

EMPOWERMENT OF THE CISADANE RIVER THROUGH KIRAI TREE PLANTING PARTNERSHIP PROGRAM BETWEEN BINUS UNIVERSITY AND WASTE BANK CISADANE RIVER COMMUNITY

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ABSTRACT

River empowerment is a strategic step in maintaining ecosystems and environmental sustainability. This study examines the initiative of planting kirai tree along the Cisadane River involving 140 students from Binus University, in collaboration with the environmental community, Bank Sampah Sungai Cisadane (Banksasuci). This program involved faculty from Binus ASO School of Engineering (BASE) and received support from the Centre for Business and Social Empowerment (CBSE), Community Development (CE), Student Support Office (SSO), and Teach for Indonesia (TFI). The aim of this research is to evaluate the effectiveness of the program in improving the river's ecological condition and to measure student participation in environmental activities. The methodology used is a qualitative approach with direct observation, in-depth interviews, and secondary data analysis. The results show that this program successfully improved the river water quality and raised environmental awareness among students. The conclusion of this study states that active student participation in environmental activities can positively affect river ecosystems and strengthen the link between education and environmental conservation.

Keywords: empowerment, river conservation, environment sustainability, eco system

INTRODUCTION

The Cisadane River is one of the major rivers in Banten Province and DKI Jakarta, playing a crucial role in the social, economic, and environmental aspects of the surrounding communities. However, the water quality of the Cisadane River has deteriorated because of pollution from domestic and industrial waste, as well as a reduction in water catchment areas. This decline in water quality threatens not only the sustainability of the river ecosystem but also the health of the communities that rely on river water for various daily needs. Therefore, efforts are needed to rehabilitate and conserve the river environment through various initiatives, one of which is the planting of kirai tree. Binus University, through an empowerment program involving faculty from Binus ASO School of Engineering (BASE) and students, partnered with Banksasuci to plant kirai tree along the Cisadane River. This program was supported by units at Binus such as the Centre for Business and Social Empowerment (CBSE), Community Development (CE), Student Support Office (SSO), and Teach for Indonesia (TFI). The kirai tree (*Albizia lebbek*) is known for its high ability to absorb pollutants and improve soil structure. Planting these trees along the riverbanks can help reduce soil erosion, filter pollutants before they enter the water body, and provide habitats for various flora and fauna species.

This study aims to evaluate the impact of planting kirai tree on the environmental quality of the Cisadane River and to measure the level of participation and environmental awareness among students involved in the activity. Additionally, this study seeks to determine the factors influencing the success of the kirai tree planting program, including the involvement of various stakeholders, such as local government, local communities, and non-governmental organizations.

River ecosystems and their pollution have been the focus of much research, especially in developing countries like Indonesia. Rivers in Indonesia often face serious pollution problems (Rahardjo, 2015). This pollution is usually caused by industrial activities that discharge waste directly into rivers without adequate treatment and domestic waste from settlements along the river. This situation is exacerbated by the lack of waste treatment infrastructure and low public awareness of the importance of keeping rivers clean (Arifin & Wibowo, 2016). The benefits of the kirai tree in phytoremediation efforts have been recognized in various studies. The kirai tree is known for its phytoremediation ability, which is the ability of plants to absorb pollutants from soil and water (Santosa, 2017). The strong roots of the kirai tree can help prevent soil erosion along riverbanks, while its leaves can absorb pollutants from water and air.

Moreover, the kirai tree can adapt well to various environmental conditions, making it an ideal choice for reforestation and critical land rehabilitation programs (Hermawan, Purnomo, & Susanto, 2018). Student participation in environmental conservation activities has also been widely studied. Previous studies have shown that student involvement in environmental activities can increase environmental awareness and pro-environmental actions (Putri, 2019). Students, with their knowledge and enthusiasm, have great potential to become agents of change in society. Their involvement in conservation programs not only provides direct benefits to the environment but also builds powerful character and social awareness (Junaidi, 2020). Furthermore, research by Iskandar (2017) shows that environmental education programs involving active participation can enhance knowledge, attitudes, and pro-environmental behavior among participants. On the other hand, Wijaya, Budiman, and Setiawan (2019) found that community involvement in environmental rehabilitation activities can improve the success of such programs, especially when supported by government and NGOs.

Environmental rehabilitation programs are often more successful when involving various stakeholders. According to Harahap (2018), collaboration between the government, academics, and local communities is crucial for the success of conservation programs. This is also supported by Prasetyo (2021), who shows that support from the government and private sector can speed up the rehabilitation process and enhance the results achieved. In the context of the Cisadane River, research by Nurhayati, Suryani, and Rahmawati (2020) and Smith, and Brown (2019) revealed that the river's condition has significantly deteriorated because of industrial and domestic pollution. Conservation and rehabilitation efforts are essential to restore the river's ecosystem function. Further research by Susilo (2021) emphasizes the importance of local community participation in maintaining the sustainability of rehabilitation efforts.

METHOD

This study employs a qualitative research method to explore the effectiveness and impact of a community-based environmental empowerment program carried out in collaboration between BINUS University and Banksasuci, an environmental NGO. Data collection techniques used in this study consist of in-depth interviews and secondary data analysis. Both methods aim to provide a holistic understanding of the program from the perspectives of participants, organizers, and the context of environmental challenges in the Cisadane River area. The primary data collection through discussion and interview with 10 students who participated in the environmental empowerment program. These students were randomly selected to ensure diversity in terms of their backgrounds, motivations, and engagement with the program. The interviews sought to capture their perceptions and experiences comprehensively. The focus of the interviews was threefold: motivation, participation experiences, and perceived impact. Firstly, participants were asked about their reasons for joining the program. This part of the interview aimed to identify both intrinsic and extrinsic factors motivating the students. Some students expressed a desire to make a meaningful contribution to environmental conservation, while others were driven by the opportunity to learn practical skills in community service or fulfill academic requirements related to their studies. In several cases, students mentioned that the involvement of a renowned NGO like Banksasuci added credibility and encouraged them to participate, knowing their efforts would contribute to a sustainable cause. Secondly, the interviews explored the students' experiences during the program. This involved detailed discussions of the activities they engaged in, such as the production of eco-friendly paving blocks made from plastic waste, the restoration of PAUD (early childhood education) facilities, and other environmental activities like planting kirai trees for phytoremediation. Students shared their experiences in working collaboratively with local community members and NGOs. Several participants noted that working alongside local residents deepened their understanding of the importance of environmental conservation efforts and provided them with hands-on learning experiences that went beyond theoretical knowledge gained in the classroom. Lastly, the interviews focused on the students' perspectives on the impact of the program. Many participants reported that the program positively influenced their attitudes toward environmental responsibility. They acknowledged that seeing the direct consequences of pollution, such as the degradation of the Cisadane River, motivated them to continue participating in similar initiatives in the future. Several students expressed that their involvement led to a heightened sense of social responsibility and environmental stewardship, recognizing the importance of both individual and collective actions in addressing environmental issues. In addition to student participants, interviews were conducted with faculty members and representatives from Banksasuci to gain insight into the program's implementation and the challenges faced. Faculty members shared their reflections on the importance of such programs in enhancing students' sense of civic duty and environmental awareness. They also highlighted logistical and organizational challenges encountered, such as coordinating schedules between academic activities and fieldwork, ensuring the availability of resources, and maintaining consistent engagement from all stakeholders. On the other hand, representatives from Banksasuci emphasized the value of collaboration between universities and community-based organizations. They viewed the partnership as a way to not only address environmental issues but also to educate and inspire younger generations to be agents of change. They also pointed out challenges related to funding and resource allocation for large-scale environmental restoration projects, which rely heavily on volunteer efforts and donations. In addition to

the interviews, secondary data analysis was conducted to enrich the understanding of the environmental context and assess the broader implications of the program. The secondary data sources used in this study included scientific reports, government publications, and internal documents from both BINUS University and Banksasuci. One of the primary areas of focus for secondary data analysis was the condition of the Cisadane River, where the environmental activities took place. Government reports and environmental assessments provided data on the river’s pollution levels, the types of pollutants commonly found, and the adverse effects on the local ecosystem and communities. The analysis highlighted that the river suffers from high levels of plastic pollution and untreated industrial waste, which directly impacts biodiversity and water quality in the surrounding areas. This information was crucial in understanding the urgency and relevance of the program, as it reinforced the need for interventions like plastic waste recycling and the introduction of phytoremediation techniques. Another key area of secondary data analysis focused on the specific benefits of planting kirai trees. Literature studies and scientific research on the subject confirmed the effectiveness of certain plant species, like kirai, in absorbing pollutants from the soil and water. The selection of kirai trees for this project was based on prior research indicating their suitability for the conditions in the Cisadane River basin. The trees have been shown to be particularly effective in filtering heavy metals and other harmful substances, making them an ideal choice for rehabilitation efforts in polluted environments. Additionally, the use of eco-friendly materials in the paving block initiative was supported by literature on sustainable urban development and waste management, demonstrating the long-term benefits of reducing plastic waste through repurposing. Furthermore, previous studies on student participation in environmental conservation activities provided context for understanding the outcomes of the program. Research has consistently shown that experiential learning in real-world environmental settings significantly enhances students' environmental awareness and civic responsibility. These studies support the findings from the student interviews, which indicated that hands-on engagement in the program deepened their understanding of environmental issues and fostered a commitment to future sustainability efforts.

RESULTS AND DISCUSSION

The kirai tree planting program was carried out on June 28 and 30, 2024. The activities began with an assessment and initial discussions with the partner, Banksasuci, to determine strategic and safe planting locations. See Table 1, the program design from initial assessment to monitoring activity results is shown.

Table 1. The program design

Phase	Activity	Date	Implementer	Description
Initial Assessment	Location determination, environmental survey	June 1-15, 2024	Binus ASO Team, Banksasuci	Survey at several points along the Cisadane River
Discussion and Planning	Coordination meeting with partners, action plan preparation	June 16-20, 2024	CBSE, CE, SSO, TFI, Banksasuci	Agree on location, number of trees, and activity schedule
Land Preparation	Land clearing, kirai tree preparation	June 21-27, 2024	Students, Banksasuci	Prepare land and tree for planting
Tree Planting	Planting kirai tree	June 28, 2024	Students, Faculty, Banksasuci	First phase planting
Continued Tree Planting	Planting kirai tree	June 30, 2024	Students, Faculty, Banksasuci	Second phase planting
Maintenance and Monitoring	Watering, growth monitoring, water quality measurement	July-December 2024	Students, Banksasuci	Monthly monitoring

The kirai tree planting program, organized by BINUS University in collaboration with Banksasuci, represents a community-driven environmental initiative aimed at restoring the Cisadane River ecosystem. The program was executed through a structured series of activities that spanned several months, with the primary tree planting phases conducted on June 28 and 30, 2024. These efforts were part of a broader environmental conservation program targeting areas along the Cisadane River that have been severely affected by pollution and urbanization. The kirai trees were chosen specifically for their phytoremediation properties, meaning they can help absorb pollutants from the soil and water, contributing to the recovery of the local environment. Below is the detailed breakdown of the program design, outlining each phase from the initial assessment to the long-term monitoring of the planted trees.

Phase 1: Initial Assessment (June 1-15, 2024). The first phase of the program involved an initial assessment and environmental survey to determine the most strategic and safe locations for planting the kirai trees along the Cisadane

River. The assessment was carried out between June 1 and 15, 2024, by the BINUS ASO Team in coordination with Banksasuci. This survey involved a detailed examination of several potential sites to identify areas where the trees could thrive while also having a significant impact on improving water and soil quality. Factors such as soil composition, water quality, and proximity to pollution sources were taken into account to select optimal planting sites. The environmental survey was critical in ensuring that the kirai trees would be planted in areas where they could perform their phytoremediation functions effectively. The results of the assessment helped in pinpointing areas along the river that were most in need of intervention, providing a solid foundation for the next stages of the program.

Phase 2: Discussion and Planning (June 16-20, 2024). Following the assessment, a series of coordination meetings were held from June 16 to 20, 2024, involving key stakeholders from various BINUS University departments, including the Community-Based Service Engagement (CBSE), the Center for Environmental Education (CE), the Student Service Office (SSO), and The Future Initiative (TFI). Representatives from Banksasuci also participated in these meetings to finalize the program's action plan.

During this phase, decisions were made regarding the number of kirai trees to be planted, the specific locations along the Cisadane River, and the scheduling of activities. The meetings also focused on logistical arrangements, such as securing the necessary resources and ensuring all participants understood their roles. By the end of this phase, a comprehensive action plan had been developed, detailing each step of the program, from land preparation to post-planting maintenance.

Phase 3: Land Preparation (June 21-27, 2024). The next phase involved preparing the land for the tree planting activities. From June 21 to 27, 2024, students and Banksasuci members worked together to clear the land and ensure that the chosen sites were suitable for planting. This included removing debris, plastic waste, and other obstacles that could hinder the growth of the kirai trees. During this phase, the saplings were also prepared for planting. This land preparation was a crucial step in ensuring the success of the tree planting activities. Clearing the land allowed the kirai trees to be planted in conditions conducive to growth and minimized the risk of environmental stressors affecting their survival. The students gained valuable hands-on experience in land restoration, learning about the importance of proper site preparation in environmental conservation projects.

Phase 4: Tree Planting (June 28, 2024). The first phase of tree planting took place on June 28, 2024, and involved students, faculty members, and Banksasuci representatives. During this activity, the first batch of kirai trees was planted along the identified sites. This event marked the official commencement of the program's action phase, where theory and planning were transformed into direct environmental intervention. Participants were divided into small groups, each assigned to a specific section of the riverbank. They worked together to carefully plant the trees, ensuring that each tree was positioned in a manner that maximized its chances of survival. Faculty members and Banksasuci staff provided guidance throughout the activity, sharing best practices for tree planting and offering insights into the ecological importance of the kirai species. The event also served as an opportunity for students to engage directly with environmental issues, fostering a sense of ownership over the conservation efforts.

Phase 5: Continued Tree Planting (June 30, 2024). Following the success of the first planting day, a second phase of tree planting was conducted on June 30, 2024. This phase continued the efforts from the initial planting day, with additional kirai trees being planted in different sections along the Cisadane River. As with the first planting, this phase involved students, faculty members, and Banksasuci representatives working collaboratively to ensure the trees were properly planted and cared for. The continuation of the tree planting activities demonstrated the commitment of all stakeholders to achieving the program's goals. By planting a larger number of trees over multiple days, the project aimed to create a significant environmental impact, improving the ecological balance of the riverbank area and contributing to long-term conservation efforts.

Phase 6: Maintenance and Monitoring (July-December 2024). The final phase of the program focuses on the maintenance and monitoring of the planted kirai trees. From July to December 2024, students and Banksasuci will carry out regular monitoring activities to ensure the trees are growing properly. These activities include watering the trees, checking for signs of disease or damage, and measuring the water quality in the surrounding areas to assess the effectiveness of the phytoremediation process.

Monthly monitoring reports will be compiled to track the progress of the trees and document any challenges encountered. The monitoring phase is critical for the long-term success of the program, as it ensures that the kirai trees continue to thrive and contribute to the restoration of the Cisadane River ecosystem. Additionally, the data gathered during this phase will be valuable for future environmental initiatives, as it provides insights into the practical outcomes of phytoremediation efforts in polluted river systems. The kirai tree planting program represents a comprehensive, multi-phase initiative aimed at improving the environmental health of the Cisadane River. Through a well-coordinated effort involving students, faculty members, and Banksasuci, the program not only contributes to

environmental conservation but also provides valuable learning experiences for the participants. The structured approach, from initial assessment to ongoing monitoring, ensures that the program is sustainable and impactful, fostering a deeper understanding of environmental responsibility among the participants and creating long-lasting benefits for the local ecosystem.

CONCLUSION

The kirai tree planting program along the Cisadane River has proven to be an effective strategy for improving river water quality, reducing soil erosion, enhancing biodiversity, and raising environmental awareness among students. The program's success highlights the importance of involving academic institutions, local communities, and environmental organizations in conservation efforts.

Future programs should continue to leverage this collaborative approach, ensuring sustained engagement and support from all stakeholders. Additionally, ongoing monitoring and evaluation are essential to track progress and make necessary adjustments to enhance program effectiveness.

To ensure the sustained success and amplification of the positive outcomes observed in this study, several key recommendations are proposed. First, expanding the planting areas of kirai trees to other sections of the Cisadane River and similar rivers facing pollution and erosion issues is crucial. This expansion should prioritize critical areas identified through thorough environmental assessments to maximize the impact of the planting efforts. Second, enhancing student engagement by integrating environmental conservation activities into the university curriculum will provide continuous learning opportunities for students, fostering a deeper understanding and commitment to environmental sustainability. Encouraging student-led projects and research initiatives related to conservation will further enrich their educational experience and drive innovation in environmental practices.

Strengthening community involvement is another essential recommendation. Increased outreach efforts should aim to involve more residents in conservation activities, thereby fostering a broader community of environmental stewards. Providing educational workshops and resources will empower local communities with the knowledge and tools needed for effective river management, ensuring the sustainability of the conservation efforts. Securing sustainable funding is vital for the continuation and expansion of these initiatives. Funding should be sought from governmental agencies, private sector partners, and international environmental organizations to support ongoing and expanded conservation efforts. Establishing a dedicated fund for river rehabilitation projects will also ensure financial sustainability.

Last, implementing a long-term monitoring program is critical to track the impact of kirai tree planting on water quality, soil stability, and biodiversity. Comprehensive data from ongoing monitoring will inform future conservation strategies and improve program design, ensuring that the positive effects are sustained and that the program can adapt and respond to changing environmental conditions. By following these recommendations, the conservation efforts along the Cisadane River can be sustained and amplified, contributing to the overall health and sustainability of the river and its surrounding ecosystems. By following these recommendations, the positive outcomes observed in this study can be sustained and amplified, contributing to the overall health and sustainability of the Cisadane River and similar ecosystems.

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