ABDIMAS: Jurnal Pengabdian Masyarakat Universitas Merdeka Malang
Vol.7(3) August 2022, 441-450
p-ISSN: 2721-138X e-ISSN: 2548-7159
http://jurnal.unmer.ac.id/index.php/jpkm

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The biopore's movement as flood prevention in Sungai Nangka Village, Balikpapan

Gerakan biopori sebagai pencegah banjir di Kelurahan Sungai Nangka, Kota Balikpapan

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ARTICLE INFO:

Received: 2022-01-30
Revised: 2022-02-13
Accepted: 2022-03-25

Keywords:
Biopore infiltration holes, Community service program, Flooding

ABSTRACT

Flooding can be defined as the submergence of a place because a high overflow of water exceeds the water capacity of an area. In Balikpapan, many areas are still inundated during heavy rains. Especially in Pondok Karya Agung Housing RT.18 Sungai Nangka Village, flooding is a major problem that occurs in the area. This community service program aims to increase community knowledge about flood prevention at Pondok Karya Agung Housing RT.18 Sungai Nangka Village. Methods of implementation in these services socialized and practiced planting biopore infiltration holes. The implementation phase includes preparation, implementation, and evaluation of increasing participants' understanding of making biopore infiltration holes. This community service program was attended by 25 participants. There are 24 points for biopore locations. These activities will be held for two days. The results show that understanding and interest in implementing increased after the socialization and practice of installing biopore infiltration holes.

How to cite: Harfadli, M. M., Wicaksono D. A., & Mahdy, R. Z. (2022). The biopore's movement as flood prevention in Sungai Nangka Village, Balikpapan. *Abdimas: Jurnal Pengabdian Masyarakat Universitas Merdeka Malang, 7*(3), 441-450. https://doi.org/10.26905/abdimas.v7i3.7636

1. INTRODUCTION

Indonesia is one of the countries that has a wet tropical climate with high rainfall and part of its land is surrounded by vast oceans. Based on information from the Meteorology, Climatology and Geophysics Agency, the period from September to March is the peak of the rainy season in almost all parts of Indonesia, which is marked by high rainfall so that the level of vigilance increases to face this period. The high intensity of rainfall will result in one of the natural phenomena commonly referred to as flooding. Flooding is the inundation of an area due to the overflow of water that exceeds capacity so that it can harm the affected community (Rahayu et al., 2009). Rainfall that increases significantly and dynamically generally occurs due to an increase in global warming such as the increase in temperature

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on the earth's surface due to the many activities that produce greenhouse gases (Rachmat & Pamungkas, 2014).

According to Rahardjo (2014), there are seven factors that cause flooding in urban areas, which are unsustainable development, lack of a clean lifestyle in the community, a drainage system that is not planned and managed properly, lack of firmness from the local government in terms of land allocation according to the RTRW, lack of effort, water conservation, lowering of ground water level due to excessive groundwater extraction, very high rainfall. Harfadli & Ulimaz (2021) stated that flood vulnerability in Balikpapan can be seen from land cover, slope, soil type and high rainfall. Additionally, Ariyaningsih et al. (2022) also stated the main driving factors for flood vulnerability in Balikpapan City are increasing population growth due to urbanization, increasing demand for land, high rainfall, and climate change due to human activities.

Flooding is an environmental problem that has not been handled properly in Balikpapan City. One of the flood-prone points in Balikpapan City is located at Pondok Karya Agung Housing RT.18 Sungai Nangka Village. Areas that are developing slowly will experience changes in activities, facilities and infrastructure, as well as the function of the shape or appearance of the city. Changes in activity experienced in Sungai Nangka Village until 2021 are the increase in residential areas with sufficient density. The increase in residential activities will increase the number of building constructions so that it has the potential to create negative impacts such as flooding. To reduce these negative impacts, preventive measures can be taken, such as socialization and training on planting biopore infiltration holes. Besides to absorb standing water, another function of the biopore infiltration hole is to provide ground water supply and as a composter for organic waste such as dry leaves. After 2 – 3 months, the community can also use the compost as organic fertilizer (Sanitya & Burhanudin, 2013; Santosa et al., 2018).

Biopore infiltration hole is a cylindrical hole that is installed perpendicularly into the ground with a hole diameter range of 10 – 30 cm and a pipe length of about 100 cm or if the soil conditions are shallow, the length of the pipe should not exceed the depth of water table (Halaudin et al., 2016). According to the Regulation of the Minister of Forestry Number: P.70/Menhut-II/2008 concerning Technical Guidelines for Forest and Land Rehabilitation, biopore infiltration holes are formed in the soil due to the activities of various organisms. The holes will be filled with air and become a medium for water to flow in the soil. In general, the biopore infiltration holes is filled with organic waste so that microorganisms can live in it. Microorganisms such as earthworms are then tasked with making pores or tunnels in the soil (Halaudin et al., 2016).

The shape of the biopore resembles a small, branching tunnel. The tunnel directs water and air to the ground very effectively. Composting organic waste in biopore infiltration holes encourages fauna such as worms, termites and other soil insects to be present. The presence of soil organisms in biopore infiltration holes can accelerate the process of decomposition of organic waste into organic fertilizer (compost). (Santosa et al., 2018).

Based on the results of research conducted by Khoirunisa et al. (2015), the effect of biopore infiltration holes on the rate of infiltration has a significant effect. The results of the comparison of the soil infiltration rate test in biopore with non-biopore showed that the biopore treatment was able to increase the infiltration rate. The increased infiltration rate not only results in an increase in the amount of groundwater for plant growth, but is also able to reduce the potential for inundation and erosion of the soil surface by run off (Victorianto & Qomariyah, 2014; Halaudin et al., 2016). The infiltration rate will be directly proportional to the number of soil pores. The greater the number of soil pores, the greater the infiltration rate.

The application of biopore infiltration holes is basically very easy, so it can be carried out and developed by all circles of society. Biopore infiltration holes are a simple and effective method to increase soil absorption. Biopore is also a solution for water conservation in the dry season. In addition, due to the activity of microorganisms in the soil, biopores are also able to maintain land or soil fertility (Setyaningsih & Endriastuti, 2018; Arifin et al., 2020; Nurhayati et al., 2021; Sine & Kolo, 2021).

The purpose of this community service is to provide knowledge to the community about the benefits of biopore infiltration holes through socialization and direct practice of making it. In addition, it can also be a means of socializing between ITK Environmental Engineering students and the community.

2. METHODS

Problem Assessment

Assessment is done by conducting a direct survey to the location of the service to see conditions before and after the rain and coupled with conducting interviews with residents in RT.18 Pondok Karya Agung Housing. The purpose of this identification is to determine the location and number of biopore infiltration holes' points to be installed. After the identification stage, there will be a socialization and practice stage which will be carried out using the method of counseling or briefing on theories related to the making of biopore infiltration holes and direct demonstration of making biopore infiltration holes.

Socialization on Biopore Infiltration Hole

Before making biopore infiltration holes, socialization was carried out to the residents of RT.18 Sungai Nangka Village, South Balikpapan District. The socialization was carried out at the Melati Posyandu, RT.18 Pondok Karya Agung Housing. The purpose of this socialization is to provide an overview and initial information about biopore infiltration holes, their benefits in flooding prevention and giving the residents of RT.18 an initial guidance.

Making Biopore Infiltration Holes

After socializing, the next step is to prepare the tools and materials used to make the biopore infiltration hole. The making of biopore infiltration holes will be demonstrated by students and immediately practiced by the people of RT.18. The equipment used holes are crowbar, earth auger, hand drill, drill bit, hacksaw, and cement spoon. And the materials are 4-inch pipes and pipe hubcaps.

After preparing the tools and materials, the next step is to choose a location for making biopore infiltration holes to drill. The steps taken are as follows: (1) cut a 4-inch pipe using a pipe saw with a size of 70 cm – 80 cm. (2) Perforate the pipe that has been cut using a hand drill with a distance of 2-3 cm around the pipe body and the hubcap of the pipe is also perforated using a hand drill. These steps can be seen in Figure 1. (3) After the pipe has been drilled, the next step is to drill a hole for the biopore hole planting point using a soil drill with a diameter of 10 cm and a depth of 100 cm which is made vertically into the soil. The distance of each biopore infiltration hole is 50-100 cm between holes. How to perforate the point of the biopore infiltration hole can be seen in Figure 2. (4) Soil that has been perforated is inserted into the pipe which aims to prevent erosion and the mouth of the pipe is also closed with a hubcap. These steps can be seen in Figure 3. (5) Biopore infiltration holes that have been planted can be filled with organic waste (dry leaves, food scraps such as vegetables, fruit peels and the like). Figure 4 shows how to fill organic waste into the biopore infiltration hole. (6) The compost can be collected and taken to be reused as fertilizer.

Figure 1. How to make a hole in the pipe
Figure 2. How to perforate the mounting point

Figure 3. How to install biopore infiltration hole pipe into the ground
Figure 4. How to fill organic waste into biopore infiltration hole

Evaluation Plan

The results of this community service program can be seen through the delivery of material about biopore infiltration holes. As the public understanding about the importance of biopore infiltration holes increasing, the community now is able to install it. There are 24 biopore infiltration holes installed, exactly the same amount as predetermined target.

3. RESULTS AND DISCUSSION

Results

Community service were carried out on October 16 and 23, 2021 at RT.18 Pondok Karya Agung Housing, Sungai Nangka Village in the form of training and socialization. The main target for this activity is 50 residents of RT.18. However, in practice only 25 people were willing to attend the socialization and practice of making biopore infiltration holes. This is due to the fact that at the time of carrying out the activities the city of Balikpapan was still experiencing the COVID-19 pandemic.

Preparation

The initial stage in implementing the activity is surveying the location and gaining approval of local authorities to carry out activities. Then proceed with identifying the locations of flood points or

puddles when it rains in the area of RT.18 Housing Pondok Karya Agung Sungai Nangka Village. When determining this point, checking the soil condition is also carried out to determine whether or not it is easy to use a biopore drill.

Figure 5. Location survey

Figure 5 shows the conditions before and after the rain at the location of RT.18 Housing Pondok Karya Agung Sungai Nangka Village, South Balikpapan. Based on the survey results obtained 24 points that will be planted with biopore infiltration holes. Soil conditions in the RT.18 Housing Pondok Karya Agung Sungai Nangka Village, South Balikpapan is classified as a soil type with clay fraction with no rocks. Meaning that the infiltration ability is smaller but it is easier to make biopore infiltration holes.

Implementation

Organizing the necessary tools and materials is needed before starting the activities. There are 4-inch pipe with a length of 1 m with holes drilled, soil drill and organic waste such as spoiled vegetables, fruits and dried leaves.

Figure 6. Preparation of tools and materials
Figure 6. Preparation of tools and materials

Figure 6 shows the preparatory activities carried out before community service. Preparations carried out such as cutting and perforating pipes and pipe hubcaps. This community service involves students as members in its implementation. After being prepared, the tools and materials will be immediately brought to the activity location in RT.18 Pondok Karya Agung Housing, Sungai Nangka Village, South Balikpapan.

The implementation divided into two meetings. The first day of implementation took place on October 16, 2021, where on that day socialization was carried out by conveying material related to

biopore infiltration holes. Residents of RT.18 Housing Pondok Karya Agung Sungai Nangka Village were very enthusiastic in understanding the material. Before the socialization material, residents were given a paper containing a questionnaire aimed at measuring the level of initial understanding of the community towards biopores.

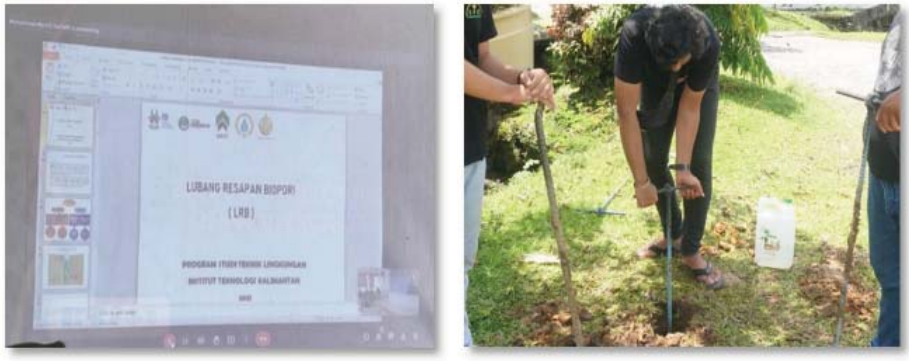

Figure 7. Documentation of the First Day of Community Service

Figure 7 shows a series of service activities on the first day starting with the delivery of remarks from the Head of the Service Team, then the delivery of remarks from the Head of the RT and the Head of the Sungai Nangka Village Head. After delivering their remarks, residents were asked to fill out a questionnaire to assess their understanding and interest in biopore infiltration holes. The next activity is the delivery of socialization materials by the Service Team. The material presented was about the meaning of biopore infiltration holes, the benefits, installation practices and how the results were, tools and materials as well as the provisions needed. Furthermore, residents are invited to biopore infiltration holes installation process.

Figure 8. Documentation of the Second Day of Community Service

Figure 8 shows the continuation of activities on the second day, October 23, 2022. On the second day of implementation, the Community Service Team succeeded in installing biopore infiltration holes in the remaining 17 points. After the installation, residents were asked to fill out a questionnaire aimed at measuring the level of understanding after the socialization and practice of making and installing the biopore infiltration holes.

Discussion

In accordance with the purpose of implementing the activity, this community service can increase the understanding and interest of residents to implement biopore infiltration holes as an effort to prevent flooding of RT.18 Pondok Karya Agung Housing, Sungai Nangka Village. This can be shown in the results of the questionnaires that have been filled out by residents.

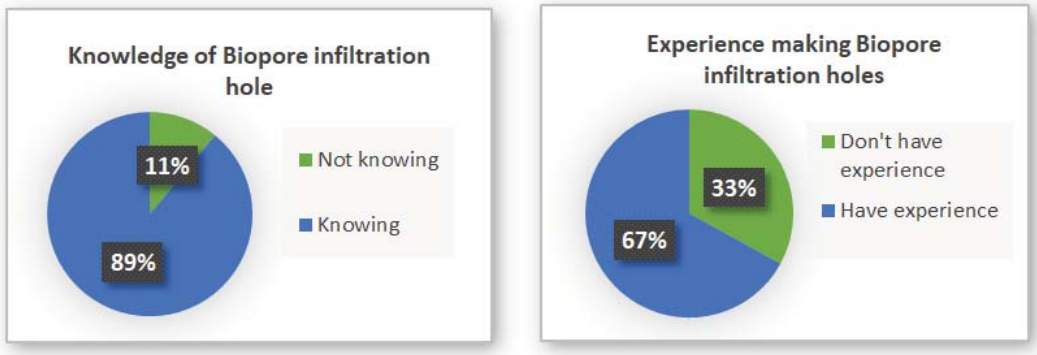

Figure 9. Pre-socialization questionnaire results

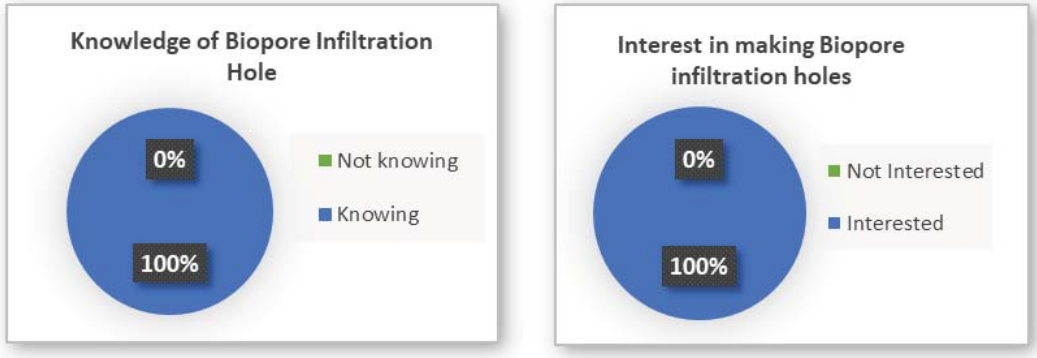

Figure 10. Post-socialization questionnaire results

Figure 9 and 10 shows the results of the pre-socialization and post-socialization questionnaires. Based on the results of the pre-socialization questionnaire, almost all residents who took part as participants did not know the benefits of biopore infiltration holes as indicated by the percentage value of knowledge and experience of residents related to biopore infiltration holes. 89% of the residents who attended answered that they had never participated in the socialization of materials related to biopore infiltration holes making, and 11% answered that they had participated in biopore infiltration holes socialization. 67% of the residents who attended had never made biopore around their homes and 33% had made biopore. While the results on the questionnaire after the socialization and planting practice showed that 100% of the residents who attended answered that their understanding of the benefits and ways of making biopore increased after participating in direct manufacturing practices, 100% of the residents who attended answered that they were very enthusiastic about making biopore around their homes. The suggestions from residents are that the socialization activities and the practice of installing this biopore infiltration holes can be carried out in other RT in Sungai Nangka Village.

Monitoring activities were carried out by interviewing one of the residents who had applied the biopore infiltration holes. After two months of planting, residents feel that the puddle of water when it rains can decrease in locations where there are biopore infiltration holes installed. So that people don't worry anymore when it rains heavily. In addition, the biopore infiltration hole also helps them in maximizing the processing of organic waste from the rest of their activities at home. However, when the monitoring was carried out, the organic waste contained in the biopore infiltration holes had not been completely decomposed so that it could not be taken to be used as compost.

Based on the results of the monitoring, the biopore infiltration holes has not worked optimally because the organic waste has not been completely decomposed. Baguna et al. (2021), stated that the biopore infiltration holes in the absorption of rainwater is said to be optimal characterized by no puddles of water around the hole and the decomposition of organic waste that is inserted into the hole, and the formation of organic fertilizer from the utilization of the organic waste.

Figure 10. Monitoring biopore infiltration holes

Figure 10 is one of the biopore infiltration holes conditions resulting from the monitoring that was carried out. It can be seen that around the biopore infiltration hole location there are no puddles of water. This shows that the holes can still work well when there is a puddle and the placements are considered quite effective. In the implementation of community service, there are several inhibiting factors that occur during the implementation of activities, namely: (1) Implementation is carried out during Covid-19 conditions, so that residents who participate do not meet the expected targets (2) Monitoring of biopore infiltration holes conditions is rarely carried out by residents, every time it rains or puddles.

4. CONCLUSION AND SUGGESTIONS

This activity is able to increase residents' understanding of the use of biopore, then residents of RT.18 Pondok Karya Agung Housing, Sungai Nangka Village, are able to make their own biopore at home. An increase in the understanding of residents can be shown by the results of a comparison of questionnaires before and after the activity. Based on this comparison, 100% of residents understand the benefits and methods of making biopore infiltration holes and this service activity is able to increase residents' interest in implementation to prevent flooding around their homes. Meanwhile, based on monitoring results, biopore infiltration holes is able to work well in reducing puddles when it rains. However, the compost has not been produced yet, because the decomposition process of organic waste in it has not been carried out optimally.

There is a need for regular monitoring by residents who install biopore infiltration holes around their homes. So that it can be known the condition of the holes and the problems that occur. There needs to be feedback from residents to develop a sustainability program. It is also necessary to add EM4 so that it can speed up the composting process in the biopore infiltration holes.

ACKNOWLEDGEMENT

The authors would like to thank LPPM Kalimantan Institute of Technology for the funding provided. In addition, the authors also thank the head of RT.18 and all residents of Pondok Karya Agung Housing, Sungai Nangka Village, who are willing to be partners and support community service activities so that they are carried out well.

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