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LOCAL KNOWLEDGE IN WATERSHED GOVERNANCE FOR ECOSYSTEM RESTORATION: A CASE STUDY OF THE BATANG GADIS RIVER BASIN IN THE SETTLEMENT LANDSCAPE OF MANDAILING NATAL

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ABSTRACT

The Batang Gadis Watershed in Mandailing Natal faces mounting ecological pressures from environmental degradation, changing land-use patterns, and insufficient community participation in conservation initiatives. To address these challenges, the indigenous ecological wisdom of the Mandailing community presents a culturally appropriate and proven framework for watershed stewardship.

This study explores local knowledge systems used in river management and evaluates their contribution to ecosystem restoration. Through a qualitative case study methodology, researchers gathered data via interviews with community elders, direct observation of practices, and comprehensive documentation of river-centered cultural traditions.

The study reveals that traditional practices including as lubuk larangan (sacred fishing prohibition areas), ceremonial rituals (marpangir), and streamside management protocols constitute an integrated ecological governance framework. These customary practices help preserve water quality, safeguard biological diversity, and strengthen community-based resource stewardship.

The findings demonstrated that indigenous knowledge systems substantially improve watershed resilience. Incorporating these

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traditional approaches into official environmental framework offers a context-sensitive, community-driven, and culturally authentic pathway for ecological restoration.	

1. INTRODUCTION

The Batang Gadis Watershed (DAS Batang Gadis) is a significant hydrological area in Mandailing Natal Regency of North Sumatra Province. The watershed is crucial for maintaining ecological integrity and supporting the socio-economic livelihoods of neighboring communities. The Batang Gadis River runs through traditional Mandailing communities and serves as a primary source of irrigation, drinking water, and freshwater fisheries. Its strategic importance is further emphasized by its incorporation into the Batang Gadis National Park (TNBG), which is noted for its substantial biodiversity and essential conservation value [1].

Over the past twenty years, the watershed has faced mounting ecological pressures. Extensive deforestation in the upper catchment area, primarily caused by the proliferation of oil palm plantations, has resulted in increased sedimentation, deteriorating water quality, and impaired watershed protection functions [2]. Furthermore, extensive illegal gold mining in the upper and middle watershed areas has exacerbated ecosystem degradation due to heavy metal pollution and altered river morphology [3]. Unregulated changes in land use, especially the conversion of forests into urban areas and smallholder plantations, have exacerbated riverbank erosion, localized flooding, and reduced water infiltration capacity.

Technocratic methods for ecosystem restoration have proven inadequate in addressing these challenges without substantial involvement from local communities. Consequently, incorporating local knowledge into watershed management is a strategic and sustainable option. The Mandailing community, like many other local groups in the Indonesian archipelago, has a deep system of ecological values, customary norms, and traditional practices passed down through generations. These include *lubuk larangan* (customary no-fishing zones), regulations for utilizing the riparian zone, and spiritual rituals that signify the sacred connection between humanity and nature [4]. This approach aligns with community-based resource management frameworks that emphasize social participation, recognition of customary rights, and local involvement in decision-making process [5], [6].

Several studies have explored the intersection of indigenous knowledge and watershed governance. For instance, [7] examined how traditional community forest management in Nepal

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supported hydrological recovery and soil conservation, yet their focus remained primarily on forest cover and slope management without delving deeper into spiritual-ecological linkages. In Kalimantan, Indonesia, research by [8] analyzed the effectiveness of Dayak customary land practices in peatland conservation through adat zoning. However, that study focused on peat ecosystems rather than upland watersheds. Meanwhile, [9] highlighted Himalayan practices of terracing and sacred water rituals but in a context that is distinct from Mandailing lowland-alluvial systems due to its mountainous and monsoonal characteristics.

This study differs in that it focuses on integrating specific *Mandailing* indigenous ecological practices, including sacred zoning, water rituals, and riverine customary law, within the context of a lowland watershed embedded in both a national park and a settlement landscape. Unlike previous works that have generalized or separated ecological and spiritual domains, this research aims to examine holistically how culturally rooted practices directly support ecosystem restoration outcomes. This study examines the Local ecological knowledge employed by the Mandailing community in the management of the Batang Gadis Watershed, evaluating its significance as an effective and sustainable strategy for ecosystem restoration.

In light of the preceding context, this study addresses the following research questions: What local wisdom practices does the Mandailing community employ in managing the Batang Gadis Watershed? How do these local knowledge practices facilitate ecosystem restoration initiatives? The objectives of this study are: 1. To identify and analyze the manifestations of local wisdom integrated into watershed management. 2. To assess the contributions of these local practices to ecosystem restoration efforts.

2. RESEARCH METHODOLOGY

2.1 Methodology

This study uses a qualitative descriptive methodology to understand how the Mandailing community uses local wisdom to manage the Batang Gadis Watershed (DAS) and the impact of these practices on ecosystem restoration initiatives. Local wisdom is a socio-cultural phenomenon that cannot be quantified, so this methodology was selected to understand values, meanings, and practices inherent in community life [10].

2.2. Research Classification

The case study focuses on specific villages in the traditional Mandailing Natal settlement area that have maintained customary water resource management practices, especially along the Batang Gadis River. The case study design allows for a thorough examination of the unique social, environmental, and cultural contexts of the research environment [11].

2.3. Research Location and Participants

The research was carried out in villages within the Batang Gadis watershed that possess

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significant historical contexts of customary environmental governance. These villages include Huta Godang, and Kotanopan. The research subjects included: traditional leaders and local stakeholders, community members engaged in watershed management, village officials and both formal and informal watershed managers.

2.4. Methods of Data Acquisition

A combination of data collection techniques was employed to acquire comprehensive and contextual information.

a. Comprehensive Interviews

Interviews were conducted with customary figures, such as adat leaders, village imams, community members engaged in lubuk larangan practices, watershed managers, and senior villagers well-versed in the history and evolution of traditional ecological practices. A semi-structured format was employed to explore narratives and local significance related to the river and its environment.

b. Field Observation

Direct observations were conducted in areas where local knowledge is employed, such as lubuk larangan zones, ritual sites along the river, and riparian zones. Participatory observation was used to record the community's daily interaction with the river, such as ritual performances, fishing regulations, and collaborative clean-up efforts.

c. Documentation and Archival Analysis

Data were collected from traditional manuscripts, village records, community maps, customary regulations (ughi), and minutes from community meetings concerning watershed management.

2.5. Methods of Data Analysis

a. Data Reduction and Classification

The data obtained from interviews and observations were refined to extract relevant information, which was then classified into the following thematic categories: local wisdom practices, ecological functions, cultural and spiritual values, conservation strategies and societal regulation.

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b. Thematic Analysis

Thematic analysis was used to identify significance and connections between local knowledge and the principles of ecosystem restoration, including biodiversity conservation, hydrological rehabilitation, and riparian buffer zone protection. This analysis established links between regional narratives and socio-ecological theory.

c. Data Triangulation

To augment the validity of the findings, data triangulation was performed by corroborating information from various sources (interviews, observations, and documents) and validating consistency among different informants (Yin 2000 in [12]; Moleong 2000 in[13], Yin 2000 in [14]; Moleong 2000 in**[15]**; [16], [17].

3. THEORETICAL REVIEW

3.1. The Definition of Watershed (DAS)

A watershed is a geographic area where precipitation collects and converges into a shared outlet via a system of rivers that ultimately empty into an ocean or a lake. Watershed functions as a cohesive unit for managing water resources, encompassing ecological and administrative aspects.

Watersheds uphold ecosystem equilibrium by conserving biodiversity, safeguarding vegetation cover, and regulating biogeochemical cycles. Its hydrological functions encompass regulating water flow, replenishing groundwater, and managing erosion and sedimentation [18]. Watersheds facilitate human livelihoods by supplying irrigation, potable water, supporting freshwater fisheries, and functioning as venues for cultural exchange and traditional governance [19].

Imbalances in watershed management can undermine these three fundamental functions, potentially resulting in land degradation, flooding, drought, and social conflicts among resource users.

3.2. Community-Oriented Ecosystem Rehabilitation

Community-based ecosystem restoration actively engages local populations in rehabilitating compromised ecological systems. This participatory model emphasizes the importance of local stakeholders' involvement in the planning, executing, and evaluating restoration programs [20].

The efficacy of community-based restoration largely depends on strengthening local institutions, including traditional groups, village organizations, and community conservation entities. Community involvement fosters a sense of ownership, economic efficiency, and long-term sustainability [21]. A study by Mansuetus et al. (2023) demonstrates that watershed restoration initiatives in East Nusa Tenggara (NTT) that use customary institutions are much more effective than top-down strategies.

3.3. Local Knowledge in Resource Management

Local knowledge refers to the system of values, norms, and practices that are passed down through generations and developed by local communities to sustainably manage natural resources. In Indonesia, numerous traditional practices implicitly promote ecological conservation. One example is the *lubuk larangan* system in West Sumatra and Mandailing, which designates specific areas and times when fishing is prohibited to allow fish populations to replenish [4]. Cultural rituals such as the *marpangir* ceremony in Mandailing signify a sacred connection between humans and rivers. These rituals function as spiritual practices and mechanisms for socially regulating environmental conduct [23]. Other prevalent examples throughout Indonesia include traditional spatial zoning systems such as *leuweung larangan* (prohibited forest) in Sundanese communities, *awig-awig* regulations in Bali, and the *sasi* system in Maluku. These systems all exemplify conventional management practices rooted in local values and spiritual beliefs [6].

3.4. Prior Research

Prior research pertinent to this subject includes a study by Zulkifli (2021) investigating the *lubuk larangan* practice in Huta Godang Village, Mandailing Natal. The study revealed that communities continue to uphold traditional values for managing river usage, significantly influencing the conservation of local fish species. Sibarani (2020)examined river-centric cultural narratives within the Batak-Mandailing community, demonstrating that rivers are perceived as integral to social and spiritual identity, not merely as water sources. Lestari et al. (2021) studied Way Seputih Watershed in Lampung and found that river restoration initiatives based on local institutions and traditional knowledge produced better results than technocratic methods alone. Together, these studies indicate that combining ecological methodologies with local cultural values is a viable strategy for sustainable watershed management. Figure 1 illustrates conceptual frameworks of local knowledge.

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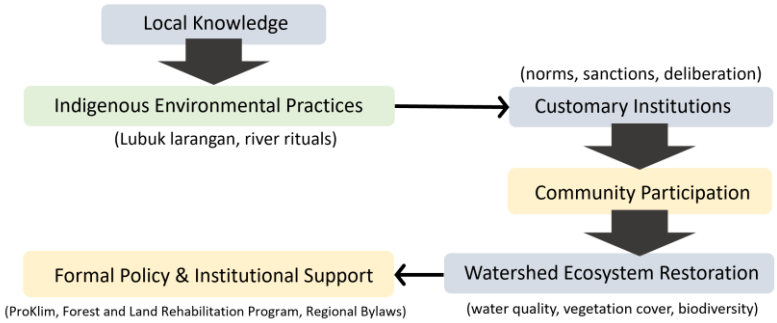

Fig 1. Conceptual frameworks

4. RESULTS

4.1 Identification of the Location and Context of the Batang Gadis Watershed

a. Geographic Location of the Batang Gadis Watershed

The Batang Gadis Watershed (DAS Batang Gadis) is located in the Mandailing Natal Regency (abbreviated as Madina), in the North Sumatra Province, Indonesia. The Batang Gadis River originates from the upper catchment of the Bukit Barisan Mountain Range and discharges into the Strait of Malacca. Its geographical coordinates are approximately 0°15' – 1°00' N and 99°00' – 100°00' E, and it encompasses multiple sub-districts, including Panyabungan, Batang Natal, Kotanopan, as well as neighboring regions. The watershed size is approximately 3,700 km², making it one of the most important watersheds in western North Sumatra.

b. Physical Attributes of the Watershed

The watershed has a varied topography, with mountainous areas upstream and flat plains downstream. The watershed experiences a humid tropical climate with annual rainfall exceeding 2,000 mm, which affects runoff and erosion. The fertile latosol and andoso soils are prone to erosion, especially in areas of deforestation. The upper catchment is dominated by protected forests within Batang Gadis National Park. In contrast, the middle and lower areas are increasingly used for agriculture and settlements.

c. Strategic Functions of the Watershed

Ecologically, the watershed supports rich biodiversity, including the Sumatran tiger, and provides essential services such as water supply and flood control. The watershed also holds deep cultural value for the Mandailing people, as evidence by practices such as *lubuk larangan*. Economically, the watershed supports agriculture, aquaculture, and plantations, while also supplying water for

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domestic use. However, mining activities in nearby areas have triggered environmental degradation and social tensions.

d. Current Strains on the Watershed

The watershed is facing severe deforestation due to the expansion of oil palm plantations and illegal logging. Unregulated gold mining causes pollution, including mercury contamination and sediment buildup. Converting land without conservation measures increases erosion, and natural disasters like floods and landslides are becoming more frequent. These issues are worsened by the weak enforcement of spatial regulations and the limited control of upstream activities.

e. Community Connections and Local Knowledge

Local communities remain highly dependent on the watershed for their livelihoods. Traditional ecological knowledge, such as the *lubuk larangan* system, reflects long-standing environmental stewardship. However, modernization and reduced intergenerational transmission of values have led to the decline of such practices, exacerbating environmental degradation.

f. Implications for Regional Planning

Due to its ecological and socio-economic importance, the Batang Gadis Watershed should be a focus in regional planning. Conservation areas must be clearly designated in the RTRW to protect watershed functions. Collaboration among stakeholders in integrated watershed management is essential, with a focus on restoration efforts based on local knowledge and community participation.

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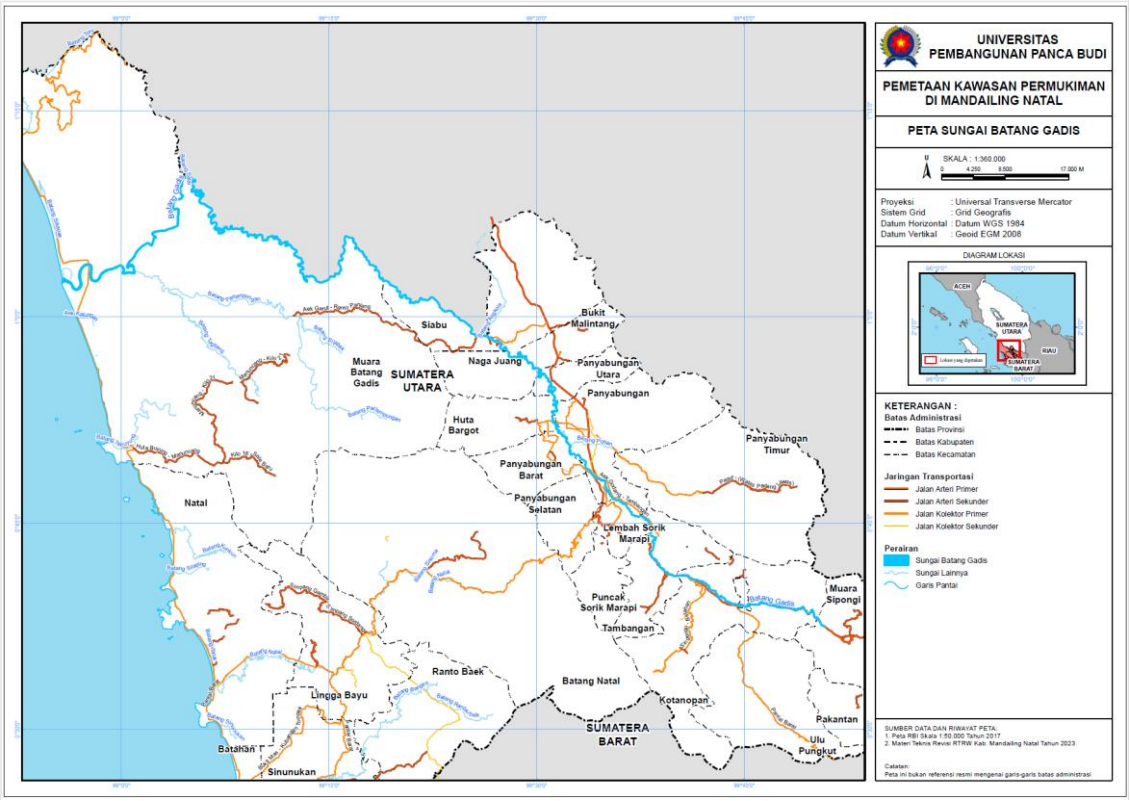
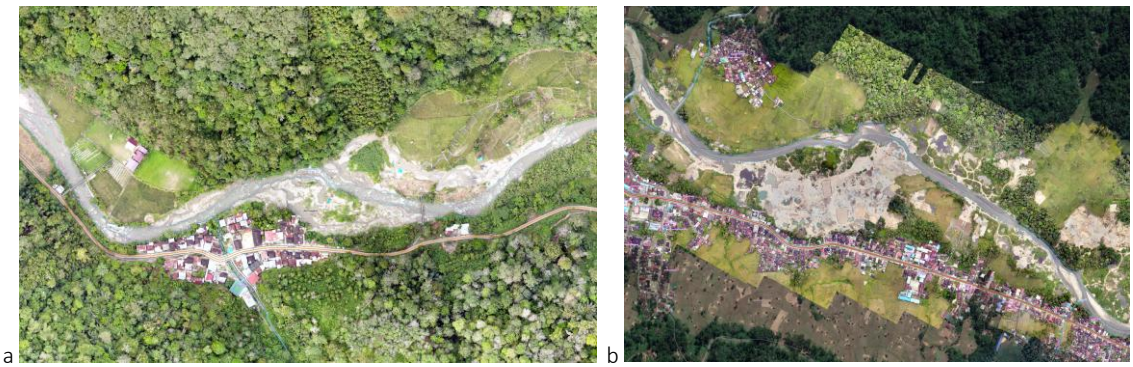


Fig 2 . The flow map of the Batang Gadis River in Mandailing Natal



a b

Fig 3. The watershed map of the Batang Gadis River as observed in the two case study areas—Patahajang Village (a) and Kotanopan (b)

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4.2 Local wisdom practices related to the management and restoration of the watershed

1. Local Knowledge Practices

Local wisdom refers to traditional knowledge and practices that have been passed down through generations and have been shown to be effective in preserving the environment, especially river ecosystems.

a. Lubuk Larangan (Customary No-Fishing Areas). These are particular segments of a river that are established as no-fishing zones for a specified duration in accordance with customary agreements. The objective is to preserve fish populations and maintain ecological balance in freshwater ecosystems. These zones are established by customary leaders and ratified through community discussions.

Fishing is permitted only during specific customary events, e.g., traditional festivals, and the catch is generally used for communal purposes, including rituals or developing social infrastructure. Those who transgress are subject to standard penalties, including monetary fines or social ostracism.

b. Rituals Associated with Rivers: a) Marpangir: a ritualistic bath or spiritual purification practice conducted in the river. Usually observed before *Ramadan*, during nuptial ceremonies, or on traditional ceremonial occasions. b) *Mangido dohot boru ni ari*: A ritual of supplication to ancestral spirits or river guardians. Performed through sacred ceremonies by the river with offerings (sesaji) to seek safety and agricultural abundance. c) Ecological significance: These rituals cultivate reverence for nature, particularly water, and enhance the spiritual bond between humans and rivers as essential components of life systems.

c. Traditional Land Utilization and Agricultural Practices: The Mandailing people traditionally engage in crop rotation, cultivating rice, maize, and vegetables in accordance with seasonal calendars and customary cycles. Forest conservation: A stringent ban exists on deforesting areas in river headwaters, which are believed to be the homes of water spirits. Erosion control: Riverbanks are stabilized with erosion-resistant flora such as bamboo (Bambusa), Hibiscus tiliaceus, and sugar palm (Arenga pinnata) rather than concrete structures.

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d. Established Norms and Penalties

A set of implicit guidelines exists to maintain balance between humans and the environment. Examples of customary norms: Discharging waste or sewage into the river is unequivocally prohibited. Indiscriminate tree felling in the upstream region is also prohibited. Sanctions vary from verbal admonitions and monetary penalties in the form of rice, sugar, or poultry to exclusion from communal activities. Enforcement: Sanctions are implemented by traditional institutions, including the Raja Adat or *Hatobangon* (senior customary elders).

4.3 Principal Stakeholders and Trends in Community Engagement

The principal stakeholders in the Batang Gadis region's local wisdom–based ecosystem management consist of various community actors. First, traditional leaders such as the *Raja Adat* and *Hatobangon* serve as custodians of customary values and play a key role in establishing *lubuk larangan* zones and customary land-use systems. Second, local community members, including farmers, fishers, and rural women, are the primary practitioners of ecological traditions. They possess extensive traditional ecological knowledge related to seasonal cycles, indigenous crops, and water resource management. Third, rural youth and scholars actively participate in environmental initiatives and facilitate intergenerational knowledge transfer. They also participate in digital storytelling and the participatory mapping of cultural and ecological assets. Lastly, village heads and local government entities facilitate the incorporation of local knowledge into development planning and collaborate with community members on ecosystem restoration projects.

Community engagement in the Batang Gadis Watershed reflects the interplay between tradition and contemporary environmental governance. Collective action, or *gotong royong*, remains a core practice, with community members collaborating on river cleanups, tree planting, and constructing clean water facilities. Customary deliberation (*musyawarah adat*) plays a vital role in decision-making, and natural resource management is guided by communal consensus in traditional assemblies. Knowledge is transmitted through oral traditions such as storytelling and folk songs, as well as experiential learning, particularly involving children and youth. In recent years, local communities have also become increasingly involved in state-sponsored programs such as Community-Based Watershed Management, *Hutan Desa* (Village Forests), and Critical

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Land Rehabilitation initiatives. The application of local wisdom in the Batang Gadis Watershed illustrates a resilient socio-ecological system that is rooted in spiritual values, customary laws, and communal solidarity. Traditional practices such as *lubuk larangan*, river rituals, and customary land-use systems contribute to ecological sustainability and reinforce the cultural identity and social cohesion of the Mandailing community.

5. DISCUSSION

5.1. Analysis of the Contribution of Local Practices to Watershed Ecosystem Quality

A. The impact of *lubuk larangan* (traditional no-fishing zones) on the viability of local fish populations

a. Definition and Operation Mechanism.

Lubuk larangan refers to a traditional conservation zone established along river stretches where fishing is typically prohibited for a set period. This practice is governed by customary deliberation (*musyawarah adat*) and collectively agreed upon by the entire community. These zones are usually located in areas with natural pools or deep, calm sections of the river that provide favorable habitats for fish to breed. Local residents actively guard Lubuk larangan sites, which are clearly marked. Harvesting, or the temporary lifting of restrictions, occurs once or twice a year and involves traditional rituals. The fish catch is distributed or used communally.

b. Contribution to the Watershed Ecosystem.

1) Supporting local fish populations by providing adequate space and time for reproduction. It supports the conservation of endemic species, including *garing, lemeduk, and baung*. Prevents overexploitation, which can lead to species extinction.

2) Maintaining the balance of the aquatic food web. Fish play a crucial role in the riverine trophic chain. Maintaining fish populations helps to control aquatic insect larvae, zooplankton, and riparian vegetation.

3) Reducing ecosystem pressure through fishing bans reduces the use of harmful tools such as poisons and electric shocks.

4) Raising community ecological awareness. Educating communities on the value of recovery zones in freshwater systems and conservation-based management practices.

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B. The integration of spiritual values and ecological functions

a. The Meaning of River Sacredness in Mandailing Culture

In Mandailing tradition, rivers are more than just water sources; they are considered living entities inhabited by spiritual beings not just water sources. As such, rivers are revered and respected.

Littering, urinating, or engaging in careless activities near the river is considered a spiritual offense that can bring misfortune.

b. Rituals and Spiritual Values that Influence Ecology

1. Marpangir Ritual: Physical and spiritual purification.

   Before Ramadan, the people would clean the river collectively as part of their preparation. This ritual acts as a regular restoration event for the river, reducing waste and pollution.

2. Mangido Doa (River Prayer Ritual) is a blessing ritual for ancestral spirits held in peaceful riverside locations. It creates a sense of sacredness in river zones, leading to increased protection efforts.

3. Customary Taboos: Cutting down large trees near the river is prohibited because they are believed to be the homes for supernatural creatures. Disposing of kitchen waste or using chemical detergents at sacred river sites is also prohibited.

Spiritual beliefs play a vital role in reinforcing ecological functions within the Batang Gadis watershed. Sacred riverbanks are respected and left undisturbed, allowing natural vegetation to thrive and contributing to biodiversity conservation. Community-based norms and spiritual taboos help regulate pollution and protect water quality, often more effectively than formal enforcement. Practices such as *lubuk larangan* (customary no-fishing zones) and river rituals serve as informal yet powerful ecological buffer zones. These traditions support low-cost conservation efforts, safeguard native species, and foster a deeply rooted ecological ethic. By embedding environmental stewardship within cultural and spiritual frameworks, local communities establish sustainable systems of ecological monitoring and protection. The integration of spiritual values, customary law, and ecological knowledge offers a resilient model of participatory watershed management that holds potential for broader application across

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Indonesia

5.2. Linkages Between Local Norms and Contemporary Ecological Restoration Principles

a. Conventional Practices in the Management of Natural Resources

The relationship between communities and their environment is governed by customary norms, which are unwritten rules that are rooted in long-standing ancestral values. In the context of the Batang Gadis Watershed, these norms include the following: a) Prohibition of tree cutting in upstream areas (a prohibition against the clearing of sacred forests); b) Prohibition of fishing in *lubuk larangan* ("customary no-fishing zones"); and c) Social sanctions for the ecosystem degradation or river pollution.

b. Modern Ecosystem Restoration Principles

The following are key principles of ecosystem restoration, as outlined in the guidelines of both national and international institutions (e.g., Indonesia's Ministry of Environment and Forestry – KLHK, the Food and Agricultural Organization of the United Nations--FAO, United Nations Environment Program--UNEP): 1) The restoration of ecosystem functions (e.g., hydrology, biodiversity); 2) The active involvement of local communities; 3) Socio-ecological and landscape -based approaches and 4) A sustainable, long-term perspective.

c. Convergence Between Customary Norms and Restoration Principles

Customary norms embody inherent conservation values that are closely aligned with scientific principles of ecosystem restoration. Thus, customary norms can be integrated complementarily into modern environmental governance frameworks, as shown in Table 1.

Table 1. integrated complementarily

Customary Norms	Modern Restoration Principles	Alignment
Prohibition of logging in sacred customary forests	Conservation of upstream catchment areas	Protection of watershed recharge zones
Lubuk larangan (no-fishing zones)	Aquatic species protection zones	Restoration of riverine biodiversity
Rituals and taboos related to river use	Environmental education and awareness	Cultivating ecological sustainability values
Customary deliberation in decision-making (*musyawarah*)	Participatory planning	Community-based governance

5.3. Opportunities for Replicating and Reinforcing Local Institutional Frameworks in National Ecosystem Restoration Initiatives

a. Existing local institutional systems as follows: 1) Customary institutions (*Raja Adat*, *Hatobangon*): These institutions regulate customary norms and impose traditional sanctions related to environmental stewardship. 2) Forest Farmer Groups (*Kelompok Tani Hutan/KTH*): These groups are established in several villages to manage forest protection and the utilization of non-timber forest products. 3) Youth Networks and Nature Schools: These are local initiatives focused on ecological education for children and adolescents in rural communities.

b. Replication Potential at the National Level: 1) Locally rooted restoration models can be replicated in other watersheds with similar socio-cultural structures (e.g., in Tapanuli, Minangkabau, Dayak regions). 2) Participatory and customary-based approaches can be used as instruments for ecological restoration, particularly in a) Critical land rehabilitation programs; b) Riverbank and riparian zone protection initiatives; 3) Integration of customary institutions into national programs such as: a) Forest and Land Rehabilitation (RHL) Program.; b) Participatory Integrated Watershed Management Programs; and c) Climate Village Program (*Program Kampung Iklim/ProKlim*).

c. Strengthening Strategies: 1) Legal recognition: Formalizing the status of customary institutions through village regulations (*Perdes*) or district head decrees (*Perbup*); 2) Technical capacity building: Community-based restoration training delivered by extension workers or NGOs; and 3) Multi-stakeholder partnerships: Facilitating collaboration among government agencies, universities, and traditional leaders.

5.4. Challenges and Constraints of Modernization to the Sustainability of Local Knowledge

Modernization poses serious challenges to the sustainability of local knowledge in managing socio-ecological systems. Key obstacles include:

(a) Socio-cultural shifts: Urban migration and formal education lacking local content lead to generational disconnection from traditions. Values shift from collectivism and conservation to individualism and from conservation to exploitation.

(b) Economic and industrial pressure: Economic hardship forces communities to clear sacred forests for plantations and tolerate illegal mining, often beyond customary control.

(c) Policy and legal conflicts: Many customary lands lack formal recognition, and top-down national programs often ignore local contexts and practices.

(d) Environmental and cultural threats: Climate crises and disasters disrupt traditionally governed ecosystems, while modern narratives marginalize customary values.

To address these issues, we must reframe local wisdom in modern terms and integrate it into public policy. We should promote ecological education through schools and media, embed customary norms in spatial planning and environmental policy, and offer incentives like REDD+ benefits or ecotourism certifications to encourage preservation.

6. CONCLUSION

The ecological wisdom of the Mandailing community—such as *lubuk larangan*, river rituals, and customary norms—plays a vital role in sustaining watershed ecosystems. National programs such as RHL, ProKlim, and Integrated Watershed Management should formally integrate these local practices into their planning and implementation processes. Legal frameworks such as ministerial regulations or *Perda* must support the participation of customary institutions in restoration governance. A collaborative, context-sensitive approach involving the government, academia, NGOs, and communities is essential—moving beyond technocratic models to embrace place-based socio-ecological values.

Local wisdom is often sidelined in modernization efforts. Strengthening the institutional capacity of customary leaders, farmer groups, and youth communities is critical to ensuring their participation in development. Environmental education rooted in local culture should be prioritized, particularly for youth. Prioritizing environmental education rooted in local culture, particularly for youth, is essential. Legal recognition of *ulayat* land, village regulations, and customary communities is necessary to protect practices such as *lubuk larangan*. Inclusive policy dialogue must align economic growth with the preservation of cultural and ecological values.

Mandailing's local practices offer replicable models for other regions with similar ecological conditions. These practices must be documented through books, films, articles, and digital platforms to ensure intergenerational transmission. Collaboration among the government, academia, and NGOs is essential to compile comparative studies and adapt local models, such as transforming *lubuk larangan* into conservation zones in coastal or swamp areas. National programs on eco-tourism, climate resilience, and community forestry should expand these proven approaches.

To ensure effective and culturally rooted ecosystem restoration, local wisdom must be recognized as a strategic ecological asset. It must be integrated into policy and legal protection.

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