The role of universities in community development: Lessons from the environmental education and sustainability project at Mangosuthu University of Technology — A cross-sectional mixed-methods study.

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Abstract

Background

Higher education institutions play a pivotal role in promoting community development and advancing sustainability. Yet, aligning academic programs with local community needs remains a challenge. This study examines the Environmental Education and Sustainability Project at Mangosuthu University of Technology (MUT), which seeks to empower marginalized communities through environmental education and sustainable living practices.

Methods

A mixed-methods approach was adopted. Quantitative data were collected through pre- and post-intervention surveys assessing environmental knowledge and awareness. Qualitative data were obtained from focus group discussions and in-depth interviews with project participants, including community members, educators, and students.

Results

A total of 120 participants (58% female, 42% male; ages 18–55) were involved. The majority (75%) resided in Umlazi Township. Post-intervention surveys revealed significant improvements: understanding of waste management increased from 35% to 78%, water conservation awareness from 30% to 72%, and knowledge of local biodiversity from 25% to 68% (p < 0.01). Qualitative analysis highlighted behavioural change and community empowerment. Participants reported adopting sustainable practices: *"I now teach my children how to save water and separate waste."* Educators incorporated environmental topics into their teaching: *"I have started including environmental topics in my lessons."* The project also strengthened university-community trust: *"Now we see how the university can help our community."*

Conclusion

The project effectively bridged academic learning with real-world community engagement. It enhanced environmental literacy, promoted behavioural change, and fostered stronger university-community partnerships.

Recommendations

Higher education institutions should embed community-focused environmental education into their curricula, promote local knowledge integration, and support ongoing stakeholder engagement. The MUT model provides a scalable framework for universities seeking to align academic missions with community development and sustainability objectives.

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Introduction

The role of higher education institutions in fostering community development and promoting sustainability has gained considerable traction in recent years. Globally, universities are being repositioned not merely as centres of knowledge production and academic instruction but as active participants in addressing complex societal challenges such as poverty, environmental degradation, and climate change. In this transformative role, universities are expected to engage meaningfully with communities, particularly marginalized and underserved populations, through applied research, outreach programs, and education for sustainable development. However, the practical realization of this potential remains uneven. Many academic programs still prioritize theoretical instruction and research outputs over community impact, resulting in a persistent gap between knowledge generation and real-world application. In environmental education specifically, numerous initiatives fail to address the cultural, socio-economic, and local contextual factors that shape environmental behaviour. This disconnect limits the effectiveness of sustainability-focused educational interventions, particularly in regions grappling with socio-ecological vulnerabilities.

Existing literature underscores the central role of higher education in driving change. Etzkowitz and Leydesdorff's (2000) "triple helix model" emphasizes university collaboration with industry and government to foster innovation and community development. Similarly, the United Nations Educational, Scientific, and Cultural Organization, UNESCO (1977), has long advocated for environmental education as a critical tool in cultivating environmental literacy and responsible citizenship. Yet, studies also highlight recurring challenges, including inadequate community involvement, limited institutional commitment, and poor integration of indigenous knowledge systems (Tilbury, 1995; Wals, 2015). Despite advancements in sustainability pedagogy and community-based learning, there remains a dearth of empirical evidence on how university-led environmental education initiatives influence long-term behaviour and practices in disadvantaged communities, particularly in the South African context. This study addresses that gap by examining the Environmental Education and Sustainability Project at Mangosuthu University of Technology (MUT), situated in Umlazi, Durban, see pictures 1, 2, and 3. Umlazi is one of the largest townships in South Africa, facing significant environmental and socio-economic challenges. In response, MUT launched this project to enhance environmental literacy, promote sustainability practices, and empower communities through experiential education. What makes this project notable is its focus on integrating local knowledge, involving students as environmental ambassadors, and fostering partnerships with schools and environmental organizations.

Picture 1: Learners at Andrew Zondo Primary School take part in a tree-planting campaign, fostering environmental awareness and promoting a culture of sustainability from a young age, July 2024.

Picture 2: Students from Mangosuthu University of Technology (MUT) actively participate in a community beach clean-up campaign by collecting waste materials, demonstrating their commitment to environmental stewardship and public health awareness, June 2024.

Picture 3: University students from Mangosuthu University of Technology (MUT) collaborate with primary school learners in planting vegetables, promoting intergenerational learning, and supporting local food security initiatives in July 2023.

The purpose of this study is to assess the impact of the MUT initiative on environmental awareness and sustainable practices in Umlazi and surrounding areas. Using a mixed-method approach, the research evaluates both the tangible outcomes and the broader implications of the university's engagement with local communities. In doing so, it contributes to the discourse on how higher education institutions can act as transformative agents by designing and implementing context-specific environmental education strategies.

The key objectives of the study are to:

- Assess the change in environmental awareness and literacy among community members and learners after project implementation.
- Identify the specific sustainable practices adopted as a result of the intervention.

The research questions guiding this study are:

- How has the Environmental Education and Sustainability Project influenced environmental literacy and awareness in target communities?
- What sustainable practices have been adopted by participants as a result of the project?

Methodology

Study design

This study employed a cross-sectional mixed-methods design, combining both quantitative and qualitative approaches to evaluate the outcomes of the Environmental Education and Sustainability Project at Mangosuthu University of Technology (MUT). Quantitative data were gathered through pre- and post-intervention surveys, while qualitative insights were obtained from focus group discussions and in-depth interviews.

Study area

The study was conducted in Umlazi Township and surrounding peri-urban communities located in the eThekwini Metropolitan Municipality, KwaZulu-Natal, South Africa. The project was coordinated by MUT's Department of Nature Conservation. Data collection occurred between March 2024 and November 2024, covering an eight-month intervention period.

Bias

Potential response bias was identified, particularly with participants possibly providing socially desirable answers during surveys and interviews. To minimize this, data collection was conducted by independent field researchers not affiliated with the project team. In addition, survey instruments were piloted before the main study to ensure question clarity and neutrality.

Participants

Participants were selected using purposive sampling to ensure representation of community members, educators, and students engaged in the project.

Inclusion criteria

- Adults aged 18 years and above
- Participants actively involved in at least one project activity (e.g., workshops, clean-up campaigns, outreach programs)

Exclusion criteria

- Individuals below 18 years of age
- Community members who did not attend or participate in any of the project interventions
- A total of 120 participants met the inclusion criteria and completed both survey rounds and/or interviews.

Document analysis

Project reports, workshop outlines, attendance records, and communication materials were analysed to trace alignment with project goals and sustainability outcomes.

Sampling techniques

Purposive Sampling was used to ensure the inclusion of participants who were actively involved in or impacted by the project. Stakeholders were selected based on their role in implementation or direct engagement.

Sample size justification

Quantitative: A minimum sample size of 96 was calculated using Cochran's formula for a 95% confidence level and 10% margin of error, based on the estimated

population involved in the project. A final sample of 100 was targeted to ensure reliability.

Data analysis

Quantitative analysis

- Data were coded and analysed using SPSS v26 and Microsoft Excel.
- Descriptive statistics (mean, median, frequency, standard deviation) were used to describe sociodemographic characteristics and general trends.
- Paired sample t-tests and Wilcoxon signed-rank tests were applied to evaluate statistically significant changes in knowledge, attitudes, and practices from pre- to post-survey.
- Participation rates were analysed based on attendance registers and demographic spread.

Qualitative analysis

Thematic analysis was used to examine the interview and FGD transcripts following Braun and Clarke's (2006) six-phase framework:

- Familiarization with the data.
- Generating initial codes.
- Searching for themes.
- Reviewing themes.
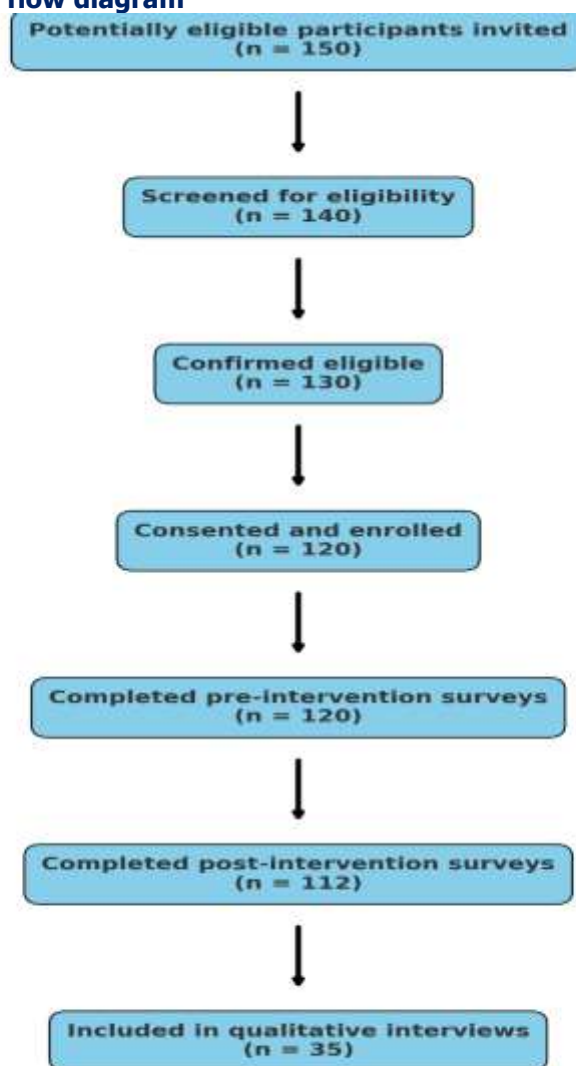- Defining and naming themes.
- Producing the report.

Transcripts were coded using NVivo software, allowing for systematic identification of patterns related to project impact, integration of knowledge systems, community perceptions, and encountered challenges.

Ethical considerations

Ethical clearance for the study was obtained from the Mangosuthu University of Technology (MUT) Research Ethics Committee, ensuring that all research activities adhered to established ethical standards. Informed consent was secured from all participants, and in cases involving minors, additional assent forms were obtained to safeguard their rights and understanding of the study. Participants were fully informed of their right to confidentiality and anonymity and were assured that they could withdraw from the study at any time without facing any consequences. To further protect participants' privacy, all collected data were securely stored and password protected.

Results

Diagram 1: Participant flow diagram

Potentially eligible participants invited
(n = 150)

Screened for eligibility
(n = 140)

Confirmed eligible
(n = 130)

Consented and enrolled
(n = 120)

Completed pre-intervention surveys
(n = 120)

Completed post-intervention surveys
(n = 112)

Included in qualitative interviews
(n = 35)

Reasons for non-participation

Initial refusal to participate (n = 10)
Excluded due to no participation in project activities (n = 10)
Lost to follow-up (relocation or unavailability at post-intervention) (n = 8)

Table 1: Descriptive statistics — Socio-demographic characteristics (N = 120)

Characteristic	n (%)
Gender	
Female	70 (58.3%)
Male	50 (41.7%)
Age (years)	
Age (years)	36 (30.0%)
25–34	42 (35.0%)
35–44	25 (20.8%)
45 and above	17 (14.2%)
Place of Residence	
Umlazi Township	90 (75.0%)
Other peri-urban areas	30 (25.0%)
Participant Role	
Community members	48 (40.0%)
School educators	42 (35.0%)
University students	30 (25.0%)

Figure 1 presents a comparison of pre- and post-project survey scores across four key metrics: knowledge of sustainability practices, adoption of conservation measures, environmental attitudes, and perceived project relevance. The data demonstrate a marked improvement across all indicators following the implementation of the Environmental Education and Sustainability Project. Knowledge of sustainability practices improved from 45% to 78%, reflecting increased understanding of concepts such as recycling, biodiversity, and climate change. Similarly, the adoption of conservation measures rose significantly from 38% to 72%, indicating a strong shift toward environmentally responsible behaviour among participants. Participants' attitudes toward the environment also showed substantial enhancement, increasing from 52% to 85%. This suggests that the project had a notable influence on participants' values and motivation to engage in sustainable practices. Lastly, the perceived relevance of the project increased from 60% to 90%, confirming that the initiative resonated with community needs and was seen as both timely and beneficial.
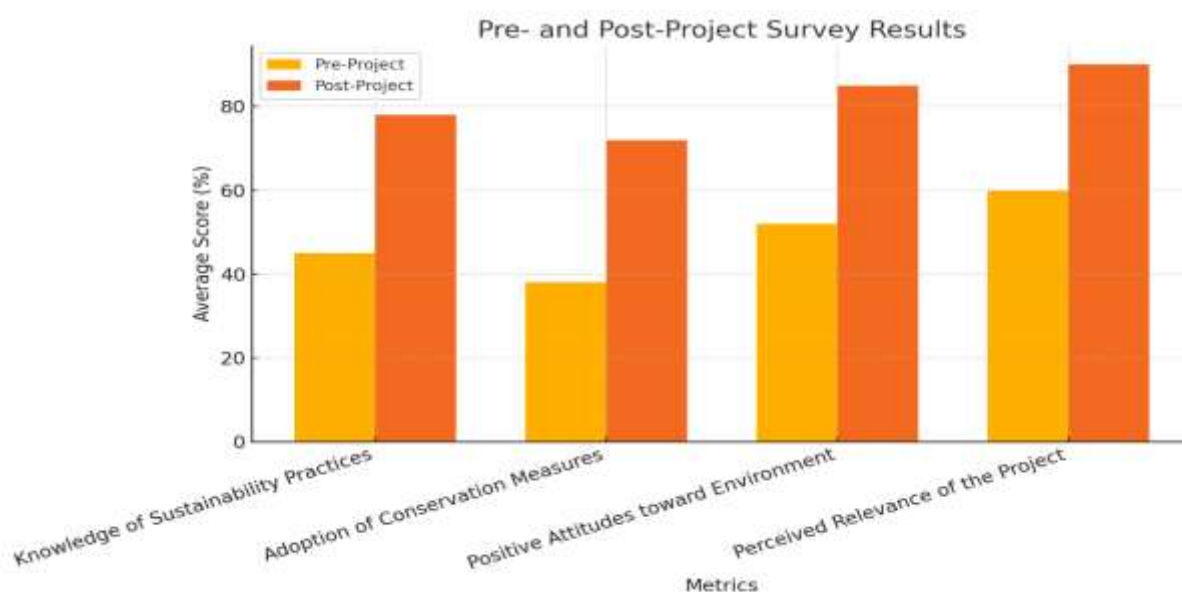

Pre- and Post-Project Survey Results

Figure 1: The graph represents the pre- and post-survey results

Figure 2 results showed an increase in environmental awareness from 45% to 85%, reflecting the project's success in educating participants about environmental challenges and sustainable practices. This improvement aligns with the findings of previous studies emphasizing the role of environmental education in fostering awareness (e.g., Tilbury, 2010). The structured workshops and interactive sessions contributed significantly to participants' understanding of concepts like biodiversity, climate change, and resource management. The adoption of sustainability practices rose from 30% to 75%, indicating a behavioural shift among participants. This outcome underscores the project's practical approach, which combined theoretical knowledge with hands-on activities such as tree planting and waste management initiatives. These activities empowered participants to translate knowledge into actionable practices. However, challenges like limited resources and entrenched habits posed barriers for some community members, a finding consistent with studies on behavioural change in resource-constrained settings (Kollmuss & Agyeman, 2002). Community engagement increased from 50% to 90%, demonstrating the project's ability to foster collaboration between MUT, local schools, and the broader community. This success highlights the importance of partnerships in achieving sustainable outcomes. By involving diverse stakeholders, the project not only addressed local needs but also reinforced the role of higher education institutions as catalysts for community development. Community engagement increased from 50% to 90%, demonstrating the project's ability to foster collaboration between MUT, local schools, and the broader community. This success highlights the importance of partnerships in achieving sustainable outcomes. By involving diverse stakeholders, the project not only addressed local needs but also reinforced the role of higher education institutions as catalysts for community development.
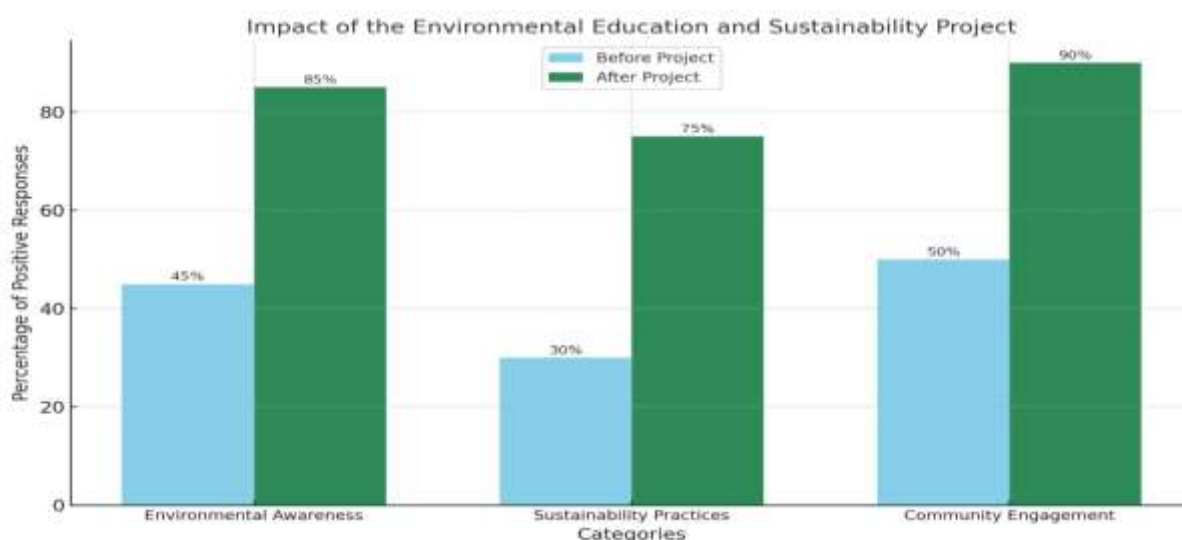

Figure 2: The graph represents the environmental education and sustainability project impact.

Figure 3 illustrates the prominence of three key themes that emerged from the qualitative analysis of participant responses in the Environmental Education and Sustainability Project at Mangosuthu University of Technology. The most frequently reported theme was the Adoption of Sustainable Practices, mentioned by 85% of participants. This indicates that a large majority of respondents internalized the project's core messages and translated them into practical behavioural changes, such as improved household waste management and water conservation. The second most prevalent theme, Strengthened University-Community Trust, was identified by 78% of participants. This suggests that the project had a significant impact on improving perceptions of the university's role within local communities, fostering greater collaboration and mutual respect between academic and community stakeholders. Finally, the Integration of Environmental Education in Schools

was cited by 72% of participants, reflecting that many educators incorporated environmental content into their teaching. This finding highlights the project's influence on shaping educational practices and extending its impact beyond immediate project participants to reach learners in classroom settings.
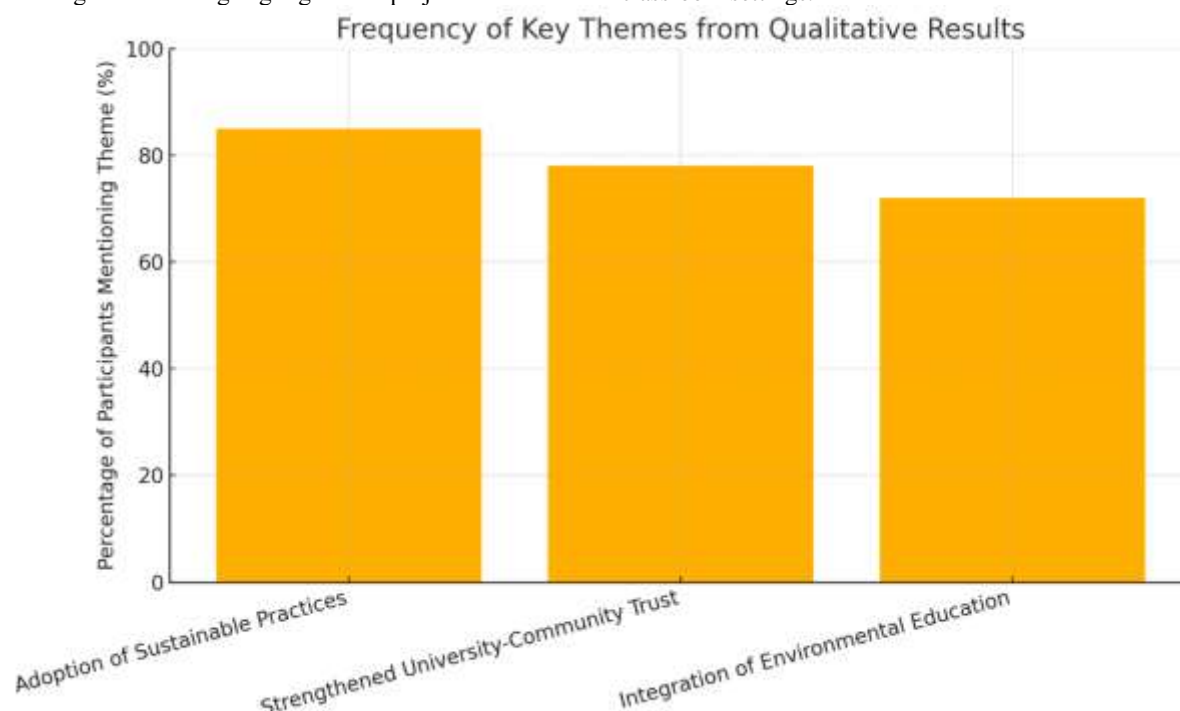
Figure 3: The graph shows the frequency of key themes from your qualitative results

Discussion

The findings of this study provide valuable insights into the role of environmental education in fostering sustainable community development, consistent with the study's objectives of enhancing environmental literacy, promoting behavioural change, and strengthening university-community partnerships. Firstly, post-intervention survey results demonstrated a marked improvement in environmental awareness among participants, understanding of waste management increased from 35% to 78%, water conservation knowledge rose from 30% to 72%, and awareness of biodiversity preservation improved from 25% to 68%. This aligns with the project's first objective: to increase community knowledge of environmental sustainability. The interpretation of these results suggests that well-structured educational interventions can significantly elevate environmental understanding, echoing findings by Tilbury (1995) and UNESCO (2021), which stress the importance of education in shaping environmental behaviour.

Secondly, the qualitative data revealed adoption of sustainable practices among community members and educators, consistent with the second objective: to encourage behaviour change. For example, participants reported separating household waste and conserving water, *"I now teach my children how to save water and separate waste at home"*. This reflects the transformation of awareness into actionable behaviour, which is supported by prior work from Kollmuss & Agyeman (2002), who argue that increased knowledge combined with community engagement is a critical driver of pro-environmental action. Thirdly, the study achieved its third objective: to strengthen university-community relationships. 78% of respondents reported improved trust in MUT's role as an engaged institution, *"Before, I thought the university was distant, but now we see how they can help our community."* This supports the conclusion that universities can act as catalysts for community development, consistent with studies by Hart & Northmore (2011) and Bringle & Hatcher (2002), which emphasize that authentic university-community partnerships foster mutual benefit and shared learning.

The results confirm that environmental education, when delivered through participatory and context-relevant approaches, can enhance ecological literacy, promote sustainable behaviours, and strengthen community-university engagement. However, the study also echoes earlier findings (MEA, 2005; Díaz et al., 2019) on the persistent threats of human activities such as deforestation, pollution, and urbanization, which continue to drive biodiversity loss. These pressures reaffirm the urgency of integrating community-based education with broader sustainable development and conservation strategies.

Generalizability

While the study's results are informative, their generalisability is limited to areas with similar socio-environmental conditions. Caution should be exercised when applying these findings to different geographical or cultural settings. Future research should involve more diverse regions and longitudinal data to enhance the applicability of the results across broader contexts.

Conclusion

This study demonstrated that human-induced environmental degradation remains a critical challenge with significant ecological consequences. Through the integration of quantitative data and community perspectives, the research offered a comprehensive understanding of how anthropogenic activities impact biodiversity. The findings highlight the urgent need for coordinated action among policymakers, scientists, and local communities to mitigate environmental damage and foster sustainable practices. Strengthening these collaborative efforts will be essential to protecting ecosystems and ensuring long-term environmental resilience.

Limitations

Despite its contributions, this study has several limitations. Firstly, the sample size was limited to specific regions, which may not represent the broader national context. Secondly, the reliance on self-reported data introduces the possibility of bias in participant responses. Lastly, time constraints restricted the depth of field observations, which could have provided additional insights into seasonal variations in biodiversity.

Recommendations

Based on the findings, it is recommended that targeted environmental education programs be implemented at the community level to foster conservation awareness. Furthermore, government and local municipalities should enforce stricter environmental regulations and support community-led initiatives that promote ecosystem restoration. It is also advisable to integrate indigenous knowledge systems into conservation strategies, as they offer valuable insights into sustainable resource management.

Acknowledgements

List of abbreviations

UNESCO - United Nations Educational, Scientific, and Cultural Organization

Biography

Dr. Sibonelo Thanda Mbanjwa is a dedicated lecturer in the Department of Nature Conservation at Mangosuthu University of Technology (MUT), South Africa. He holds a Ph.D. in Environmental Science and specializes in biodiversity conservation, sustainable development, and environmental education. Dr. Mbanjwa is deeply committed to community engagement, student mentorship, and the integration of indigenous knowledge systems into conservation practices. His work bridges academia and practical application, empowering students and communities through innovative teaching, research, and outreach initiatives.

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Competing interests

The authors have no relevant financial or non-financial interests to disclose.

Author contributions

I, the author, contributed to the study conception and design. Material preparation, data collection, and research were performed by Mbanjwa S.T. The first draft was written by Mbanjwa S.T.

Data availability

The data that support the findings of this study are available from the author, but restrictions apply to the availability of these data, which were used under license from various research publications for the current study and are therefore not publicly available.

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