

LOCAL ECOLOGICAL KNOWLEDGE, ENVIRONMENTAL ETHICS, AND RESILIENCE: Insights from the 2025 Sumatra Floods

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Abstract: Local Ecological Knowledge, Environmental Ethics, and Resilience: Insights from the 2025 Sumatra Floods The ecological disaster that struck Sumatra in late November 2025, particularly affecting communities in Gayo and Central Tapanuli, underscores the complex relationship between human activities, forest exploitation, and environmental degradation. This study examines the 2025 floods through the lens of local wisdom and environmental conservation. Using a qualitative phenomenological approach, it explores how communities perceive, practise, and transmit ecological knowledge in Central Aceh, Bener Meriah, and Central Tapanuli. The findings show that local wisdom is embedded in educational practices, cultural values, and community-based economic activities that connect forest knowledge with environmental stewardship and livelihoods. Ecological values are also passed across generations through oral traditions, religious and customary ceremonies, customary law, traditional arts, education, and tourism. These practices demonstrate that local ecological wisdom functions not only as cultural heritage but also as practical knowledge for sustainable resource management. Strengthening such knowledge through education, cultural practices, and community-based management can support conservation and disaster resilience.

Keywords: Environmental Conservation, Ecological Knowledge, Gayo Community, Tapanuli Community, 2025 Sumatra Floods

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Introduction

The ecological condition of Sumatra at the end of November 2025 is remains in quantifying the cumulative, cascading hydro-geomorphic disruptions ultimately leading to severe watershed degradation¹ and damage to catchment areas caused by deforestation,² raising questions about how to position the environment in relation to human existence. The community must conserve the environment and develop long-term mitigation strategies.³ Hydrological disruptions caused by the failure of water control infrastructure from upstream to downstream of the river can certainly be explained as extreme geological damage resulting from exploitation, reflecting the relationship between humans and nature. This hydrometeorological disaster has exerted a social effect in various regions in Aceh, North Sumatra, and West Sumatra, causing 69,239 people to abandon the homes, while 45,733 others are directly affected by the disaster,⁴ infrastructure damage, as well as agricultural and basic food crises.⁵ These conditions show the need to strengthen risk-based spatial planning, environmental conservation, and geospatial modeling as a long-term mitigation strategy.⁶

The phenomenon is grounded in the development paradigm that prioritizes economic growth in environmental policy, where forests are often treated as state assets to be exploited for investment.⁷ An estimated 63% of tenure conflicts in the forestry sector stem from overlapping industrial concessions with customary areas.⁸ This explanation shows that the indigenous community, as conservation partners, is considered an obstacle to development, and ecological environmental governance continues to be ignored. In contrast, the local wisdom of the indigenous community places forests and rivers within a moral and spiritual ethical framework that naturally provides blessings in the form of pure economic space. In Minangkabau and Riau, for example, *ulayat* customary forest management⁹ and the *buka rimbo* ritual¹⁰ emphasize that forest use must not exceed ecological carrying capacity.

The community tradition of protecting nature is based on ethical and spiritual relations.¹¹ For example, in the Toba Batak mythology, *Hariara Sundung* in the sky is known as a sacred tree with deep symbolic meaning,¹² giving rise to the concept of *Na Ture*, namely an invitation to preserve good nature.¹³ Similarly, the local wisdom of Aceh, *kenduri blang*, shows the spiritual relationship between Allah SWT, humans, and nature through traditional processions to maintain the sustainability of rice fields before harvest.¹⁴ In Aceh, the *Panglima Uteun*, village officials (*gampong*), and traditional institutions play a strategic role in forest management and maintaining ecological balance¹⁵ as well as preventing degradation. Local wisdom of the community serves as the answer to natural disasters. When the upstream forest is damaged, the natural hydrological cycle is disturbed, and all forest functions are at risk of being lost. Therefore, deforestation is identified with human actions that violate community traditions in forest management. Deforestation disrupts hydrological cycles, reducing soil absorption capacity due to the

loss of root systems, which increases surface runoff and intensifies flooding. The effect of flood in Aceh Tamiang explains how the modernization of the legal economic systems¹⁶ has contributed to deforestation through the expansion of palm oil plantations, industry, and infrastructure that ignore sustainability.¹⁷

Local wisdom emphasizes the balance of nature¹⁸ and is related to ethics and spirituality. Ecological crisis¹⁹ also reflects the failure of humans as caliphs on earth in upholding the mandate of conservation.²⁰ Since the 1960s, Nasr has initiated the concept of Islamic ecotheology as a theological reconstruction of the relationship between humans, God, and nature.²¹ Within this framework, nature is understood as a sign of divinity based on rationality-laden²² with moral and spiritual values,²³ not an object of exploitation. Therefore, the phenomenon of disasters reflects a problematic anthropocentric relationship and the neglect of nature intrinsic value. Disasters should emphasize the moral dimension,²⁴ ecological justice, and ecosystem sustainability in mitigation. In the context of Islamic teachings, natural disasters caused by human actions and the effects²⁵ are considered normal and unrelated to sin. Ecological studies essentially involve an intersection between faith and ecological awareness.²⁶ Forest exploitation that damages the environment and creates inequality is a form of *fasâd* (destruction) and *khiyânah* (betrayal of the earth mandate).²⁷

This explanation shows that socio-ecological solutions play a role in disaster management. Community-based resilience is embedded in local and customary traditions that have evolved through generations of lived experience and the intergenerational transmission of environmental knowledge.²⁸ The *Pawang Uteun* tradition in Aceh and the *Lubuk Larangan* system in Tapanuli have become customary laws for managing forest ecosystems and watershed dynamics. The 2025 Sumatra flood situation represents a complex interaction between climate and hydrology, triggering unprecedented geomorphology and economic paralysis across Aceh and North Sumatra. A complex empirical understanding of customary institutions is required when facing 21st-century climate anomalies.

Scientific studies following the 2025 Sumatra flood have emphasized a purely geological science approach and environmental law enforcement. Meanwhile, local wisdom focuses more on mitigating tsunamis and coastal floods, showing hydrometeorological analysis and economic losses. However, comparative studies mapping local wisdom in disaster mitigation between the highland community in Aceh (such as Central Aceh and Bener Meriah) and the indigenous community in Tapanuli (such as the conservation of the Batang Toru forest, *Lubuk Larangan*, etc.) have not been widely conducted since the 2025 flood tragedy. This empirical study provides information on the governance of local wisdom through socio-anthropological analysis in response to the chain of disasters.

The phenomenon of flood and landslide contrasts with the traditions of the Acehnese and Tapanuli community regarding the environment. Examples include the *Panglima Uteen* tradition (customary forest leader) or the *Wase Glee* norm (customary rules regarding the

use of forest products) in Aceh and the *Tombak Larangan* tradition (Batak customary protected/prohibited forest) in Tapanuli. An interesting aspect of this study is the comparison between Acehnese traditions and the sharia/village customary approach as well as between Tapanuli traditions and the *Dalihan Na Tolu* kinship approach. To comprehensively examine local wisdom and the environment, four aspects were evaluated, namely (1) the principles of local wisdom, (2) the mechanisms for transmitting local wisdom values, (3) the vitality of local wisdom regarding conservation, and (4) the relevance of local wisdom regarding nature conservation to the 2025 flood disaster in the Gayo and Central Tapanuli community. The results are expected to provide solutions for environmental management based on local wisdom.

Method

Data on local wisdom regarding the environment were collected using a qualitative, phenomenological approach.²⁹ The objective is to describe the socio-cultural and spiritual realities within community traditions in the context of local wisdom regarding the environment. The approach enables this study to interact directly with informants and engage in community social activities. The location was the regencies of Central Aceh and Bener Meriah, which are part of the Gayo community, as well as the Central Tapanuli Regency. The participants selected share a commonality of being affected by the flood of late 2025. Data were obtained through detailed, accurate, and extensive field recording and interviews.³⁰

The emphasis in qualitative analysis with fieldwork is on the accuracy of observations and interview results, as well as documenting the data for processing and reflection.³¹ The samples were selected using a purposive sampling technique to provide direct experience of local environmental wisdom in the Gayo and Tapanuli community. The results are expected to provide a holistic and authentic understanding of local environmental wisdom among the regencies of Central Aceh, Bener Meriah and Central Tapanuli Regency.³² The data were analyzed by organizing and sorting into patterns, from which in-depth themes regarding the problems being analyzed were identified. This analytical process was conducted continuously throughout the study, from the initial stages of data collection

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Results and Discussion

The results support a multi-approach framework that integrates character education, ecoreligious values, social ecology, and community economic development. The philosophy held by the Aceh is expressed in a traditional proverb, *adat ngon hukom lage zat ngon sifeut* (culture with religion is like substance with nature).³⁴ The community believes that when a disaster occurs, humans have committed many sins and Allah SWT is not trustworthy as the caliph on earth. Accordingly, the feast serves as an expression of repentance and a reaffirmation of spiritual and social responsibility.³⁵

Local wisdom in Tapanuli is also inseparable from the community belief that nature is a gift from the Almighty, despite multicultural and multi-religious traditions. From this perspective, the flood in Aceh and North Sumatra towards the end of 2025 is inseparable from the disharmony between humans and nature. The local wisdom of the community, inherited from ancestors, emphasizes a good relationship with nature. This study analyzes how the flood event reflects the local wisdom of the Aceh Gayo and Central Tapanuli community. The figure below shows the conditions in Aceh and Tapanuli during the flood at the end of 2025 that devastated the region.

Principles of Local Wisdom of the Gayo Community and Central Tapanuli Community Related to Nature Conservation

Several key principles underpin environmental stewardship in these community and contribute to the maintenance of harmonious human–nature relations.

Human Ethics Towards the Environment

The local wisdom emphasizes preventive mechanisms to avoid environmental damage by regulating the use of nature. The Gayo and Central Tapanuli community response to the flood at the end of 2025 suggests that human greed has made nature unfriendly. Nature has provided human needs and economic resources from both plantations and forests.³⁶ Aside from coffee, the Gayo community also produces palm sugar, a soft drink made from the fruit of the sugar palm tree. For the Central Aceh community, specifically in the Silih Nara, Linge, Bintang, Ketol, and Celala districts, the sugar palm tree is a primary source of income. The process of cultivating and harvesting palm sap requires considerable effort, often involving early morning forest visits and returning at dusk. Good quality plants can produce 30 liters of palm sap per day. However, the cultivation process is long-term, as palm trees require approximately 15 years from the time the seed is planted. This long growth cycle has fostered a strong tradition of environmental care, particularly in maintaining forest sustainability and ensuring the continuity of palm resources.

The Tapanuli forest is known for the vastness and rich diversity of flora and fauna, such as the Batang Toru area, which maintains a cyclical system for sustainability. It also has a diverse range of beautiful orchids and other distinctive flowers, recognized for the economic value. The wildlife contributes to tree reproduction by distributing seeds from uneaten plants. The Batang Toru ecosystem, for example, serves as a clean water buffer in the districts of Batang Toru, Angkola Sangkunar, Muara Batang Toru, and Mandailing Natal. It also has nine watersheds that supply water for agriculture, plantations, and households across three districts. Therefore, the Batang Toru ecosystem is a source of water and a livelihood for the Tapanuli community, who have been cultivating the forest for generations, including frankincense resin (*hamijon*). As a form of local wisdom, the Tapanuli community believes that when the forest is damaged, life is also threatened. From

an economic perspective, the Simardangiang Indigenous community in Central Tapanuli Regency earns an average of 5 kilograms of frankincense per week, with a selling price of IDR 40,000 to IDR 390,000 per kilogram. Customary norms regulate this activity, including rules that prohibit tapping trees before maturity and restrict excessive incision to prevent damage. These practices reflect a conservation ethic embedded within local economic life.

Forest preservation is widely understood as a source of ecological “blessings,” as healthy natural forests help control erosion. Conversely, deforestation is associated with increased vulnerability to flash flood. In contrast to these traditional conservation practices, modern economic pressures have contributed to the conversion of water catchment areas into plantations and sites of illegal logging. This implies that during the period, the rate of loss is significant, although the forests remain relatively extensive. Similarly, the condition of forests in North Sumatra is more concerning, with forest cover reduced to approximately 29% of the land area ($\pm$ 2.1 million hectares) in 2020. The forest is fragmented across the western Bukit Barisan mountains (including part of the Gunung Leuser National Park) and conservation areas in the Tapanuli region. The Batang Toru forest has even become an area for corporate activities, plantation clearing, and gold mining. Scientifically, the 2025 flash flood in Sumatra was caused by accumulated forest destruction in the upper watersheds and was triggered by extreme weather.³⁷ Ultimately, the regional environmental carrying capacity and resilience to extreme climatic events are determined by the sustainability of the ecosystems.

There are two attitudes toward local environmental wisdom, namely preservation and moral damage. Local wisdom educates the community on how to maintain an ethical relationship with the environment as a return to the forest that has provided blessings to humanity. Recommendations and taboos are the core of local wisdom regarding the environment for the Gayo and Tapanuli community. Forests provide benefits to humans, including beauty, economic value, and the maintenance of the balance of nature. Therefore, community traditions give rise to beliefs and a series of views on magical actions towards forests that provide benefits and balance to human life. These views regulate attitudes towards proper forest management and use. Ethics towards the environment is reflected in the local wisdom of the Central Aceh community, in managing forest areas for farming (*meuglee*), and in performing the *kenduri* tradition as a form of gratitude and respect for nature. The practices are reinforced by customary and taboo times for clearing fields, such as Friday and Wednesday. Furthermore, local wisdom improves the standard of living in managing forests by minimizing damage to the environmental balance. From this perspective, contemporary forest damage is caused by the community violation of the customary provisions of *meuglee*. However, the modern community, driven by market economic interests, has dismissed local wisdom as outdated. This has fueled the indiscriminate and unsustainable rate of forest encroachment in recent years, particularly in Central Aceh and Benar Meriah.

The local wisdom of Central Tapanuli in preserving nature, such as *Aek Sipitu Mata* (Water Resources Management), includes unwritten rules not to pollute or damage the area around the spring, maintaining the spiritual and domestic functions. The *maragat tuak bagot* ritual (extracting palm sap) is not only a process of making palm wine, but also symbolizes respect for nature. This process includes ethical practices in harvesting natural products to ensure the trees remain sustainable, reflecting the community ecological imagination. Furthermore, the *Marari Sabtu* Tradition (Parmalim belief) regulates the relationship between humans and God and the environment, including in daily behavior that maintains the cleanliness of nature. *Tombak Raja* (Frankincense Forest), the custom of managing frankincense forests is considered sacred, and ensures the sustainability of the ecosystem. Basically, the local wisdom of the Tapanuli community in using forest products requires permission from the *Raja Huta* and traditional elders to prevent excessive exploitation. There is a customary prohibition on cutting down certain trees in protected forest areas. The belief that protecting the forest preserves life is often supported by traditional rituals respecting nature. When forest cover is lost, disasters are not only a threat but an inevitability. In this context, local wisdom emphasizes the ethical principles of humankind towards the environment, a crucial element in instilling in the next generation through education.

Local Wisdom-Based Education

The noble values embedded in local wisdom contain strong moral foundations that risk being lost when not transmitted to younger generations. The inheritance of traditional values is inseparable from the educational process. Local wisdom instills values and morals that serve as guidelines for community behavior. This includes respect for ancestors, environmental ethics, and the preservation of values. Education based on local wisdom empowers the community while promoting culture,³⁸ encouraging creativity, and fostering social involvement.³⁹ In general, environmental degradation has become a crucial topic, with the traditions of the Gayo and Central Tapanuli community incorporated into the formal education curriculum. This emphasizes the importance of incorporating moral values regarding the environment into knowledge for future generations. Local wisdom-based education, grounded in culturally relevant pedagogy, develops students cultural competencies within a social context. The primary principles of this education are recognition and appreciation of local culture, ecological awareness, and moral responsibility.

Wisdom-based education aims to build a culture of community character and strengthen identity. This objective is in line with National education, namely building students cultural identity, increasing environmental awareness, as well as developing character and ethics. The environment is part of human life, and humans are guided to appreciate culture and the importance. Therefore, local wisdom is a holistic, integrative approach to education that strengthens students character and identity in the learning process. The phenomenon of flash flood and landslides in the Central Aceh and Central Tapanuli regions at the end of

2025 poses a serious challenge due to damage to ecosystems. There is an element of intentionality in the destruction of forests, whether individual or group, while local wisdom aims to maintain the harmony of forest life and nature. It is important for developing a young generation that is adaptive, wise, and responsible in the face of an era of turmoil.⁴⁰

The disasters that occurred in November 2025 emphasize the two roles of local environmental wisdom in education. The first role is the importance of instilling ethics and gratitude for the environment (*hablum minal alam*). The second role is the tradition of harmonizing nature and humans, which should be continued for future generations. Therefore, formal education should integrate a curriculum that emphasizes understanding local environmental wisdom and ecological awareness. The emphasis is not only on academics but also on developing moral responsibility for the environment. The objective is to reduce the risk of future disasters through a trauma-informed learning approach, as practiced in Central Aceh through the *Didong* tradition. The local environmental wisdom of the Gayo and Central Tapanuli community emphasizes education as a means of ecological education, as well as psychosocial protection for children vulnerable to disasters. It is important to instill the philosophy that forests and humans live harmoniously to avoid disasters.

Local wisdom-based education is also important in teaching forest management, as shown by the Gayo community system of spatial forest governance. This system includes the *Peruweren* (livestock area) and the *Wih Aunen* (water area). The institutional structure for forest management is called *Sarak Opat* (*Tuha Peut*) and *Pawang Uten* (Forest Shaman). The *Pawang Uteun* has the authority to regulate forest use, designate protected areas, and enforce customary rules prohibiting environmental damage. Through this system, forest management is guided by strict customary regulations that clearly define zones where land clearing and logging are prohibited. The tradition of the *kekeberen* forest prohibits the cutting of trees in watersheds, springs, and sacred places to prevent disasters. Incorporating this tradition into the curriculum, specifically in regional educational institutions, is important to preserve the environment.

Within the environmental context, local wisdom-based education instills attitudes and character in ethical principles. Aceh local wisdom is grounded in Islamic values that connect spiritual teachings with local wisdom, supporting the preservation of environmental governance.⁴¹ The values of education based on local wisdom are in line with the goals of National and Islamic education, namely to form attitudes, both towards God, fellow humans, and nature. In responding to the environment, it emphasizes how exploring religious beliefs,⁴² values, and practices⁴³ affects attitudes⁴⁴ and behavior towards the environment.⁴⁵ The emphasis on attitudes and morals in education is the main basis for instilling divine values in the space of human spirituality. The formation of human spirituality, which gives rise to the practice, the abstraction of divine values, and conservation,⁴⁶ has become the main foundation in environmental ethics. This is the basis for a complete human life of building relationships with God, fellow humans, and nature.

Education-based local wisdom is not only the presentation of abstract theories, but also a forum for the formation and inheritance of divine, humanitarian, and moral values integrated into a comprehensive curriculum. The principle emphasizes rationality, ethics, and real-world experiences, enabling individuals to provide solutions. Therefore, local wisdom in the context of education emphasizes how embodied experiences and institutional processes together produce ecological meaning. The religious perspective on ecology identifies the boundary conditions for faith-based educational pathways to support global environmental governance.⁴⁷ The ecological crisis demands a renewed worldview and a new ethical orientation, often drawing on indigenous cosmologies.⁴⁸ and religions⁴⁹ to reframe humanity relationship with the Earth.

Joint Economic Development

The imbalance in nature affected social life, similar to the flood phenomenon in late 2025 across various regions of Aceh, North Sumatra, and West Sumatra. Thousands of hectares of rice fields and gardens were destroyed, paralyzing residents primary sources of income. As of mid-January 2026, agricultural products from central Aceh remained difficult to market due to the complete severance of land access, as shown below:



Image: Residents of Takengon and Bener Meriah selling agricultural produce to Lhokseumawe, North Aceh, Bireuen, and other areas. (sumber: <https://www.bbc.com/indonesia/articles/c4gpjm2z8dzo>)

Disasters caused by uncontrolled exploitation of natural resources, such as flood, landslides, and erosion, often claim lives and affect the economy. Meanwhile, the local wisdom of the Gayo and Central Tapanuli community in forest management remains focused on maintaining harmony with the environment. This concept has traditional customs that regulate human activities in the forest to ensure sustainable use. The objective is for the forest to continuously serve as a regulator of water and oxygen, a carbon store, and a habitat for flora and fauna. The main basic emphasis of the local wisdom is practical rules and a life view of nature. This view emphasizes the tradition of taboos and customary law rules, which have a positive effect on natural resource conservation. The tradition is evident in the Tapanuli community beliefs about “*naborgo-borgo*” places and taboos on cutting certain types of wood.

The local wisdom of the Gayo and Tapanuli community is a form of adaptation to natural and social environmental conditions⁵⁰ as well as resource management systems.⁵¹ Many community members continue to adhere to customary laws that support environmental preservation, while also deriving economic benefits from these systems. The community develops agriculture and plantations across a topography ranging from lowlands to mountains, ideal for various plant types. Fertile forests create a warm tropical climate and sufficient rainfall conditions conducive to the growth of food crops and horticulture. These agricultural and plantation products have become a commodity for the community to market both locally and for export due to the high economic value of horticultural crops.⁵² The empowerment of local wisdom as a source of knowledge and competitive advantage extends beyond agriculture and plantation systems. It also contributes to the development of tourism, which in turn supports regional economic growth.⁵³ This potential positions Central Aceh as the highest source of economic growth in Aceh by 2024, showing optimal use of the region natural resources. The beautiful natural surroundings also attract tourists, contributing to the region economy.⁵⁴ This sector is a potential economic driver, particularly with the emphasis on natural and cultural tourism, as well as the strengthening of the halal concept.⁵⁵ Tourism has a positive effect on economic growth and the development of small and medium enterprises (SMEs).⁵⁶

The “blessings” associated with the forests in Central Aceh and Central Tapanuli are closely related to the community readiness to manage and preserve nature. Long-standing local traditions and wisdom, with socio-cultural characteristics, contribute to maintaining natural harmony.⁵⁷ In this context, local wisdom is a policy that is based on philosophy, values, ethics, and behavior traditionally institutionalized to manage resources sustainably. This worldview fosters traditions that are perceived as bringing prosperity to the community, where healthy forests are believed to directly support human wellbeing. For example, coffee cultivation in the Gayo community starts with clearing land using the *seumegang* or *mumeger* tradition (land clearing) and the *tulak bele* (feast to be kept away from disasters). From the planting period until post-harvest, the community still uses traditions such as the *pemberkah* (feast of gratitude), *bejamu*, *mangan lo*, and *man biayaan*. This ethic towards nature has benefits and should be preserved in the development of the community economy.

Mechanism for Inheriting Local Wisdom Values of Batak and Aceh Across Generations

The transmission of local environmental wisdom values across generations is a continuous process. This process represents a sustainable ecological solution passed down from older to younger generations, through both informal (family/community) and formal (education) approaches. It is the most common and powerful mechanism, occurring through daily interactions and direct experience.

Oral Tradition

Oral tradition is a classic form of learning and the oldest in community education. This includes folktales, legends, proverbs, regional songs, and parental advice, often containing hidden messages about the prohibition of destroying forests or polluting springs. It is directly practiced by traditional leaders and conveyed through local wisdom processions. For example, in the Gayo community, ceremonies such as *kenduri* or *mungerje* are performed before planting to ensure the plant grows well. In this tradition, enquiry is first made to the *tetue* (elders) for the right time to plant. Before determining the time, the traditional elders hold the *mumenge leng Imo* ritual, during which these individuals listen for the sound of orangutans (*imo*) screaming in the forest. Prolonged or intensified vocalizations are interpreted as natural indicators of impending heavy rainfall and potential landslides.

In central Tapanuli, oral traditions also apply, which are strongly affected by the coastal culture of Barus and Batak. Values of environmental stewardship are conveyed through traditions, including *Manyonggot* (traditional lamentations), which serve as a means of communicating messages, feelings, collective memory, and emotional reflections on the human-nature relationship. In addition, *Talibun*, a form of *pantun* or ancient poem typical of the coastal community of Sibolga/Central Tapanuli, is used to emphasize cultural identity and local wisdom values in social gatherings. This oral tradition is primarily applied during traditional activities and is also passed down within families across generations. Another typical local wisdom for the Tapanuli community is *Poda Na Lima*, which provides practical guidance for living in harmony with God, fellow humans, and the natural environment. This guidance has the meaning of *paias rohamu* (cleansing the heart), *paias pamatangmu* (cleansing the body), *paias parabitonmu* (cleaning clothes), *paias bagasmu* (cleaning the dwelling), and *paias pakaranganmu* (protecting and preserving the environment).

Through oral traditions, environmental knowledge is transmitted in a relatively uniform and consistent manner within the community, shaping collective perceptions and behaviours toward nature. For example, in the Gayo community, the context of flood includes the cries of *imo* (gibbons) and *teger* (a thundering sound in the sky), as well as murky river water mixed with oil. As an early warning, the community observes changes in nature, with dark clouds showing heavy rain, while continuous rain will raise the river surface and cause flood. These traditions provide the community with knowledge about working together to protect the surrounding environment. Customary rules and prohibitions strictly regulate forest use, including prohibitions against tree cutting in protected areas. Furthermore, the community is willing to plant trees voluntarily to preserve the forest. These trees are not very tall, but have extensive roots that bind the soil and help control landslides.

Religious Rituals/Traditional Ceremonies, Customary Law, and Arts

Religious rituals, traditional ceremonies, and arts serve as vehicles for conveying local wisdom, values, and messages to maintain harmony in life. These traditions are an expression of gratitude for the abundance of natural blessings in human life, while also serving as a message for future generations to protect and preserve nature and not be greedy for the beauty. In Aceh, the *kenduri blang* tradition is commonly known as an expression of gratitude to Allah SWT for the gifts of nature to humanity. It addresses the relationships with Allah SWT, other humans, and nature. The embodiment of these three relationships is the preservation of nature as a form of worship in general sense.⁵⁸ Specifically, the local wisdom of the Central Aceh community in showing gratitude towards nature is as follows:

- a. *Peusijuek* (Tepung Tawar).
- b. *Munyekot* (Catching fish in the river).
- c. *Kenduri Nangal* (A traditional thanksgiving ceremony performed by the Gayo community).

In the Tapanuli context, similar values are also expressed, as evident in the respect for the sacred tree in Batak Toba mythology, *Hariara Sundung*. The values embedded in this symbol provide a cultural foundation for addressing environmental degradation and promoting conservation ethics. This worldview is further reflected in the concept of *Na Ture*, an invitation to properly preserve nature in the Batak Toba community. Similarly, the *Maragat Tuak Bagot* tradition encourages reflection on the importance of maintaining the balance of nature and respecting creation. Several traditions in ceremonies serve as forms of gratitude and respect for nature. For example, *Kenduri Laut* (sea feast) is an annual tradition for the coastal community of Central Tapanuli (specifically in the Barus region) as a form of gratitude for abundant marine resources and a request for safety at sea. This ritual is usually held with great fanfare, featuring the slaughter of buffalo or goats, communal meals, and prayers on the beach from nightfall to daybreak. Furthermore, the *kenduri bersih desa* is held by the community as a form of gratitude to God and the hope that the village would be spared from disaster.

Cultural heritage and the environment are also preserved through art, such as *didong* in the Gayo community. This art form combines elements of literature (poetry), vocals (singing), and handclaps. It is performed by a group of men (15-25) sitting cross-legged, often in the form of duels or inter-village competitions. *Didong* poetry contains messages, stories, and jokes that reflect the social and religious life of the community. Through this art, messages are conveyed about ethics in life, protecting nature, and the consequences of violating social and religious rules. In general, *didong* art is performed at traditional events, such as weddings (often with the *Didong Jalu* or tanding system), circumcisions, harvest festivals, or official government events. In the Central Tapanuli community, traditions such as *umpasa*, *pantun*, and similar oral narratives are used to

provide advice, offer prayers, and strengthen bonds. These traditions play an important role as collective memory, moral guardians, and a means of transmitting hereditary culture in the region.

Education and tourism

Educational institutions are a systematic vehicle for transmitting and integrating local wisdom values into the curriculum or special programs. The Gayo community has traditions in education, such as the implementation of *sumang percaraken* (maintaining speech/manners) for the younger generation and the traditional *munyerahni murid ku tengku guru* procession to instill traditional values from an early age. Gayo culture, the soul of the Central Aceh community, is manifested not only in customs and art but also in attitudes, speech, and the perspective on life. Noble values such as *mutentu* (solidarity), *semayang* (cooperation), and *arah tuah* (moral responsibility) are part of local wisdom that must be preserved. These values are unwritten rules that have become traditions carried out in community and educational institutions. The main challenge presently is bridging the gap between cultural preservation and the needs of the modern community. The flow of digitalization, the shift toward practical lifestyles, and the younger generation declining interest in traditional values are real challenges to the sustainability of regional culture.

For the Tapanuli community, traditions are instilled in educational institutions. In addition to traditional programs for implementing arts activities, educational institutions still instill sacred values rich in moral meaning, including those of *Poda Na Lima*. Aside from educational institutions, which act as a vehicle for passing on the values of local wisdom to the environment, tourism also plays an important role. As previously explained, Central Aceh and Tapanuli are home to a wealth of forests, flora, and fauna. This natural wealth is the main attraction for tourists, which in turn encourages the community to protect the environment. In this regard, government involvement in designating and managing tourism areas becomes essential,⁵⁹ particularly in addressing broader global environmental challenges such as industrial expansion and large-scale land exploitation.⁶⁰

Local wisdom regarding the environment develops from natural ecological adaptation, giving rise to traditions that regulate the use of nature. In a traditional community, the concept of harmony between humans and nature is a basic principle that guides daily activities. Local wisdom is considered a preventive mechanism to prevent environmental damage and a source of inspiration for modern policies related to nature conservation and sustainable development.⁶¹ These villages not only offer cultural and traditional experiences to tourists but also serve as socio-ecological laboratories, showing how community integrate environmental aspects into daily lives.⁶² Tourism villages are important spaces where this local wisdom can be observed and practiced. Local wisdom

in tourism villages provides warnings and explanations on environmental issues, such as restrictions on tree felling, prohibitions on fishing during certain seasons, and traditional waste management.

The moral message of local wisdom in environmental conservation is that preserving nature does not always need modern technology, rather, it requires cultural values and norms. Ecotourism based on local wisdom is an alternative approach to preserving and protecting the environment. In addition to enjoying the natural beauty, tourists also gain knowledge about local wisdom related to the environment. This indirectly fosters ecological awareness among the community while also promoting environmental and cultural sustainability.⁶³ Furthermore, preserving local wisdom has important implications for policymakers to design programs in harmony with community culture.⁶⁴ The geography of Central Aceh offers enchanting forest and highland tourist destinations, dominated by cool air, views of Laut Tawar lake, and expanses of Gayo coffee. Popular spots include Pantan Terong and Bur Telege, which offer views of the “land above the clouds,” and the adrenaline-pumping Lukup Badak whitewater rafting. Beyond these attractions, visitors can also enjoy Gayo Arabica coffee at various cafes with natural views and learn about local arts and culture, including *didong*. Similarly, the geography and culture of Central Tapanuli, covering approximately 2,194.98 km², comprises beaches, mountains, and pristine forests.

The Vitality of Local Wisdom Regarding Nature Conservation Among the Gayo and Tapanuli Community in Disaster Areas

The flood in Sumatra at the end of 2025 is assumed to violate the local wisdom of the Gayo and Central Tapanuli community regarding environmental management. Community traditions regarding the environment are governed by customary laws,⁶⁵ with forests, rivers, water sources, and seas being managed under rules that must be followed. Therefore, customary regulations are enforced through sanctions, such as fines, goat slaughter, or, under certain conditions, being forced to leave the village. This philosophical foundation, grounded in faith, remains a guiding principle for building harmony between nature and humans. However, local wisdom is eroded in practice by the current tide of modernization, economic pressures, and dissatisfaction with the necessities of life. This is one of the principles of modern humans, with the negative aspects, with forests and the environment being commodified.

Specifically, the philosophy of local wisdom among the Central Aceh (Gayo Tribe) is rooted in customary and Islamic values, which emphasize *mukemel* (self-respect), *tertib* (organized), *setia* (commitment), *sesuir* (appropriate), *serep* (humble), *kire* (thinking), and *lelang* (patient). In practice, these values apply to social activities, nature conservation, and harvest celebrations. Local wisdom regarding the environment emphasizes togetherness and the spirit of cooperation for the common good. With these values, the community built

a tradition rooted in shared interests. In forest management, the Central Aceh community broadly categorizes the forest into *Ulee' tanoh* (in the form of *uten tuha* and *uten muda*), *lampoh* or fields for secondary crops (*palawija*), *peniyuh* (stopping places), *root* (small roads), and *alue* (grooves). In the context of forest management, the community acts for the common good and does not damage the forest. Similarly, the traditions of the Central Tapanuli community toward the environment are as follows:⁶⁶

- 1) *Harangan do mulmulan, saba do panyabian, kobun do paccalongan, aek do parihanan, bagas do parpodoman, pakarangan do parsipurpuran* (Forest as a source of water, rice fields as a place to harvest rice, gardens as a place to pick vegetables, rivers as a place to catch fish, houses as a place to rest, yards as a place to breathe fresh air).
- 2) *Na tola mangarabi bulu di topi ni aek* (It is forbidden to cut bamboo trees that are on the riverbank).
- 3) *A tola manaba hayu giot digadis* (It is forbidden to cut trees for sale).
- 4) *Na tola manaba haruaya parsilaungan* (It is forbidden to cut banyan trees, because they function as shelter)
- 5) *Taba sada, tanom dua* (If one tree is cut down, it is replaced by planting two trees).
- 6) *Dohot tor* (It is forbidden to open new land around mountains and hills).
- 7) *Na tola mangarabi harangan ni saba, kobun dohot huta* (Preserving forests around rice fields, gardens, and villages).
- 8) *Eme na hu pagodang-godang, eme na pagodang-godang au* (rice that I raise, rice that also plays a role in raising me).

Violations of environmental traditions are subject to customary sanctions in *Dalihan na Tolu*. The sanctions given are *dipaingot* (when the public interest is undisturbed), *didondoni* (when the perpetrator has already been sanctioned), *derajat* (lowered social status in the tradition), and *dibondarkon* (not included in all customary activities). These customary rules contribute to maintaining the sustainability of nature⁶⁷ while upholding ethical and moral values in protecting the environment. Furthermore, local wisdom regarding the environment emphasizes the need to anticipate natural disasters. Customary rules on opening fields, prohibitions on destroying forests, prohibitions on harvesting fish before time, and other rules strongly emphasize protecting the forest. The geography of Central Aceh⁶⁸ and Tapanuli Regencies,⁶⁹ which have rich forests with varied flora and fauna, offers ideal conditions for various types of crops⁷⁰ supported by a warm tropical climate and sufficient rainfall.

The existence of customary law in forest management makes local environmental wisdom a crucial legal basis supported by the government. Community traditions in forest management form a complex foundation comprising the division and control of territorial areas and forest utilization, enabling proper anticipation of cross-border exploitation. The ideological foundation of these community has started to erode, shaping social attitudes that affect forest utilization. Therefore, local wisdom is experiencing

weaknesses in developing the wisdom that grew and lived in the past. Cultural creations evolved as a form of adaptation to the natural and social conditions of the time, and this is crucial to revitalization. Consequently, community traditions continue to shape culture. This shows the importance of preserving local environmental wisdom and establishing regulations that collaborate in resolving environmental crises.

Pawang Uteun in Aceh has the authority to determine zoning for timber use and forest management. This phenomenon is also similar in the *Lubuk Larangan* and the *Hatabosi* institution in South Tapanuli, characterized by a philosophy of protecting *Bona ni Aek* (upstream springs).⁷¹ The phenomenon of the 2025 flood in Sumatra is not essentially an internal sociocultural failure of the indigenous community, but rather the result of external intervention that disrupts the feedback system.⁷² Ecological destruction can be attributed to forest use by formal institutions without involving *Pawang Uteun* or the administrators of the prohibited forest, as well as the loss of legal authority to enforce customary law.

The Relevance of Local Wisdom on Nature Conservation to the 2025 Flood Disaster

Local environmental wisdom for the Gayo and Tapanuli community is relevant for nature conservation. It serves as a customary guideline that balances human needs with the preservation of natural ecosystems. Forest damage violates customary law and will lead to disasters, as evident in the flood that occurred in late November 2025. Therefore, the relevance of local environmental wisdom for the Gayo and Central Tapanuli community in nature conservation includes:

Character Education

The study of local wisdom regarding nature emphasizes attitudes and morals. Central Aceh and Tapanuli Regencies possess abundant natural resources, particularly agricultural and plantation products, which can be developed into various industrial activities. The proper use of nature bounty can improve the community economic well-being when managed properly. The flash flood and landslides that occurred at the end of November 2025 left a trail of extraordinary destruction. Hundreds of villages were inundated, infrastructure was severely damaged, 1,200 residents were reported dead, 143 people were missing, and 113,903 people were displaced. These events show that a group of people only cares about selfish interests at the expense of nature, underscoring the importance of character education rooted in local wisdom about the environment. Character education is crucial for strengthening generations with a strong cultural identity while also encouraging sustainable, environmentally conscious behavior.

The value of character education is evident in the *Poda Na Lima* philosophy, which emphasizes maintaining a clean body, a pure soul, and a clean environment as an expression of social responsibility. Local wisdom on nature conservation reinforces this tradition,

teaching the community to live in harmony with nature and to prevent environmental damage. The role of the local community is crucial because these individuals are closest to the natural resources and ecosystems around. The long-standing traditions reflect generations of experience in managing and preserving the environment through inherited practices.

The chain of knowledge, values, norms, and practices shapes attitudes and character, which gradually become traditions. Environmental damage shows a problem with an individual character, as community traditions strictly protect conservation. Local wisdom embodies moral and ethical values, showing a responsibility to maintain environmental balance. The awareness motivates efforts to minimize environmental damage. In this context, traditions serve as a social control mechanism for the use of forests and other natural resources. This is in line with Islamic teachings, which define environmental damage as a form of moral degradation caused by greed. Practical confirmation is reflected in Islamic jurisprudence (*fiqh*), which prohibits urinating in holes or fruit-bearing trees, and this prohibition also applies to deforestation, causing environmental damage.

Sustainable Natural Resource Management

Forest use is not prohibited in a traditional community, provided the principle of harvesting natural resources does not damage the ecosystem. This principle is the foundation of local wisdom regarding the environment, reflecting the long-standing efforts of the ancestors to maintain ecological sustainability. Conversely, in the modern era, environmental damage is commonplace without any sense of guilt. Damage to nature and forests not only affects the present but also affects future generations. Formally, the Central Aceh community, in particular, has a tradition of managing customary forests led by traditional institutions, namely:

- a. *Mukim*, holds sovereignty over customary territories, including customary forests.
- b. *Pawang Uteun* or *Pawang Glee* (forest commander). This is a customary institution specifically tasked with “managing” and “enforcing” forests and leading customary practices.

The local wisdom of the Aceh community generally divides forest areas into several zones with different use rules. Although the names are different in each region, the functions are similar, such as:

- a. Forbidden Forest (sacred area): A core forest area that is prohibited from being entered or disturbed because it is considered sacred, serves as a water source, or is vital to the ecosystem (wildlife habitat).
- b. Limited Use Forest (fruit zone): An area permitted for limited management or use, for example, for the collection of non-timber forest products (NTFP).
- c. Cultivated Land (*meuladang* or *meulampoeh*): An area allocated for farming or gardening activities by the indigenous community.

Based on the explanation above, the local wisdom of the Central Aceh and Tapanuli community regarding the environment is important to incorporate into formal policy. Community traditions consider nature as part of themselves, not a commodity. Therefore, this view should not only be in legal policies but also be preserved by integrating it into educational institutions. The contextuality of local wisdom sustains the preservation of nature and moral values in the community social life. The role of all social parties in the community is to maintain traditional heritage, ensuring that social practices supporting a sustainable environment are maintained. Nature is a resource that takes a long time to return to a perfect state, hence, environmental issues in the modern era require serious attention. The phenomenon of forestry is currently experiencing a decline due to conservation being converted to economic interests. Moreover, conflicts between the indigenous and modern community are a frequent phenomenon due to environmental damage. This problem involves not only the physical environment but also moral issues.⁷³

The environmental conservation traditions of the Gayo and Central Tapanuli community guide the younger generation through local environmental wisdom. These traditions emphasize a harmonious relationship with nature and provide knowledge about protected, production, and customary forests, as well as resource management. Aceh even pays special attention to local environmental wisdom by establishing customary institutions for forest management. This is evident in the formation of the Central Aceh Regency Qanun Number 10 of 2002 concerning Gayo Customary Law, which includes the function of the *pengulu uten*. However, forest problems arise, sometimes causing imbalances in management⁷⁴ due to selfish parties, showing the need for greater seriousness in maintaining the balance of the ecosystem. Forest preservation is an obligation from various perspectives. In Islamic teachings, this falls under the category of worship, and human spirituality is shaped through the use, abstraction of divine values, and conservation.⁷⁵ For the Tapanuli community, forest management is similarly guided by practical norms and a worldview that positions nature as inseparable from human life.

The local wisdom of the Gayo and Tapanuli community has achieved modern standards, as evidenced by the tradition of structured, systematic forest management. The inherent values emphasize the principle of togetherness in forest utilization.⁷⁶ Harmonizing humans with nature is a tradition and local wisdom, emphasizing ethical values, attitudes, and morals. These values are instilled across generations to become a form of education within the scope of local wisdom. Education grounded in local wisdom shapes a generation with contextual, adaptive, and transgenerational attitudes to maintain harmonious relationships with God, each other, nature, and ancestors. Consequently, the Sumatran flood disaster at the end of 2025 may be interpreted as a manifestation of environmental imbalance associated with forest and the environment degradation, resulting in numerous human casualties.

This situation shows the urgency of re-emphasizing local environmental wisdom within both community practices and formal policy and educational institutions. At present, community seriousness about preserving the environment is starting to erode. The commitment of the indigenous community towards maximizing the function of customary forests, implementing the values of *dalihan natolu* and *poda na lima* in maintaining environmental areas, as well as upholding highly valued traditions, must be respected and appreciated. Management of forest areas with local wisdom is a community-based system that adheres firmly to customary laws and norms passed down across generations as the main guide, rather than state regulations. The objective is to ensure the sustainability of forests, not only as an economic source, but also a living, spiritual, and cultural space.

Empirically, the *Pawang Uteun* tradition, the *kenduri blang (mengereja)* in Aceh, and the management of the *Batang Toru* and *Lubuk Larangan* in Tapanuli have ecological relevance and critical vitality as community-based disaster mitigation instruments. Failure to maintain these traditional instruments is directly correlated with the damage caused by the 2025 Sumatran flash flood. Forest clearing should be authorized by the customary leader. *Lubuk Larangan* plays a role in controlling river sedimentation and maintaining river morphology, reducing the effects of hydraulic blockages during flood. Local wisdom, such as the *Didong* and *Kekeberen* traditions, plays a role in social development during disasters, contributing to community strengthening and post-disaster recovery when formal logistics are hampered.

Conclusion

In conclusion, based on the results, several conclusions can be drawn. First, the principles of local wisdom in the Gayo and Central Tapanuli community related to nature conservation involve customary norms and spiritual values that foster conservation and ecological balance. The development of a shared economy and education-based local wisdom makes the cultural aspect an important variable in restructuring the natural resource management system. Second, the mechanism of inheriting local wisdom values across generations is through a continuous process that instills traditional knowledge, attitudes, and practices to maintain harmony between humans and nature. It is passed down through oral tradition, religious rituals/traditional ceremonies, customary law, arts, education, and tourism. Third, local wisdom not only serves as practical knowledge but also provides a basis for sustainable natural resource management. Traditional values remain highly effective in maintaining the ecosystem, despite significant challenges posed by modernization. Fourth, the relevance of local wisdom about nature conservation to the 2025 flood disaster is evident in the role as a customary guideline that balances human needs with the preservation of natural ecosystems. This tradition fosters a belief in values passed down across generations. Customary rules limit excessive exploitation to maintain the sustainability of the forest in providing benefits to humanity. Therefore,

the relevance of local wisdom in nature conservation includes character education regarding sustainable resource management. Overall, it is essential to re-emphasize the importance of local environmental wisdom at multiple levels, including within community, formal policy frameworks, and particularly within educational institutions, as a key strategy for environmental sustainability and disaster risk reduction. The implications of this study are categorized into four main aspects including environmental policy reform, culturally based environmental education, sustainable resource management and ecotheological approach.

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