Open Global Scientific Journal 02 (02): 94-102 2023

Contents lists available at openscie.com

Open Global Scientific Journal

Journal homepage: http://ogsj.openscie.com/journal

Analysis of rural environmental quality in Glagah Subdistrict, Lamongan Regency, East Java

Eko Sutrisno[1]*, Mulono Apriyanto[2], Sri Ndaru Arthawati[3], Apriningsih Apriningsih[4], Lilla Puji Lestari[5]

[1] Faculty of Engineering, Majapahit Islamic University, Indonesia
[2] Faculty of Agriculture, Indragiri Islamic University, Indonesia
[3] Faculty of Economics and Business, Sultan Ageng Tirtayasa University, Indonesia
[4] Faculty of Health Sciences, Universitas Pembangunan Nasional Veteran Jakarta, Indonesia
[5] Faculty of Health Sciences, Maarif Hasyim Latif University, Indonesia

*Correspondence: E-mail: ekosudrun@yahoo.com

ARTICLE INFO

Article History:
Received 21 September 2023
Revised 27 December 2023
Accepted 29 December 2023
Published 31 December 2023

Keywords:
Environmental quality,
Environmental pollution,
Disaster mitigation,
Glagah Subdistrict.

ABSTRACT

There are several types of environmental pollution in rural areas in Glagah Subdistrict, Lamongan Regency, such as water, soil, and air pollution. Air pollution occurs because the Glagah Subdistrict is crossed by the inter-regency axis road, which is travelled by many vehicles. Meanwhile, water and soil pollution in this area occur due to fish farming and ponds. In addition, Glagah Subdistrict in Lamongan Regency is considered a flood-prone area due to high rainfall that causes the overflow of Bengawan Solo River. This study aims to determine the quality of the rural environment in Glagah Subdistrict. This study used survey and questionnaire methods. Data were analyzed quantitatively using statistical calculations and frequency tables supported by descriptive analysis. The research parameters observed were environmental quality, disaster-prone potential, and the existence of disaster response by the local village government. The results of this study show that villages in Glagah Subdistrict do not experience air or soil pollution, as they are located far from industrial areas. Instead, water pollution occurs every year, characterized by the proliferation of water hyacinth that covers the surface of the rivers, thus inhibiting the flow of river water. Potential disasters in Glagah Subdistrict are flooding and tornado. Flooding occurs in seven villages located near Bengawan Jero (a tributary of Bengawan Solo) and can be categorized as annual flooding. Villages that are annually affected by flooding do not have disaster mitigation plans, even though funds for such activities are available. Therefore, cross-sectoral cooperation is needed to overcome the annual flooding in Glagah Subdistrict.

1. Introduction

Human in all their activities will always intersect with the environment (Mustar *et al.*, 2020). In interacting with the environment, they will often dispose various kinds of material or substance that are no longer needed. The disposed materials eventually become garbage and waste (Suhel *et al.*, 2019; Sitorus *et al.*, 2021). The presence of waste will indirectly reduce the environmental quality in an area. Poor environmental quality will indirectly affect human lives, especially in terms of welfare and health, as these two elements affect each other. For example, a person who lives in an environment that is susceptible to natural disasters or pollution will often experience discomfort and anxiety, which adversely affects their health and well-being (Streimikiene, 2015). Knowledge of the elements of environmental quality in the village area will greatly assist the government in determining a policy related to environmental health and spatial planning (Stossel *et al.*, 2015; Nemati *et al.*, 2019).

Environmental problems that occur in village areas are very diverse, including water and soil pollution, and conversion of agricultural/fishery land into housing. Data from Central Bureau of Statistics (2021) stated that 10,683 villages in Indonesia experience pollution, of which 1,152 villages are located in East Java. The sources of water pollution are the household waste, factory waste, and other sources. In addition, a total of 1,499 villages/hamlets are affected by soil pollution and 5,644 villages/hamlets are affected by air pollution, while the rest (around 69,966 villages/hamlets) are not affected by pollution, either air, water, or soil pollution. Poor drainage systems and improper waste management can cause a decline in environmental quality and lead to a number of diseases that disrupt the health of local residents (Oktiawan & Amalia, 2012).

Geographically, Glagah Subdistrict is located in the eastern part of Lamongan Regency, East Java. The northern part of Glagah Subdistrict is bordered by Karangbinangun Subdistrict, the eastern part is bordered by Manyar Subdistrict (Gresik Regency), the southern part is bordered by Deket Subdistrict, and the western part is bordered by Deket Subdistrict and Karangbinangun Subdistrict (Central Bureau of Statistics, 2022). In general, Glagah Subdistrict has a relatively flat topography with an altitude of ±5 meters above sea level. It is also known as a fertile area and has the potential for the development of agriculture and aquaculture ponds (Utojo et al., 2012). However, like the majority of areas in Indonesia, villages in Glagah Subdistrict also face various environmental problems, such as water pollution. This is especially apparent during the rainy season, which is mainly characterized by the covering of the surface of the rivers in this area by water hyacinth plants. The environmental quality in villages in Glagah Subdistrict is indirectly related to the participation of villagers in maintaining and caring for their living environment (Ronizi, 2022). Fortunately, Glagah Subdistrict is not crossed by the ring of fire or continental plates so that the potential for earthquakes and tsunami in this area is very small. Nonetheless, natural disasters that often occur in Glagah Subdistrict are flooding and tornado.

The government has launched a disaster-prepared village program, where several efforts have been made by the village government, including disaster mitigation training for the community, religious leaders, and students (Muthmainnah et al., 2020; Buchari, 2020; Sukamto et al., 2021; Hilman et al., 2021). Besides, the Ministry of Villages of the Republic of Indonesia also launched a program known as Sustainable Development Goals, in which one essential point stipulated is disaster mitigation and awareness of the impacts caused by climate change. The budget for these activities can be deduced from the village funds that are channelled annually to each village. In addition to social and economic factors, environmental factors also determine whether a village is categorized as independent, developed, developing, or underdeveloped area (The Ministry of Villages, 2015). Good development in any given area should always maintain a balance between environmental functions and the welfare of local residents (Hall & Pfeiffer, 2000; Jazuli, 2015). The need for housing in an area increases as the

population increases so that if there is inappropriate spatial planning in the respective area, the environmental balance will be disturbed (Amane et al., 2023).

From that background, it is necessary to analyze the environmental quality index in villages in Glagah Subdistrict, which includes observations on water, soil, and air pollution. With many areas in Indonesia experiencing natural disasters, it is necessary to examine the extent of readiness of the village government and village communities to face natural disasters in the area where they live. The results of this study can be used as a source of information for village governments in preparing disaster response villages to prevent and mitigate environmental pollution in the village area.

2. Methods

This study was conducted in 29 villages in Glagah Subdistrict, Lamongan Regency. The research parameters observed were i) environmental quality, which includes water, air, and soil pollution, ii) disaster-prone potential, which is the potential for the occurrence of natural disasters, such as flooding, landslides, and tornadoes, and iii) disaster response, namely the efforts or actions of the village government and related parties to prevent or anticipate several potential natural disasters. The methods used in this study were field surveys and interviews with several village officials. Field data and interview results that had been obtained were analyzed descriptively using statistical tests as basic information to determine the distribution of data so that it can be used to generate conclusions regarding the environmental quality in the research location (Alaslan et al., 2023). Then, the data were analyzed quantitatively using frequency tables.

3. Results and discussion

This study was conducted in Glagah Subdistrict, Lamongan, which consists of 29 villages. The names of the villages, their area, and population are presented in Table 1.

Table 1. Profile of villages in Glagah Subdistrict

No.	Vilage's Name	Area (km^2)	Population (people)
1.	Kentong	1.83	1,971
2.	Wangen	2.13	1,400
3.	Bangkok	1.64	677
4.	Meluntur	1.67	474
5.	Dukuhtunggal	3.63	2,460
6.	Bapuhbandung	1.65	1,563
7.	Tanggungprigel	2.03	1,324
8.	Sudangan	1.43	1,304
9.	Karangagung	1.27	1,066
10.	Duduklor	1.57	1,564
11.	Medang	1.47	1,067
12.	Mendogo	1.44	1,362
13.	Began	0.73	596
14.	Menganti	2.36	1,766
15.	Rayunggumuk	1.93	1,962
16.	Gempol Pendowo	1.11	1,180
17.	Soko	2.11	1,788
18.	Morocalan	1.08	1,086
19.	Pasi	1.86	1,855
20.	Margoanyar	1.97	2,304
21.	Glagah	2.14	2,600
22.	Bapuhbaru	1.70	1,127
23.	Jatirenggo	2.23	2,007
24.	Konang	0.85	596

25.	Wonorejo	1.21	1,287
26.	Panggang	1.52	1,121
27.	Wedoro	1.10	1,036
28.	Karangturi	1.83	1,711
29.	Meluwur	1.48	1,218

Source: Central Bureau of Statistics of Lamongan Regency (2022)

Table 1 shows that Dukuhtunggal Village has the largest area (3.63 km^2), while Began Village has the smallest area (0.73 km^2). The highest population is in Glagah Village, with 2,600 people, while Meluntur Village has the smallest population, namely 474 people.

3.1 Environmental quality

Environmental quality in an area can vary depending on various factors, such as geographical location, natural resource management, and the level of public awareness of the importance of protecting the environment. The primary factor that can affect environmental quality in the village is the awareness of the community to manage their waste, because the majority of waste generated in the village typically comes from household activities. The management of natural resources, such as water and soil can help maintain the survival of flora and fauna in the village. Natural resources management can be implemented by managing groundwater and reducing the use of hazardous chemicals in agriculture practices. Monitoring of environmental quality in villages in Glagah Subdistrict involves several measurement parameters, namely the availability of water sources and the presence or absence of water, soil, and air pollution. In Glagah Subdistrict, there are many rivers that function for irrigation to support fish farming and ponds. Therefore, it is necessary to know whether or not there is an impact of environmental pollution on rivers affected by waste disposal and the existence of village spatial planning related to the change of land use from the agricultural sector to the non-agricultural sector.

Table 2. Environmental parameters in vilages in Glagah Subdistrict

No.	Environmental condition	Exist	Does not exist
1.	Availability of clean water sources	29	0
2.	Water pollution	3	26
3.	Soil pollution	0	29
4.	Air pollution	0	29
5.	Impact of environmental pollution	7	22
6.	Rivers affected by sewage discharges	0	29
7.	Village spatial planning	0	29
8.	Land conversion from agricultural to non-agricultural sectors	21	8

The availability of water resources in an area can be influenced by various factors, such as rainfall, topographic conditions, and the quality of water resources management. If the availability of water sources is not managed properly, this will have an adverse impact on the health of the local community as well as the agricultural and industrial sectors. The villages in Glagah Subdistrict obtain their clean water from ground wells, by utilizing the availability of river water and rainwater (Sutrisno, et al., 2023a; Sutrisno, et al., 2023b). Several villages already receive clean water through a government program known as PAMSIMAS (Community-based Water Supply and Sanitation). Of the 29 villages in Glagah Subdistrict, 21 have been shown to experience frequent clean water shortages during the dry season. To meet their bathing and washing needs, the residents in these villages procure water from

mobile vendors who sell carts of 10 jerry cans with a volume of 30 liters, at a price per jerry can of IDR 30,000.00. For cooking and drinking needs, they use refillable gallon water at a price per gallon of IDR 5,500.00

Several other efforts to obtain clean water have been made, such as by making boreholes, but this was proved unsuccessful because the water that comes out tends to be salty so that it cannot be utilized. Water pollution can be caused by various factors, such as industrial waste, household waste, and fisheries and agricultural activities. In 2022, rivers in three villages experienced pollution, but it was not classified as severe pollution. The river pollution was caused by waste disposal that contains many medicinal chemicals. Water pollution that is not handled properly can cause damage to the water ecosystem and the spread of various diseases, thus disrupting the health of the local community.

The environmental pollution that occurred in seven villages in Glagah Subdistrict in 2022 had an adverse impact on villagers, namely the onset of itchy skin symptoms on the feet and hands. There are no industrial estates or medium-sized SMEs in Glagah Subdistrict so that there is generally no industrial waste discharged into the river, except for several local residents who throw their garbage into the river when they go to work. This kind of behavior has actually been warned by the respective village government in every activity involving the villagers, whether at meetings held at the village hall, mosque, or during community meetings in each village.

On the other hand, almost all villages in Glagah Subdistrict do not have village spatial planning. At the initial of their tenure, the village government create document that present their planned activities in general for the next six years. This document is known as a Village Medium-Term Development Plan (*RPJMDes*). The *RPJMDes* itself is derived from community proposals at the village-level consultative meetings. However, this document almost never regulates village spatial planning at all. When a young villager is married and has children, they will live separately from their parents by living or building their own house. As a result, agricultural land/ponds in the village will be converted into residential areas. In 2022, many agricultural and aquaculture lands in 21 villages in Glagah Subdistrict were converted into residential areas.

3.2 Disaster-prone potential

A natural disaster is a natural event that can cause damage and unfavorable effects to the environment and human life. For this reason, natural disaster mitigation is highly necessary to minimize the magnitude of potential losses that may occur (Sigit, 2018).

Table 3. Natural disasters that often occur in Glagah Subdistrict area

No.	Potential disaster	Frequency (%)
1.	Flooding	100
2.	Whirlwind/tornado	17.3
3.	Drought	20.7

Figure 1. Drought condition in Glagah Subdistrict.

Of the various types of natural disasters that often occur worldwide, especially Indonesia, the Glagah Subdistrict is considered a safe area from a number of natural disasters. Nevertheless, flooding occurs almost every year in this region. It occurs due to high rainfall, which causes Bengawan Solo and Bengawan Njero streams to overflow the surrounding area (Lusiana, 2021). In addition, Glagah Subdistrict is one of the flood-prone areas in Lamongan Regency due to land slope and land use factors. The land slope in this area ranges from 0–8% and 59.3% of the total area, especially in the downstream area of Bengawan Solo, is used as rice fields and ponds (Hasan, 2015).

In the event of flooding, the fisheries sector loses the most because flooding can cause pond bunds to sink, thus causing fish to disappear from the ponds. In order to overcome this situation, local residents make *waring* (nets) around the ponds so that the fish are not swept away by the flood (Agustin, 2014; Huda, 2016; Nurfianah, 2017). Besides, flooding also hampered community mobilization, and schools had to be closed because the classrooms were submerged in water, especially in seven villages, namely Soko, Pasi, Morocalan, Gempol Pendowo, Margoanyar, Rayunggumuk, and Jatirenggo.

A natural event that also poses a high risk to residents of villages in Glagah Subdistrict is tornado. Of the 29 villages, Soko, Morocalan, Rayunggumuk, Pasi, Gempolpendowo, and Margoanyar have been most frequently affected by tornadoes. In addition, drought often occurs in 14 villages (figure 1). For bathing/washing/toilets (*MCK*) activities, the villagers obtain water by utilizing geomembrane reservoir technology (Agustapraja & Alifuddin, 2020; Alifuddin & Hartantyo, 2018). Several villagers also utilize rainwater by collecting it in tanks (also known as rainwater harvesting system) (Sutrisno et al., 2016; Tamelan et al., 2020). Residents of Wangen Village drilled into the river using a 2.5 cm diameter pipe. During the rainy season, water is allowed to enter. As the dry season approaches, the water pipe is inserted and sealed, after which water is collected using a water pump machine.

3.3 Disaster response

Disaster mitigation is a series of efforts to reduce disaster risk, both through physical development as well as awareness development aiming to improve of the community's ability to face the threat of disaster (Law No. 24/2007). The Law No. 24/2007 on Disaster Management stipulated many aspects pertaining to disaster mitigation. The simplest form of disaster mitigation is the creation of evacuation routes. In villages in Glagah subdistrict, there are no evacuation routes. According to the village government and local community leaders, the Glagah Subdistrict area does not have any tall building, nor had it experienced any earthquakes, hence they assume that evacuation routes are not necessary. However, there are several evacuation routes in a number of office buildings, such as subdistrict

offices, community health centers, *koramil* (military headquarter in subdistrict level), police stations, and several educational institutions.

The majority of villages in Glagah Subdistrict (around 72.4%) do not have a guardhouse so that the *kentongan* is no longer found there. Funds for disaster mitigation activities are available and contained in the Village Budget (*APBDesa*) in villages in Glagah Subdistrict, but the funds are not used for this purpose because budget changes are made in advance through *APBDesa* deliberations in the current year (Amane et al., 2023; Marit et al., 2021). Instead, the funds were diverted to finance the physical developments, such as retaining walls and the improvements of farming roads (figure 2).

Figure 2. Support from stakeholder/goverment.

4. Conclusions

The environmental quality in the villages in Glagah Subdistrict is still very good because there is not much pollution in the water, soil, and air. The most dominant water pollution in this area occurs during the rainy season, when the entire surface of many rivers is covered by water hyacinth plants. As a natural disaster that occurs every year, flooding is caused by the overflow from Bengawan Solo River due to high rainfall. During the dry season, drought occurs, making it difficult for the villagers to obtain clean water. Nonetheless, their anticipation in the event of disaster is considered quite good. Although the majority of the villages are not equipped with disaster mitigation tools, the villagers currently rely on communication through WhatApp social media rather than using *kentongan* or other traditional disaster mitigation tools. Allthough each village has funds for supporting disaster mitigation, the funds are never used for this purpose because they are diverted to finance the physical development.

7. References

Agustapraja, H. R., & Alifuddin, M. (2020). Penampungan air bersih pada musim kemarau dengan pemanfaatan embung geomembran (Studi kasus: Desa Tanggung Prigel, Glagah, Lamongan). *Wahana Teknik Sipil: Jurnal Pengembangan Teknik Sipil*, *25*(1), 55–65.

Agustin, W. D. W. I. (2014). *Pola adaptasi petani tambak dalam pengurangan risiko bencana banjir musiman di Desa Pomahanjanggan, Lamongan*. Skripsi. Prodi Sosiologi Fakultas Ilmu Sosial dan Ilmu Politik, Universitas Jember. https://repository.unej.ac.id/handle/123456789/61539

Alaslan, A., Amane, A. P. O., Suharti, B., Laxmi, Rustandi, N., Sutrisno, E., Rustandi, Rahmi, S., &

Darmadi, R. (2023). *Metode penelitian kualitatif*. Rumah Cemerlang Indonesia Association.
Alifuddin, M., & Hartantyo, S. D. (2018). Penggunaan embung geomembran sebagai penampungan air bersih di Desa Tanggung Prigel. *Civilla: Jurnal Teknik Sipil Universitas Islam Lamongan*, *3*(1), 108–115.
Amane, A. P. O., Hutajulu, H., Rahmawati, A., Rusdiyana, E., Utama, J. Y., Sutrisno, E., Sekarsari, R. W., Andari, S., Afandi, A. H., Santosa, & Lailin, M. I. A. H. (2023). *Pembangunan desa*. Rumah Cemerlang Indonesia Association.
Buchari, R. A. (2020). Manajemen mitigasi bencana dengan kelembagaan masyarakat di daerah rawan bencana Kabupaten Garut Indonesia. *Sawala: Jurnal Pengabdian Masyarakat Pembangunan Sosial, Desa, dan Masyarakat*, *1*(1), 1–7.
Central Bureau of Statistics. (2021). *Statistics of villages potential in Indonesia 2021*. Central Bureau of Statistics of the Republic of Indonesia.
Central Bureau of Statistics. (2022). *Glagah Subdistrict in number: 2022*. Central Bureau of Statistics of Lamongan Regency.
Hall, P., & Pfeiffer, U. (2000). *Urban future 21: A global agenda for 21st century cities* (1st ed.). Routledge. https://doi.org/https://doi.org/10.4324/9781315011523
Hasan, M. F. (2015). Analisis tingkat kerawanan banjir di Bengawan Jero, Kabupaten Lamongan. *Swara Bhumi*, *3*(3), 239-247
Hilman, Y. A., Khoirurrosyidin, K., & Nasution, R. D. (2021). Peningkatan kapasitas kelembagaan desa tanggap bencana. *Jurnal Abdimas Bina Bangsa*, *2*(1), 204–210.
Huda, I. A. S. (2016). *Bentuk-bentuk adaptasi masyarakat dalam menghadapi bencana banjir (Studi Kasus di Desa Pelangwot, Kecamatan Laren, Lamongan)*. Prosiding Seminar Nasional Geografi UMS 2016: Upaya Pengurangan Risiko Bencana Terkait Perubahan Iklim, pp. 299–314 https://publikasiilmiah.ums.ac.id/xmlui/handle/11617/8569
Jazuli, A. (2015). Dinamika hukum lingkungan hidup dan sumber daya alam dalam rangka pembangunan berkelanjutan. *Jurnal Rechts Vinding: Media Pembinaan Hukum Nasional*, *4*(2), 181–197.
Law Number 24 of 2007 on Disaster Mitigation. Jakarta. Enacted on April 26, 2007.
Lusiana, N. U. R. A. (2021). *Mitigasi bencana sebagai upaya pengurangan dampak bencana banjir di Kabupaten Lamongan*. Jurusan Administrasi Publik. Fakultas Ilmu Sosial dan Politik. UPN Veteran Jatim. http://repository.upnjatim.ac.id/id/eprint/3935
Marit, E. L., Revida, E., Zaman, N., Nurjaya, M., Werimon, S., Rahmadana, M. F., Silalahi, M., Purba, B., Sutrisno, E., & Pardede, A. F. (2021). *Pengantar otonomi daerah dan desa*. Kita Menulis Foundation.
Mustar, M., Purba, D. W., Supriadi, M. N., Kusumadewi, Y., Sutrisno, E., Juliana, J., Bahri, S., Saputro, A. N. C., Silalahi, M., & Tamrin, A. F. (2020). *Ilmu sosial budaya dasar*. Kita Menulis Foundation.
Muthmainnah, M., Hermawan, T., Suryanto, S., Suharyanto, I., Mughits, A., & Muhaini, A. (2020). Penguatan peran takmir masjid dalam tanggap bencana gempa bumi di Desa Bangunharjo. *Nuansa Akademik: Jurnal Pembangunan Masyarakat*, *5*(2), 63–74.
Nemati, R., Fatahi, A., Poortaheri, M., & Ahmadi, A. (2019). Evaluating the components of environmental quality of health in rural areas (Case Study: Lorestan Province, Iran). *Sustainable Rural Development*, *3*(1), 63–74. https://doi.org/10.32598/JSRD.02.02.50
Nurfianah, N. (2017). Strategi adaptasi masyarakat petani pemilik lahan di Desa Bojoasri, Kecamatan Kalitengah, Kabupaten Lamongan dalam menghadapi banjir. *Paradigma*, 5 (3), 1–7.
Oktiawan, W., & Amalia, S. (2012). Pengaruh kondisi sistem drainase, persampahan, dan air limbah terhadap kualitas lingkungan (Studi kasus Kelurahan Kuningan, Kecamatan Semarang Utara). *Jurnal Presipitasi: Media Komunikasi dan Pengembangan Teknik Lingkungan*, *9*(1), 41-

50.
Ronizi, S. R. A. (2022). Measurement and prioritization of rural area based on environmental quality indicators (Case Study: Hematabad District). *Regional Planning*, *12*(45), 139–156. https://doi.org/10.30495/jzpm.2021.27942.3888
Sigit, A. (2018). *Buku pintar mengenal bencana alam*. Deepublish Publisher.
Sitorus, E., Sutrisno, E., Armus, R., Gurning, K., Fatma, F., Parinduri, L., Chaerul, M., Marzuki, I., & Priastomo, Y. (2021). *Proses pengolahan limbah*. Kita Menulis Foundation.
Stossel, Z., Kissinger, M., & Meir, A. (2015). Assessing the state of environmental quality in cities – A multi-component urban performance (EMCUP) index. *Environmental Pollution*, *206*, 679–687. https://doi.org/10.1016/J.ENVPOL.2015.07.036
Streimikiene, D. (2015). Environmental indicators for the assessment of quality of life. *Intellectual Economics*, *9*(1), 67–79. https://doi.org/10.1016/J.INTELE.2015.10.001
Suhel, H, N., Wibawanto, A. E., & Hidayat, R. (2019). Analisis kualitas lingkungan pemukiman menggunakan metode skoring dan teknologi sistem informasi geografi (Studi kasus: Kelurahan Kelayan Dalam). *Jurnal INTEKNA : Informasi Teknik dan Niaga*, *19*(2), 78–84. https://doi.org/10.31961/intekna.v19i2.795
Sukamto, F. I., Nurhidayat, S., & Verawati, M. (2021). Pelatihan siswa tanggap bencana sebagai upaya mitigasi bencana di Ponorogo. *Amalee: Indonesian Journal of Community Research and Engagement*, *2*(1), 15–22.
Sutrisno, E., Siregar, Y. I., & Nofrizal, N. (2016). Pengembangan sistem pemanenan air hujan untuk penyediaan air bersih di Selatpanjang, Riau. *Dinamika Lingkungan Indonesia*, *3*(1), 1–8.
Sutrisno, E., Nirtha, R. I., Hutagalung W. L. C., Iswahyudi, Sudarmin, Purwandito M., Hasibuan H. S., Mutia E., Lydia E. N., Masthura L., & Jafar M. I. (2023a). *Air hujan, sumber air bersih: Konsep, teknik, dan manfaat panen air hujan*. Kita Menulis Foundation.
Sutrisno E., Asmorowati E. T., Rahmawati A., Sakati S. N., Winaktu G., Kurniawan A. A., Khaerudin D. N., Rusdiyana E., & Permanasari P. (2023b). *Sistem panen air hujan*. Rumah Cemerlang Indonesia Association.
Tamelan, P. G., Kapa, M. M. J., & Harijono, H. (2020). Upaya panen air hujan untuk mengatasi kekurangan air berbasis teknologi konservasi sumberdaya air di Kabupaten Rote Ndao. *Jurnal Teknologi*, *14*(2), 8–15.
The Ministry of Villages. (2015). *Rural development index*. South Jakarta: The Ministry of Villages, Development of Disadvantaged Regions, and Transmigration of the Republic of Indonesia.
Utojo, U., Pirzan, A. M., & Mustafa, A. (2012). Kesesuaian lahan budidaya tambak berkelanjutan di Kabupaten Lamongan, Jawa Timur dengan pertimbangan karakteristik dan pengelolaan lahan. *Prosiding Forum Inovasi Teknologi Akuakultur*, pp. 939–952.