

Outreach on Constructing Biopore Drainage Using Various Types of Bamboo to Reduce Flood Inundation in Sampang Regency

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ABSTRACT: Sampang Regency, located on Madura Island in East Java Province, is an area vulnerable to waterlogging and flooding, primarily due to low soil infiltration capacity, suboptimal drainage systems, and increasing land-use conversion. This Community Service (PKM) activity aims to enhance the knowledge and skills of residents in Sreseh District, Sampang Regency, regarding the construction of bamboo-based biopore drainage systems—an appropriate technology solution that is simple, cost-effective, and environmentally friendly. The implementation methods included structured outreach, hands-on practical demonstrations, interactive discussions, and evaluations using pre-test and post-test instruments. The activity involved 16 local residents. The material covered basic biopore concepts, the characteristics of various local bamboo species for infiltration media, and the technical steps for constructing and installing biopore drainage. Evaluation results showed that 14 out of the 16 participants improved their understanding, with an average score increase of 18.75%. These results indicate that the outreach method employed was effective in enhancing the community's cognitive competence regarding bamboo-based biopore technology. The program also resulted in the handover of this innovative technology to partners, as well as the production of a scientific article and activity documentation for dissemination purposes. This community service activity is expected to contribute sustainably to local resource-based flood mitigation efforts in Sampang Regency.

KEYWORDS: biopore drainage, local bamboo, flood inundation, water infiltration, community service, Sampang Regency, appropriate technology

1. INTRODUCTION

Sampang Regency is one of the regencies located on Madura Island, East Java Province. Geographically, the regency is situated between coordinates 7°44'–8°26' South Latitude and 113°57'–114°27' East Longitude.

Administrative Boundaries:

Northern Boundary : Madura Strait (bordering Bangkalan Regency and Surabaya).

Eastern Boundary : Pamekasan Regency.

Southern Boundary : Java Sea.

Western Boundary : Sumenep Regency.

Sampang Regency covers an area of approximately 1,304.01 km², with a landscape ranging from lowlands to moderately high mountains at elevations of 0 to 500 meters above sea level. The region comprises 14 districts: Jrengik, Jrakah, Kelungkung, Camplong, Dringu, Dulung, Gabus, Jember, Karangpenang, Loho, Sampang, Sokok, Sreseh, and Trimulyo.

According to information from various official sources, including local mass media, Sampang Regency shares borders with districts in neighboring regencies within the administrative region of East Java—an area known for its potential in natural tourism, cultural entertainment, and

developing educational facilities. The population of Sampang Regency has shown a steady upward trend; 2020 census data recorded a population of approximately 213,046, while the figure rose to 214,653 in 2022, reflecting an average annual growth rate of 0.12%.

Sampang Regency is one of the areas on Madura Island that continues to face issues with water pooling and flooding, particularly during periods of high rainfall. These conditions are driven by low soil infiltration capacity, suboptimal drainage systems, and increasing land-use conversion that reduces water absorption areas. The resulting inundation not only disrupts community activities but also has the potential to cause economic losses and degrade environmental quality.

One alternative solution for reducing water pooling is the use of biopore drainage technology. Biopores are infiltration holes designed to enhance the soil's capacity to absorb rainwater, thereby reducing surface runoff. This technology is relatively simple, easy to implement, and utilizes locally available materials. Bamboo is a promising material for this purpose, as its natural structure facilitates water infiltration, it is easily obtained, and it is environmentally friendly.

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Sreseh District in Sampang Regency possesses abundant bamboo resources that can be utilized as the primary material for constructing biopore drainage systems. However, public knowledge regarding the function, benefits, and construction techniques of bamboo-based biopore drainage remains relatively limited. Consequently, the use of bamboo as a simple technology to mitigate water pooling has not yet been optimized.

In response to these issues, a Community Service Team from the Faculty of Engineering at the State University of Surabaya (Unesa) conducted an outreach program for the residents of Sreseh District, Sampang Regency, on the construction of biopore drainage systems using bamboo. The initiative aimed to enhance the community's knowledge and skills regarding the use of local bamboo as an effective water infiltration medium to reduce water pooling and flood risks.

The outreach activity was conducted through the presentation of information, a demonstration on constructing biopore drainage systems, interactive discussions, and evaluations using pre- and post-tests. Through this initiative, the community is expected to understand the benefits of biopore technology, learn the construction process, and gain the ability to implement the technology independently in their respective neighborhoods. Furthermore, the activity aims to raise public awareness regarding the importance of rainwater management and environmental conservation through the sustainable use of available local resources.

2. SOLUTIONS AND OUTCOMES

The recurring issues of water pooling and flooding in Sampang Regency require solutions that are simple, cost-effective, and easy for the community to implement. To address these problems, the Community Service Team from the Faculty of Engineering at the State University of Surabaya (Unesa) conducted an outreach program on constructing biopore drainage systems using local bamboo. The initiative aims to enhance community knowledge and skills in utilizing local resources to create eco-friendly water infiltration systems.

The PKM team provided a session covering the basic concepts of biopores, their benefits for enhancing rainwater infiltration, and the steps for constructing bamboo-based biopore drainage systems. In addition to the presentation of material, the activity included practical demonstrations, interactive discussions, and evaluations via pre- and post-tests to assess the participants' level of understanding.

The expected and achieved outcomes of this activity are as follows:

1. Participants gained an understanding of the concepts, functions, and benefits of biopore drainage as an alternative method for managing water pooling and flooding in residential areas.

2. Participants were able to identify various local bamboo species suitable as primary materials for constructing biopore drainage systems and understood the specific characteristics of each bamboo type.
3. Following the outreach session and demonstration, participants could explain the construction steps for biopore drainage, ranging from material preparation, perforating the bamboo, and installation in the ground, to filling the system with supporting materials such as humus and gravel.
4. Participants received educational materials to serve as learning resources and references for independently implementing biopore technology in their respective environments.
5. Evaluation results indicated an improvement in participant understanding following the outreach activity. Out of the 16 participants, 14 showed higher post-test scores compared to their pre-test scores, with an average increase in understanding of 18.75%.
6. The innovative technology was successfully handed over to the partner organization to ensure program sustainability, enabling the community to independently implement and further develop biopore drainage technology.
7. Activity outputs were produced, including a Community Service (PKM) report, a scientific article ready for publication in a community service journal, and activity documentation (photos and videos) to serve as dissemination media for sharing program results with the wider public.

Through this activity, the community gained additional knowledge and skills regarding the use of local bamboo as a material for biopore drainage systems. The participants' increased understanding and high level of engagement demonstrate that the implemented Community Partnership Program (PKM) has made a positive contribution to supporting sustainable efforts to reduce water pooling and flooding in Sampang Regency.

3. EXAMINATION METHOD

The implementation method for the Community Service (PKM) activity involved an approach combining outreach, interactive discussions, and practical demonstrations on constructing bamboo-based biopore drainage systems. The stages of the activity included:

- a. The activity began with coordination between the PKM team and the local village government to outline the objectives, benefits, and implementation plan for an outreach

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- program on constructing biopore drainage systems to mitigate water pooling and flooding.
- b. The PKM team presented material covering the basic concepts, functions, and benefits of biopores, as well as their role in enhancing water infiltration into the soil. The presentation also introduced various local bamboo species suitable for use as the primary material in biopore drainage construction.
 - c. Prior to the presentation, participants took a pre-test to assess their baseline knowledge regarding biopore technology and the use of bamboo as a medium for water absorption.
 - d. The material was delivered through an active and interactive presentation, enabling participants to more easily grasp the concepts, benefits, and construction steps of biopore drainage.
 - e. The PKM team conducted a live demonstration of the biopore drainage construction process, covering everything from selecting and preparing the bamboo (cutting and cleaning) to perforating the bamboo, installing it in the ground, and filling it with supporting materials such as humus and gravel.
 - f. Participants were given the opportunity to discuss and ask questions about the material presented. This Q&A session aimed to deepen understanding and provide solutions for local water pooling issues.
 - g. Upon completion of the outreach program, participants took a post-test to measure the improvement in their understanding. The results were analyzed to evaluate the program's effectiveness in increasing community knowledge regarding bamboo-based biopore drainage technology.

- h. To ensure program sustainability, the innovative technology was formally handed over to the partners, supporting the community in independently implementing biopore technology to reduce the risk of water pooling and flooding in the Sampang Regency area.

The outreach activity involved 16 participants from the community of Sreseh District, Sampang Regency. Through a combination of presentations, demonstrations, discussions, and evaluations, the participants were expected to understand and implement bamboo-based biopore drainage technology as a simple, cost-effective, and eco-friendly solution for rainwater management and the reduction of flood inundation.

4. ACTIVITY METHOD

The Community Partnership Program (PKM) activities were carried out in Sreseh District, Sampang Regency, comprising the following:

1. An educational session on utilizing biopores as a solution to reduce water pooling and prevent flooding, leveraging local bamboo materials available in Sampang Regency.
2. A demonstration and introduction to constructing biopore drainage systems using various types of local bamboo, covering everything from material selection and the fabrication process to installation techniques suited to local soil conditions.

5. RESULTS

Based on the pre-test and post-test results administered to the 16 PKM participants, data indicate that the majority of participants experienced an increase in understanding after attending the outreach session. Pre-test scores were used to measure the participants' initial level of knowledge, while post-test scores were used to assess their level of understanding after receiving the session's material.

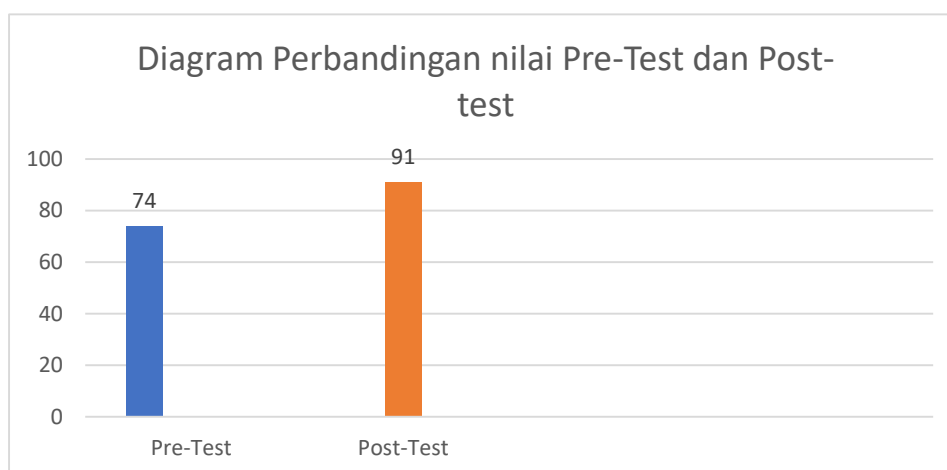
List of Pre-test and Post-test Scores for the PKM Extension Program, Sreseh District, Sampang Regency:

No.	Participant Name	Age (Years)	Pre-test Score	Post-test Score	Percentage Increase (%)
1.	Abd. Malik	56	80	100	20
2.	Jamila	26	80	90	10
3.	Misriyah	34	80	90	10
4.	Rostan Nawawi	29	90	100	10
5.	Sulaiman Fadli	45	70	90	20
6.	Abd. Somad	52	70	70	-
7.	Wahyudi	20	60	100	40
8.	Fadli Ahmad	36	80	100	20
9.	Miftahur Rohman	21	80	90	10
10.	Faris Ramuna	37	80	80	-
11.	Siti Ussaudah	29	70	90	20
12.	Sosnita Rahayu	20	80	90	10

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13.	Sufiroah	40	60	100	40
14.	Ulva	34	60	70	30
15.	Siti Shafiyah	41	80	100	20
16.	R. Faun Arham	29	60	100	40
	Jumlah:				300
	Rerata :				18,75

After attending the educational session, the participants' average score increased by 18.75%.



Overall, the total percentage increase in participants' scores reached 300%, with an average improvement of 18.75%. These results demonstrate that the outreach activity successfully enhanced participants' knowledge and understanding of the material presented. The improvement in post-test scores compared to pre-test scores also indicates that the methods used—including material presentation, discussions, and Q&A sessions—were effective and well-received by the participants.

6. CONCLUSIONS AND RECOMMENDATIONS

The outreach activity successfully motivated participants to attend every session organized by the Unesa PKM team and the community of Sreseh District, Sampang Regency. Following guidance from the Unesa PKM team, there was an 18.75% increase in knowledge regarding the definition, function, and construction of drainage systems using various types of bamboo. Seven participants achieved a perfect score of 100 on the post-test. The activity involving the construction of biopore drainage using bamboo provided the community with new knowledge, enabling participants to develop the skills to build such systems at their own homes or on their respective properties.

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