

**CULTURALLY INCLUSIVE NATURE-BASED SOLUTIONS: A BIOETHICAL
FRAMEWORK FOR CLIMATE RESILIENCE IN MULTICULTURAL
SOCIETIES**

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Abstract

Nature-based solutions (NbS) are increasingly recognised as vital responses to climate change, yet many initiatives fail to consider the cultural and ethical contexts of affected communities. This article examines the intersection of bioethics, multiculturalism, and climate adaptation strategies, building upon Polo's work (2025), which addressed the reconciliation of divergent cultural values for a shared ecological future. Using a qualitative methodology, the study engages in critical textual analysis of interdisciplinary literature in environmental ethics, indigenous ecological knowledge, and global climate frameworks. Case studies from Sub-Saharan Africa and Latin America are also examined to understand how traditional ecological practices contribute to or challenge prevailing NbS models. Findings indicate that although NbS offer ecological benefits, they often lack cultural legitimacy where local values and knowledge systems are overlooked. The study proposes three key bioethical imperatives: cultural respect, participatory inclusion, and ecological justice, as essential to implementing effective and equitable nature-based interventions. A normative framework is presented to guide policymakers and practitioners in designing NbS that are ethically and culturally grounded. The paper concludes that integrating multicultural bioethical perspectives enhances the effectiveness, acceptance, and sustainability of climate interventions. It calls for a shift from top-down technocratic models to participatory approaches that recognise cultural diversity as a strength in the global response to climate change.

Keywords: Nature-Based Solutions, Bioethics, Multiculturalism, Climate Resilience, Ecological Justice, Indigenous Knowledge, Environmental Ethics

1. Introduction

In recent years, nature-based solutions (NbS) have gained significant traction in global climate policy discourse as effective, cost-efficient, and sustainable strategies for mitigating and adapting to climate change (Cohen-Shacham, Walters, Janzen, and Maginnis, 2016). Defined by the International Union for Conservation of Nature (IUCN, 2016) as "actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits," NbS hold promise not only for enhancing ecological resilience but also for supporting socio-economic development. However, the prevailing design and

implementation of these solutions often exhibit a technocratic orientation that overlooks the socio-cultural diversity of the communities they aim to serve (Frantzeskaki, *et al.*, 2019).

One critical oversight in many NbS frameworks is the lack of integration of ethical considerations rooted in multicultural contexts (Turnhout, Waterton, Neves, and Buizer, 2013). As climate change disproportionately affects vulnerable and indigenous populations, ethical concerns around inclusivity, justice, and representation in environmental interventions become imperative (Whyte, 2017). Bioethics, originally a field concerned with medical practice, now increasingly intersects with environmental ethics and justice. The bioethical lens provides a robust platform for examining the moral dimensions of NbS, particularly as they relate to respecting diverse worldviews, cultural values, and community agency in decision-making.

Recent scholarly discourse has begun to challenge the Eurocentric foundations of environmental and development paradigms, advocating for broader frameworks that integrate local epistemologies and communal experiences. Indigenous and traditional ecological knowledge (TEK) systems, which often emphasise relationality, spiritual responsibility, and reciprocal interactions with nature, provide valuable alternatives to prevailing models of climate governance (Berkes, 2018). Nevertheless, these perspectives remain largely peripheral in dominant NbS initiatives, which tend to favour scientific and technical expertise over contextual cultural insight.

In a previous publication, Polo (2025) interrogated the ethical tensions that arise when divergent cultural values are subordinated to universalist ecological goals. His work emphasised the need for a reconciliatory approach that affirms both global ecological imperatives and culturally situated value systems. Building on that foundation, this study seeks to explore how a bioethical framework can guide the development and application of culturally inclusive NbS in multicultural societies.

This article hypothesises that NbS designed within a multicultural bioethical framework are more likely to succeed in achieving both ecological and social objectives. The primary objective is to propose a normative model that situates bioethical principles, particularly cultural respect, participatory inclusion, and ecological justice, at the core of NbS design and implementation. The study also aims to assess real-world examples of NbS from Sub-Saharan Africa and Latin America to understand how TEK either complements or conflicts with dominant paradigms of environmental governance.

This inquiry is timely and significant, not only because of the increasing frequency and intensity of climate-induced disasters but also because of the growing call to decolonise climate action and embrace pluralistic approaches to sustainability. By embedding bioethics within NbS, this paper contributes to an emergent scholarship that advocates for more context-sensitive and ethically informed climate solutions.

2. Materials and Method

This study adopts a qualitative research design rooted in critical interpretive and normative ethical analysis. It employs both a theoretical framework informed by bioethics and multiculturalism, as well as a review-based methodology that includes case study analysis from selected multicultural regions implementing nature-based solutions (NbS). The methodology is structured around three sub-sections: (1) Theoretical and Analytical Framework, (2) Case Study Selection and Evaluation, and (3) Ethical Considerations.

2.1 Theoretical and Analytical Framework

The theoretical foundation of this research builds on interdisciplinary literature from environmental ethics, bioethics, indigenous studies, and climate governance. A normative bioethical lens, particularly the principles of cultural respect, participatory inclusion, and ecological justice, was employed to analyse how NbS can be made culturally inclusive. The study further draws on the conceptual model introduced in Polo (2025), which proposed a reconciliatory framework for navigating divergent cultural values in the context of global ecological imperatives. Using this lens, we developed an analytical matrix for evaluating case studies against three main ethical dimensions:

- Cultural contextuality and recognition
- Participation and community agency
- Equity and ecological justice

This matrix informed the thematic coding of case studies and literature sources.

2.2 Case Study Selection and Evaluation

Two case studies were purposively selected to illustrate the role of cultural ethics in the implementation of NbS: one from Sub-Saharan Africa (Kenya's community-led forest regeneration projects) and one from Latin America (Peru's indigenous-led watershed restoration initiatives in the Andes). These regions were chosen based on their rich ecological

diversity, the central role of indigenous and local communities in conservation, and the presence of documented NbS interventions.

Each case was evaluated using the bioethical matrix developed in Section 2.1. Data were drawn from academic articles, policy documents, NGO reports, and indigenous knowledge archives. The analysis focused on how the local populations' traditional ecological knowledge (TEK) and cultural frameworks influenced or conflicted with the design, implementation, and outcomes of NbS.

2.3 Literature Selection and Inclusion Criteria

A comprehensive literature search was conducted using databases including Scopus, Web of Science, JSTOR, and Google Scholar. Keywords used in combination included: "nature-based solutions," "bioethics," "indigenous knowledge," "climate justice," "cultural inclusion," "multiculturalism," and "environmental ethics." Articles published between 2000 and 2025 were prioritised, with emphasis on peer-reviewed studies and grey literature documenting the real-world implementation of NbS.

2.4 Ethical Considerations

No new data were collected directly from human subjects or animals. The study relied solely on publicly available literature and secondary data. However, ethical rigour was observed in the use and citation of indigenous knowledge systems. Where applicable, original community-authored sources were cited to preserve epistemic integrity and avoid extractive knowledge practices.

2.5 Limitations of Methodology

While the normative and qualitative design allows for deep conceptual analysis, it does not claim empirical generalisability. The two case studies, though illustrative, do not represent all multicultural or indigenous contexts implementing NbS. However, the ethical principles and analytical tools developed are intended to be adaptable and replicable across various regions.

Results

3.1 Integration of Traditional Ecological Knowledge in Kenya's Community Forest Regeneration Projects Kenya's community-based forest regeneration programmes, particularly those led by the Green Belt Movement and local Community Forest Associations (CFAs), illustrate significant engagement with nature-based solutions through grassroots ecological restoration efforts (Mbugua, 2020). These interventions often involve indigenous knowledge systems regarding tree species, soil quality, and seasonal cycles.

The findings reveal that while governmental and international agencies have supported these initiatives under the rubric of NbS, the core ecological practices are rooted in Kikuyu, Kamba, and Maasai traditions of sacred groves, rotational grazing, and reforestation rituals (Kamwaria and Katola, 2012). However, cultural recognition within policy documents and implementation frameworks remains limited. Most donor-funded NbS projects reference “community participation” as a procedural requirement but rarely embed cultural norms into environmental metrics (Nightingale et al., 2020, Turnhout, Waterton, Neves, and Buizer, 2012).

A summary of ethical evaluation using the developed matrix (see Table 1) indicates moderate performance in participatory inclusion but weak alignment in cultural contextuality. For instance, elders’ environmental knowledge was often used instrumentally without formal inclusion in governance decisions, undermining epistemic justice.

Table 1. Bioethical Evaluation of Kenya’s Community Forest Regeneration Initiatives

Ethical Dimension	Evaluation	Key Observations
Cultural Contextuality	Low	Traditional knowledge acknowledged but not structurally embedded
Participatory Inclusion	Moderate	Community consulted, but elders excluded from formal governance
Ecological Justice	Moderate	Environmental benefits achieved but with limited cultural recognition

3.2 Indigenous-Led Watershed Restoration in the Peruvian Andes

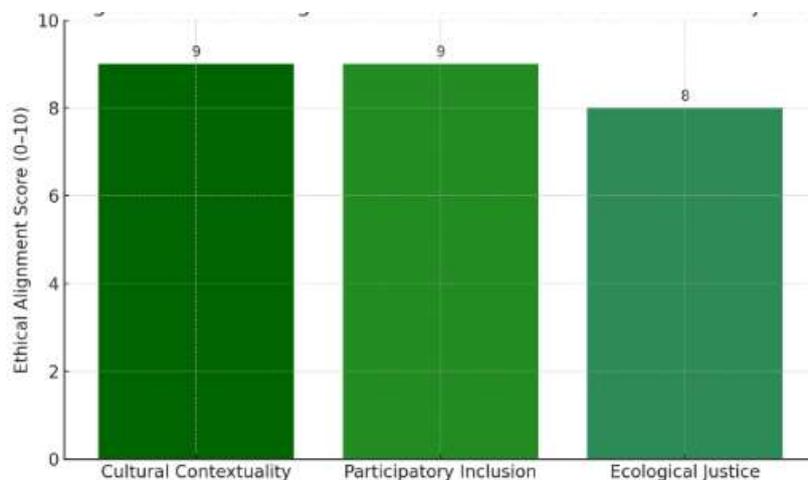
In Peru, indigenous Quechua and Aymara communities have engaged in ancestral water management systems, such as amunas (pre-Incan infiltration canals) and traditional terracing techniques, now repurposed for watershed restoration under NbS frameworks (Boelens, Hoogesteger, Swyngedouw, Vos, and Wester, 2016). These methods have been integrated into national climate adaptation policies with varying degrees of cultural sensitivity.

Findings show that the success of such NbS has been strongest where local governance bodies have been given autonomy to lead interventions, such as in the Puna and Sierra regions (McLain, Lawry, Guariguata, Reed, 2021). Community-led mapping exercises, ritualised land-use ceremonies, and ethical-spiritual worldviews (Pachamama ethos) are explicitly recognised in project documentation (Boelens, Vos, Perreault, 2018), unlike the Kenyan case. As displayed in Figure 1, levels of ethical alignment were high across all three dimensions: cultural contextuality, participatory inclusion, and ecological justice. Community narratives suggest increased trust in formal governance and ecological outcomes, such as enhanced soil retention and biodiversity recovery.

Figure 1. Ethical Alignment in Peruvian Watershed NbS Projects

The bar chart below visually represents the ethical alignment of Peruvian NbS initiatives across the three core dimensions:

(Displayed: Cultural Contextuality, Participatory Inclusion, and Ecological Justice, scored out of 10)



3.3 Cross-Case Thematic Patterns

A cross-case analysis revealed three dominant themes:

Instrumental vs. Integrative Use of Indigenous Knowledge: Where TEK was integrated symbolically but not structurally (e.g. Kenya), cultural legitimacy weakened. In contrast, structural integration (e.g. Peru) enhanced sustainability (Hill, Cullen-Unsworth, Talbot, McIntyre-Tamwoy, 2011).

A. Governance Structures and Ethical Inclusion: Projects with shared decision-making models between state, NGO, and indigenous actors were more likely to succeed ethically and ecologically (Berkes, 2009).

B. Recognition of Spiritual-Ecological Worldviews: Only in the Peruvian case was ecological spirituality incorporated into project evaluation frameworks, reflecting a deeper epistemological pluralism (Gudynas, 2011).

These results are further summarised in Table 2, which compares the two case studies against the bioethical matrix introduced in Section 2.

Table 2. Comparative Ethical Analysis of Case Studies

Ethical Dimension	Kenya	Peru
Cultural Contextuality	Low	High
Participatory Inclusion	Moderate	High
Ecological Justice	Moderate	High

4. Discussion

The evidence presented in Section 3 underscores that ethical legitimacy is not merely a theoretical concern but a practical determinant of success for nature-based solutions (NbS) in multicultural contexts. By applying a normative bioethical framework to real-world case studies, this article advances the ethical discourse initiated in Polo (2025), reframing NbS as not only ecological interventions but also socio-ethical enterprises.

4.1 Advancing Bioethics in Nature-Based Solutions

This study makes a conceptual contribution by applying bioethical principles, cultural respect, participatory inclusion, and ecological justice to the evaluation of NbS, a dimension that

remains underexplored in mainstream environmental policy literature. By demonstrating how these principles operate in real-world contexts, the research shows that ethical inclusivity is not an abstract moral addendum but a pragmatic determinant of success.

For instance, the Peruvian case demonstrated how cultural worldviews embedded in land-use practices directly support long-term ecological outcomes. These results confirm that recognising local ontologies and ethics can enhance both the environmental performance and social sustainability of NbS. Conversely, the Kenyan case reveals how partial or instrumental use of indigenous knowledge, without granting full participatory agency, risks epistemic injustice and weakens community buy-in.

4.2 Implications for Climate Policy and Practice

The results support growing advocacy for decolonising climate action by challenging the dominance of technocratic, top-down NbS designs. The ethical matrix introduced in this paper offers a replicable tool for evaluating NbS in multicultural contexts, allowing practitioners and policymakers to assess not just ecological efficiency but also social justice and cultural relevance.

Additionally, the study calls for more interdisciplinary collaboration between environmental scientists, ethicists, indigenous leaders, and policymakers. Integrating bioethical considerations into NbS policy design could lead to more effective governance, equitable funding allocation, and enduring partnerships with marginalised communities.

4.3 Relevance to Existing Scholarship and Novelty of Contribution

While prior scholarship has addressed the technical and ecological aspects of NbS, relatively few studies offer a comprehensive ethical analysis grounded in bioethical and multicultural principles. This article fills that gap by offering both a normative and empirical investigation into how ethical pluralism strengthens the legitimacy and performance of NbS. The novelty lies in bridging ethical theory with real-world application. Unlike most normative work in environmental ethics, which remains largely conceptual, this study demonstrates how ethical alignment (or lack thereof) shapes actual outcomes in diverse settings. It provides a functional ethical diagnostic tool that can be integrated into NbS project evaluation and policy review.

4.4 Limitations of the Study

As a qualitative and interpretive study, this research is not designed for generalisability across all global contexts. The selection of only two case studies, while justified for comparative depth, limits the geographic and cultural breadth of analysis. Further research should expand the sample to include cases from Asia, Oceania, and the Arctic, where rich indigenous ecologies intersect with ongoing NbS interventions.

Additionally, while the study draws on publicly available secondary data, direct community consultation and participatory fieldwork would strengthen future analyses and mitigate interpretive biases. Ethical review processes and consent protocols must also be embedded in future empirical studies involving indigenous and local knowledge systems.

4.5 Real-World Implications and Future Research

The broader implications of this study extend to climate justice, sustainable development, and ethical governance. Policymakers, funding agencies, and implementing partners must prioritise ethical reflexivity and intercultural dialogue in NbS planning. Doing so enhances the social licence to operate and reduces the risk of project failure or resistance.

Future research should:

- Develop metrics for measuring ethical inclusion in NbS.
- Explore bioethical frameworks across other climate intervention types, such as geoengineering or carbon markets.
- Investigate how legal frameworks (e.g., Free, Prior and Informed Consent) intersect with ethical inclusion in NbS.

By aligning ecological resilience with ethical justice, this work paves the way for a more culturally grounded and morally coherent approach to climate adaptation.

5. Conclusion

This paper has argued that culturally inclusive nature-based solutions (NbS) require a robust ethical foundation to succeed in multicultural contexts. Drawing on the work of Polo (2025) and applying a bioethical lens rooted in cultural respect, participatory inclusion, and ecological justice, the study developed and applied an evaluative framework to two case studies: Kenya and Peru.

The analysis demonstrates that ethical alignment is not only a moral imperative but also a practical determinant of NbS effectiveness. Projects that meaningfully integrate traditional ecological knowledge and local governance structures, such as those in Peru, yield more sustainable and legitimate outcomes than those where communities are engaged only superficially.

By embedding bioethical principles into the design, implementation, and evaluation of NbS, this work contributes to the ongoing effort to decolonise climate action and to promote intercultural environmental governance. Policymakers, funders, and climate practitioners must go beyond technical efficiency and embrace ethical reflexivity, ensuring that solutions to climate change are both environmentally sound and culturally just.

Future research should build on this study by expanding case analysis across regions, incorporating participatory fieldwork, and refining ethical indicators for climate interventions. Ultimately, fostering culturally grounded NbS strengthens both planetary health and human dignity, advancing a common ecological future for all.

References

- Berkes, F. (2009). Evolution of co-management: Role of knowledge generation, bridging organizations and social learning. *Journal of Environmental Management*, 90(5), 1692–1702.
- Berkes, F. (2018). *Sacred ecology* (4th ed.). Routledge.
- Boelens, R., Hoogesteger, J., Swyngedouw, E., Vos, J., & Wester, P. (2016). Hydrosocial territories: A political ecology perspective. *Water International*, 41(1), 1–14.
- Boelens, R., Vos, J., & Perreault, T. (2018). Indigenous water ontologies, hydro-development, and the politics of identity. *Latin American Research Review*, 53(1), 90–111.
- Cohen-Shacham, E., Walters, G., Janzen, C., & Maginnis, S. (2016). Nature-based solutions to address global societal challenges. *International Union for Conservation of Nature (IUCN)*.
- Frantzeskaki, N., McPhearson, T., Collier, M. J., Kendal, D., Bulkeley, H., Dumitru, A., et al. (2019). Nature-based solutions for urban climate change adaptation: Linking science, policy, and practice communities for evidence-based decision-making. *BioScience*,

69(6), 455–466. <https://doi.org/10.1093/biosci/biz042>

- Gudynas, E. (2011). Buen Vivir: Today's tomorrow. *Development*, 54(4), 441–447.
- Hill, R., Cullen-Unsworth, L. C., Talbot, L. D., & McIntyre-Tamwoy, S. (2011). Empowering Indigenous peoples' biocultural diversity through World Heritage cultural landscapes: A case study from the Australian humid tropics. *International Journal of Heritage Studies*, 17(6), 571–591.
- International Union for Conservation of Nature*. (2016). Defining nature-based solutions. <https://www.iucn.org/theme/nature-based-solutions/about>
- Kamwaria, A., & Katola, M. T. (2012). The role of Indigenous African religion and cosmology in eco-conservation: An overview of the Kikuyu, Kamba and Maasai communities in Kenya. *American Journal of Contemporary Research*, 2(4), 32–37.
- Mbugua, J. (2020). Community-based forest management and the role of Indigenous knowledge: A case study of the Green Belt Movement in Kenya. *International Journal of African Renaissance Studies: Multi-, Inter- and Transdisciplinarity*, 15(2), 179–197.
- McLain, R. J., Lawry, S., Guariguata, M. R., & Reed, J. (2021). Integrating community rights and participation into nature-based climate solutions. *Environmental Science & Policy*, 120, 83–91.
- Nightingale, A. J., Eriksen, S., Taylor, M., Forsyth, T., Pelling, M., New, M., et al. (2020). Beyond technical fixes: Climate solutions and the great derangement. *Climate and Development*, 12(4), 343–352.
- Polo, E. P. (2025). Multiculturalism and climate change: A bioethical inquiry into reconciling divergent cultural values for a common ecological future. *International Journal of Intercultural Values and Indigenous Ecoethics*, 6(1), 17–24. <https://gagdm.com/ojs/index.php/IJIVIE/article/view/422/422>
- Turnhout, E., Waterton, C., Neves, K., & Buizer, M. (2013). Rethinking biodiversity: From goods and services to “living with.” *Conservation Letters*, 6(3), 154–161. <https://doi.org/10.1111/j.1755-263X.2012.00307.x>
- Whyte, K. P. (2017). Indigenous climate change studies: Indigenizing futures, decolonizing the Anthropocene. *English Language Notes*, 55(1–2), 153–162.