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Efforts to Reduce Carbon Emissions in Rural Areas through Household Waste Management

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ABSTRAK

Pengabdian kepada masyarakat tersebut berangkat dari isu belum cukup baiknya pengelolaan sampah/limbah rumah tangga di desa Sakatiga khususnya daerah Kawasan Pesantren Raudatul Ulum, kabupaten Ogan Ilir, South Sumatera, dimana community service ini bertujuan agar masyarakat desa tersebut menyadari bahwa urusan persampahan belum benar-benar selesai di TPA. Termasuk menyadarkan masyarakat bahwa isu emisi karbon, perubahan iklim dan pemanasan global juga merupakan akibat dari pengelolaan sampah yang buruk. Untuk itu mereka harus ikut berperan dan berpartisipasi aktif dalam menjaga kelangsungan kebersihan lingkungan secara produktif dan berkelanjutan. Dengan menggunakan metode experiential learning dan practical application, kegiatan tersebut dilakukan melalui beberapa tahapan kegiatan seperti sosialisasi dan edukasi materi, diskusi interaktif, pelatihan dan praktek terjun langsung ke lapangan dengan melakukan cara-cara sederhana pengelolaan sampah rumah tangga, seperti pemilahan sampah dan bagaimana treatment dari jenis sampah tersebut. Pengabdian tersebut cukup berhasil mengajak masyarakat untuk bergerak memilah dan mengelola sampah rumah tangganya menjadi lebih baik dan berkelanjutan, sehingga pencemaran dan emisi karbon di sekitaran desa dapat dikurangi serta lingkungan menjadi lebih bersih dan sehat.

ABSTRACT

This community service initiative stems from the issue of inadequate domestic waste management in the village of Sakatiga, specifically in the Raudatul Ulum Pesantren area, Ogan Ilir Regency, South Sumatra. This community service aims to raise awareness among the local population that waste management issues are not truly resolved at the landfill site. It also seeks to inform the community that carbon emissions, climate change, and global warming are also consequences of poor waste management. Therefore, the residents must actively maintain environmental cleanliness productively and sustainably. By employing experiential learning and practical application methods, The activity was carried out through several stages, including socialisation and educational sessions, interactive discussions, training, and hands-on field practice in simple domestic waste management techniques, such as waste segregation and proper treatment of different waste types. The community service quite successfully encouraged the local residents to start segregating and managing their household waste more effectively and sustainably. Thus, the pollution and carbon emissions around the village were reduced, contributing to a cleaner and healthier environment.

1. INTRODUCTION

Environmental issues represent a major global challenge today, ranging from ecosystem degradation, climate change, global warming, to the overwhelming accumulation of waste and rubbish from various sectors of activity. Indonesia is among the countries currently struggling to address these issues. One such environmental issue concerns the large volume of waste and waste management. According to the latest data from the National Waste Management Information System (SIPSN) of the Ministry of Environment and Forestry (KLHK), Indonesia generated approximately 34 million tons of waste throughout 2024, with the largest share of waste originating from the household sector. In terms of composition, the majority of national waste consists of food waste, accounting for 41.20%, followed by plastic waste at 18.30%. Other waste types include wood/branches (12.10%), paper/cardboard (10.40%), metals (3.40%), textiles (2.80%), glass (2.60%), rubber/leather (2.40%), and other waste types (6.80%) (Annur, 2023; Dermawan et al., 2018). The volume of household waste continues to increase in line with population growth, economic development, and changes in consumption patterns and lifestyles (Voukkali et al., 2024). This issue becomes more problematic when it is not accompanied by public awareness regarding waste management. Poor and improper waste management has various detrimental consequences, such as foul odours, increased carbon emissions, aesthetic disruption, flooding, intensification of climate change,

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worsened environmental sanitation, and the rising threat of various diseases (A Alabi et al., 2023). For example, burning waste can result in air pollution, generating large amounts of carbon emissions and contributing to global warming. Furthermore, decaying organic waste produces unpleasant smells and poses health risks (Roy et al., 2023).

The population of Ogan Ilir Regency, South Sumatra, is steadily increasing due to the presence of numerous educational institutions, ranging from schools and universities to pesantren (Islamic boarding schools). This has led to a rise in household waste and rubbish. One of the well-known pesantren in Ogan Ilir Regency is Raudatul Ulum, located in Sakatiga Village. Observations made by the community service team, in collaboration with local leaders, indicate that most residences are habitable, and the welfare and economic conditions of the residents are generally sufficient to meet daily needs. However, the community's role in waste management appears to be suboptimal. This is evident from the considerable amount of waste scattered along various streets. Furthermore, the villagers have yet to develop sufficient awareness and knowledge regarding the importance of waste management. As a result, much organic waste is mixed with inorganic waste in piles of rubbish around residents' homes. Additionally, the majority of residents tend to burn waste in the front or back yards of their homes. This practice stems from a lack of knowledge about proper waste management. In response to this phenomenon, efforts need to be made to enhance the community's active role through education in the form of outreach, training, and direct practical activities related to waste management. Education on managing organic and inorganic waste in the village has been identified as a solution to inform the residents about proper waste management practices (Erviana et al., 2019; Mustika et al., 2020).

The objective of this community service activity is to raise awareness and foster a sense of responsibility among the community regarding waste issues in their surroundings. Furthermore, this community service initiative aims to empower the residents by encouraging active participation in managing household waste. It is expected that this will lead to a change in behaviour towards waste management (Aleshaiwi, 2023). Community empowerment can be carried out through female adolescents and housewives, thus involving every household in managing their waste. Proper waste management is also beneficial in reducing carbon emissions in the village environment (Farah et al., 2022). It is expected that a significant reduction in greenhouse gas emissions will be achieved. Furthermore, this initiative aims to raise awareness within the village community about the importance of environmental preservation and understanding the negative impacts of carbon emissions. Through this community service activity, it is hoped that the community will adopt sustainable waste management practices, such as segregating organic and non-organic waste and reusing waste with economic value. This activity also aims to improve the environmental quality of the village by reducing pollution and creating a cleaner and healthier environment. Additionally, effective waste management could open new economic opportunities for the community, such as composting or recycling businesses (Hardika et al., 2021), which in turn could enhance the well-being of the village residents. Thus, this programme also seeks to strengthen partnerships between the community, government, and other relevant stakeholders to build a sustainable village and support global efforts to address climate change (Hemali & De Alwis, 2022).

2. METHOD

The community service involved socialisation, education, providing training and guidance, and hands-on fieldwork in collaboration with the community to sort and categorise organic, inorganic, and hazardous (B3) waste. Below is the conceptual framework for providing solutions to waste management issues.

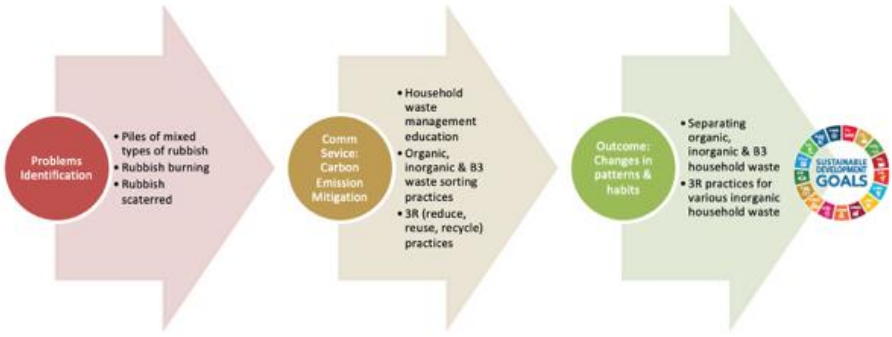

Figure 1. Problem Solving Framework Scheme

The community service initiative with this theme results from observations conducted by the community service team and discussions with several local figures in the village. Given that the economic activities

in the area are advancing, the population is increasing, and consumption patterns are becoming more diverse, the waste produced from household production and consumption activities is also steadily increasing, accumulating, and diversifying in types. Based on the results of these observations and discussions, the idea for sustainable waste management emerged. Thus, the rural communities need to receive knowledge, training, and practical experience in an integrated manner concerning carbon mitigation movements and waste management in household environments.

Several methods that can be implemented in this community service initiative to achieve positive and maximal results include socialisation, education, training, and hands-on fieldwork for waste segregation and categorization (Dulal & Mu, 2023). These activities include socialisation about the importance of maintaining environmental cleanliness (Vukojević Medvidović et al., 2024), education and training on the harmful effects of waste on the environment, education on simple mitigation measures to reduce carbon emissions and other environmental pollution (Pudin, 2015), as well as direct guidance on segregating organic, inorganic, and hazardous (B3) waste. Waste management can begin with the segregation and separation of organic, inorganic, and hazardous waste (such as electronic and medical waste). The community can utilise organic waste for composting (Suraya et al., 2021). Inorganic waste can be turned into useful items with potential economic value through the 3Rs (reduce, reuse, recycle) (Darajati et al., 2022). The hazardous impact of B3 waste can be mitigated through certain simple methods, such as destruction in a closed space (e.g., incinerator furnaces) (Torkayesh et al., 2022).

The target community comprises approximately 25 teenage girls and housewives in the Raudatul Ulum Pesantren complex in Sakatiga Village, Indralaya District, Ogan Ilir Regency, South Sumatra. This community service activity represents the initial step in building awareness and action within the village community regarding environmental issues, particularly in mitigating carbon emissions, through a movement for independent waste management (Anti Ahsanti et al., 2022). Additionally, this activity supports the Sustainable Development Goals, particularly SDG 12 (Responsible Production and Consumption), SDG 13 (Climate Action), and SDG 15 (Life on Land).

3. RESULT AND DISCUSSION

local leaders and village officials to identify the problems faced by the village and determine the most suitable form of community service. The identified problem are piles of mixed types of rubbish such as rubbish burning and scattered. Furthermore, these visits allowed the team to assess the situation and conditions of the village and establish the location and timing for the community service activities. In line with the objectives of this community service, which are to educate and motivate the community to understand and take action to reduce carbon emissions from household waste management, the service team introduced environmentally friendly waste management methods through household waste management education, organic; inorganic; B3 waste sorting practices and 3R (reduce, reuse, recycle) practices. The methods were delivered through education, focusing on hands-on field practice alongside the community, including converting waste into compost or alternative energy. These methods were implemented through a series of activities, as outlined below.

3.1. Socialisation of the Importance of Waste Management in the Community

The material covered the significance of waste management, as it directly affects environmental cleanliness, public health, and ecosystem balance. Poorly managed waste can lead to air, water, and soil pollution, as well as cause various diseases due to waste accumulation (Kumar & Prakash, 2020). It was also highlighted that waste left to accumulate at landfills contributes to greenhouse gas emissions, such as methane, which exacerbates climate change (Meyrena & Amelia, 2020). Therefore, effective waste management can create a clean, healthy, and comfortable environment for current and future generations. Consequently, each community member, often unconsciously, contributes to their village's development and the global climate.

Figure 2. Socialisation of the Importance of Waste Management

One of the team members delivered the material. The presentation was also interspersed with ice-breaking activities to energise the participants and maintain their enthusiasm for listening to the material.

Figure 3. Education and Interactive Discussion of Waste and Carbon Emissions

The presenter explained that waste and carbon emissions are closely linked, as poor waste management can increase the amount of greenhouse gases, such as carbon dioxide (CO_2) and methane (CH_4), which contribute to climate change (Gautam & Agrawal, 2021). Organic waste that decays in landfills produces methane, a gas far more effective at trapping heat than carbon dioxide (Ayalon et al., 2001). Additionally, the presentation also covered the issue of waste burning, particularly plastic, which releases CO_2 and other harmful pollutants into the atmosphere (Unwaru et al., 2022).

3.3. Education and Interactive Discussion: How to Reduce Carbon Footprint

This session was more focused on discussion. It explained that properly managing domestic waste is an effective way to reduce the carbon footprint. Organic waste, which is typically discarded, can be processed into compost, thereby reducing methane emissions produced by the decomposition of waste in landfills (Gupta et al., 2022). Additionally, the segregation and recycling of inorganic waste, such as plastic, can reduce the use of new resources and lower carbon emissions from producing new materials (Tiwari et al., 2023).

Figure 4. Education and Interactive Discussion to Reduce Carbon Footprint

The presenter emphasised that the rural community can play an active role in minimising the negative impact on the environment, while also maintaining the cleanliness and sustainability of the village. These actions not only directly reduce the carbon footprint but also foster a collective awareness of the importance of environmental preservation, from the local to the global level.

3.4. Education and Discussion on Wider Benefits of Waste Management

In this session, the material was presented in an interactive and engaging manner, incorporating games. The topic discussed was the benefits of proper waste management for the environment, health, and the economy.

Figure 5. Discussion on Wider Benefits of Waste Management

From an environmental perspective, proper waste management, such as recycling and composting, can reduce soil, water, and air pollution, as well as lower greenhouse gas emissions that contribute to climate change (Nordahl et al., 2023). From a health perspective, correct waste management helps prevent the accumulation of waste that can become a source of disease, thus creating a cleaner and healthier environment. The discussion also highlighted how waste management can create new business opportunities, such as recycling industries, compost production, and waste-to-energy initiatives (Nogueira, 2023). Efficient waste management also alleviates the burden on landfills, which often face overcapacity, and encourages more sustainable consumption and production patterns, supporting environmentally friendly development. This session allowed both the village community and students to brainstorm about these benefits.

3.5. Field Practice: Segregation of Organic, Inorganic Waste and Hazardous (B3) Waste

The practice involved the local community and students, with a larger portion of student involvement. The community service team implemented this strategy, as the students represent the community's younger generation who can ultimately become agents of change for their village by advocating for and educating the broader community on environmental issues.

Figure 6. Segregation Practice of Organic Waste

In this practice, students were taught to separate organic waste, such as food scraps, leaves, and other biodegradable materials, from inorganic waste, such as plastics, paper, and metals, which require recycling. Waste segregation aims to reduce the amount of waste sent to landfills and minimise the negative impacts, such as environmental pollution and greenhouse gas emissions.

Figure 7. Segregation Practice of Inorganic and B3 Waste

Through this activity, students not only learned about the techniques of waste segregation but also understood how small daily actions can contribute to reducing carbon footprints and supporting a cleaner, healthier environment. This also fosters environmental awareness from an early age, which can be applied in their future lives. Furthermore, these good habits can be passed on to the local community to create positive and significant change.

4. CONSLUSION

The community service activity has been successfully carried out, and positive feedback from the target audience has been received. The activity results indicate that the participants benefited from the programme, gaining valuable information, knowledge, and insights related to the theme, which they can apply in their daily lives. The community has become reasonably proficient in waste segregation practices and is willing to implement them on a daily basis. This also signifies the development of environmental awareness within the community, particularly concerning reducing carbon emissions. Moreover, the community has discovered new economic

opportunities by converting organic and inorganic waste into marketable products, such as compost production and making accessories.

Therefore, a recommendation for the future is that ongoing education on waste management should involve not only the local community but also engaging or partnering with relevant stakeholders. This would be beneficial if the activities require future support regarding facilities or infrastructure development related to waste recycling.

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