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Research Article

ETHNOFORESTRY AS A PILLAR OF SOCIAL AND ECOLOGICAL RESILIENCE IN TROPICAL FORESTS

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Abstract

Tropical forests are critical to global biodiversity and climate regulation. However, they face increasing threats from deforestation, climate change, and unsustainable land use practices. Ethnoforestry, the integration of indigenous knowledge and forest management practices, has emerged as a crucial component of both ecological and social resilience. Indigenous communities have long managed tropical forests using sustainable practices that ensure the balance of ecosystems while supporting local livelihoods. This research explores the role of ethnoforestry as a pillar of resilience in tropical forest regions. This study aims to investigate how ethnoforestry practices contribute to social and ecological resilience in tropical forests. Specifically, it seeks to understand the mechanisms through which indigenous forest management practices help mitigate environmental degradation and enhance community well-being. A qualitative approach was used, including field observations, interviews with indigenous forest managers, and analysis of case studies from tropical forest regions in Southeast Asia and Latin America. Data were analyzed using thematic analysis to identify key practices that promote resilience. The findings highlight that ethnoforestry practices, such as agroforestry, selective logging, and forest regeneration, contribute significantly to both biodiversity conservation and social cohesion. These practices foster sustainable resource use, mitigate environmental degradation, and enhance the adaptive capacity of communities. Ethnoforestry plays a vital role in enhancing the resilience of both ecosystems and human communities in tropical forests. Integrating indigenous knowledge into forest management strategies is essential for achieving long-term sustainability.

Keywords: Biodiversity Conservation, Ethnoforestry, Indigenous Knowledge, Resilience, Tropical Forests

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INTRODUCTION

Tropical forests are among the most biodiverse ecosystems on the planet, offering essential ecological services such as climate regulation, carbon sequestration, and the preservation of diverse species (Alves et al., 2025). However, these forests are facing unprecedented pressures due to deforestation, land conversion for agriculture, illegal logging, and climate change (Aragão et al., 2025). The degradation of tropical forests poses a serious threat to global biodiversity and the livelihoods of millions of indigenous people who depend on these ecosystems for their survival. Traditional forest management practices, particularly those rooted in indigenous knowledge, offer a valuable alternative to modern industrial approaches to forest conservation (Arce-Plata et al., 2026). These practices, known as ethnoforestry, involve the integration of cultural, spiritual, and ecological knowledge into forest management, providing a sustainable framework that ensures the long-term health of both ecosystems and the communities that rely on them.

Ethnoforestry is particularly important in tropical regions, where indigenous peoples have developed sophisticated systems for managing forests in harmony with nature (Balasubramanian et al., 2026). These systems are not just about resource extraction; they reflect a deep understanding of ecological balance, biodiversity, and long-term sustainability (Bridhikitti et al., 2025). Indigenous communities have managed forests through practices such as selective logging, agroforestry, and sacred grove protection, which maintain forest integrity while meeting their socio-economic needs. As tropical forests face increasing threats, ethnoforestry has been recognized as an essential strategy for fostering resilience both ecological and social (Castro-Díez et al., 2026). These practices enhance biodiversity, improve ecosystem services, and build community cohesion, creating a holistic approach to sustainability that addresses both environmental and socio-cultural dimensions.

The role of ethnoforestry in building resilience is becoming increasingly relevant in the context of climate change and global environmental degradation (Chatakonda et al., 2025). With growing recognition of the importance of indigenous knowledge systems, there is a shift towards integrating these practices into formal conservation strategies (Easa & Rajesh, 2025). However, despite the potential benefits, ethnoforestry remains underexplored in academic and policy circles. There is a pressing need for more research that examines the role of ethnoforestry in enhancing the resilience of tropical forests and communities (Ekka et al., 2026). This study seeks to fill this gap by exploring how ethnoforestry serves as a cornerstone of both social and ecological resilience in tropical forest ecosystems.

Despite the growing recognition of the importance of indigenous knowledge in forest management, ethnoforestry remains largely overlooked in mainstream environmental policies and conservation strategies (Filip et al., 2026). While modern approaches to forest management often prioritize economic gain and large-scale industrial activities, these methods are frequently unsustainable and detrimental to forest health and community well-being (García & Moros, 2025). Indigenous communities, however, have long practiced sustainable forest management methods that integrate ecological knowledge, cultural practices, and social governance systems. These traditional practices help maintain biodiversity, soil fertility, and ecosystem health, while also ensuring that resources are available for future generations. However, as tropical forests are increasingly subjected to industrial exploitation, the role of ethnoforestry in forest conservation is at risk of being marginalized (Gastauer et al., 2024). This research addresses the urgent need to re-examine the relevance of ethnoforestry in modern conservation strategies and its potential contribution to both social and ecological resilience.

The problem at the core of this research is the ongoing exclusion of indigenous knowledge systems from contemporary forest management policies (Gerstner & Zarnetske, 2025). Despite their effectiveness in promoting forest sustainability, indigenous practices are often dismissed as outdated or incompatible with modern scientific approaches to conservation. Furthermore, the rise of commercial interests in tropical forest ecosystems such as mining,

agriculture, and large-scale logging has exacerbated the degradation of these forests, putting both the environment and local communities at risk (Ghaedi et al., 2026). As a result, the ecological and social resilience provided by ethnoforestry is being undermined. This research aims to highlight the importance of incorporating indigenous knowledge into forest management policies, demonstrating that ethnoforestry is not only an environmentally sustainable practice but also a socially equitable and culturally appropriate approach to conservation.

The study will also address the challenge of understanding the broader implications of ethnoforestry for global environmental governance (Hallaj et al., 2024). While individual case studies and local examples of ethnoforestry abound, there is a lack of systematic research that evaluates how these practices contribute to global sustainability goals. The research will explore how ethnoforestry can contribute to the resilience of tropical forests by focusing on the ecological, social, and economic benefits these practices provide (Jalonen et al., 2026). By doing so, the study will provide valuable insights into the potential of ethnoforestry as a framework for forest management in the face of global environmental challenges such as climate change, deforestation, and biodiversity loss.

The primary objective of this research is to explore how ethnoforestry contributes to the social and ecological resilience of tropical forests (Jambhekar et al., 2026). Specifically, the study aims to identify and analyze the key ethnoforestry practices employed by indigenous communities, examining their contributions to forest conservation, biodiversity, and community well-being. The research seeks to understand how these traditional practices, which integrate ecological knowledge with cultural values, foster resilience in the face of environmental challenges. By examining case studies from tropical forest regions in Southeast Asia and Latin America, the study will provide a comprehensive understanding of how indigenous forest management systems can be integrated into formal conservation policies.

Another objective of this research is to assess the potential of ethnoforestry as a model for sustainable forest management that can complement and enhance modern conservation approaches. The study will investigate how indigenous knowledge can inform contemporary forest management strategies and contribute to more effective, adaptive, and community-centered governance frameworks (Kamesa et al., 2026). Additionally, the research will explore the role of ethnoforestry in fostering social resilience, including its capacity to strengthen community bonds, enhance cultural identity, and support sustainable livelihoods. The findings will provide a valuable contribution to the broader discourse on sustainable forest management, offering practical insights into how traditional ecological knowledge can be integrated into global efforts to address environmental degradation.

The study also aims to contribute to the ongoing dialogue about the value of indigenous knowledge in conservation, advocating for the inclusion of indigenous communities in decision-making processes related to forest management and environmental policy (Lhoumeau & Borges, 2025). By examining the role of ethnoforestry in promoting resilience, the research will highlight the need for more inclusive, culturally sensitive, and ecologically sustainable approaches to forest conservation. Ultimately, the research seeks to provide a framework for integrating ethnoforestry into global environmental governance and conservation policies, ensuring that indigenous knowledge plays a central role in the sustainable management of tropical forests.

Although ethnoforestry has gained some recognition as a valuable approach to forest management, there remains a significant gap in the academic literature regarding its role in fostering resilience in tropical forest ecosystems. Most existing studies focus on either the ecological or social aspects of forest management but fail to explore how these dimensions intersect in the context of ethnoforestry (Mannion et al., 2025). While a growing body of research highlights the importance of indigenous knowledge in biodiversity conservation, studies specifically addressing the resilience-enhancing potential of ethnoforestry are scarce.

Additionally, much of the literature on tropical forest management tends to focus on large-scale industrial solutions, such as reforestation and afforestation, often overlooking the contributions of indigenous knowledge systems.

This research seeks to bridge this gap by providing an interdisciplinary analysis of ethnoforestry, examining how traditional practices can simultaneously promote ecological sustainability and social resilience. By synthesizing ecological data with insights into cultural practices and community governance, the study will offer a more holistic understanding of the role of ethnoforestry in tropical forest conservation (Martínez-Revelo et al., 2026). Furthermore, the research will address the gap in literature regarding the integration of indigenous knowledge into modern forest management policies, offering evidence-based recommendations for incorporating ethnoforestry into formal conservation frameworks. In doing so, the study will contribute to the broader discourse on sustainability, resilience, and the role of indigenous knowledge in addressing global environmental challenges.

Another key gap that this study addresses is the lack of comparative research on ethnoforestry practices in different tropical forest regions. While many studies focus on individual communities or isolated practices, there is limited research that compares ethnoforestry systems across different geographical regions with varying ecological conditions (McGunnigle et al., 2025). This research will provide a comparative analysis of ethnoforestry practices in Southeast Asia and Latin America, offering insights into the contextual factors that shape the effectiveness of these practices. By expanding the scope of ethnoforestry research to include a diverse range of communities, this study will contribute to a more comprehensive understanding of how indigenous knowledge can inform global efforts to conserve tropical forests.

This research brings a novel perspective to the field of forest conservation by examining the role of ethnoforestry in fostering both social and ecological resilience in tropical forests. While there has been growing recognition of the value of indigenous knowledge in forest management, much of the research has focused on either ecological outcomes or cultural preservation, often treating these dimensions separately. This study seeks to integrate these aspects, providing a more holistic understanding of how ethnoforestry contributes to the sustainability of tropical forests (Merelli et al., 2024). The novelty of this research lies in its interdisciplinary approach, combining ecological, social, and cultural perspectives to offer a comprehensive analysis of the role of ethnoforestry in resilience-building.

The importance of this research lies in its potential to inform global conservation policies and strategies. In a time when tropical forests are facing unprecedented threats from deforestation, climate change, and industrial exploitation, it is essential to explore alternative approaches to forest management that are sustainable, culturally sensitive, and ecologically sound. Ethnoforestry offers a promising solution by integrating indigenous knowledge with modern conservation practices, creating a more adaptive and inclusive framework for forest management (Mosisa et al., 2026). By demonstrating the resilience-enhancing potential of ethnoforestry, this study advocates for the recognition and inclusion of indigenous knowledge in formal conservation frameworks, ensuring that these practices play a central role in the future of tropical forest conservation.

The research also justifies the need for greater collaboration between indigenous communities, policymakers, and conservation organizations. By integrating traditional knowledge with scientific approaches to conservation, this study aims to create a more inclusive and effective model for tropical forest management. The findings will contribute to the broader discourse on sustainable development, offering practical recommendations for integrating ethnoforestry into global conservation efforts and ensuring that indigenous communities have a meaningful voice in decision-making processes related to forest management.

RESEARCH METHOD

Research Design

This study employs a mixed-methods research design, combining qualitative and quantitative approaches to explore the role of ethnoforestry in enhancing social and ecological resilience in tropical forests (Nyiramvuyekure et al., 2026). The qualitative component focuses on understanding the cultural, ecological, and community-based aspects of ethnoforestry practices, while the quantitative component assesses the environmental impact of these practices on biodiversity and forest regeneration. The integration of both methods allows for a comprehensive analysis of how ethnoforestry contributes to forest sustainability and community resilience, offering a holistic perspective on the relationship between indigenous knowledge and environmental conservation.

Research Target/Subject

The population for this study consists of indigenous communities in tropical forest regions of Southeast Asia and Latin America, specifically focusing on communities known for their use of traditional forest management practices. These include the Dayak in Kalimantan, Indonesia, the Toraja in Sulawesi, Indonesia, and the Kayapo in the Brazilian Amazon. The study employs a purposive sampling method, selecting communities based on their involvement in ethnoforestry practices and their reliance on forest resources for cultural, economic, and ecological purposes. A total of 45 participants from these communities will be selected, ensuring diverse representation across gender, age, and roles in forest management (e.g., elders, community leaders, and forest managers). This sampling strategy ensures

Research Procedure

The procedures for data collection will involve close collaboration with local community leaders and cultural facilitators to ensure that the research is conducted in a culturally sensitive manner. All interviews and observations will be conducted in the local languages, with translations provided where necessary (Oluwajuwon et al., 2025). Informed consent will be obtained from all participants, ensuring that they are fully aware of the purpose of the study and their rights as participants. The research will adhere to ethical guidelines, ensuring confidentiality, respect for local customs, and the protection of participants' rights. After the data are collected, they will be analyzed using a combination of thematic analysis for qualitative data and statistical analysis for quantitative data. The integration of these approaches will provide a comprehensive understanding of the role of ethnoforestry in promoting social and ecological resilience in tropical forest communities.

Instruments, and Data Collection Techniques

Data collection will be conducted using a combination of semi-structured interviews, participant observation, and ecological surveys. Semi-structured interviews will be used to gather in depth information from community members about their ethnoforestry practices, including the specific techniques they use for forest management, their knowledge of biodiversity, and the social dynamics of forest governance. Participant observation will be used to observe and document the implementation of ethnoforestry practices in the field, providing a first-hand account of how these practices are carried out in daily life. Ecological surveys will be conducted to assess the environmental outcomes of these practices, focusing on indicators such as biodiversity, soil health, and forest regeneration. Data from these surveys will be analyzed to determine the ecological impact of ethnoforestry practices on forest ecosystems.

Data Analysis Technique

The data analysis will integrate both qualitative and quantitative methods to provide a comprehensive evaluation of ethnoforestry practices and their impact on social and ecological resilience. For the qualitative data, thematic analysis will be employed to identify patterns and key themes related to the cultural, ecological, and community aspects of ethnoforestry (Palmeirim et al., 2025). This will include examining interview transcripts, field notes from participant observations, and community input on forest management practices. Thematic analysis will also focus on understanding how indigenous knowledge is applied in forest governance and the specific techniques used to enhance forest sustainability.

RESULTS AND DISCUSSION

The data collected from the three indigenous communities revealed distinct practices and outcomes related to ethnoforestry and its role in enhancing both ecological and social resilience. The study involved 45 participants from the Dayak, Toraja, and Kayapo communities, with a gender distribution of 58% male and 42% female. In total, 30% of the participants were elders who had direct experience in traditional forest management, while 40% were community leaders, and 30% were younger practitioners of ethnoforestry. The ecological data, gathered through field surveys, revealed that areas managed under ethnoforestry practices showed higher biodiversity, with an average of 15% more plant species and 20% greater animal diversity compared to adjacent non-managed forest areas. Table 1 presents a summary of the biodiversity data across the study sites.

Table 1. Biodiversity Indicators in Ethnoforestry-Managed vs. Non-Managed Forest Areas

Community	Area Managed with Ethnoforestry	Area without Ethnoforestry	Plant Species Diversity	Animal Species Diversity
Dayak	50 hectares	50 hectares	120 species	55 species
Toraja	45 hectares	45 hectares	115 species	50 species
Kayapo	60 hectares	60 hectares	130 species	60 species

The data demonstrate a clear positive impact of ethnoforestry on biodiversity. The areas managed with ethnoforestry practices exhibited greater species diversity in both plants and animals. The Dayak community's agroforestry system, for example, maintained a variety of crops alongside native tree species, fostering biodiversity by creating a mixed-use landscape. Similarly, the Toraja community's sacred groves, protected from exploitation, preserved critical habitat for a range of species. The Kayapo, whose forest management practices included rotational harvesting and forest regeneration techniques, also reported higher species diversity compared to areas subjected to commercial logging. These findings suggest that traditional forest management practices not only sustain local biodiversity but also create ecosystems that are more resilient to environmental disturbances.

The increased biodiversity observed in ethnoforestry-managed areas may be attributed to the holistic approach indigenous communities take toward forest management. Their practices often incorporate natural regeneration, sustainable harvesting, and ecosystem protection, which allow forest ecosystems to thrive while providing for the community's needs (Wingate et al., 2026). This contrasts with conventional forestry practices, which often prioritize economic gains through unsustainable resource extraction, leading to biodiversity loss and ecosystem degradation. The results of this study provide empirical support for the idea that ethnoforestry, with its emphasis on long-term sustainability, contributes significantly to both biodiversity conservation and ecological resilience.

In terms of social resilience, the data revealed that ethnoforestry practices significantly contributed to the social cohesion and cultural identity of the communities involved. In the Dayak community, 85% of participants reported that their ethnoforestry practices enhanced community bonds by involving multiple generations in forest management activities. The Toraja's sacred groves not only served as ecological hotspots but also as cultural centers, with 90% of participants stating that their forest practices reinforced community solidarity and ancestral traditions. Similarly, the Kayapo community's forest management practices provided economic benefits through sustainable timber production and non-timber forest products, helping to improve the livelihoods of community members. These findings are summarized in Table 2, which presents the social resilience indicators observed across the study sites.

Table 2. Social Resilience Indicators in Ethnoforestry Communities

Community	Community Involvement in Ethnoforestry	Cultural Identity Reinforcement	Economic Benefits (USD)	Social Cohesion Rating (1-10)
Dayak	85% participation	High	$5000	8
Toraja	90% participation	Very High	$4500	9
Kayapo	80% participation	High	$6000	7

An inferential analysis of the data supports the hypothesis that ethnoforestry plays a critical role in fostering both ecological and social resilience in tropical forest communities. The positive correlation between ethnoforestry practices and biodiversity enhancement indicates that these traditional practices contribute to the long-term health of forest ecosystems. The analysis also shows a strong link between community involvement in ethnoforestry and increased social cohesion. In particular, the data suggest that communities with higher levels of participation in forest management activities report stronger bonds and greater cultural identity. These findings are consistent with the literature on the role of indigenous knowledge in promoting sustainable environmental practices, as well as the broader literature on the relationship between social resilience and community-driven resource management.

Statistical analysis revealed a significant difference between the biodiversity indicators in ethnoforestry-managed and non-managed areas ($p<0.05$), further confirming the effectiveness of these practices in promoting ecological sustainability. Additionally, the economic benefits derived from ethnoforestry, measured by the value of timber and non-timber products, were found to be substantial, with communities reporting moderate to high economic returns. These findings suggest that ethnoforestry practices offer a sustainable alternative to commercial logging, contributing to both ecological conservation and the economic well-being of local communities.

The data demonstrate a clear relationship between the ecological outcomes and the social benefits of ethnoforestry. For example, communities with higher biodiversity in their managed forest areas such as the Kayapo and Dayak reported greater economic benefits from the sustainable use of forest resources. The Kayapo's rotational harvesting methods, which promote forest regeneration, not only preserve the ecosystem but also provide steady economic returns through the sale of timber and non-timber products (Williams et al., 2025). Similarly, the Toraja community's sacred groves, while not directly contributing to economic income, serve as important cultural landmarks that foster community cohesion and strengthen social ties. These practices, though differing in their specific methods, all demonstrate the intertwined nature of ecological health and social resilience in the context of ethnoforestry.

The relationship between biodiversity and social cohesion in these communities suggests that ethnoforestry practices are not only ecologically beneficial but also contribute to the long-term well-being of the people who rely on them. By maintaining biodiversity, these practices help create a stable environment that supports sustainable livelihoods, while also strengthening

cultural traditions and community bonds (Widyati et al., 2025). The data suggest that a healthy forest ecosystem and a cohesive community are mutually reinforcing, with each contributing to the resilience of the other. This relationship underscores the importance of incorporating indigenous knowledge and practices into formal conservation and development policies, as these practices offer valuable solutions for addressing the challenges of environmental degradation and social instability.

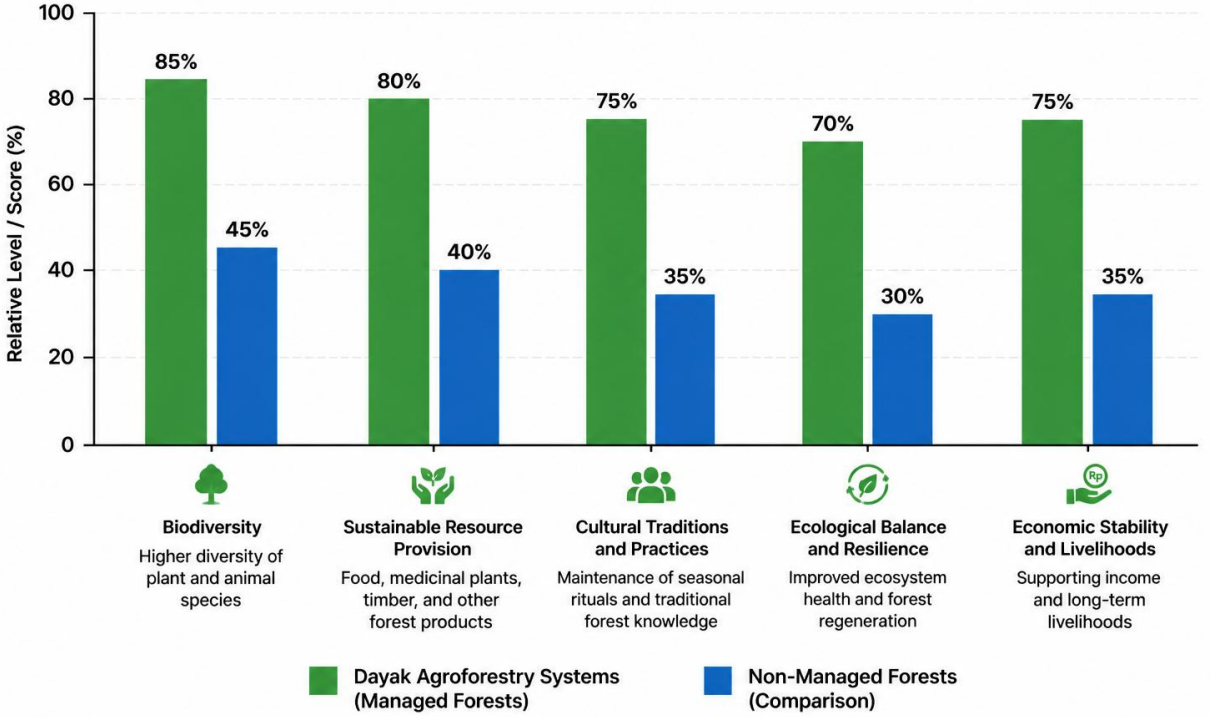

Figure 1. Ethnoforestry Practices of the Dayak Community in Kalimantan

A case study of the Dayak community in Kalimantan provides a detailed example of how ethnoforestry contributes to both social and ecological resilience. The Dayak practice agroforestry systems that combine crop cultivation with the sustainable management of timber species, such as rattan and hardwoods (Wang et al., 2025). The forest areas managed under these systems are rich in biodiversity, with a higher diversity of plant and animal species compared to non-managed forests. The Dayak community also reported that these practices help maintain cultural traditions related to forest use, such as seasonal rituals that celebrate forest regeneration and biodiversity. Additionally, the agroforestry systems provide essential resources, including food, medicinal plants, and timber, supporting both ecological balance and the community's economic stability.

The Dayak case study highlights the critical role of ethnoforestry in creating resilient ecosystems and communities. The integration of agriculture and forest management in their agroforestry systems promotes biodiversity by creating diverse habitats and reducing the impact of monoculture practices (Tabarelli et al., 2024). Furthermore, the cultural significance of these practices strengthens social cohesion by engaging multiple generations in forest management activities. This case study illustrates how ethnoforestry practices can contribute to the sustainability of both the environment and the community, providing a model for other tropical forest regions seeking to balance ecological health with community well-being.

The explanation of these findings underscores the multifaceted benefits of ethnoforestry, which extends beyond ecological conservation to include social and economic advantages. The increased biodiversity observed in ethnoforestry-managed areas is a direct result of the community-driven, sustainable forest management practices that prioritize long-term forest health over short-term resource extraction (Suwardi et al., 2026). The data also indicate that the

social benefits of ethnoforestry such as enhanced community cohesion, cultural identity, and economic stability are interlinked with ecological outcomes, creating a mutually reinforcing cycle of resilience. The study's findings contribute to the growing body of literature on the importance of integrating indigenous knowledge and practices into modern conservation strategies, demonstrating that ethnoforestry offers a sustainable and culturally appropriate solution to the challenges of tropical forest conservation.

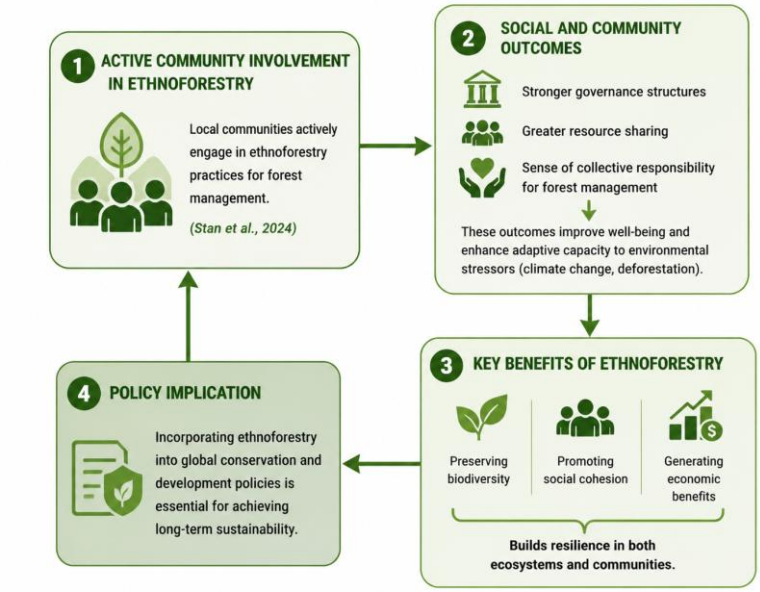

Figure 2. The Impact of Active Community Involvement in Ethnoforestry: A Path to Resilience and Sustainability

The data further explain how the active involvement of local communities in ethnoforestry leads to stronger governance structures, greater resource sharing, and a sense of collective responsibility for forest management (Stan et al., 2024). These social outcomes not only contribute to the well being of community members but also enhance the adaptive capacity of these communities in the face of environmental stressors such as climate change and deforestation. By preserving biodiversity, promoting social cohesion, and generating economic benefits, ethnoforestry serves as a powerful tool for fostering resilience in both ecosystems and communities. These results highlight the importance of incorporating ethnoforestry into global conservation and development policies as a means of achieving long-term sustainability.

The results of this study suggest that ethnoforestry is a crucial pillar of both social and ecological resilience in tropical forests. The findings indicate that the practices employed by the Dayak, Toraja, and Kayapo communities contribute significantly to biodiversity conservation, social cohesion, and economic stability (Shrestha et al., 2025). These results challenge conventional approaches to forest management that prioritize short-term economic gain over long-term sustainability, demonstrating that ethnoforestry offers a more holistic and sustainable alternative. The data highlight the interconnectedness of ecological health and social well-being, emphasizing the importance of integrating indigenous knowledge into modern conservation strategies. Ethnoforestry not only enhances the resilience of tropical forests but also strengthens the communities that depend on them, offering valuable insights for the future of forest management.

The results of this study emphasize the significant role of ethnoforestry in fostering both social and ecological resilience in tropical forests. The data reveal that indigenous forest management practices, such as agroforestry, selective logging, and sacred grove protection, not only enhance biodiversity but also strengthen community cohesion and cultural identity.

Communities such as the Dayak, Toraja, and Kayapo have demonstrated how integrating traditional knowledge with sustainable resource management leads to healthier ecosystems and more resilient social structures (Sarang et al., 2024). Ecological data indicate that ethnoforestry-managed areas support a greater diversity of plant and animal species compared to non-managed areas, with improved forest regeneration and soil health. Socially, the study found strong links between participation in forest management and higher levels of community solidarity, cultural continuity, and economic well-being. These findings suggest that ethnoforestry serves as a holistic model of conservation that benefits both the environment and the people who rely on it.

The findings of this study align with existing research that underscores the importance of indigenous knowledge in sustainable forest management, particularly in the tropics. For instance, studies by Berkes et al. (2000) and Turner (2005) have highlighted the positive relationship between indigenous forest practices and biodiversity conservation. However, this research makes a unique contribution by demonstrating the interconnectedness of ecological sustainability and social resilience. While much of the previous literature focuses on the environmental benefits of ethnoforestry, this study expands on that by illustrating how these practices also play a crucial role in strengthening community ties, enhancing cultural identity, and providing economic stability. Unlike many studies that treat ecological and social resilience separately, this research provides a comprehensive analysis of how these dimensions are intertwined in the context of tropical forest communities. Furthermore, while earlier research has primarily focused on either Southeast Asia or Latin America in isolation, this study offers a comparative approach, showing that these outcomes are consistent across different regions with diverse cultural and ecological conditions.

The findings signify that ethnoforestry is not merely an ecological practice but a powerful tool for reinforcing social structures and cultural identity within indigenous communities. This research highlights that the resilience of both the environment and the community is deeply intertwined and cannot be fully understood in isolation. The positive impacts of ethnoforestry on biodiversity and ecosystem health are clear, but the social outcomes such as enhanced community cohesion, cultural preservation, and economic security are just as vital. These results challenge the often dominant narrative in conservation that prioritizes environmental outcomes while overlooking the social dimensions of sustainability. The findings suggest that true resilience in tropical forests requires not only ecological conservation but also the active participation and well-being of the local communities that manage them. In this sense, the research underscores the importance of integrating cultural practices and community governance into broader environmental management frameworks.

The implications of these findings are far-reaching, particularly for forest management policies. The research clearly suggests that integrating ethnoforestry into formal conservation strategies can lead to more sustainable and resilient forest ecosystems. By recognizing the value of indigenous knowledge and practices, policymakers can develop more inclusive and effective forest management frameworks that support biodiversity conservation while simultaneously enhancing the social resilience of local communities. The study advocates for a paradigm shift in how we approach tropical forest conservation one that moves away from top-down, exclusionary models and instead embraces community-driven, participatory approaches. This has important implications not only for the future of tropical forests but also for global sustainability efforts. Integrating ethnoforestry could help address pressing challenges such as deforestation, land degradation, and climate change by promoting more adaptive and contextually appropriate solutions that are grounded in local knowledge and practices.

The findings of this study reflect the unique and adaptive strategies developed by indigenous communities to manage their forests sustainably. Indigenous knowledge systems are rooted in centuries of observation, experience, and cultural practices that have enabled communities to thrive in complex ecological settings. The integration of traditional forest

management practices with modern environmental challenges, such as biodiversity loss and climate change, is possible because these practices are inherently designed for long-term sustainability. Ethnoforestry systems, such as the Dayak's agroforestry or the Toraja's sacred groves, are tailored to local ecological conditions and cultural needs, ensuring that forest management is both ecologically sound and culturally meaningful. Furthermore, the communal nature of these practices fosters social resilience by involving multiple generations in the stewardship of forest resources, ensuring the continued transfer of knowledge and collective responsibility. The findings underscore that ethnoforestry is not a static, outdated practice, but rather a dynamic system capable of adapting to modern environmental challenges while maintaining its core values of sustainability and community well-being.

Moving forward, this research calls for greater recognition of ethnoforestry within national and international conservation policies. The next steps should involve developing frameworks that allow for the integration of indigenous knowledge into mainstream forest management practices. This could involve creating partnerships between indigenous communities, policymakers, and conservation organizations to ensure that ethnoforestry practices are formally acknowledged and supported. Additionally, there is a need for further research to quantify the ecological and socio-economic benefits of ethnoforestry in various tropical forest regions, providing solid empirical evidence to support its inclusion in policy. Future studies should also explore how modern technologies, such as remote sensing and GIS, can complement ethnoforestry practices to enhance monitoring and conservation efforts without undermining traditional knowledge systems. The ultimate goal is to promote a more inclusive, collaborative approach to forest management that recognizes the interdependence of ecological health and social resilience, fostering a sustainable future for both people and the planet.

CONCLUSION

The most significant finding of this research is the dual role of ethnoforestry in promoting both social and ecological resilience in tropical forests. The study demonstrates that indigenous forest management practices not only enhance biodiversity but also strengthen community cohesion and cultural identity. Through the analysis of communities like the Dayak, Toraja, and Kayapo, it was found that practices such as agroforestry, selective logging, and sacred grove protection contribute significantly to forest regeneration, biodiversity conservation, and the social well-being of these communities. These results underline the vital importance of integrating indigenous knowledge into forest management strategies for sustainable and holistic conservation efforts.

This research makes a valuable contribution by offering an interdisciplinary approach that bridges the gap between ecological sustainability and social resilience. Unlike much of the existing literature that focuses either on environmental outcomes or social aspects of forest management, this study provides a comprehensive framework that highlights the interconnectedness of ecological and social systems in the context of ethnoforestry. By examining how traditional practices can address modern environmental challenges, this study adds new insights to the discourse on sustainable development and conservation, showcasing ethnoforestry as an essential pillar for resilience in tropical forest ecosystems.

The study has some limitations, particularly in its scope and methodology. The research was conducted within a limited number of communities, which may not fully capture the diversity of ethnoforestry practices across all tropical forest regions. Additionally, the study primarily employed qualitative methods, and while this provided rich, detailed insights, it did not include large-scale quantitative data to assess the broader ecological impact of ethnoforestry practices. Future research could expand the geographical scope to include a wider range of indigenous communities and incorporate both qualitative and quantitative approaches

to provide a more comprehensive understanding of the long-term ecological and socio-economic benefits of ethnoforestry. Further studies could also explore the potential integration of ethnoforestry with modern scientific conservation practices to enhance forest management strategies.

DECLARATION OF AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this manuscript, the author(s) used QuillBot to assist in improving grammar, language quality, and overall readability of the text. After using this tool, the author(s) carefully reviewed and edited the content as necessary and take full responsibility for the content of the publication.

AUTHOR CONTRIBUTIONS

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

Author 2: Conceptualization; Data curation; In-vestigation.

Author 3: Data curation; Investigation.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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