

Strengthening the Role of Students in Environmental Conservation through Environmental Education and Sustainable Tree-Planting Actions

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Abstract—Environmental degradation and the declining quality of urban green spaces require collaborative conservation initiatives involving higher education institutions and university students. This community service program aimed to strengthen the role of students in environmental conservation through environmental education and sustainable tree-planting activities conducted at Medan Urban Forest on 22 June 2026 involving fifteen students from the Management Study Program of Sekolah Tinggi Ilmu Manajemen Sukma. The program employed an integrated approach consisting of environmental education, participatory discussions, practical planting of mango (*Mangifera indica*) and mangosteen (*Garcinia mangostana*) trees, and post-activity evaluation. The results demonstrated significant improvements in participants' environmental competence, with ecosystem knowledge increasing from 41% to 85%, environmental awareness from 65% to 98%, environmental responsibility from 35% to 100%, and environmental empathy from 51% to 78%. Participant satisfaction was also highly positive, with 55% reporting being very satisfied, 34% satisfied, and 11% moderately satisfied with the implementation of the program. These findings indicate that integrating environmental education with experiential conservation activities effectively enhances environmental literacy, strengthens pro-environmental attitudes, and encourages active participation in sustainable environmental stewardship. Therefore, this community service program provides a practical and replicable model for universities seeking to integrate environmental education, student empowerment, and community engagement in support of sustainable urban environmental conservation.

Keywords: Environmental Education; Environmental Conservation; Community Service; Sustainable Tree Planting; Student Participation; Urban Forest.

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1. INTRODUCTION

Rapid urbanisation, land conversion, climate change, and decreasing green open spaces have accelerated ecosystem degradation, biodiversity loss, and environmental deterioration in many countries, including Indonesia, making environmental conservation a global priority (Sugiarto & Gabriella, 2020; Latuamury et al., 2024). These environmental challenges need collaborative efforts of governments, educational institutions, and communities to promote sustainable conservation initiatives to balance between ecological preservation and social development (Nugroho et al., 2025). Environmental education has been broadly acknowledged as a successful method for enhancing environmental consciousness, promoting responsible conduct, and increasing public engagement in conservation initiatives (Idris et al., 2026). Furthermore, educational activities that combine practical conservation actions are more effective in promoting long-term pro-environmental attitudes than theoretical learning (Shara et al., 2025). Tree planting is one of the important strategies for conserving the environment in terms of carbon sequestration, biodiversity conservation, ecosystem restoration, and urban environmental improvement (Pramudita, 2025). Hence, sustainable implementation of tree-planting programs requires continuous public participation and institutional commitment rather than one-time ceremonial activities (Noor et al., 2026). Therefore, universities are expected to integrate environmental conservation in community service activities by empowering students to be active contributors to sustainable development (Muliasari et al., 2024; Luthfi et al., 2025).

Higher education institutions have strategic roles in developing environmentally responsible graduates because universities not only function as centers of knowledge but also as agents of social transformation (Puspa & Muchtar, 2018). Students are seen as agents of change who can advance environmental conservation via education, advocacy, and direct community engagement (Assa, 2022). Previous studies show that students who participate in conservation activities will increase environmental awareness, strengthen civic responsibility, and foster collaboration in environmental actions within the community (Septiani et al., 2025). Community service programs are effective media for integrating academic knowledge with practical environmental conservation activities that directly address local environmental problems (Abdillah et al., 2025). Conservation initiatives become more sustainable when participants actively collaborate with



community stakeholders, as demonstrated by various universities that have organised environmental campaigns, green movement programs, and tree-planting activities with students and local communities (Khusna, 2025; Sibarani et al., 2024). Environmental education coupled with participatory conservation activities enhances ecological understanding while fostering long-term commitment to the environment among participants (Fithria & Rezekiah, 2025). Thus, the enhancement of students' roles in environmental conservation is an integrated educational process that integrates environmental knowledge, civic responsibility, and practical conservation experience (Pratiwi et al., 2023).

Indonesia has not been free from environmental problems related to decreasing vegetation cover and urban environmental degradation. Urban forests are increasingly important as ecological buffers and environmental education centers (Sugiarto & Gabriella, 2020; Latuamury et al., 2024). Sustainable management of urban forests requires not just government action but also active involvement from universities and local communities (Noor et al., 2026). This community service activity was therefore implemented at Medan Urban Forest on June 22, 2026 in collaboration with 15 students of the Management Study Program of Sekolah Tinggi Ilmu Manajemen Sukma. Preliminary observations suggested that conservation activities involving university students were still limited and generally carried out as short-term environmental campaigns with no continuous educational reinforcement (Assa, 2022; Muliasari et al., 2024). Opportunities to combine environmental education with practical conservation actions were still lacking, leading to a lack of environmental literacy and long-term commitment to conservation among students (Septiani et al., 2025). Accordingly, this program integrated environmental education with the planting of mango (*Mangifera indica*) and mangosteen (*Garcinia mangostana*) trees to strengthen students' environmental knowledge, practical conservation skills, and active participation in urban greening initiatives (Pramudita, 2025; Fithria & Rezekiah, 2025).

Previous research on community service has consistently shown positive effects of environmental education and tree planting but there remain significant gaps in the research. Environmental education and tree planting were implemented in an Islamic boarding school by Fithria and Rezekiah (2025), while Latuamury et al. (2024) targeted elementary school students. Nugroho et al. (2025) stressed the importance of mangrove conservation in coastal ecosystems, while Pramudita (2025) highlighted adaptation to climate change through community tree planting. Idris et al. (2026) had integrated environmental seminars with tree planting for school students, yet these studies did not specifically strengthen university students' roles as sustainable environmental conservation agents. Likewise, Abdillah et al. (2025), Khusna (2025), Putriana et al. (2025), Septiani et al. (2025), and Mujito et al. (2025) demonstrated the importance of student participation in environmental conservation; nevertheless, their programs generally examined environmental education, student participation, or tree planting separately rather than integrating these components into a comprehensive urban conservation model. Moreover, few studies have adopted structured community service activities in urban forest ecosystems that can enhance environmental literacy, practical conservation competencies, and sustainable student participation at the same time. This gap indicates the need for an integrated conservation model that combines environmental education, participatory tree planting, and student empowerment within an urban environmental context (Luthfi et al., 2025).

Therefore, the implementation of this community service program is very relevant because urban environmental degradation needs collaborative and sustainable conservation efforts involving higher education institutions and young generations (Sugiarto & Gabriella, 2020). Urban greening programs enhance ecological resilience, environmental quality, and biodiversity and raise public awareness of environmental sustainability (Noor et al., 2026). This program is expected to improve students' environmental literacy, increase their conservation competency, and promote long-term participation in environmental protection through environmental education and the planting of mango and mangosteen trees (Idris et al., 2026; Pramudita, 2025).

This activity also contributes to the mission of higher education community service by using academic knowledge in solving environmental problems and developing civic responsibility among students (Abdillah et al., 2025). This community service is intended to strengthen the role of students in environmental conservation through integrated environmental education and sustainable tree-planting activities at Medan Urban Forest. The expected outcomes include improved environmental awareness among participants, increased urban vegetation through tree planting, strengthened collaboration between universities and local communities, and the development of an integrated community service model that contributes both practically and academically to sustainable urban environmental management.

2. METHODOLOGY

2.1 Contemporary Literature Review

Environmental conservation is increasingly recognized as a shared responsibility requiring collaboration among governments, educational institutions, and communities to achieve sustainable ecosystem management (Sugiarto & Gabriella, 2020). Contemporary conservation emphasizes environmental education as an effective approach for improving ecological literacy, encouraging responsible behavior, and promoting long-term community participation in conservation initiatives (Latuamury et al., 2024; Idris et al., 2026). Educational activities integrated with practical conservation actions have been shown to generate stronger environmental awareness than theoretical learning alone because participants directly experience environmental stewardship through real activities (Shara et al., 2025). Tree planting is widely acknowledged as an effective conservation strategy because it supports carbon sequestration,



biodiversity conservation, ecosystem restoration, and urban environmental improvement (Pramudita, 2025). Sustainable implementation of these programs requires continuous participation from educational institutions, particularly universities, which play important roles in integrating academic knowledge with community engagement activities (Muliasari et al., 2024). Consequently, strengthening students' participation in environmental education and tree-planting initiatives represents an effective strategy for developing environmental responsibility while supporting sustainable development (Luthfi et al., 2025).

Recent community service studies further demonstrate that student involvement significantly contributes to successful environmental conservation because university students possess the capacity to promote environmental awareness and mobilize community participation (Assa, 2022). Community service activities enable experiential learning by allowing students to apply academic knowledge directly to environmental problems while strengthening their civic responsibility (Abdillah et al., 2025). Previous programs integrating environmental education with conservation practices have consistently reported improvements in environmental awareness and participant engagement (Fithria & Rezekiah, 2025). Likewise, collaborative conservation activities strengthen partnerships between universities and local communities while expanding the social contribution of higher education institutions (Putriana et al., 2025). Integrating environmental literacy, participatory learning, and practical conservation into a single educational framework therefore provides measurable ecological and social benefits (Septiani et al., 2025). This approach also supports the implementation of higher education community service by promoting sustainable environmental management through collaborative action (Mujito et al., 2025; Pratiwi et al., 2023).

2.2 Location, Date, and Participants

This community service program was implemented at Medan Urban Forest, Medan, Indonesia, on 22 June 2026. The activity **involved** 15 students from the Management Study Program of Sekolah Tinggi Ilmu Manajemen Sukma as the primary participants and community partners. Medan Urban Forest was selected because it functions as one of the city's important green open spaces that contributes to environmental sustainability and ecological balance. The program combined environmental education with sustainable tree-planting activities to strengthen students' environmental awareness and conservation participation. The tree species planted consisted of mango (*Mangifera indica*) and mangosteen (*Garcinia mangostana*), selected according to local environmental conditions and their ecological benefits. Throughout the activity, participants actively engaged in every stage of implementation, from preliminary observation to the final evaluation and closing session.

2.3 Implementation Procedures

The following is Figure 1 of the stages in implementing the community service.



Figure 1. Stage of CSR

The implementation began with a field observation conducted jointly by the community service team and participants to assess environmental conditions within Medan Urban Forest and identify suitable planting locations. In this phase, the participants observed the vegetation conditions, perceived the need for conservation and assessed the environmental features that support sustainable tree planting. The observation process also helped participants learn about the ecological functions of urban forests and strengthened their understanding of environmental conservation in urban areas. Field assessments informed the development of educational materials and implementation strategies. This phase also improved the participants' coordination before the implementation of the main activities.

After the first observation a joint discussion was held between the implementation team and participants on the focus of the community service program and the proper implementation strategy. discussions identified environmental problems relevant to urban conservation and referred to educational materials that underpinned practical conservation activities. The program implementation saw participants exchanging ideas on environmental sustainability, the importance of tree planting and individual responsibilities. The discussion also agreed to plant mango and mangosteen trees according to their environmental suitability and ecological value. This participatory planning process enhanced collaboration and ensured participants' understanding of the objectives and expected outcomes of the activity before implementation.

After the planning phase, preparations were made to ensure that all needed resources were available. Before implementation, educational materials, logistical support, planting equipment, and healthy tree seedlings were prepared. The implementation team also organised participant responsibilities to facilitate efficient and organised activities. Before the tree planting, environmental education sessions were held to impart participants with knowledge on conservation principles, tree maintenance, and sustainable environmental management. Then participants were assisted by the implementation team to plant mango and mangosteen trees in their respective locations in Medan Urban Forest. The incorporation of environmental education with hands-on conservation activities allowed participants to convert theoretical knowledge into actual environmental action and enhance their conservation skills.

The last phase was evaluation and closing activities to assess the effectiveness of the program and to identify participants' responses to activities implemented. Evaluation was done by direct observation, interactive discussion and reflections of the participants on educational sessions and tree planting experiences. Participants were invited to share their views, their experiences of implementation and their ideas for future conservation activities. The assessment showed that participants responded positively to the integration of environmental education with sustainable tree planting and showed an increased motivation to take part in future initiatives on environmental conservation. The program ended with a collective reflection on the importance of taking care of the planted trees and continuing with environmental responsibility even after the community service activity was completed. This closing session reaffirmed participants' commitment to continuing efforts of environmental conservation both in academic and community environments.

3. RESULT AND DISCUSSION

3.1 Analysis of the Initial Implementation of the Community Service Program

The community service program entitled "Strengthening the Role of Students in Environmental Conservation through Environmental Education and Sustainable Tree-Planting Actions" was successfully implemented at Medan Urban Forest on 22 June 2026 with the participation of fifteen students from the Management Study Program of Sekolah Tinggi Ilmu Manajemen Sukma. The program was designed to address the identified partner problems related to limited environmental literacy, inadequate conservation experience, and the need for greater student involvement in sustainable environmental initiatives. The implementation adopted an integrated approach by combining environmental education with practical tree-planting activities, allowing participants to connect theoretical concepts with real conservation practices. Educational sessions focused on ecosystem functions, biodiversity conservation, urban environmental issues, and the ecological importance of sustainable tree planting, followed by collaborative planting of mango (*Mangifera indica*) and mangosteen (*Garcinia mangostana*) trees. Throughout the implementation, participants demonstrated strong enthusiasm, active participation, and effective teamwork, indicating that the learning process successfully encouraged collaborative engagement and environmental responsibility. The direct involvement of all participants in both educational and field activities strengthened their understanding of environmental conservation while fostering a sense of ownership toward urban greening initiatives. Overall, the implementation achieved its primary objective by transforming environmental knowledge into practical action and providing meaningful learning experiences that addressed the environmental challenges identified during the preliminary assessment. Figure 2 shows the participation of participants in the community service activities carried out.



Figure 2. Community service activities

3.2 Analysis and Recapitulation of Participants Before the Activity

The initial assessment revealed that participants possessed moderate environmental awareness but relatively limited ecological knowledge and practical conservation experience. Baseline data showed that ecosystem knowledge reached only 41%, while awareness of environmental issues was 65%, indicating that participants understood current environmental problems but lacked comprehensive knowledge regarding ecosystem conservation and sustainable environmental management. Environmental attitudes also required improvement, as the level of environmental responsibility was only 35%, and environmental empathy reached 51%, suggesting that awareness had not yet been translated into consistent conservation behavior. These findings confirmed the necessity of implementing an integrated educational intervention capable of strengthening both cognitive understanding and environmental attitudes before participants engaged in practical conservation activities. The baseline assessment also served as an important reference for measuring the effectiveness of the intervention by providing clear indicators for evaluating changes in participants' knowledge and environmental behavior after program implementation. Therefore, the initial participant profile justified the need for environmental education combined with participatory tree planting as an appropriate strategy for improving environmental literacy and conservation competence.

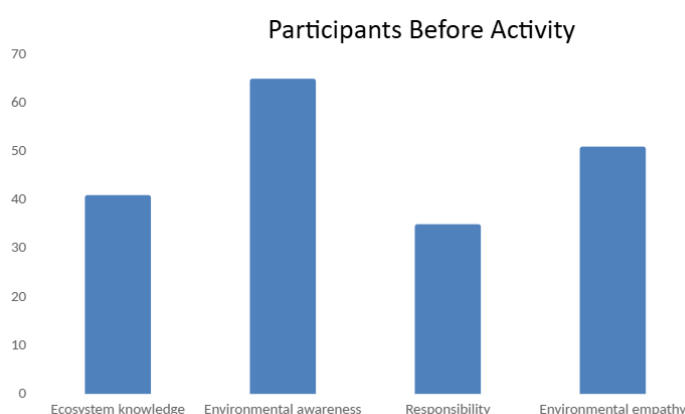


Figure 3. Baseline environmental competence of the participants

Figure 3 illustrates the baseline environmental competence of the participants before the implementation of the community service program. The results indicate that participants possessed moderate awareness of environmental issues (65%) but relatively limited ecosystem knowledge (41%), environmental responsibility (35%), and environmental empathy (51%). These findings demonstrate that although participants recognized environmental challenges, they still lacked comprehensive ecological understanding and practical conservation attitudes. Therefore, the baseline assessment confirmed the necessity of implementing environmental education combined with participatory tree-planting activities to strengthen environmental literacy and conservation behavior among university students.

3.3 Analysis of Participant Impacts and Satisfaction

The post-activity evaluation demonstrated significant improvements across all assessment indicators, confirming the effectiveness of integrating environmental education with sustainable tree-planting activities. Ecosystem knowledge increased from 41% to 85%, representing an improvement of 38 percentage points, while awareness of environmental issues increased from 65% to 98%, reflecting a 29 percentage-point improvement. Environmental responsibility showed the greatest increase, rising from 35% before the activity to 100% afterward, whereas environmental empathy improved from 51% to 78%, demonstrating substantial positive changes in participants' environmental attitudes. These results indicate that experiential learning effectively strengthened participants' cognitive understanding while simultaneously encouraging positive behavioral change toward environmental conservation. Participant satisfaction further supported

these findings, with 55% reporting that they were very satisfied, 34% indicating that they were satisfied, and the remaining 11% stating that they were moderately satisfied with the overall implementation of the program. Participants acknowledged that combining environmental education with practical conservation activities created meaningful learning experiences, strengthened teamwork, and increased their motivation to participate in future environmental initiatives. Collectively, these findings demonstrate that the community service program successfully enhanced environmental knowledge, responsibility, and conservation awareness while generating high participant satisfaction, thereby confirming the effectiveness of participatory environmental education as an approach for strengthening sustainable environmental stewardship among university students.

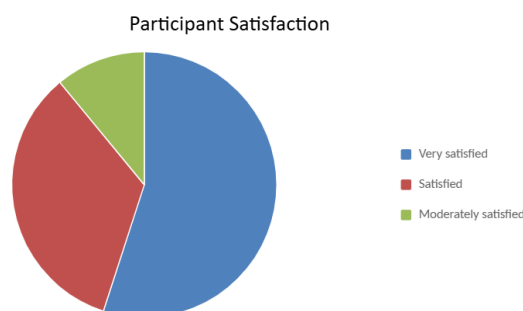


Figure 4. Level of participant satisfaction following the completion of the CSR program

Figure 4 presents the level of participant satisfaction following the completion of the community service program. More than half of the participants (55%) reported being very satisfied, while 34% were satisfied, and only 11% indicated that they were moderately satisfied. These results suggest that the integration of environmental education with sustainable tree-planting activities created a meaningful learning experience that successfully met participants' expectations. The high satisfaction level also indicates that the program was effectively implemented and contributed positively to participants' environmental knowledge, practical skills, and motivation to engage in future conservation activities.

3.4 Analysis of Comparison Before and After the Activity

A comparative analysis between the baseline and post-activity assessments clearly demonstrates that the community service program produced measurable improvements in participants' environmental competence and conservation attitudes. Ecosystem knowledge increased from 41% before the intervention to 85% afterward, while awareness of environmental issues improved from 65% to 98%, indicating that the educational sessions effectively strengthened participants' understanding of ecological concepts and current environmental challenges. Similar progress was observed in environmental attitudes, where environmental responsibility increased from 35% to 100%, representing the greatest improvement among all indicators, whereas environmental empathy improved from 51% to 78% after participants were directly involved in conservation activities. These findings indicate that combining theoretical learning with experiential field practice successfully transformed environmental knowledge into practical awareness and encouraged participants to become more actively involved in environmental conservation. The consistency between the quantitative improvements and the high level of participant satisfaction further confirms that the implemented learning approach effectively addressed the participants' initial knowledge gaps while strengthening their environmental commitment. Overall, the comparison between the conditions before and after the program provides strong evidence that participatory environmental education combined with sustainable tree planting represents an effective strategy for improving environmental literacy and promoting long-term conservation behavior among university students.

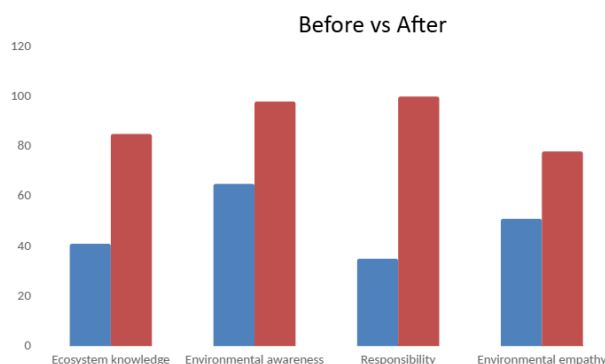


Figure 5. Compares participants' environmental competence before and after the implementation

Figure 5 compares participants' environmental competence before and after the implementation of the community service program. Significant improvements were observed across all assessment indicators, particularly environmental responsibility, which increased from 35% to 100%, followed by ecosystem knowledge (41% to 85%), environmental awareness (65% to 98%), and environmental empathy (51% to 78%). These findings demonstrate that integrating environmental education with practical conservation activities effectively enhanced participants' environmental literacy, strengthened conservation attitudes, and encouraged greater participation in sustainable environmental stewardship. The comparison confirms that the community service intervention successfully achieved its intended educational and environmental objectives.

3.5 Discussion

The results of this community service program demonstrate that integrating environmental education with sustainable tree-planting activities effectively improves students' environmental knowledge, awareness, and conservation attitudes. The substantial improvements observed in ecosystem knowledge and environmental awareness support previous studies reporting that experiential learning provides stronger educational outcomes than classroom-based instruction alone (Idris et al., 2026; Shara et al., 2025). Likewise, the remarkable increase in environmental responsibility and empathy indicates that direct participation in conservation activities strengthens both cognitive understanding and emotional attachment toward environmental sustainability. These findings are consistent with studies emphasizing that environmental education combined with practical conservation activities produces lasting behavioral change and stronger environmental commitment among participants (Fithria & Rezekiah, 2025; Latuamury et al., 2024). Furthermore, the positive outcomes obtained in this program reinforce the strategic role of university students as agents of environmental change capable of promoting sustainable conservation within their communities. Similar conclusions were reported by Assa (2022), Luthfi et al. (2025), and Septiani et al. (2025), who found that active student participation significantly contributes to environmental stewardship and strengthens civic responsibility through collaborative environmental action (Assa, 2022; Luthfi et al., 2025; Septiani et al., 2025). The high level of participant satisfaction also indicates that integrating environmental education with practical conservation creates a more engaging learning experience than conventional awareness campaigns while increasing participants' motivation to continue participating in future environmental initiatives. Therefore, this community service program contributes not only to improving environmental literacy but also to providing an applicable model for integrating higher education, community engagement, and sustainable urban conservation that can be replicated by other universities and community organizations seeking to strengthen long-term environmental stewardship (Muliasari et al., 2024; Mujito et al., 2025; Putriana et al., 2025).

4. CONCLUSION

This community service program has successfully improved the role of university students in environmental conservation by integrating environmental education and sustainable tree-planting activities at Medan Urban Forest. The comparison between the baseline and post-activity assessments demonstrates that the intervention produced substantial improvements across all evaluated indicators, including ecosystem knowledge, which increased from 41% to 85%, environmental awareness from 65% to 98%, environmental responsibility from 35% to 100%, and environmental empathy from 51% to 78%. These results demonstrate that the combination of environmental education and practical conservation is an effective way to improve cognitive understanding and pro-environmental attitudes, while promoting active student participation in sustainable environmental management. Participant satisfaction was also very high, with 55% reporting that they were very satisfied, 34% satisfied, and 11% moderately satisfied, suggesting that the program was able to provide meaningful learning experiences and increase participants' motivation to engage in future conservation efforts. The implementation has also directly contributed to urban greening with the planting of mangoes and mangosteens and strengthened collaboration between higher education and community based environmental conservation. However, the community service activity has some limitations such as the number of participants is relatively small, the implementation is carried out in only one place, and the evaluation is carried out directly after the program, without long-term monitoring of behavioural sustainability and tree survival. Therefore, future community service programs should involve greater numbers of participants, broaden to many urban conservation sites, and include long-term evaluations of the persistence of environmental attitudes, conservation behaviour, and ecological effects over time. Overall, this integrated community service model shows great potential to be replicated by higher education institutions as an effective strategy for enhancing environmental literacy, student engagement, and sustainable urban environmental conservation.

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