foundations*, 59(3), 764–782. <https://doi.org/10.1016/j.sandf.2019.01.006>
- Koto, J., & Negara, R. B. (2017). Japanese's river culture as an alternative flood prevention remedy in DKI Jakarta during rainy season. *Journal of Aeronautical-Science and Engineering*, 11(10), 1–12. <https://isomase.org/JAse/Vol.11 Aug 2017/11-1.pdf>
- Li, G., West, A. J., & Qiu, H. (2019). Competing effects of mountain uplift and landslide erosion over earthquake cycles. *Journal of Geophysical Research: Solid Earth*, 124(5), 5101–5133. <https://doi.org/10.1029/2018JB016986>
- Lin, X., Huang, G., Wang, G., Yan, D., & Zhou, X. (2021). Risk assessment of dam-Breach flood under extreme storm events. *Frontiers in Environmental Science*, 9, 1–15. <https://doi.org/10.3389/fenvs.2021.742901>
- McLeod, S. (2016). Indigenous literacy: Literacy & foundational learning for indigenous adults. In *Investment Strategy & Framework to Guide Calgary Learns*. <https://eur-lex.europa.eu/legal-content/PT/TXT/PDF/?uri=CELEX:32016R0679&from=PT%0Ahttp://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52012PC0011:pt:NOT>
- Melisa, F. (20 Juli 2013). Bendungan Way Ela jebol, ribuan masyarakat mengungsi. *News . Republika . Co . id .* <https://news.republika.co.id/berita/mqj1fo/bendungan-way-ela-jebol-ribuan-masyarakat-mengungsi>
- Osok, R. ., & Putuhuru, F. (2015). Pola perubahan curah hujan di Pulau Ambon terhadap kejadian banjir bandang di das Wae Ela Desa Negeri Lima. *Proseding Konferensi Nasional Forum Perguruan Tinggi Untuk Pengurangan Risiko Bencana*, 29–36. <https://psb.lppm.uns.ac.id/wp-content/uploads/sites/17/2019/12/Prosedin-g-KN-FPT-PRB-2015-1.pdf>
- Psomiadis, E., Tomanis, L., Kavvadias, A., Soulis, K. X., Charizopoulos, N., & Michas, S. (2021). Potential dam breach analysis and flood wave risk assessment using HEC-RAS and remote sensing data: A multicriteria approach. *Water*, 13(3), 1–24. <https://doi.org/10.3390/w13030364>
- Rizal, E., Khadijah, U. L. S., Nurislaminingsih, R., & Anwar, R. K. (2020). Community literacy about tsunamis in three villages (Hutumuri, Hative Kecil and Galala) - Ambon Island. *European Journal of Molecular and Clinical Medicine*, 7(1), 3684–3700. https://ejmcm.com/article_4182.html
- Sarkhel, J. K. (2016). Strategies of indigenous knowledge management in libraries. *Qualitative and Quantitative Methods in Libraries (QQML)*, 5(2), 427–439. <http://www.qqml.net/index.php/qqml/article/view/329>
- Shabbir, W., Omer, T., & Pilz, J. (2023). The impact of environmental change on landslides, fatal landslides, and their triggers in Pakistan (2003–2019). *Environmental Science and Pollution Research*, 30(12), 33819–33832. <https://doi.org/10.1007/s11356-022-24291-z>
- Suneth, M. N., Pattiselano, A. E., & Adam, F. P. (2016). Strategi adaptasi ekologi (studi kasus bencana alam Way Ela di Desa Negeri Lima Kecamatan Leihitu Kabupaten

- Maluku Tengah). *Jurnal Agrilan*, 4(2), 26–40. https://ejournal.unpatti.ac.id/ppr_paperinfo_lnk.php?id=1697
- Wati, A. A., & Rahmi. (2021). LAM (Libraries, Archives, Museums) dalam preservasi pengetahuan. *Berkala Ilmu Perpustakaan dan Informasi*, 17(2), 181–194. <https://doi.org/https://doi.org/10.22146/bip.v17i1.1722>
- Widuri, N. R., Sulaksana, N., Zakaria, Z., Rachmawati, R., Tupan, & Yoganingrum, A. (2022). Bibliometric approach for innovations analysis on disaster risk reduction. *Berkala Ilmu Perpustakaan dan Informasi*, 18(1), 16–30. <https://doi.org/https://doi.org/10.22146/bip.v18i1.2431>
- Wisyanto, & Naryanto, H. S. (2022). Analisis longsor dan pembentukkan dam alam Way Ela, Negeri Lima, Leihitu, Maluku Tengah. *Jurnal Sains dan Teknologi Mitigasi Bencana*, 16(2), 30–39. <https://doi.org/https://doi.org/10.29122/jstmb.v16i2.5391>
- Yakti, B. P., Adityawan, M. B., Farid, M., Suryadi, Y., Nugroho, J., & Hadihardaja, I. K. (2018). 2D modeling of flood propagation due to the failure of Way Ela natural dam. *MATEC Web of Conferences*, 147, 1–5. <https://doi.org/10.1051/mateconf/201814703009>
- Yunita, F. ., & Puspitosari, D. . (2014). Risk management in dam break disaster: Lessons learned from Way Ela natural dam break. *Jurnal Sosek Pekerjaan Umum*, 6(3), 140–221.

TABLE LIST

Table 1. Demographic data of the informants

Nmbr	Initial	Gender	Status	Occupation	Role Description
1	WT-01	Female	A Resident of Negeri Lima	Housewife	Witnesses of natural signs (felt earthquakes and saw the strange behavior of animals, dark clouds, heavy rain, and flash flood)
2	MK-02	Female	A Resident of Negeri Lima	Housewife	Saw natural signs of disaster (howling wind from the mountain, river water suddenly dried up, flash flood)
3	SA-03	Female	A Resident of Negeri Lima	Housewife	Witnesses of natural signs (saw the forest animals enter the village, animals ran to the mountains, the river suddenly dried up, flood as high as a coconut tree, also felt cooler air and strong wind)
4	SM-04	Female	A Resident of Negeri Lima	Housewife	Saw natural signs of disaster (did not see cats around village and flood)
5	SP-05	Male	A Resident of Negeri Lima	Village head (now former)	Checked the dam, observed the cracks in the ground around it, and witnessed the dam explode and flood as high as a coconut tree
6	IS-06	Male	A Resident of Negeri Lima	Village secretary	Checked the dam, observed the cracks in the ground around it, and witnessed the dam breaking and flood
7	WD-07	Male	Non-Resident of Negeri Lima	Student (as volunteer)	Checked the dam, observed the cracks in the ground around it, and witnessed heavy rain and flash flood
8	JS-08	Male	Non-Resident of Negeri Lima	Government employee at the <i>Balai Wilayah Sungai Maluku</i> (river territory office of Maluku)	Acknowledged the natural signs before the mountain collapsed and the dam broke down that were started with earthquakes. The dam that broke down sounded like an explosion.

Source: Interview results, 2022

Table 2. Natural Signs of the Formation and the Breakdown of Dam

Signs of Nature of the formation of the dam	Signs of nature before the dam broke
Earthquake	Earthquake
Howling wind	Dark clouds
Landslide	Heavy rain
The river suddenly dried up	Cracked ground
Strange behavior of the animals	Strange behavior of the animals
-	Colder air
-	Strong wind

Source: Interview results, 2022

Table 3. Phenomena when the dam broke

Phenomena when the dam broke
Explosive sound
Flood
Water as high as a coconut tree

Source: Interview results, 2022