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Community Empowerment Through Biopore Creation as an Effort to Mitigate Flood and Organic Waste Management

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Abstract: The problem of flooding and organic waste management is still a major issue in residential areas with high levels of density and suboptimal drainage systems. Low soil permeability and lack of public awareness in managing waste worsen environmental conditions. This activity aims to increase community capacity in flood mitigation and organic waste management through the creation of empowerment-based biopore infiltration holes. The method used is Participatory Action Research (PAR) which actively involves the community in the planning, implementation, observation, and reflection stages. Data collection techniques are carried out through observation, interviews, documentation, and focus group discussions. The results of the activity show that this program is able to increase community understanding, skills, and participation in environmental management. The application of biopores has been proven to increase water infiltration, reduce inundation, and encourage the use of organic waste as compost. In addition, there has been a change in community behavior in sorting and managing waste independently. Although there are still obstacles in consistency and equal participation, in general this program is effective as a simple, economical, and sustainable solution. Thus, the biopore-based empowerment model has the potential to be replicated in community-based environmental management efforts.

Keyword: Biopores, Community Empowerment, Flood Mitigation, Organic Waste, PAR.

INTRODUCTION

The problem of flooding and organic waste management is still a crucial issue in various residential areas, especially in areas with high population density and suboptimal drainage systems. Floods are not only caused by high rainfall factors, but also exacerbated by low soil permeability due to land conversion and lack of public awareness in protecting the environment. Urban flooding is greatly influenced by a decrease in soil infiltration capacity and increased surface runoff due to land-use changes. On the other hand, the increase in the volume of household organic waste that is not managed properly contributes to worsening environmental conditions, causing pollution, and increasing public health risks (Suripin 2020). Research results shows that organic waste dominates the composition of waste in developing countries and is a major challenge in urban waste management systems Kaza et al. (2021).

This condition is also reflected in Sukabumi City, where the waste problem is still a strategic issue in the region. The volume of household waste continues to increase in line with population growth and community economic activities, while the management capacity and public awareness are not fully optimal. Based on a report by the local Environment Agency, most of the waste composition in Sukabumi City is dominated by organic waste that has not been optimally managed at the source level. Unsorted waste disposal practices and limited processing facilities cause some waste to end up in landfills in mixed conditions, causing odors, pollution, and contributing to the potential blockage of drainage channels that can trigger local flooding.

Structural flood mitigation efforts often require large costs and long time, so an alternative solution that is simpler, economical, and based on community participation is needed. One approach that can be applied is the creation of biopore infiltration holes. This technology not only increases the infiltration power of water into the soil, but also becomes a medium for processing organic waste naturally. Biopore infiltration holes are able to increase soil porosity through the activity of organisms so that they are effective in reducing water runoff (Lubis 2019). Research by Suryani, Rahmawati, & Nugroho (2022), also shows that the application of biopores can reduce waterlogging while reducing the volume of household organic waste.

However, the implementation of biopore technology at the community level still faces various obstacles, such as low understanding, limited technical skills, and lack of ongoing mentoring. In the perspective of empowerment, Chambers (2018) emphasized that the success of the program is highly determined by the active participation of the community. This is strengthened by the research of Sari, Putra, & (Wijaya 2021) which shows that a participatory approach is able to significantly improve the sustainability of environmental programs.

Based on these conditions, community service activities through empowerment in making biopores are very relevant to be applied in Sukabumi City. This approach not only answers the problem of flooding, but also becomes an innovative solution in community-based organic waste management. Thus, it is hoped that a cleaner, healthier, and more sustainable environment will be created as well as increasing public awareness in maintaining the quality of the environment collectively.

The formulation of the problem in this article is prepared in the form of directed and systematic research questions as a basis for examining the problems raised. These questions are the main focus that will be analyzed in depth in the discussion section, by referring to the data, theories, and results of service activities that have been carried out. Furthermore, each problem formulation that is proposed will be answered comprehensively in the conclusion section, so as to produce clear, measurable findings, and in accordance with the purpose of writing the article.

METHOD

The method of implementing this community service activity uses the Participatory Action Research (PAR) approach, which is an action research method that involves the active participation of the community in the entire activity process, from planning, implementation, to evaluation. This approach was chosen because it is able to integrate the empowerment process with direct problem solving in the field. According to Kemmis & McTaggart (2014), PAR is a collaborative approach that aims to produce social change through a cycle of reflection, action, and improvement in a sustainable manner.

In the context of empowerment activities through the creation of biopores as an effort to mitigate floods and manage organic waste, the PAR method is implemented through several stages of the cycle. The first stage is planning, which is the identification of problems with the community related to floods and organic waste, as well as the preparation of action plans that are relevant to local conditions. This stage emphasizes the active involvement of the community in formulating solutions, as emphasized by Robert Chambers that community participation is the key to the success of community-based programs (Chambers 2018).

The second stage is action, namely the implementation of programs in the form of socialization, training, and direct practice of making biopore infiltration holes. At this stage, the community is not only the beneficiary, but also the main actor in the activity. The direct involvement of the community in biopore practices will increase the understanding and sustainability of the application of the technology (Chambers 2018)

The third stage is observation, which is the process of monitoring the implementation of activities and their impact on the environment, such as reducing waterlogging and the use of organic waste. Data is collected through direct observation, documentation, and discussions with the community. Suryani's research shows that participatory observation is able to provide a more comprehensive picture of the effectiveness of community-based environmental programs (Suryani, Rahmawati, & Nugroho 2022)

The fourth stage is reflection, which is a joint evaluation between the implementation team and the community on the results of the activities that have been carried out. This reflection aims to identify successes, obstacles, and opportunities for future program development. This PAR cycle is cyclical, so the results of reflection become the basis for planning the next action. A sustainable participatory approach is very effective in creating behavior change and increasing community environmental awareness (United Nations Environment Programme, 2022)

Using the PAR method, this service activity is not only oriented to the final result, but also to the joint learning process that is able to increase the capacity of the community in a sustainable manner in dealing with environmental problems.

RESULTS AND DISCUSSION

In this community service activity, it is shown that the Participatory Action Research (PAR) approach applied is able to have a real impact on increasing community capacity in flood mitigation and organic waste management through biopore technology. The results of activities at the planning stage show that most communities do not have an adequate understanding of the relationship between organic waste, soil permeability, and flood potential. This condition indicates a knowledge gap that is an important basis for education-based interventions and direct practice.

At the action stage, socialization activities and training on making biopore infiltration holes received a positive response from the community. Active participation can be seen from the involvement of residents in the direct practice of making biopores in their respective environments. The community is beginning to understand that organic waste that was previously considered waste can be used as biopore filler with ecological value. This is in line

with the opinion of Kamaludin Lubis who stated that biopores not only function as a means of water infiltration, but also as a medium for processing organic waste into compost.



Figure 1: FGD with the Village Government and the Community



Figure 2 : Implementation of Biopore Making

The results of the observation showed a change in community behavior, marked by the start of organic waste sorting and an increase in the number of biopore holes made independently. In addition, several points that previously experienced waterlogging showed a decrease in inundation intensity after the application of biopores. These findings support the results of the research of Suryani et al. (2022) who stated that biopores are effective in increasing water infiltration and reducing surface runoff.

At the reflection stage, the community and the implementation team identified that the success of the program was greatly influenced by the level of participation and sustainability of the assistance. The obstacles that are still faced include the limitation of tools, consistency in filling organic waste into the biopores, and the uneven involvement of all residents. However, in general, this activity has been able to increase the community's collective awareness of the importance of independent environmental management. This is in line with the view of Robert Chambers who emphasized that the success of empowerment is highly dependent on the active involvement of the community in the change process.



Figure 3: Program Evaluation

The results and discussions show that the application of the PAR method in this activity not only produces outputs in the form of biopore holes, but also outcomes in the form of changes in knowledge, attitudes, and behavior of the community. This program has proven to be a simple but effective solution in reducing flood risk while managing organic waste sustainably. Thus, this biopore-based empowerment model has the potential to be replicated in other regions with similar problem characteristics.

CONCLUSION

Kegiatan pemberdayaan masyarakat melalui pembuatan lubang resapan biopori di Kota Sukabumi menunjukkan bahwa pendekatan Participatory Action Research (PAR) efektif dalam meningkatkan kapasitas masyarakat dalam mitigasi banjir dan pengelolaan sampah organik. Melalui keterlibatan aktif pada tahap perencanaan, pelaksanaan, observasi, dan refleksi, masyarakat tidak hanya memperoleh pengetahuan, tetapi juga keterampilan praktis dalam penerapan teknologi biopori. Hasil kegiatan menunjukkan adanya peningkatan pemahaman masyarakat terkait hubungan antara sampah organik, daya resap tanah, dan potensi banjir, serta perubahan perilaku dalam pemilahan dan pemanfaatan sampah organik.

Penerapan biopori terbukti mampu meningkatkan infiltrasi air ke dalam tanah sehingga mengurangi genangan, sekaligus berfungsi sebagai media pengolahan sampah organik menjadi kompos. Meskipun demikian, keberlanjutan program masih menghadapi tantangan berupa keterbatasan sarana, konsistensi pemanfaatan biopori, serta belum meratanya partisipasi masyarakat. Oleh karena itu, diperlukan pendampingan berkelanjutan dan penguatan kelembagaan lokal agar program dapat berjalan secara optimal dan berkesinambungan. Secara keseluruhan, model pemberdayaan berbasis biopori ini merupakan solusi yang sederhana, ekonomis, dan berkelanjutan serta berpotensi untuk direplikasi di wilayah lain dengan karakteristik permasalahan yang serupa.

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