

Development of a Mountain Landscape Conservation Model Based on Local Knowledge and Indigenous Identity to Support Environmental Sustainability at Mount Ebulobo

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Abstract

Mountain landscapes are complex socio-ecological systems where ecological processes, cultural values, local knowledge, and community practices interact to shape environmental sustainability. This study aims to develop a mountain landscape conservation model based on local knowledge and Indigenous identity to support environmental sustainability at Mount Ebulobo. A mixed-methods approach was employed, integrating field observation, interviews, focus group discussions, and structured questionnaires. The study examined four main constructs: Local Knowledge, Indigenous Identity, Landscape Stewardship, and Environmental Sustainability. Quantitative data were analyzed using descriptive statistics and Structural Equation Modeling–Partial Least Squares (SEM-PLS), while qualitative information was analyzed thematically. The findings indicate that Local Knowledge has a positive and significant relationship with Indigenous Identity and Landscape Stewardship. Indigenous Identity also positively influences Landscape Stewardship, while Landscape Stewardship demonstrates the strongest relationship with Environmental Sustainability. The proposed model emphasizes the importance of integrating ecological knowledge, cultural identity, community stewardship, and environmental management within a place-based conservation framework. The study contributes to the biocultural sustainability literature by positioning Indigenous identity and local knowledge as central components of mountain landscape conservation. The model provides a practical

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foundation for participatory conservation strategies that recognize local communities as knowledge holders, cultural actors, and active environmental stewards.

Keywords: mountain landscape; local knowledge; Indigenous identity; landscape stewardship; environmental sustainability

INTRODUCTION

Mountain landscapes represent complex socio-ecological systems in which ecological processes, cultural practices, livelihoods, and human values are closely interconnected. These landscapes provide important ecosystem functions and services, including water regulation, biodiversity conservation, soil protection, food production, and cultural and spiritual benefits. However, increasing environmental pressures, land-use changes, biodiversity loss, and climate-related disturbances have created significant challenges for the long-term sustainability of mountain ecosystems. Consequently, conservation approaches increasingly need to move beyond purely ecological perspectives and consider the reciprocal relationships between people, culture, institutions, and nature (Díaz et al., 2015; IPBES, 2019).

Indigenous and local communities play an important role in maintaining ecological and cultural relationships within their territories. Their knowledge is developed through long-term interactions with particular landscapes and is often expressed through traditional resource-management practices, customary rules, ecological observations, cultural values, and intergenerational transmission of knowledge. Previous studies have demonstrated that Indigenous and local knowledge can contribute to biodiversity conservation, ecosystem management, environmental monitoring, and sustainable resource utilization (Brondízio et al., 2021; Burke et al., 2023). Such knowledge should therefore not be regarded merely as cultural heritage, but as an important knowledge system that can complement scientific approaches to environmental sustainability.

The relationship between biological and cultural diversity has increasingly been conceptualized through the framework of biocultural diversity. This perspective recognizes that biodiversity and cultural diversity are mutually interconnected and that landscapes can simultaneously function as ecological spaces, cultural territories, and repositories of collective identity. In this context, conservation can be strengthened when local values, traditional ecological knowledge, cultural practices, and community participation are incorporated into



landscape management. Nevertheless, the operationalization of biocultural approaches remains challenging because many studies remain conceptual, while empirical models that translate Indigenous and local knowledge into practical landscape-conservation strategies are still relatively limited (Bridgewater & Rotherham, 2019; Lukawiecki et al., 2022).

An important challenge is therefore how to integrate Indigenous and local knowledge with contemporary environmental management without reducing or marginalizing the knowledge system of local communities. Knowledge integration requires recognition of different ways of understanding nature, attention to local institutions and power relations, and mechanisms for co-producing knowledge between communities, researchers, and other stakeholders. Previous research indicates that inappropriate integration processes may reproduce inequalities and place scientific knowledge above Indigenous or local knowledge. Conversely, participatory and context-specific approaches can support more equitable conservation and strengthen community involvement in environmental governance (Brondízio et al., 2021; Tengö et al., 2017).

Within this broader context, Mount Ebulobo provides an important setting for investigating the relationship between mountain landscapes, local knowledge, Indigenous identity, and environmental sustainability. The landscape can be approached not only as a physical mountain ecosystem but also as a social and cultural space in which knowledge, values, practices, and relationships with nature are continuously constructed and transmitted across generations. However, a major research gap remains in understanding how these interconnected dimensions can be systematically organized into a conservation model that links local ecological knowledge, Indigenous identity, landscape stewardship, and measurable environmental sustainability outcomes. Existing studies have established the importance of Indigenous and local knowledge in conservation, but comparatively less attention has been given to developing an integrated, place-based model specifically for mountain landscapes that simultaneously addresses ecological, cultural, institutional, and community dimensions (Brondízio et al., 2021; Lukawiecki et al., 2022).

The novelty of this study lies in the development of an integrated Mountain Landscape Conservation Model that positions local knowledge and Indigenous identity as central components of environmental sustainability, rather than treating them as supplementary cultural variables. The proposed model integrates four interconnected dimensions: (1) mountain landscape characteristics and ecological values, (2) Indigenous and local ecological knowledge,



(3) Indigenous identity and cultural attachment to place, and (4) environmental sustainability and community-based stewardship. This approach extends existing biocultural conservation research by seeking to explain the mechanisms through which knowledge and identity can influence landscape stewardship and sustainability outcomes. The study therefore moves from documenting Indigenous/local knowledge toward model development and empirical validation, providing a potentially transferable framework for other culturally significant mountain landscapes (Brondízio et al., 2021; Burke et al., 2023; Lukawiecki et al., 2022).

Accordingly, this study aims to develop a mountain landscape conservation model based on local knowledge and Indigenous identity to support environmental sustainability at Mount Ebulobo. Specifically, the study seeks to identify the forms of local ecological knowledge associated with the mountain landscape, examine the role of Indigenous identity and cultural attachment in environmental stewardship, analyze the relationship between local knowledge, identity, and conservation practices, and formulate an integrated model for sustainable mountain landscape management. By connecting ecological, cultural, and institutional dimensions, this research is expected to contribute theoretically to the biocultural sustainability literature and practically to community-based landscape conservation and sustainable environmental governance.

METHODOLOGY

This study employs a **mixed-methods, place-based research design** to develop a Mountain Landscape Conservation Model based on local knowledge and Indigenous identity for environmental sustainability at Mount Ebulobo. The research is conducted through four sequential stages: **(1) identification and documentation of the mountain landscape and its ecological-cultural characteristics, (2) exploration of local and Indigenous knowledge and community identity, (3) analysis of the relationships among local knowledge, Indigenous identity, landscape stewardship, and environmental sustainability, and (4) development and validation of an integrated conservation model.** Primary data are obtained through field observations, semi-structured interviews with community members and key local stakeholders, focus group discussions, and structured questionnaires, while secondary data are collected from scientific publications, government documents, spatial information, and relevant cultural and environmental records. The qualitative data are analyzed thematically to identify recurring patterns of knowledge, cultural values, conservation practices, and community perceptions,



while quantitative data are analyzed using descriptive statistics and **Structural Equation Modeling–Partial Least Squares (SEM-PLS)** to examine the proposed relationships between the research constructs. The integration of qualitative and quantitative findings is subsequently used to formulate a context-specific conservation model that emphasizes the interaction between **local knowledge, Indigenous identity, landscape stewardship, and environmental sustainability**.

RESULTS AND DISCUSSION

Respondent Characteristics

The study involved 150 respondents representing community members and local stakeholders associated with the Mount Ebulobo landscape. The respondents were characterized based on gender, age, educational background, and length of residence. These characteristics provide an overview of the social profile of the respondents and their potential interaction with the mountain landscape.

Table 1. Respondent Characteristics

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	82	54.7
	Female	68	45.3
Age	18–30 years	38	25.3
	31–40 years	44	29.3
	41–50 years	39	26.0
	>50 years	29	19.3
Education	Primary/Junior High	48	32.0
	Senior High	67	44.7
	University	35	23.3
Length of residence	<10 years	21	14.0
	10–20 years	39	26.0
	>20 years	90	60.0

The results indicate that male respondents represented 54.7% of the sample, while female respondents accounted for 45.3%. The largest age group was 31–40 years (29.3%),



followed by respondents aged 41–50 years (26.0%). Regarding educational background, senior high school graduates represented the largest proportion at 44.7%. Furthermore, 60.0% of respondents had lived in the study area for more than 20 years. The relatively long duration of residence provides an important social context for understanding local knowledge, cultural attachment, and community-based landscape stewardship.

Descriptive Statistics of Research Constructs

The study examined four main constructs: **Local Knowledge (LK)**, **Indigenous Identity (II)**, **Landscape Stewardship (LS)**, and **Environmental Sustainability (ES)**. Each construct was measured using a five-point Likert scale.

Table 2. Descriptive Statistics of Research Constructs

Construct	Code	Mean	SD
Local Knowledge	LK	4.18	0.51
Indigenous Identity	II	4.11	0.56
Landscape Stewardship	LS	4.05	0.59
Environmental Sustainability	ES	3.97	0.61

Local Knowledge obtained the highest mean value of 4.18, indicating a strong recognition of the importance of knowledge concerning the mountain environment and its resources. Indigenous Identity recorded a mean of 4.11, demonstrating a strong relationship between cultural identity and the surrounding landscape. Landscape Stewardship had a mean of 4.05, while Environmental Sustainability recorded a mean of 3.97. Overall, the results indicate positive perceptions across all four constructs.

Measurement Model Assessment

The reliability and convergent validity of the constructs were evaluated using Cronbach's Alpha, Composite Reliability, and Average Variance Extracted (AVE).

Table 3. Reliability and Convergent Validity

Construct	Cronbach's Alpha	Composite Reliability	AVE
Local Knowledge	0.884	0.918	0.737



Indigenous Identity	0.901	0.931	0.731
Landscape Stewardship	0.872	0.911	0.719
Environmental Sustainability	0.895	0.927	0.761

All constructs demonstrate Cronbach's Alpha values above 0.70, ranging from 0.872 to 0.901. Composite Reliability values range from 0.911 to 0.931, indicating satisfactory internal consistency. The AVE values range from 0.719 to 0.761, exceeding the recommended threshold of 0.50. These results indicate that the measurement model demonstrates adequate reliability and convergent validity.

Structural Model and Hypothesis Testing

The structural model was evaluated to examine the relationships among Local Knowledge, Indigenous Identity, Landscape Stewardship, and Environmental Sustainability.

Table 4. Hypothesis Testing

Hypothesis	Relationship	β	t-value	p-value	Decision
H1	LK $\rightarrow$ II	0.62	9.14	<0.001	Supported
H2	LK $\rightarrow$ LS	0.34	4.21	<0.001	Supported
H3	II $\rightarrow$ LS	0.47	6.38	<0.001	Supported
H4	LS $\rightarrow$ ES	0.68	11.27	<0.001	Supported

The results demonstrate a positive and significant relationship between Local Knowledge and Indigenous Identity ($\beta = 0.62$; $p < 0.001$). This finding indicates that stronger local ecological knowledge is associated with stronger Indigenous identity and cultural attachment to the mountain landscape.

Local Knowledge also has a positive and significant effect on Landscape Stewardship ($\beta = 0.34$; $p < 0.001$). This relationship suggests that knowledge concerning natural resources, environmental conditions, traditional practices, and landscape management contributes to community stewardship.

Indigenous Identity has a stronger direct relationship with Landscape Stewardship ($\beta = 0.47$; $p < 0.001$). This indicates that cultural attachment and identity may encourage individuals and communities to participate in activities aimed at maintaining and protecting the mountain landscape.



The strongest relationship is observed between Landscape Stewardship and Environmental Sustainability, with a path coefficient of 0.68 and a significance level of $p < 0.001$. This finding demonstrates that stronger landscape stewardship is associated with better environmental sustainability outcomes.

Coefficient of Determination

Table 5. Coefficient of Determination

Endogenous Construct	R ²	Interpretation
Indigenous Identity	0.384	Moderate
Landscape Stewardship	0.567	Moderate
Environmental Sustainability	0.462	Moderate

The R² value for Indigenous Identity is 0.384, indicating that Local Knowledge explains 38.4% of the variance in Indigenous Identity. Landscape Stewardship has an R² value of 0.567, indicating that Local Knowledge and Indigenous Identity jointly explain 56.7% of its variance. Meanwhile, Environmental Sustainability has an R² value of 0.462, indicating that Landscape Stewardship explains 46.2% of the variance in environmental sustainability.

DISCUSSION

The findings demonstrate that **Local Knowledge plays an important role in strengthening Indigenous Identity and Landscape Stewardship**. The significant relationship between Local Knowledge and Indigenous Identity indicates that ecological knowledge developed through long-term interaction with the mountain environment is closely connected with cultural identity. This finding supports the argument that Indigenous and local knowledge represents not only a source of ecological information but also an important component of cultural continuity and relationships between communities and their environments (Brondizio et al., 2021; Tengö et al., 2017).

The positive relationship between Indigenous Identity and Landscape Stewardship further demonstrates the importance of cultural dimensions in environmental conservation. Communities that have a strong cultural attachment to their landscape may be more likely to perceive environmental protection as part of their collective responsibility. This finding is consistent with the biocultural diversity perspective, which emphasizes the interconnectedness



of biological diversity and cultural diversity in landscape conservation (Bridgewater & Rotherham, 2019).

The strongest relationship in the structural model occurs between **Landscape Stewardship and Environmental Sustainability ($\beta = 0.68$)**. This result indicates that environmental sustainability is strongly associated with the ability of communities to translate knowledge and cultural values into concrete stewardship practices. Local knowledge and Indigenous identity therefore need to be connected to practical conservation activities, community participation, environmental monitoring, and sustainable resource management.

The findings also strengthen the proposed **Mountain Landscape Conservation Model**, in which Local Knowledge functions as an important foundation for Indigenous Identity and Landscape Stewardship, while Landscape Stewardship serves as a major pathway toward Environmental Sustainability. This integrated approach extends conventional conservation perspectives by incorporating ecological, cultural, and community dimensions into a single framework. Such an approach is consistent with the growing recognition that effective sustainability strategies should integrate multiple knowledge systems and local values rather than relying exclusively on conventional scientific approaches (Brondízio et al., 2021; Burke et al., 2023; Lukawiecki et al., 2022).

Overall, the results indicate that conservation of the Mount Ebulobo landscape should not be limited to ecological protection. **The integration of local knowledge, Indigenous identity, community stewardship, and environmental sustainability provides a more comprehensive framework for mountain landscape conservation.** This model can potentially serve as a basis for developing participatory conservation policies that recognize local communities as active knowledge holders and environmental stewards.

CONCLUSION

This study concludes that the integration of local knowledge, Indigenous identity, landscape stewardship, and environmental sustainability provides a comprehensive framework for conserving the Mount Ebulobo mountain landscape. The findings indicate that local knowledge contributes positively to Indigenous identity and landscape stewardship, while Indigenous identity strengthens community involvement in landscape conservation. Landscape stewardship demonstrates the strongest relationship with environmental sustainability, highlighting the importance of translating ecological knowledge and cultural values into concrete



conservation practices. The proposed Mountain Landscape Conservation Model therefore emphasizes that sustainable management of Mount Ebulobo should integrate ecological protection with cultural identity, local knowledge, community participation, and sustainable resource management. This integrated approach provides a foundation for developing place-based conservation strategies that recognize local communities as important knowledge holders and active stewards of mountain ecosystems.

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