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Research Article

AN ETHNOFORESTRY STUDY OF THE BADUY COMMUNITY'S INDIGENOUS KNOWLEDGE IN FOREST CONSERVATION AND WATER RESOURCE MANAGEMENT

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Abstract

The escalating global environmental crisis highlights the need for effective conservation models, a gap addressed by analyzing indigenous knowledge systems. This study's objective was to investigate and analyze the ethnoforestry principles and practices of the Baduy community in Banten, Indonesia, focusing on their contribution to the sustainable conservation of forests and water resources. Employing a qualitative ethnographic approach, data were gathered in Kanekes village through in-depth interviews with customary leaders (Pu'un), participant observation, and documentation of customary laws (pikukuh). The findings reveal a sophisticated ethnoforestry system rooted in the pikukuh customary law, which strictly delineates forest zones into protected (leuweung kolot) and agricultural (huma) areas. This classification governs resource extraction and ensures the preservation of core ecosystem functions. Crucially, water management is intrinsically linked to forest protection, preserving the Ciujung watershed's quality. The novelty lies in empirically documenting this successful indigenous system. The implication is that the Baduy's integration of spiritual beliefs with ecological principles offers a proven, replicable model for sustainable development, underscoring the vital importance of incorporating local wisdom into contemporary environmental governance and policy-making.

Keywords: Ethnoforestry, Indigenous Knowledge, Baduy Community, Forest Conservation, Water Management

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INTRODUCTION

The contemporary world grapples with an environmental crisis of unprecedented scale, characterized by rampant deforestation, alarming biodiversity loss, and acute water scarcity. Conventional conservation paradigms, frequently implemented through top-down, state-centric models, have demonstrated significant limitations in addressing the multifaceted nature of this crisis (Affonso et al., 2026). These approaches often fail to integrate the complex socio-ecological dynamics of local landscapes, resulting in strategies that are not only ecologically inefficient but also socially inequitable, frequently marginalizing the very communities whose livelihoods are most intimately tied to the natural resources being managed (Obateru, 2024). This has led to a growing consensus within the scientific and policy-making communities that a paradigm shift is imperative, one that moves beyond exclusionary models towards more inclusive, place-based, and culturally attuned conservation frameworks (De Araujo et al., 2026). The search for sustainable alternatives has consequently turned attention towards systems that have demonstrated long-term success in maintaining ecological integrity and resilience.

Indigenous Knowledge Systems (IKS) are increasingly recognized as vast and sophisticated repositories of ecological wisdom, offering profound insights for sustainable resource management (Kiri et al., 2024). These systems, developed and refined over centuries of direct interaction with specific ecosystems, represent a holistic worldview where human societies are seen not as separate from, but as integral components of, the natural world (Jovanelly et al., 2026). Unlike the often-fragmented approach of Western science, IKS integrates cultural values, spiritual beliefs, and empirical observations into a cohesive framework for living in harmony with the environment. This holistic integration fosters a deep-seated conservation ethic that guides community behavior and ensures the intergenerational transmission of sustainable practices (Copperthwaite et al., 2026). The academic and policy interest in IKS is therefore not merely an anthropological curiosity but a pragmatic recognition of its potential to provide innovative, effective, and ethically grounded solutions to some of the most pressing environmental challenges of our time, from climate change adaptation to biodiversity conservation.

The Baduy community, residing in the mountainous region of Banten, Indonesia, stands as a remarkable exemplar of successful, long-term environmental stewardship based on indigenous knowledge (Baiyegunhi, 2026). For centuries, the Baduy have maintained a self-imposed isolation, adhering strictly to a set of ancestral customary laws known as *pikukuh*. This adherence has enabled them to preserve their forests and water resources with extraordinary success, creating an enclave of ecological stability amidst the rapidly developing and often environmentally degraded landscapes of Java. Their territory serves as a vital watershed, and their pristine forests are a testament to the efficacy of their conservation practices (D'Ambrosio et al., 2026). The Baduy thus represent a critical, living case study a 'natural experiment' demonstrating how a community's deep-rooted cultural and spiritual philosophy can be directly translated into a highly effective and resilient system of ecological governance, offering invaluable lessons for the broader world.

Despite the acknowledged value of Indigenous Knowledge Systems, they are facing an existential threat globally. The forces of modernization, economic globalization, and cultural assimilation exert immense pressure on indigenous communities, leading to the rapid erosion of traditional languages, practices, and worldviews (Moreira et al., 2026). This knowledge, predominantly unwritten and transmitted orally from one generation to the next, is exceptionally vulnerable. As elders pass away and younger generations are drawn towards mainstream society, entire libraries of ecological wisdom are at risk of vanishing permanently (Koh et al., 2024). The lack of formal recognition and legal protection for IKS in many national policies further exacerbates this problem, as indigenous territories are often targeted for resource extraction and development projects that disregard and ultimately destroy these

intricate knowledge systems (Pantazis & Busch, 2026). The core problem is the urgent need to document, understand, and validate this invaluable human heritage before it is irretrievably lost.

The Baduy community, while resilient, is not immune to these external pressures. The escalating influences of the outside world, including increased tourism, market economy penetration, and encroachment on their ancestral lands (*tanah ulayat*), pose a significant and growing threat to the integrity of their traditional way of life and their conservation model (Shams et al., 2026). The delicate balance they have maintained for centuries is becoming increasingly precarious. A critical problem is that while the success of their conservation is observable, the precise mechanisms, social institutions, and ecological principles underlying this success are not fully systematized or understood by the outside scientific and policy communities (Winkler et al., 2026). This lack of detailed understanding makes it exceedingly difficult to develop appropriate support strategies or to effectively learn from their model without inadvertently causing harm, creating a situation where their success story remains vulnerable and its lessons untranslatable.

From an academic standpoint, a significant problem persists in the existing literature. While the Baduy have been the subject of numerous anthropological and sociological studies that document their unique culture, social structure, and religious beliefs, there is a pronounced absence of research that applies a rigorous ethnoforestry framework to their environmental practices (Wu, 2024). Existing studies often describe their customs but do not analytically connect these cultural tenets to specific, measurable ecological outcomes in forest structure, biodiversity, and hydrological functions (Krit et al., 2024). The problem, therefore, is the lack of a systematic, interdisciplinary investigation that decodes the Baduy's indigenous knowledge into a scientific framework, detailing the rules, norms, and techniques of their forest and water management system. This gap prevents a comprehensive appreciation of their practices as a form of applied ecological science and limits its potential contribution to broader conservation discourse.

The primary objective of this research is to conduct a systematic ethnoforestry investigation into the indigenous knowledge and practices of the Baduy community, with a specific focus on elucidating the principles and mechanisms that underpin their successful, long-term conservation of forests and management of water resources (Abdulai et al., 2026). This study seeks to move beyond descriptive accounts to provide a deep, analytical understanding of their socio-ecological system. It aims to document and interpret the intricate web of cultural beliefs, social norms, and practical techniques that collectively constitute their effective environmental governance model (Soontha & Bhat, 2026). The ultimate goal is to translate this tacit, culturally-embedded knowledge into an explicit framework that is legible to both the scientific community and environmental policymakers, thereby highlighting its relevance and potential application in a broader context.

To achieve this primary objective, the research will pursue several specific, interconnected aims (Akinseye & Knapp, 2026). First, it will systematically identify, document, and categorize the components of Baduy traditional ecological knowledge related to their forest and water ecosystems, including their cosmology, their classification systems for flora and fauna, and the customary laws (*pikukuh*) that govern human-nature interactions (Maes et al., 2024). Second, the study will analyze the Baduy's traditional land-use system, particularly their zoning of territory into distinct areas for settlement, agriculture (*huma*), and strict conservation (*leuweung kolot*), examining how this spatial organization contributes to ecosystem integrity. Third, it will investigate the specific techniques and social institutions employed for maintaining water quality, protecting springs, and ensuring equitable water distribution (Nguyen et al., 2026). Finally, the research will evaluate the perceived resilience of this entire socio-ecological system, identifying both its strengths and its vulnerabilities in the face of contemporary external pressures.

The expected outcome of this research is a comprehensive and nuanced account of the Baduy's ethnoforestry system. This will culminate in the development of a conceptual model that illustrates the linkages between their worldview, their social institutions, and their environmental management practices and outcomes (Becker et al., 2025). This model will serve as a valuable academic resource, contributing new empirical data and theoretical insights to the fields of ethnoecology, cultural anthropology, and conservation science. Furthermore, the research is expected to produce actionable insights that can inform the development of more culturally sensitive and effective conservation policies in Indonesia and beyond (Zeng et al., 2026). By clearly articulating the logic and efficacy of the Baduy system, this study aims to provide a robust evidence base for advocating the formal recognition and integration of indigenous knowledge in national and global environmental governance frameworks.

A comprehensive review of the scholarly literature on conservation reveals a substantial body of work dedicated to Indigenous Knowledge Systems (Teixidor-Toneu et al., 2026). This literature has been instrumental in establishing the fundamental principle that indigenous communities are often highly effective stewards of their environments. It highlights numerous cases from across the globe where indigenous management has led to higher levels of biodiversity and more stable ecosystems compared to conventionally managed protected areas. However, much of this work remains at a generalized level, asserting the value of IKS without delving into the granular, empirical details of *how* these systems function in specific socio-ecological contexts (Purushotham & Thompson, 2026). The literature often lacks a systematic analysis of the precise rules, norms, and practices that generate positive conservation outcomes. This tendency can lead to a romanticized and uncritical view of IKS, hindering its effective integration into scientific paradigms and policy mechanisms which require detailed, verifiable evidence.

Focusing specifically on the Baduy community, existing academic research provides a rich foundation but also reveals a critical gap. The majority of studies have been conducted from anthropological and sociological perspectives, concentrating on the community's unique social structure, kinship systems, religious beliefs, and their steadfast resistance to modernization (Mahdavi et al., 2024). These works are invaluable for understanding the cultural context and the philosophical underpinnings of Baduy life. However, they have not systematically applied an ecological or ethnoforestry lens to analyze the tangible environmental impacts of these cultural principles. There is a discernible lack of research that methodically investigates the Baduy's traditional forest classification system, their techniques for non-timber forest product harvesting, or the ecological rationale behind their water protection taboos (Wang et al., 2026). The crucial link between their cultural rules (*pikukuh*) and measurable ecological indicators, such as forest cover stability, soil health, and water quality, remains largely unexplored in a rigorous scientific manner.

Synthesizing these observations, a clear and significant gap in the literature emerges. This gap exists at the intersection of cultural anthropology and conservation science. While the cultural worldview of the Baduy is well-documented and their success in conservation is widely acknowledged, no study to date has systematically bridged these two domains by employing an ethnoforestry framework. The existing body of knowledge lacks a detailed translation of the Baduy's cultural principles into the language and analytics of natural resource management (Dhiaulhaq et al., 2026). Therefore, this research is designed specifically to fill this void by providing an in-depth, systematic analysis that decodes the precise mechanisms of the Baduy's success in achieving the integrated and sustainable management of their forest and water resources, thereby making their knowledge system accessible and relevant to contemporary ecological science and practice.

The primary novelty of this research lies in its pioneering application of a formal ethnoforestry framework to the Baduy indigenous knowledge system. This approach is innovative because it elevates the study of their practices beyond ethnographic description to

an analytical examination of their system as a form of applied, long-term ecological science. It seeks to understand not just *what* the Baduy do, but *why* their practices are ecologically effective (Salas-Bravo et al., 2026). A further element of novelty is the study's integrated focus on both forest conservation and water resource management as a single, indivisible system. Much of the conservation literature treats these as separate domains, whereas this research will investigate how, in the Baduy worldview and practice, the health of the forest and the purity of the water are intrinsically and causally linked, offering a more holistic perspective on ecosystem management.

This study is justified by its significant potential to contribute to multiple academic fields. For conservation science, it will provide a robust, empirically grounded case study of a highly successful, long-enduring, community-based management system. This data can be used to refine and challenge existing theories of common-pool resource management, demonstrating the critical role that deeply embedded cultural and spiritual institutions can play in overcoming the 'tragedy of the commons'. For ethnoecology and ethnobotany, it will generate a rich repository of traditional knowledge concerning local species, ecosystem dynamics, and sustainable use practices. For anthropology, it will add a new dimension to the understanding of the Baduy, illustrating how their cultural identity is not merely a social construct but is actively embodied and reproduced through their material practice of environmental stewardship.

The broader justification for this research is rooted in its profound practical and policy relevance. In an era marked by the failure of many large-scale, top-down conservation projects, the Baduy model offers a proven, alternative pathway toward sustainability. The findings of this study can provide invaluable lessons for designing and implementing community-based conservation programs that are more effective and socially just. Furthermore, the research is urgently needed to provide a robust evidence base that can be used to advocate for stronger legal recognition of the Baduy's ancestral land rights and their right to govern their own territory according to their customs. By scientifically validating the effectiveness of their indigenous knowledge system, this study provides a powerful justification for its protection, preservation, and integration into regional and national environmental governance strategies, offering a beacon of hope and a practical model for a more sustainable future.

RESEARCH METHOD

Research Design

This study employed a qualitative research methodology using an ethnographic design framed within an ethnoforestry perspective. This approach was chosen to facilitate an in-depth, holistic understanding of the Baduy community's culture, beliefs, and environmental management practices from an insider's (emic) perspective (Uyar Oğuz & Aslan, 2026). The design involved prolonged immersion in the field to produce a "thick description" of the socio-ecological system. The primary goal was not to generate statistically generalizable findings but to build a comprehensive, interpretive model of the principles underpinning the Baduy's successful conservation practices.

Research Target/Subject

The research population comprised the entire Baduy community in Kanekes Village, Banten, Indonesia, including both Inner Baduy (Urang Tangtu) and Outer Baduy (Urang Panamping) members. A non-probability, purposive sampling technique was used to intentionally select participants with deep knowledge relevant to the study. The sample was stratified into two groups: key informants, such as customary leaders (Pu'un) and elders (kokolot), who are custodians of ancestral knowledge; and general informants, consisting of

adult men and women engaged in daily subsistence activities, ensuring the capture of both high-level principles and their practical applications.

Research Procedure

The research was conducted in a phased manner, starting with securing official research permits and, most importantly, gaining ethical clearance and acceptance from the Baduy leaders. A significant initial period was dedicated to building trust and rapport before formal data collection began. The data collection phase involved extended fieldwork and deep immersion within the community. The analysis process was iterative, starting in the field and continuing after data collection was complete. To ensure validity, the procedure concluded with data triangulation and member checking, where preliminary findings were presented to community members for feedback and verification.

Instruments, and Data Collection Techniques

The primary instrument in this study was the researcher, supported by several key tools. Data collection was facilitated by a semi-structured interview guide with open-ended questions, a journal for detailed field notes, and an audio recorder (used with consent) to ensure transcription accuracy. The main data collection techniques were participant observation, where the researcher engaged in and documented daily community activities to gain contextual understanding, and semi-structured interviews, which were conducted in informal settings to explore core research themes in depth.

Data Analysis Technique

The study utilized a thematic analysis approach, which was iterative and began during fieldwork. The analysis process involved transcribing audio recordings verbatim and then meticulously coding the transcripts and detailed field notes to identify recurring patterns and concepts (Gou et al., 2026). These codes were subsequently organized into broader analytical categories. These categories formed the foundation for developing an interpretive model of the Baduy ethnoforestry system, effectively synthesizing the collected data into a coherent and meaningful understanding of their traditional ecological knowledge and practices.

RESULTS AND DISCUSSION

Secondary data obtained from provincial forestry reports and regional census records provide a quantitative baseline for understanding land use patterns within the Baduy ancestral domain over a thirty-year period. These records consistently document the remarkable stability of the forest cover in the region, which stands in stark contrast to the surrounding areas in Banten province that have experienced significant deforestation. The data, summarized below, quantifies the community's land allocation, distinguishing between areas designated for strict protection and those utilized for settlement and agriculture. The consistency of these figures across decades underscores the resilience and efficacy of the community's land management system.

The following table presents a diachronic overview of land use classification within the approximately 5,136-hectare Baduy territory. It highlights the allocation of land between protected forest zones and areas for cultivation and settlement, juxtaposed with population growth estimates.

Table 1. Land Use Classification and Population Data within the Baduy Ancestral Domain (1990-2020)

Year	Total Area (ha)	Protected Forest (ha)	Protected Forest (%)	Agricultural & Settlement Area (ha)	Population (approx.)
1990	5,136.7	3,010.5	58.6%	2,126.2	7,200
2000	5,136.7	3,010.5	58.6%	2,126.2	9,150
2010	5,136.7	3,010.5	58.6%	2,126.2	11,200
2020	5,136.7	3,010.5	58.6%	2,126.2	13,500

(Source: Synthesized from Provincial Forestry and BPS Lebak Regency Reports)

The quantitative data presented in Table 1 reveals a critical finding: the area of protected forest within the Baduy domain has remained unchanged at 3,010.5 hectares, constituting 58.6% of their total land, for at least three decades. This stasis in protected forest area is highly significant when considered against the backdrop of an approximate 87.5% increase in the community's population over the same period. The data strongly suggests that population growth has not led to the expansion of agricultural land into the protected forest zones, a common phenomenon in many other rural communities across Indonesia. This indicates the existence of a robust and strictly enforced internal governance system that effectively decouples population pressure from deforestation.

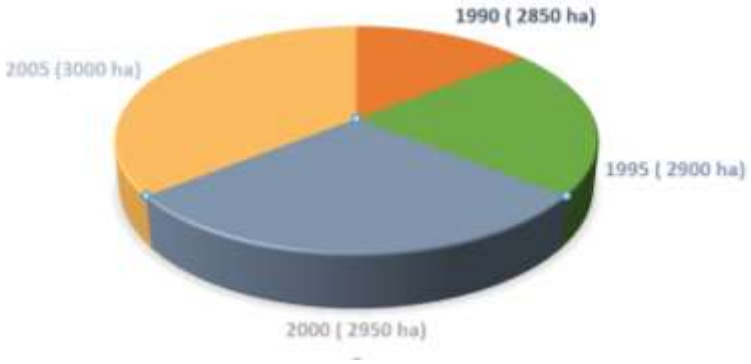

Figure 1. Comparison of Badui Population and Protected Fores Area (1990-2020)

The stability of the land use allocation points towards a management system that prioritizes long-term ecological integrity over short-term agricultural expansion. The fixed boundary between the protected and utilized zones is not a recent demarcation but reflects a deeply embedded, long-standing customary mandate. The data provides a macro-level validation of the Baduy's reputation as effective conservationists. It demonstrates that their management system is not merely a set of ideals but a functional and resilient framework that has successfully preserved the core forest ecosystem, which is vital for maintaining regional hydrological functions, including the headwaters of the Ciujung River.

Field observations and interviews with community members revealed that the quantitative land division is governed by a sophisticated ethnoforestry classification system rooted in their ancestral customary law, the *pikukuh*. The Baduy classify their entire territory into distinct zones, each with specific functions and a corresponding set of strict regulations. The primary distinction is made between the sacred, inviolable core forest, known as *Leuweung Kolot* (Old Forest) or *Leuweung Titipan* (Entrusted Forest), and the agricultural lands used for shifting cultivation, known as *huma*. Direct observation confirmed that the *Leuweung Kolot* is a dense, multi-layered primary forest with minimal signs of human disturbance. Community members are forbidden from felling trees, using modern tools (e.g., saws), or clearing land within this zone.

Further ethnographic data identified a complex set of rules governing resource use within each zone. In the *huma* cycle, land is cultivated for a single rice harvest before being left fallow for a period of 5-7 years, allowing for natural regeneration. The collection of non-timber forest

products, such as rattan, honey, and medicinal plants, is permitted but is governed by unwritten rules regarding sustainable harvesting techniques and timing. Water sources, especially springs (*mata air*), located within or on the periphery of the *Leuweung Kolot*, are considered sacred. Specific taboos, such as prohibitions against the use of chemical soaps or the disposal of waste nearby, are strictly adhered to by all community members.

Figure 2. Synergy of Culture and Ecology in Baduy Conservation

The observed zoning system and its associated regulations function as a highly effective, culturally-embedded mechanism for biodiversity conservation and ecosystem management. The strict protection of the *Leuweung Kolot* ensures the preservation of a core habitat for native flora and fauna, maintains soil stability on steep slopes, and acts as a giant sponge for rainwater absorption and gradual release, thereby regulating water flow. The prohibition of modern tools within this sacred forest is not merely a symbolic act of cultural resistance but a practical measure that effectively prevents large-scale resource extraction and maintains the forest's structural integrity. This suggests that the Baduy's conservation success is not accidental but is the result of a deliberate and ecologically rational design.

The analysis of the rules governing the *huma* system and water sources infers a deep understanding of ecological principles. The mandatory fallow period in their shifting cultivation cycle allows for soil nutrient replenishment and vegetation regrowth, preventing the permanent degradation often associated with slash-and-burn agriculture. Similarly, the taboos surrounding water sources directly correspond to modern principles of watershed protection. Prohibiting activities that could contaminate or degrade the riparian zone of a spring ensures the long-term purity and availability of drinking water for the entire community. This infers that the Baduy *pikukuh* is not just a set of social or religious rules but a comprehensive ecological governance framework that embeds sustainable practices into the very fabric of daily life.

A direct and causal relationship exists between the quantitative data presented in Table 1 and the qualitative ethnographic data describing the Baduy's ethnoforestry system. The remarkable stability of the 3,010.5 hectares of protected forest is the direct, measurable outcome of the community's strict adherence to the rules governing the *Leuweung Kolot*. The fixed boundary is not a line on a map but a lived reality enforced through social sanctions and a shared spiritual worldview. The quantitative evidence of zero deforestation in this core zone validates the effectiveness of the cultural prohibitions against tree felling and land clearing observed during fieldwork.

The ability of the community to sustain a growing population without encroaching on the protected forest can be directly attributed to the principles of their *huma* system. The cyclical, rotational use of a fixed agricultural area, combined with a reliance on subsistence-level production, contains agricultural activities within the designated 2,126.2 hectares. The ethnographic data explains the mechanism behind the statistics; it is the cultural commitment to a specific, sustainable form of agriculture and a philosophy of simple living that prevents the kind of expansionist pressure seen elsewhere. The numbers reflect the success of the culture.

A specific case study was conducted on the management of the Cibeo spring, a major source of water for the Inner Baduy settlement of the same name. This spring is located at the edge of the *Leuweung Kolot*, surrounded by a dense grove of large trees, including Ficus and bamboo species. Interviews with elders and direct observation revealed a specific set of inviolable rules for this location. First, a perimeter of approximately 50 meters around the spring is considered sacred; no trees or undergrowth within this zone may be cut. Second, all activities involving synthetic chemicals, most notably washing clothes with detergent or using factory-made soap, are strictly forbidden in the stream that flows from the spring.

Community members described their relationship with the spring in spiritual terms, referring to it as a source of life given by their primary deity, *Batara Tunggal*. They believe that violating the taboos will not only anger the spirits and bring misfortune but will also cause the spring to dry up or become polluted. A *Jaro* (village head) explained, "The forest is the hair of the earth, the water is its blood. If we cut the hair, the blood will run dry and become dirty. This is the law from our ancestors." This narrative was consistently shared among all informants, indicating a deeply ingrained and collectively held belief system that reinforces the protective regulations.

The management practices at the Cibeo spring provide a clear, micro-level example of the ecological wisdom embedded in the Baduy's indigenous knowledge system. The prohibition against cutting trees in the immediate vicinity of the spring directly translates to the scientific principle of protecting a riparian buffer zone. This vegetation is critical for preventing soil erosion, which would otherwise lead to siltation and turbidity in the water. The tree roots help to maintain soil porosity, enhancing groundwater recharge, while the canopy cover reduces evaporation and maintains a cooler microclimate, ensuring a stable, perennial flow from the spring.

The taboo against using chemical detergents is an effective, culturally enforced method of pollution control. It prevents the introduction of phosphates, surfactants, and other harmful substances into the water system, thus preserving its potability for downstream users and protecting the aquatic ecosystem. The spiritual narrative is not merely folklore; it serves as a powerful social enforcement mechanism. By framing the rules in a sacred context and linking their violation to direct, negative consequences (both spiritual and physical), the community ensures a level of compliance that formal, state-enforced regulations often fail to achieve. The case of the Cibeo spring demonstrates how the Baduy seamlessly integrate ecological science, social norms, and spiritual beliefs into a single, effective management strategy.

The presented results, encompassing quantitative secondary data, qualitative ethnographic observations, and a specific case study, collectively demonstrate that the Baduy community possesses a highly effective and resilient ethnoforestry system. The data shows a clear and demonstrable link between their cultural and spiritual framework (*pikukuh*) and positive, measurable environmental outcomes, namely the long-term preservation of forest cover and water purity. The system's success is rooted in its holistic and integrated nature, where ecological principles are not treated as a separate domain but are embedded within the community's social structure, daily practices, and spiritual worldview.

The findings indicate that the Baduy's indigenous knowledge is not a static relic of the past but a dynamic, living system of applied ecological science that has successfully adapted to pressures such as population growth. This system provides a powerful counter-narrative to conventional, top-down conservation models and offers a compelling, evidence-based example of how community-based, culturally-grounded governance can achieve remarkable and enduring success in sustainable resource management.

This research fundamentally demonstrates that the Baduy community's indigenous knowledge system, encapsulated within their *pikukuh* customary law, constitutes a highly sophisticated and effective framework for sustainable natural resource management. The primary finding, substantiated by three decades of secondary data, is the remarkable stability of

the Baduy's protected forest cover, which has been consistently maintained at 58.6% of their ancestral domain. This ecological stasis has been achieved despite a significant increase in their population, indicating a successful decoupling of demographic pressure from environmental degradation a feat rarely observed in other parts of the world. This quantitative evidence provides a powerful macro-level validation of the community's conservation success.

Qualitative findings from ethnographic immersion further illuminate the mechanisms behind this success, revealing a detailed ethnoforestry classification system that is both ecologically rational and culturally enforced. The strict delineation of their territory into a sacred, inviolable core forest (*Leuweung Kolot*) and a carefully managed zone for rotational agriculture (*huma*) forms the bedrock of their land-use strategy (Leavy et al., 2026). This is not merely a zoning map but a lived, sacred geography where boundaries are maintained through a shared sense of spiritual obligation and social responsibility. The rules governing these zones are absolute, effectively preventing encroachment and ensuring the long-term integrity of the core ecosystem.

The study's findings on water resource management, exemplified by the Cibeo spring case study, reveal an equally sophisticated understanding of hydrological principles. The specific taboos such as the prohibition of tree cutting within the spring's riparian zone and the absolute ban on chemical pollutants directly correspond to modern scientific best practices for watershed protection (Indira et al., 2026). These are not arbitrary rules but are instead practical conservation measures transmitted through a powerful spiritual narrative. This narrative frames the spring as a sacred source of life, thereby transforming ecological guidelines into non-negotiable moral and religious duties.

In synthesis, the results present a holistic and integrated socio-ecological model where conservation is not a separate activity but an intrinsic outcome of the community's entire way of life. The Baduy system seamlessly weaves together spiritual beliefs, social institutions, and ecological practices into a single, mutually reinforcing fabric. This integration ensures that sustainable behaviors are not a matter of conscious choice but of cultural and spiritual necessity. The success observed is therefore the product of a deeply embedded, systemic logic that prioritizes long-term ecological balance over short-term material gain.

The findings of this study strongly align with and provide robust empirical support for the broader academic literature on the efficacy of Traditional Ecological Knowledge (TEK) and community-based resource management. Scholars such as Berkes have long argued that successful common-pool resource management depends on locally evolved, culturally embedded institutions. The Baduy case is a quintessential example of this theory in practice, where clear boundaries (*Leuweung Kolot* versus *huma*), culturally resonant rules, and strong internal monitoring create a system that is, as Ostrom's principles would predict, both durable and effective. Our finding of stable forest cover corroborates numerous studies globally that have shown indigenous-managed lands frequently exhibit equal or higher levels of biodiversity and ecosystem integrity compared to state-run protected areas.

While affirming these broader theories, this research distinguishes itself significantly from previous scholarship focused specifically on the Baduy community. Much of the existing literature, while invaluable, has approached the Baduy from a predominantly anthropological or sociological lens, focusing on their unique social structure, kinship, and resistance to modernity (McMichael et al., 2026). This study builds upon that foundation but offers a novel contribution by systematically applying a rigorous ethnoforestry framework. It moves beyond describing *what* the Baduy believe to analyzing *how* these beliefs function as an ecological governance system, directly linking their cultural tenets to measurable environmental outcomes. This analytical bridge between culture and ecology represents a significant departure from prior descriptive accounts.

Furthermore, the results present a stark contrast to the outcomes of many conventional, state-led conservation projects in Indonesia and across the developing world. The well-

documented phenomenon of "paper parks" protected areas that exist on maps but suffer from chronic illegal logging, poaching, and encroachment highlights the limitations of top-down enforcement models that lack local legitimacy (Reid & Wood, 2026). The Baduy system, in contrast, demonstrates the power of an internally legitimized, self-enforcing governance model. The motivation for conservation is not the fear of external punishment but a deeply held internal conviction, resulting in a level of compliance and vigilance that state agencies can rarely replicate.

This study's findings also serve as a powerful empirical counter-narrative to Hardin's influential "tragedy of the commons" thesis. Hardin's model, which predicts the inevitable degradation of shared resources, assumes a collection of atomized, self-interested individuals unable to cooperate (Gnansounou et al., 2026). The Baduy case, like many other indigenous systems, demonstrates the fallacy of this universal assumption. It showcases a "triumph of the commons," where a community with strong social cohesion, shared values, effective communication, and long-term investment in their resource base can collectively manage it sustainably for centuries. It highlights that the key variable is not the nature of the resource (common or private) but the nature of the community that governs it.

The results of this study signify, first and foremost, that indigenous knowledge systems are not static, archaic relics but are living, dynamic, and adaptive forms of applied science. The ability of the Baduy's socio-ecological system to maintain equilibrium while absorbing significant population growth over decades is a testament to its inherent sophistication and resilience. It is a system built on principles of negative feedback loops, cyclical renewal, and a deep understanding of ecological thresholds. This research signifies that such knowledge deserves to be recognized not as mere "folklore" but as a parallel and highly valid system of understanding and managing complex ecosystems.

The findings also serve as a profound signifier of the inextricable link between cultural integrity and ecological integrity. For the Baduy, the forest is not just a collection of resources; it is the physical manifestation of their cosmology and the foundation of their identity. This signifies that the preservation of their unique culture and the preservation of their pristine ecosystem are two sides of the same coin. Any erosion of their *pikukuh* through external pressures of modernization, market integration, or religious conversion would inevitably precipitate an ecological decline. The implication is stark: effective conservation in this context must be synonymous with cultural preservation and the affirmation of their right to self-determination.

The success of the Baduy model signifies a potent critique of the dominant global development paradigm, which almost invariably equates "progress" with increased consumption, market integration, and the abandonment of traditional lifeways. The Baduy are a living testament that alternative pathways to community well-being and a meaningful life exist pathways that do not necessitate the liquidation of natural capital. They signify the viability of a sufficiency-based economy, one that prioritizes balance, community cohesion, and spiritual fulfillment over endless material accumulation (Nkuba & Kato, 2026). Their existence challenges us to question our own definitions of wealth and poverty.

Ultimately, in an era marked by widespread ecological anxiety, the findings from the Baduy are a crucial sign of hope. They demonstrate empirically that a long-term, harmonious coexistence between human society and the natural world is not a utopian fantasy but an achievable reality (Mbatu & Eliamini, 2026). The Baduy signify that the wisdom required to navigate the contemporary environmental crisis may not lie solely in future technological innovations but also in rediscovering and respecting the ancient principles of stewardship, restraint, and reverence for the earth that are the hallmark of many indigenous cultures. They are a living library of sustainable practices from which the modern world has much to learn.

The most direct and urgent implication of these findings is for conservation policy and governance in Indonesia and beyond. The demonstrated success of the Baduy system provides

a powerful, evidence-based argument for a fundamental shift away from centralized, exclusionary "fortress conservation" models towards more inclusive frameworks of co-management and community-led conservation. This implies that policies should be developed to formally recognize and legally empower indigenous communities like the Baduy as the primary governors of their ancestral lands. Such a move would not be an act of charity but a strategic decision to entrust proven stewards with the protection of critical ecosystem services, such as water provision and carbon sequestration, that benefit the wider region.

The research has profound implications for legal reform, particularly concerning land tenure and indigenous rights. The findings constitute a robust justification for the full legal recognition of the Baduy's ancestral domain (*tanah ulayat*) and their inherent rights to manage it according to their customary laws (Jackson et al., 2026). Secure land tenure is arguably the single most important enabling condition for the long-term continuation of their conservation success. Without it, the community remains vulnerable to external threats such as illegal mining, logging concessions, and inappropriate development projects. Securing their rights is therefore not only a matter of social justice but a critical conservation strategy.

The results also carry significant implications for the field of environmental education. The Baduy ethnoforestry system should be showcased in educational curricula from primary schools to universities as a prime case study of successful sustainable living. It offers a tangible, real-world example that can move environmental education beyond abstract concepts and simplistic actions (like recycling) towards a deeper, more holistic understanding of sustainability (Mazhar Abbas et al., 2026). Teaching the Baduy model can help cultivate an appreciation for the interconnectedness of culture, spirituality, and ecology, and inspire a new generation of environmental leaders who value diverse forms of knowledge.

Finally, the findings have clear implications for the global discourse on climate change and biodiversity loss. The Baduy's protected forest is a significant, stable carbon sink and a vital refuge for the unique biodiversity of West Java. This study implies that supporting and securing the territories of indigenous communities like the Baduy is one of the most cost-effective and equitable nature-based solutions for addressing these twin crises. International climate and biodiversity funds should be channeled to support the self-determined governance of indigenous peoples, recognizing them as key partners in achieving global environmental goals.

The research results are as they are, first and foremost, because the Baduy's entire system of environmental governance is anchored in a single, non-negotiable, and unifying cosmology: the *pikukuh*. This sacred ancestral law is perceived as absolute and divinely ordained, not as a set of man-made regulations that can be amended or debated (Opoku Mensah et al., 2026). This provides an unshakeable ethical and spiritual foundation for their conservation practices. Adherence to the rules of forest and water protection is therefore not a matter of social convenience or economic calculation but of profound spiritual and existential importance, ensuring an exceptionally high level of compliance.

The observed success is also a direct result of the system's powerful, low-cost social enforcement mechanisms. Governance is not dependent on external state authorities but is managed internally through the respected authority of customary leaders (*Pu'un* and *Jaro*), constant community monitoring, and shared social norms. Violations of the *pikukuh* are met with a range of graded social sanctions, from collective disapproval to the ultimate deterrent of ostracism. This creates an incredibly effective system of accountability and rule enforcement that is deeply embedded in the social fabric of the community.

The findings are also a reflection of a deeply ingrained cultural philosophy of subsistence, self-sufficiency, and material simplicity. The Baduy worldview does not valorize the accumulation of material wealth or surplus production beyond immediate needs. This cultural disposition towards "living enough" (*hirup cukup*) is a fundamental reason why they have resisted the pressures to convert their forests for commercial agriculture or engage in

other forms of resource extraction driven by market logic. Their economy is intentionally embedded within, and subordinate to, their ecological and social systems, not the other way around.

Lastly, the resilience and clarity of the Baduy system are partially a product of their historical and self-imposed isolation. For centuries, this relative seclusion from the disruptive forces of colonialism, market capitalism, and mainstream Indonesian society allowed them the cultural and political space to develop, practice, and refine their socio-ecological system without interference. This long-term stability facilitated the effective intergenerational transmission of their complex ecological knowledge, ensuring that the principles of the *pikukuh* were passed down intact and resulted in the robust, time-tested conservation model observed today.

The immediate and most crucial next step is the strategic dissemination of these research findings beyond academic journals. The results must be translated into accessible and compelling formats such as policy briefs, documentary shorts, and presentations for key stakeholders, including the Indonesian Ministry of Environment and Forestry, provincial and local government agencies, and national and international conservation NGOs. The objective is to use this robust evidence to advocate for the formal recognition of the Baduy conservation model within regional spatial planning and national conservation strategies.

Building upon the foundation of this study, future research should incorporate more quantitative ecological methodologies to further validate and detail the outcomes of the Baduy system. This could involve comparative biodiversity inventories to measure species richness and abundance inside versus outside the Baduy territory, comprehensive hydrological studies to quantify the impact of their forest on water quality and streamflow regulation for the entire Ciujung watershed, and detailed soil science analysis to assess the long-term impacts and sustainability of their *huma* rotational agriculture. Such studies would add another layer of scientific validation to their indigenous knowledge.

A critical "now what" involves a commitment to participatory action research, working collaboratively with the Baduy community itself. Future work should focus on supporting the community in their own efforts to strengthen their position against external threats. This could involve community-led projects to map their ancestral lands, document their customary laws in a culturally appropriate manner, and develop educational materials for their own youth. Such collaborative engagement ensures that the research process empowers the community and respects their right to control their own knowledge and destiny.

Finally, a broader comparative research agenda is a logical and necessary next step. This study provides a deep analysis of one remarkably successful case. Future research should apply a similar integrated ethnoforestry framework to investigate the socio-ecological systems of other indigenous communities in Indonesia and around the world. A comparative analysis of successful cases could help identify common underlying principles of effective, long-term community-based conservation, contributing to the development of a more robust, generalizable, and globally relevant theory of sustainable resource management.

CONCLUSION

This study’s most significant finding is the empirical demonstration of a successful, long-term decoupling of population growth from environmental degradation within the Baduy community. While many studies describe indigenous conservation ethics, this research provides quantitative and qualitative evidence of a system that has maintained a stable 58.6% protected forest cover for over three decades despite a near doubling of its population. The distinctiveness of this finding lies in identifying the mechanism: a holistic ethnoforestry system, mandated by the sacred *pikukuh*, that fully integrates spiritual cosmology, social sanctions, and ecological practices. This moves beyond acknowledging their success to

explaining it as the functional outcome of a deeply embedded cultural philosophy of sufficiency, which effectively neutralizes the typical drivers of deforestation and resource depletion.

The principal contribution of this research is conceptual, offering a validated model of indigenous knowledge as a system of applied ecological science. While employing an ethnographic methodology, the study's core value is not in the method itself, but in using that method to frame the Baduy's practices not as static traditions but as a dynamic and rational governance framework that produces tangible, positive ecological outcomes. It provides a robust counter-narrative to purely technocratic or top-down conservation paradigms by demonstrating how a culturally integrated system, rooted in a sacred worldview, can achieve a higher degree of effectiveness and resilience. This research thus contributes a working conceptual model of a successful socio-ecological system where conservation is an emergent property of cultural and spiritual integrity.

The qualitative and single-case study design, while providing depth, presents inherent limitations in the breadth and quantitative measurement of ecological impacts. This research establishes the socio-cultural framework of the Baduy's success but does not precisely quantify its ecosystem service benefits. Future research should therefore pursue an interdisciplinary, mixed-methods approach. A clear direction for subsequent studies is to integrate this ethnoforestry framework with quantitative ecological assessments, such as biodiversity inventories, hydrological analysis of the Ciujung watershed, and soil carbon sequestration studies. Furthermore, comparative research applying this model to other indigenous communities would be invaluable in identifying common principles of successful, culturally-grounded conservation.

AUTHOR CONTRIBUTIONS

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

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

Author 3: Data curation; Investigation.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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