Planting of 60,000 Calliandra and Cashew Trees for Environmental Sustainability and Renewable Energy: Collective Movement in Mojokerto

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Abstrak

Abstract: Environmental degradation caused by deforestation, resource exploitation, and climate change necessitates a collective movement involving various societal elements to ensure ecological sustainability and mitigate environmental impacts. This program represents a joint initiative involving academics, government institutions, and local communities in a reforestation effort through the planting of 60,000 Calliandra and Cashew trees in Lebakjabung, Jatirejo, Mojokerto. The selection of these tree species is based on their ecological and economic potential, particularly as bioethanol feedstock for renewable energy. In addition to reforestation efforts, this initiative also includes an ecology-based multiliteracy outreach program aimed at enhancing environmental awareness and fostering a sustainability mindset within the community. The program was attended by various stakeholders, including representatives from the local government, the BEM RAYA Mojokerto student organization, nature enthusiasts from Mapala Mojokerto, high school, and junior high school students, as well as the broader local community. The outcomes of this initiative indicate an increase in green coverage, active community involvement in environmental conservation, and opportunities for the development of biomass-based alternative energy, which has the potential to reduce dependence on fossil fuels. The success of this program is expected to serve as a model for sustainability movements that can be replicated in other regions facing similar ecological challenges.

Keywords: Tree planting, environmental sustainability, bioethanol, ecological multiliteracy, renewable energy, conservation

Introduction

The escalating environmental crisis, driven by rapid deforestation, uncontrolled exploitation of natural resources, and the increasingly evident impacts of climate change, has become a pressing issue requiring sustainable solutions. The reduction in forest cover has led to global temperature increases, extreme weather pattern shifts, and the deterioration of air and soil quality, ultimately affecting food security and community well-being (Anugrah, 2021). In Indonesia, deforestation and land degradation not only disrupt ecosystems but also contribute significantly to rising carbon emissions, thereby accelerating global warming (Saifulloh, 2024). This issue is further exacerbated by the lack of public awareness regarding the importance of environmental conservation and the insufficient integration of ecological education into everyday life (Sugandi et al., 2022). Consequently, an approach is needed that goes beyond theoretical discourse and emphasizes practical actions, actively involving all societal elements in maintaining ecosystem balance.

In response to these challenges, a collective initiative led by communities, academics, and government institutions has emerged to take concrete action in environmental conservation. The *60,000-Tree Planting Program* in Lebakjabung, Jatirejo, Mojokerto, is a form of collective movement designed to produce tangible impacts in climate change mitigation while enhancing environmental resilience. This initiative not only aims to expand green coverage but also seeks to educate the community on the significance of ecological sustainability and its implications for daily life. The movement involves various stakeholders, including university students from *BEM RAYA Mojokerto*, nature enthusiasts such as *Mapala Mojokerto*, high school and junior high school students participating in ecological education, and local residents actively engaged in tree planting and maintenance. Additionally, the program has received full support from local government authorities, marked by the presence of district heads, village leaders, law enforcement officials, military personnel, and representatives from the Mojokerto Regency Office. The synergy between communities, academics, and the government in this program demonstrates that environmental conservation efforts must be a shared movement that involves all elements of society without exception.

A distinctive feature of this program is the selection of Calliandra (*Calliandra calothyrsus*) and Cashew (*Anacardium occidentale*) trees for planting. These species not only provide ecological benefits in maintaining ecosystem balance but also hold significant potential as bioethanol feedstock for renewable energy. Calliandra and Cashew trees are known for their high biomass content and rich carbohydrate composition, making them viable sources for ethanol production, which is a more environmentally friendly alternative to fossil fuels (Raysendi et al., 2015). Thus, the planting of these trees is not merely a reforestation effort but also an opportunity to develop the renewable energy industry in resource-rich regions. Furthermore, utilizing local raw materials such as Calliandra and Cashew trees can reduce Indonesia's dependence on fossil fuel imports while enhancing farmers' economic prospects through optimized crop utilization. Moreover, this tree-planting initiative contributes to carbon sequestration and greenhouse gas emission reduction, ultimately aiding long-term climate change mitigation efforts.

To ensure that this greening effort extends beyond a symbolic movement, the program is complemented by an environmental awareness campaign based on ecological multiliteracy (Saifulloh & Anam, 2022). This initiative aims to instill in the community an understanding that environmental sustainability is not solely the responsibility of the government or specific organizations but a collective movement that requires active participation from all stakeholders. The ecological multiliteracy approach employed in this campaign emphasizes the interconnectedness between humans and the environment, integrating local values with modern conservation practices while encouraging individual engagement as agents of change in maintaining ecosystem balance. Consequently, this awareness program is not merely an information-sharing session but an interactive initiative that invites participants to engage in discussions, critical reflections, and direct environmental practices that yield tangible benefits.

Nonetheless, several challenges persist in achieving environmental sustainability through this program. One of the primary issues is the low level of public awareness regarding the importance of environmental conservation and ecological sustainability(Azzahra et al., 2024). Many individuals still perceive the environment primarily as a resource for exploitation without considering the long-term consequences for ecosystem balance. This limited understanding of sustainability is often attributed to the lack of practical environmental education (Iklil et al., 2021), leaving many people unaware of how their daily actions contribute to either environmental degradation or conservation. Additionally, the impacts of deforestation and climate change pose an escalating challenge. The loss of forests has led to rising global temperatures, increasingly erratic weather patterns, and a decline in biodiversity, which threatens ecosystems in multiple regions. If left unaddressed, these conditions will further exacerbate the ongoing environmental crisis.

This program is designed to address these challenges by implementing an approach that not only focuses on reforestation efforts but also fosters a shift in public attitudes toward environmental conservation. By engaging multiple stakeholders, this initiative is expected to generate broader and more sustainable impacts in ecological, social, and economic dimensions. The success of this program is anticipated to serve as a model for other regions in adopting conservation strategies that extend beyond mere tree planting to encompass sustainable energy utilization and community livelihood improvements.

Through the synergy between academics, students, environmental organizations, local communities, and government institutions, this program is expected not only to enhance green coverage but also to create new opportunities for biomass-based energy development and local economic empowerment. With a strong commitment and active participation from various stakeholders, this initiative is envisioned to continue growing and evolving into a broader sustainability movement, not only in Mojokerto but also in other regions across Indonesia facing similar challenges in ecosystem conservation and environmental resilience.

Methodology

The implementation of this community service program employs a transformation-based approach (De Meyer et al., 2021), integrating the concepts of eco-pedagogy, ecological multiliteracy, and active community participation. This approach was chosen to ensure that the initiative extends beyond a short-term greening project, fostering long-term impacts in raising environmental awareness and promoting the sustainable utilization of natural resources. The program consists of two main components: an environmental awareness campaign and the phased planting of 60,000 Calliandra and Cashew trees, involving multiple stakeholders.

Location and Participants

This program was conducted in Lebakjabung, Jatirejo, Mojokerto, a region with significant potential for reforestation and the development of biomass-based renewable energy. The area was selected due to its considerable environmental degradation and its suitability for cultivating economically valuable plant species. Additionally, the local community has demonstrated strong enthusiasm for conservation efforts and possesses prior experience in community-based natural resource management.

This initiative engages various societal elements and academic institutions to ensure collective involvement in the program. The participants include: Local Community: Comprising farmers, village youth, and environmentally active residents (GAK KOPEN). Students and Academics: Representatives from BEM RAYA Mojokerto and members of Mapala Se-Mojokerto (a student nature lovers' organization) who act as facilitators and support staff in the program's implementation. High School and Junior High School Students: As part of early environmental education efforts, students are introduced to the importance of conservation and trained in tree planting and maintenance techniques. Local Government Officials: Subdistrict heads, village leaders, as well as representatives from the police and military, providing administrative and logistical support.Mojokerto Regency Representatives: Officials attending the program to provide moral and policy support for the initiative's sustainability.

Fig 1. BEM (Badan Eksekutif Mahasiswa) Raya Mojokerto

Environmental Awareness Outreach Process

Before the tree-planting activities commenced, an environmental awareness campaign was conducted as part of the ecological multiliteracy approach. This campaign aimed to provide a comprehensive understanding of the importance of nature conservation, the benefits of renewable energy, and the role of individuals in maintaining ecosystem balance. The key topics covered in the outreach program included: Fundamental Concepts of Ecology and Sustainability: Understanding how ecosystems function and why their preservation is crucial. Impacts of Climate Change and the Role of Reforestation: Explaining the links between deforestation, global temperature increases, and environmental degradation. Bioethanol Potential of Calliandra and Cashew Trees: Highlighting the long-term environmental and economic benefits of the planted tree species. Community-Based Conservation Practices: Encouraging local communities to take ownership of conservation efforts and continue developing the program beyond the initial phase.

The outreach activities were conducted through interactive discussions, educational video screenings, and conservation practice simulations facilitated by academics and students. Participants were encouraged to ask questions and share their previous experiences related to environmental conservation.

Process of Planting 60,000 Trees

The tree planting was conducted in stages, considering land conditions and the readiness of the local community to maintain the newly planted trees. The process involved several key phases: Land Identification and Preparation: An initial survey was carried out to determine strategic planting locations. The land was then prepared to ensure optimal conditions for tree growth. Seedling Distribution and Technical Training: Community members received training on proper planting and maintenance techniques for Calliandra and Cashew seedlings. Each community group was assigned a specific planting area to instill a sense of ownership over the project. Mass Tree Planting: The planting process involved diverse stakeholders, including students, local residents, and government officials. Documentation was carried out to track progress and record the number of trees planted. Monitoring and Maintenance: A volunteer team comprising community members and students was established to oversee tree growth for the first six months. Regular evaluations were conducted to identify challenges in tree maintenance, allowing for necessary adjustments and improvements.

Data Collection and Program Evaluation

To assess the program's effectiveness, data collection was conducted through visual documentation, including photographs and videos, as part of reporting and evaluation measures. This documentation systematically recorded every phase of the initiative, from outreach activities and land preparation to tree planting and growth monitoring. The recorded materials serve as a reflection tool and concrete evidence of the program's progress for stakeholders.

Sustainability Strategy To ensure that the program continues beyond the initial planting phase, several sustainability strategies were implemented: Formation of Conservation Farmer Groups: Community members involved in the initiative were assigned responsibility for managing and maintaining the planted trees. Integration with School Curricula: Environmental education and renewable energy topics were proposed for inclusion in extracurricular activities at local schools. Partnerships with the Private Sector: Collaborations were sought with green energy companies to provide funding support and facilitate research on bioethanol processing. Long-Term Monitoring: Evaluations were scheduled every six months to ensure the continued growth of planted trees and to assess their ecological and economic impact.

Through this comprehensive approach, the community service program is expected to generate lasting benefits, not only in terms of reforestation but also in fostering environmental awareness and creating economic opportunities based on sustainable natural resource management.

Findings

Process of Environmental Awareness Outreach through the Ecological Multiliteracy Approach

Prior to the tree-planting activities, an environmental awareness outreach program was conducted as part of the ecological multiliteracy approach. This initiative aimed to provide participants with a comprehensive understanding of the significance of nature conservation, the utilization of renewable energy, and the role of individuals in maintaining ecological balance. The outreach covered various aspects of ecology and sustainability relevant to the local environmental conditions.

Fundamental Concepts of Ecology and Sustainability

The first phase of the outreach emphasized the fundamental concepts of ecology and sustainability. Participants were introduced to the workings of ecosystems and how their balance directly influences human life. This session aimed to raise awareness that every living organism plays a role in maintaining environmental stability.

The facilitators explained that ecology is a branch of science that studies interactions between living organisms and their environments, encompassing both biotic and abiotic factors. A key focus of the discussion was the importance of preserving biodiversity as the foundation of life. Sustainability, in this context, refers to the responsible utilization of natural resources without disrupting ecological balance.

Additionally, this session explored key ecological principles underlying sustainable environmental management. These principles include energy recycling within ecosystems, the role of food chains in population balance, and the interactions among species that contribute to overall ecosystem health.

Impacts of Climate Change and the Role of Reforestation

The subsequent session examined the effects of climate change and the role of reforestation in mitigating these impacts. Participants were provided with insights into the relationship between deforestation, rising global temperatures, and the various negative consequences of environmental degradation. Climate change is a global phenomenon primarily driven by increased greenhouse gas emissions, largely resulting from human activities such as fossil fuel combustion, deforestation, and unsustainable land use practices. One of the most visible consequences of climate change is the rising frequency and intensity of natural disasters, including floods, droughts, and tropical storms.

Within this outreach framework, participants gained an understanding of the crucial role that forests and natural vegetation play in absorbing atmospheric carbon dioxide. Tree planting,

as part of reforestation efforts, helps reduce greenhouse gas concentrations and contributes to slowing the pace of climate change. Moreover, reforestation supports the hydrological cycle, prevents soil erosion, and enhances soil fertility, ultimately benefiting sustainable agriculture.

The Potential of Bioethanol from Calliandra and Cashew Trees

One of the innovative aspects introduced during the outreach was the use of bioethanol as an alternative energy source derived from plants such as Calliandra and Cashew trees. This session provided participants with knowledge on how these plants can serve as raw materials for bioethanol production and their associated environmental and economic benefits.

Fig 2. The process of planting Calliandra and Cashew trees.

Calliandra (Calliandra Calothyrsus) is a plant with high lignocellulose content, making it a viable feedstock for bioethanol production through fermentation. Besides serving as an alternative energy source, Calliandra also provides ecological benefits by enhancing soil fertility through nitrogen fixation and aiding soil conservation in erosion-prone areas. Meanwhile, Cashew (Anacardium occidentale), widely known for its edible nuts, also holds potential for bioethanol production using waste from its fruit. With the right approach, utilizing this waste can help reduce environmental pollution while creating additional economic value for local communities.

Community-Based Conservation Practices

The conservation approach implemented in this program extends beyond the technical aspects of tree planting. It also focuses on ensuring that the community remains engaged in maintaining and further developing conservation initiatives after the primary activities are completed. Thus, the final session of the outreach was dedicated to community empowerment in conservation practices. Participants were encouraged to recognize the importance of community involvement as a key factor in sustaining conservation programs. This included organizing community groups to manage reforested areas, enhancing conservation skills, and implementing strategies to improve environmental awareness within the broader community.

Several community-based conservation models introduced in the outreach included: Forest Farmer Groups (KTH): Communities residing near forest areas receive training on sustainable forest management, including agroforestry techniques and the utilization of non-timber forest products. Tree Banks and Independent Nurseries: Communities are encouraged to establish their own nurseries to ensure that reforestation efforts continue without dependence on external aid. School and Pesantren-Based Environmental Education: Instilling environmental awareness from an early age through curriculum integration and conservation-focused extracurricular activities. Community-Based Ecotourism: Developing eco-tourism potential to generate economic benefits while promoting environmental conservation.Through

this approach, the program foster greater community engagement in environmental stewardship and raise awareness of the importance of natural resource conservation.

Program Implementation and Evaluation

During the implementation phase, various methods were applied to ensure the program's success. Initially, a preliminary survey was conducted to assess participants' baseline understanding of environmental issues before the outreach. The survey results served as the basis for tailoring the outreach materials to better align with participants' needs.

Fig. 3 Registration of outreach participants.

Throughout the outreach sessions, an interactive approach was employed, engaging participants in discussions, simulations, and hands-on conservation practices. This method aimed to enhance active participation and deepen participants' comprehension of the subject matter. Program evaluation was conducted through several stages, including: Post-Outreach Questionnaires: Measuring participants' increased understanding of the topics covered. Field Observations: Monitoring how participants applied their acquired knowledge in real-life conservation efforts. Long-Term Impact Assessment: Evaluating the sustainability of the program over time by observing behavioral changes within the community and assessing its ecological impact.

Initial evaluation results indicated a significant improvement in participants' understanding of environmental conservation. Several participants even expressed interest in engaging in long-term conservation initiatives. Through the ecological multiliteracy approach, this outreach is expected to cultivate not only short-term awareness but also a collective movement capable of generating positive environmental and societal impacts.

Discussion

The outcomes of the environmental awareness outreach and tree-planting program in Lebakjabung, Jatirejo, Mojokerto, demonstrate increased public understanding and participation in conservation efforts. The pre-planting outreach successfully enhanced participants' comprehension of ecological principles, sustainability, and the renewable energy potential of Calliandra and Cashew trees. The ecological multiliteracy approach proved effective in fostering deeper ecological awareness among participants.

The program's success is evident in the high level of enthusiasm displayed by participants during both the outreach and tree-planting activities. Participants exhibited improved awareness regarding climate change impacts and the role of reforestation in mitigating global warming effects. Additionally, the prospect of bioethanol production from Calliandra and Cashew trees was met with a positive response, as it is perceived as an innovative solution to reducing reliance on fossil fuels.

However, several challenges emerged during the program's implementation. One key issue was the limited experience of some participants in conservation practices, necessitating

further guidance in maintaining the planted trees. Moreover, unpredictable weather conditions posed additional difficulties in ensuring the successful growth of the newly planted trees. Therefore, long-term strategies, including regular monitoring and periodic evaluations, are essential to maintaining the program's sustainability.

Conclusion

The environmental awareness outreach and the planting of 60,000 trees in Lebakjabung, Jatirejo, Mojokerto, have made significant contributions to enhancing community understanding of the importance of environmental conservation. The ecological multiliteracy approach employed in the outreach proved effective in deepening participants' awareness of ecological concepts, climate change impacts, and the benefits of renewable energy from Calliandra and Cashew trees. The program's success is reflected in the strong community participation in tree-planting activities and increased awareness of individual roles in maintaining ecological balance. Furthermore, the economic potential of bioethanol production has added appeal to the initiative, reinforcing its long-term viability.

Despite its success, several challenges require attention, including participants' limited conservation experience and the impact of adverse weather conditions on tree maintenance. Therefore, strategic measures must be implemented to ensure the program's sustainability so that its positive impacts can be sustained in the long run.

References

Anugrah, Y. (2021). *Dikbud Beber Problem Pendidikan Lingkungan : Tanpa Teladan Generasi Tua*. 1–6. https://www.cnnindonesia.com/nasional/20211118150431-20-723003/dikbud-beber-problem-pendidikan-lingkungan-tanpa-teladan-generasi-tua

Azzahra, F., Nanda, M., Nasution, D. A., Aisyah, S. N., & Pohan, R. (2024). *Level of Public Awareness in Protecting the Environment in Pantai Cermin Kanan Subdistrict*. *7*(6), 838–842. https://doi.org/10.32832/pro

Iklil, A., Purwati, O., & Retnaningdyah, P. (2021). *Ecological Literacy and Social Media Trends: Teaching English as A Second Language in the Classroom*. 1–19.

Raysendi, A. R., Nurhatika, S., & Muhibuddin, A. (2015). Efektivitas Penggunaan Bioetanol Sari Buah Semu Jambu Mete (Anacardium occidentale L .) Terhadap Lama Pembakaran Kompor Bioetanol. *Jurnal Sains Dan Seni ITS*, *4*(1), 7–9.

Saifulloh, A. I. (2024). *Kritik Sastra Lingkungan: Pengantar, Pendekatan, dan Implementasinya di dunia pendidikan* (Issue March). Tema Litera.

Saifulloh, A. I., & Anam, S. (2022). Exploring Trends in Pedagogical Ecocriticism to Enhance Environmental Awareness in Post Pandemic Era. *Qalamuna: Jurnal Pendidikan, Sosial, Dan Agama*, *14*(1).

Sugandi, K. M., Inayah, M. A., Aulia, N. N., & Adellia, N. (2022). *Analisis Kesadaran dan Upaya Masyarakat dalam Permasalahan Sampah di Desa Sukamaju*. *2*(3), 441–452.