

Sustainable forest utilization based on indigenous knowledge of Mappurondo community in Mamasa District, West Sulawesi, Indonesia

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Manuscript received: 7 July 2025. Revision accepted: 20 October 2025.

Abstract. *Irwansyah, Yusran, Millang S. 2025. Sustainable forest utilization based on indigenous knowledge of Mappurondo community in Mamasa District, West Sulawesi, Indonesia. Asian J For 9: 273-283.* Indigenous forest management systems offer vital insights for sustainable natural resource governance. This study examines forest utilization practices based on the indigenous knowledge of the Mappurondo community in Malatiro Village, West Sulawesi, Indonesia, to understand how indigenous knowledge contributes to sustainable forest use. A qualitative descriptive approach was applied through field observations, in-depth interviews, Focus Group Discussions (FGDs), and questionnaires. Data were analyzed using the Miles and Huberman interactive model through processes of reduction, presentation, and conclusion drawing. The results identified that Mappurondo forest use is divided into two main categories. The first consists of *Kamalangngikam* and *Pasaram* customary forests, which are sacred and governed by strict customary rules. *Kamalangngikam* is designated for women's purification rituals, while *Pasaram* functions as a burial ground and source of ritual wood. The second category is forests outside customary boundaries, where limited extraction of firewood, food plants, and Non-Timber Forest Products (NTFPs) occurs under customary restrictions. Customary taboos, sanctions, and ritual obligations function as effective ecological safeguards, ensuring regeneration and maintaining biodiversity. The study demonstrates that Mappurondo indigenous knowledge aligns with the principles of sustainable forest management by combining cultural identity, ecological protection, and resource regulation. Its integration into social forestry and REDD+ programs offers significant opportunities for strengthening participatory conservation while enriching the cultural basis of forest policy. Policy implications include promoting collaboration between state institutions and indigenous communities, incorporating cultural values into forest governance, and enhancing local ecological education to secure long-term sustainability.

Keywords: Forest sustainability, indigenous forestry, Mappurondo, traditional knowledge, West Sulawesi

INTRODUCTION

Indonesia is experiencing very complex environmental problems (Muthmainnah et al. 2020). One of the most crucial issues is forest degradation, which not only threatens the preservation of biodiversity but also disrupts the social and economic order of communities at both local and global levels (Maes et al. 2024). To overcome this, sustainable forest management is needed by balancing ecology, social, and economy aspects (Nugroho 2021). However, the approach that has been applied so far tends to be technocratic and top-down, with limited involvement (Wheeler and Root-Bernstein 2020).

Traditional Ecological Knowledge (TEK) is an indigenous knowledge system that has developed through adaptive processes and has been passed down from generation to generation. TEK encompasses the understanding, practices, and beliefs of communities in managing natural resources based on collective experience and direct interaction with the environment (Robinson et al. 2021). In the context of conservation, TEK has been proven to contribute to socio-ecological resilience and biodiversity conservation (Souther et al. 2025). Akalibey et al. (2024) emphasize that recognizing the rights of

indigenous knowledge and integrating their knowledge into conservation policies is essential to achieving global sustainability targets.

Indigenous knowledge reflects values have been tested in managing natural resources sustainably. This knowledge is not only a cultural identity but also has great potential in supporting conservation and sustainable management of forest ecosystems (Saputra 2022). One form of indigenous knowledge is forest utilization by the community. Various regions in Indonesia have practiced forest utilization systems that are in line with sustainability principles long before the concept was introduced academically. Thus, indigenous practices can serve as living laboratories that enrich contemporary debates on sustainability and complement scientific approaches to forest governance.

Various studies have proven the contribution of indigenous knowledge in forest conservation. For example, the people of South Buton utilize the *Kaombo* customary forest for conservation purposes (Mardan and Ramadhan 2022). In South Sulawesi, the *Borong Karama* sacred forest is managed as a sacred area by the Ammatoa Kajang community, serving as a spiritual and ecological space (Samad et al. 2024). At the regional level, a similar approach is found in community-based forest management

in Nakhon Ratchasima, Thailand, which emphasizes the importance of local values in maintaining the ecological functions of the forest (Saengsanga et al. 2024). However, despite these valuable examples, many indigenous communities remain underrepresented in the academic discourse, which limits our understanding of the diverse pathways through which traditional practices contribute to sustainable forestry.

One of the indigenous communities that remains understudied is the Mappurondo community in Mamasa District, West Sulawesi, Indonesia, a group that speaks Toraja and adheres to an ancestral belief system that includes annual ceremonies, customary norms, and sacred management of strictly protected forest areas. From the Mappurondo perspective, forests have not only economic value but also a spiritual dimension that determines the social and ecological structure of the community. Another research by Nurkidam and Mahyudin (2023) shows the role of customary and religious institutions of the Mappurondo community in Mamasa District, in maintaining ecological balance. However, this study is still general in nature and does not specifically highlight the practice of forest utilization based on customary knowledge. Therefore, more in-depth research is needed to understand the forms of forest management by the Mappurondo community in order to support the integration of traditional knowledge into conservation policies. Given that Sulawesi has high biodiversity and cultural diversity, this study is expected to enrich ethnoforestry studies and challenge the technical and economically oriented forest management paradigm by emphasizing the importance of cultural and spiritual values.

This research aims to examine the forms of traditional knowledge practiced by the Mappurondo community in forest utilization in Malatiro Village, Tabulahan District, Mamasa District, West Sulawesi, Indonesia. This study identifies

rituals, norms, and customary rules that define human relations with forests, and analyzes their contribution to forest ecosystem conservation. This study also aims to demonstrate that traditional knowledge-based management can be an alternative model for sustainable forestry. These findings are expected to provide a scientific basis for integrating traditional approaches into forestry policy and highlight that effective forest conservation depends on recognizing the spiritual and cultural values embedded in local communities.

MATERIALS AND METHODS

Study area

The research was conducted for three months from September to November 2024 in Malatiro Village, Tabulahan Sub-district, Mamasa District, West Sulawesi, Indonesia (Figure 1). Malatiro Village consists of 17 hamlets, which are divided into four major areas, namely Palliabu, Salubulung, Salutimpanan, and Saludadeko. It is inhabited by 1,598 people, consisting of 414 households (857 men, 739 women). The indigenous population is referred to as the Bambam ethnicity, with strong customary characteristics, particularly in maintaining ritual cultural values. The community uses the Bambam language in daily life, but uses Indonesian outside the community. The main livelihood of the community is working as farmers or planters. The research location focuses on the Saludadeko area, which consists of the Saludadeko, Kampung Tua, Punt Kaju, Dadeko Lajuk, Peleboan, and Rante hamlets, which are inhabited exclusively by the Mappurondo community.

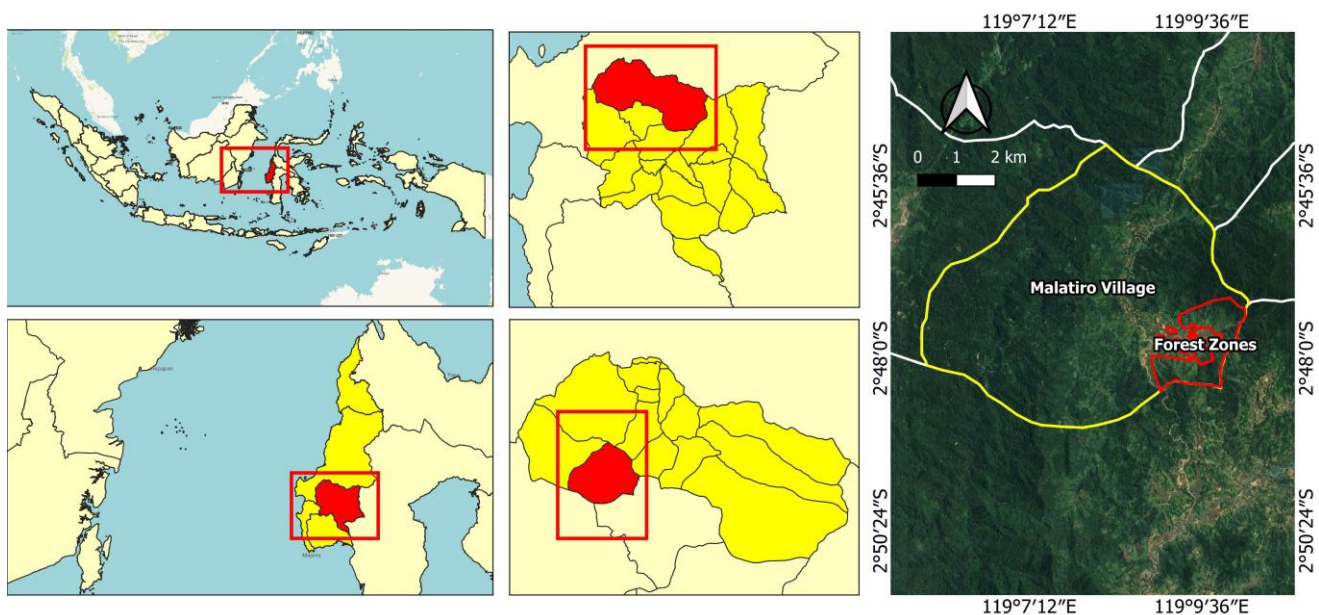


Figure 1. Map of the research location in the Mappurondo community customary forest in Malatiro Village, Mamasa District, West Sulawesi, Indonesia

According to data from the Mamasa District Indigenous Trust Organization in 2024, the total number of Mappurondo in Malatiro Village is 714 people. The Mappurondo community in the area has indigenous knowledge in forest utilization, both within the customary forest and outside the customary forest, which is closely related to forms of worship of God Almighty. This research location was chosen because initial observations had been made. The results of these activities show the access and permission given by the Mappurondo community to conduct research. They have been willing to provide data and information, with the limitation of not violating applicable customary rules and prohibitions. In addition, permission was formally obtained from the village government and customary leaders through a deliberation process, and verbal informed consent was requested from each participant before data collection to ensure compliance with ethical standards in research with Indigenous peoples.

Data collection

Respondents were determined by the purposive sampling method, with many of 36 people. The criteria for respondents are the Mappurondo indigenous people who live in Malatiro Village and are 17 years old and above. The selection of respondents includes all groups in the community. Consisting of 6 free youth, 12 general public who are married, 6 community leaders, and 6 village government (hamlet heads) who understand forest utilization based on the indigenous knowledge of the Mappurondo community. To strengthen the data, there are 4 traditional leaders, namely the Customary chief (*tomatua tondak*), General public healer (*sando*), *Kamalangngikam* officer (*tomalale*), Coffin maker (*tomantara*), as key informants regarding how the Mappurondo indigenous people utilize the forest. In addition, one representative

from the Forestry Service acted as an informant on regulations relating to forestry and indigenous peoples. The rationale for this purposive sampling was to ensure that diverse social categories were represented, while also prioritizing individuals with deep knowledge of ritual, customary law, and forest use practices, thereby capturing both everyday users and key custodians of Indigenous knowledge. Data was collected using interviews, Focus Group Discussions (FGDs), field notes and observations, and literature study. Interviews were conducted based on a questionnaire to obtain information from respondents and followed by discussion activities to equalize perceptions. Observations and field notes were conducted to complement and confirm the interview results.

A literature study was conducted to strengthen the observation data. The main tools used in data collection included semi-structured interview guides, audio recordings (with permission), field notebooks, and photographic documentation of rituals and forest sites, ensuring that both verbal narratives and non-verbal practices were captured systematically.

Data analysis

Data analysis in this study used an interactive model developed by Miles and Huberman (Abdussamad 2021; Sari et al. 2022). This model is widely used in qualitative research because it is able to capture data dynamics systematically and in depth. The analysis process takes place simultaneously and continuously during the data collection process, not waiting until all the data are collected. The Miles and Huberman analysis model consists of three main components, namely: data reduction, data display, and conclusion drawing/verification (Figure 2). These three stages are carried out circularly and interrelated as part of the process of interpreting qualitative data.

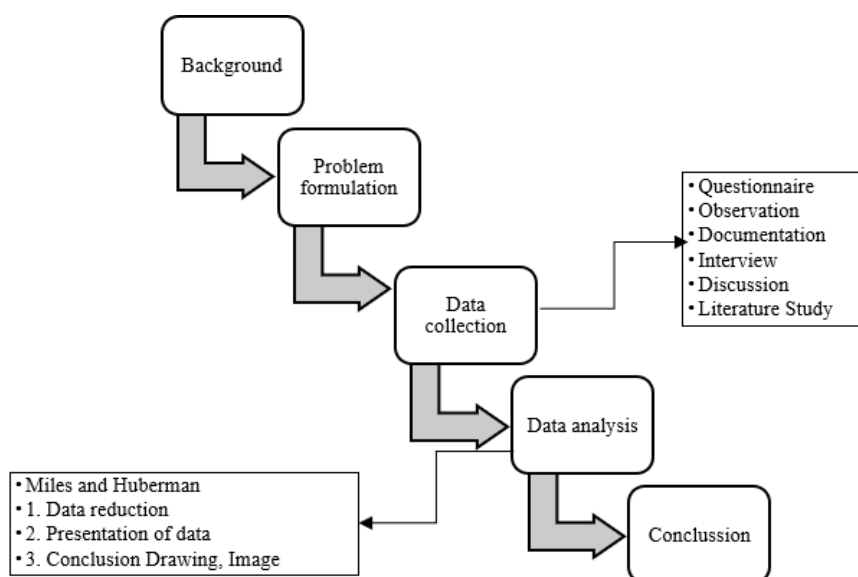


Figure 2. Hierarchy of data analysis techniques

Data reduction

Data reduction is an initial process in analysis that aims to simplify, sort, and focus the raw data that has been obtained from the field. At this stage, the researcher selects data that is relevant to the research focus, categorizes important information, and discards data that is not directly related to the research objectives. Reduction was carried out gradually through a process of thematic coding, namely, labeling or coding data units based on categories that emerged from the results of interviews, observations, and documentation. This activity helps researchers organize data into main themes related to the form, value, and function of indigenous knowledge of the Mappurondo community in forest utilization.

Data presentation (data display)

After the data has been reduced, the next step is to present the data in a systematic form to facilitate further interpretation and analysis. Data presentation can take the form of descriptive narratives, matrices, tables, flowcharts, or direct quotes from informants that have been arranged thematically. Data presentation in this research aims to show the relationship between data categories that have been coded, such as the relationship between traditional rituals and forest utilization rules, as well as how the Mappurondo belief system affects local conservation practices. At this stage, the researcher also begins to organize patterns of meaning that reflect the community's traditional ecological knowledge system.

Conclusion drawing/verification

The final stage in the Miles and Huberman model is the drawing of conclusions based on the findings that have

been arranged in the data presentation. The conclusion not only contains answers to the problem formulation, but also reflects a temporary generalization of the meaning or values contained in the practice of forest utilization by the Mappurondo community.

These conclusions are then verified through an internal validation process, such as triangulation of techniques, confirmation with informants, and reflection on field data. Verification is carried out continuously throughout the analysis process to ensure that the researcher's interpretation is unbiased, remains consistent, and is in accordance with the social reality under study. Thus, the Miles and Huberman analysis model allows researchers to deeply and systematically understand how the indigenous knowledge of the Mappurondo community not only plays a role in forest utilization, but also contributes to the principles of culture-based sustainable. The hierarchy of data analysis techniques is shown in Figure 2.

RESULTS AND DISCUSSION

Forest types and use systems

The results showed that the Mappurondo community in Malatiro Village has a forest area claimed as a customary forest that is not in the state forest. All forms of customary forest utilization are regulated by applicable customary rules and laws and controlled by authorized customary institutions, and implemented by the entire Mappurondo community. The forms of customary forest in question are the *Kamalangngikam* customary forest and the *Pasaram* customary forest, which can be seen in Figure 3.

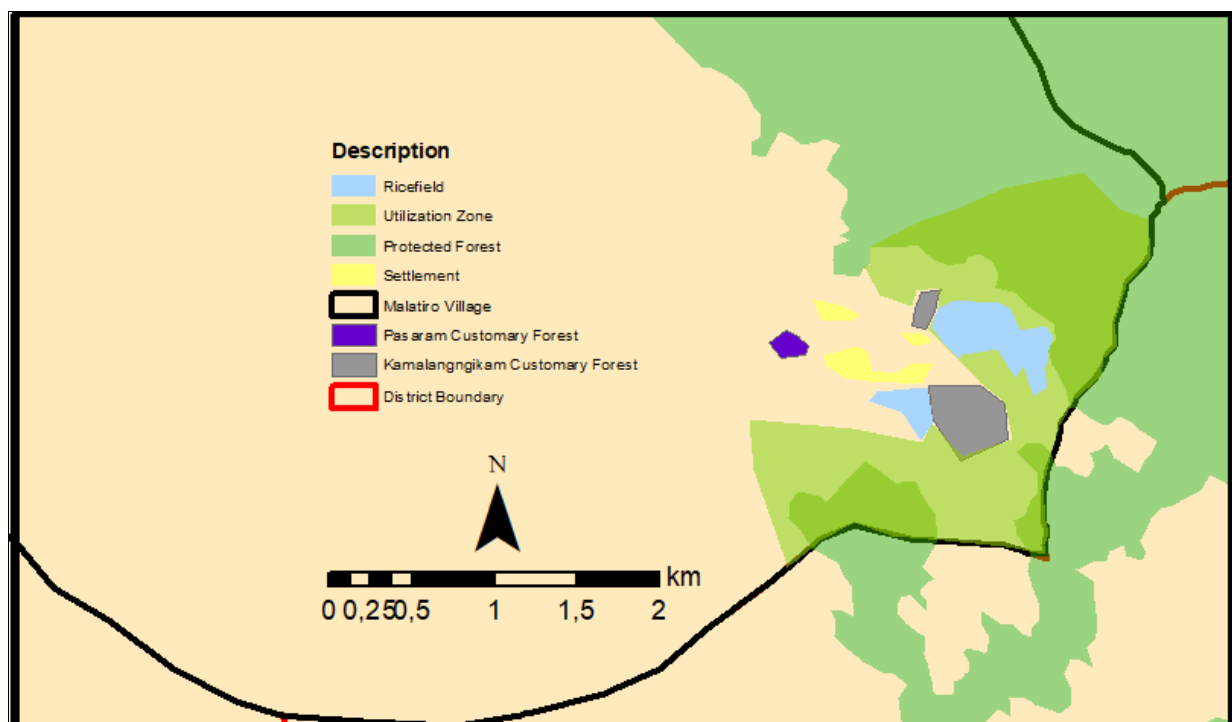


Figure 3. Map of the forest zones by the Mappurondo community in Malatiro Village, Mamasa District, West Sulawesi, Indonesia

Figure 3 shows the land use map of Malatiro Village shows the integration between customary forest areas and non-customary forest areas managed by the Mappurondo community. The customary forest is divided into two main zones: the *Kamalangngikam* Forest, a sacred area for women's purification rituals, and the *Pasaram* Forest, a special location for traditional funeral processions. Each zone has strict prohibitions against logging or exploitation outside of customary regulations. Outside the customary forest area, the community also accesses protected forests and limited utilization zones while still adhering to customary values, such as performing rituals before harvesting forest products and maintaining ecological balance. This separation of functions between customary and non-customary forests reflects an indigenous knowledge-based management system that not only preserves nature but also maintains cultural identity. This pattern is similar to the Kajang customary community in South Sulawesi, which also establishes sacred prohibition zones, but differs from the free rotation system in the customary communities in Papua, which do not establish fixed area boundaries. This division of space is in line with the principles in Government Regulation of the Republic of Indonesia No. 8 of 2021, which recognizes the rights of indigenous knowledge to manage forests based on their values and social structures.

The classification of forests in Mappurondo shown in Table 1 indicates that there is a regulatory system that integrates spatial functions with cultural values and customary norms in the specific functions of customary forests. *Kamalangngikam* forest, *Pasaram* forest, and forests outside customary areas have clear utilization restrictions and different sanction mechanisms. The *Kamalangngikam* and *Pasaram* forests emphasize the role of sacred values in conservation, where access is restricted to ritual purposes and violations are subject to graduated sanctions ranging from verbal warnings to expulsion. Meanwhile, forests outside the customary area are still used for subsistence needs such as firewood and non-timber forest products, but the principle of moderation limits their use, prohibits damaging the ecosystem, and certain ritual obligations. Sanctions in this category are more social in nature, in the form of community reprimands or informal exclusion, which emphasize collective correction rather than harsh punishment. This pattern shows that the Mappurondo community's forest management is not solely based on prohibitions, but rather on the application of graduated sanctions, ritual obligations, and ecological ethics that function both as a conservation mechanism and a means of strengthening the social order. Thus, this system reflects a community-based regulatory model that balances ecological protection and the sustainability of cultural identity.

Ritual and spiritual values

Wood is a major necessity for the Mappurondo community, both in daily life and in traditional activities. For household purposes, wood is used as a source of cooking energy, although gas stoves are readily available. In addition, wood is also used to make mortar and rice pounding tools. In the context of adat, wood is very

important for the construction of traditional houses and the making of coffins in accordance with local beliefs.

One tree that has historical and spiritual value is *Magnolia vrieseana*, which is believed to be the material for the creation of the first human being. Therefore, the bodies of indigenous people are buried using this wood to return to their origin, which is wood and soil. This wood is also recommended as a building material for traditional houses. However, the selection of wood species for traditional houses should not be arbitrary. There are certain rules and criteria as listed in Table 2.

Table 2 shows that the selection of wood for the construction of traditional houses by the Mappurondo community is regulated by customary rules that reflect spiritual and ecological values (Najib et al. 2024). Some types of wood, such as *Quercus argentata (palli)* and *Rhus taitensis (siretom)*, are prohibited from use because they are believed to bring sadness and health problems, while wood covered with epiphytes (*Drynaria sparsisora* and *Asplenium nidus*) or entwined with lianas is considered a bad omen that could potentially bring disaster. Conversely, clean wood or wood with vines parallel to the branches is seen as a symbol of good luck and abundance, in line with the symbol of buffalo bonds in Mappurondo culture. This rule represents Traditional Ecological Knowledge (TEK) that has developed through long-term interaction with the environment (Casi et al. 2021; Bojórquez-Tapia et al. 2025), and serves as a conservation mechanism by limiting the exploitation of certain species (Osebor 2024). Normatively, this practice is also in line with national forestry policies that recognize the rights of indigenous peoples to manage forest resources based on indigenous knowledge (Ministry of Environment and Forestry Regulation No. 8 of 2021). Thus, the selection of traditional Mappurondo wood demonstrates the integration of indigenous value systems, ecological conservation, and state policy legitimacy.

Ecological practices and taboo zones

Non-Timber Forest Products (NTFPs) include plants and processed products other than wood originating from forest areas. Based on the results of interviews, the Mappurondo indigenous people utilize various types of NTFPs for customary needs, consumption, medicines, and household handicraft materials. The following is a summary of the types of NTFPs and their utilization presented in Table 3.

The Mappurondo community in Malatiro Village has strong indigenous knowledge in the use of NTFPs for subsistence and ritual purposes. Field observations and interviews (September–November 2024) show that utilization is selective, covering religious rituals, traditional medicine, food, building materials, crafts, and fuel. Species such as *Areca catechu (kalosi)* and *Piper betle (baulu)* are used in the context of prayer, in contrast to practices in Kao, North Halmahera, where they serve as symbols of hospitality (Rahman and Umar 2024). *Ficus septica (lebannu)* plays a role in purification ceremonies, while *Bambusa multiplex (balo)* and *Metroxylon sagu (rombia)* provide dual benefits, both ritual and subsistence

(Bredenoord 2024). Some plants have spiritual value, such as *Saurauia elegans (najak)*, which is considered magical, and *Equisetum ramosissimum (pune)*, which is used in rituals because of its protective aroma, in line with the findings of Saefullah et al. (2024) regarding unwritten customary rules as a conservation mechanism.

The use of NTFPS is also regulated through a taboo system that establishes forest zoning. The *Kamalangngikam* forest is reserved for female purification rituals, the *Pasaram* forest for traditional burials and coffin wood, while forests outside the customary area are permitted for limited needs such as firewood, NTFPS, and building materials, with a ban on excessive exploitation. Customary sanctions are imposed in stages, ranging from verbal warnings, fines in the form of livestock or crops, to social exclusion. This regulation is in line with Regulation of the Minister of Environment and Forestry No. 8 of 2021, which recognizes the rights of indigenous peoples to access non-timber forest products based on the principle of sustainability, while emphasizing that successful management depends heavily on collective norms (Mardiyanto et al. 2024; Wong et al. 2024). Thus, the Mappurondo case demonstrates the close relationship between local knowledge, customary rules, and formal policies in maintaining ecological sustainability and socio-cultural resilience.

Structure of Mappurondo customary institution

The Mappurondo customary institution is a traditional leadership structure that regulates social life and environmental management, including customary forests and forest products. Each position in this structure has

specific duties and responsibilities, especially with regard to customary forest management. Such management includes the utilization of forest products, forest protection, as well as maintaining the sustainability of forest functions for customary ritual purposes. The complete structure of the Mappurondo customary institution in Malatiro Village is presented in Figure 4.

The traditional institutional structure of Mappurondo in Malatiro Village is a social system that regulates community life, including the management of customary forests. The composition and roles of traditional figures are presented in Table 4. this Customary chief (*Tomatua tondak*), Assistant to the customary chief (*Tomalanto*), General public healer (*Sando*), and General public (*Randangan puduk*). Each has specific roles and functions that are deeply rooted in traditional and spiritual values. The traditional leader (*Tomatua tondak*) serves as the central figure with the highest authority in decision-making, ritual implementation, and enforcement of customary sanctions. In practice, the traditional leader is assisted by *Tomalanto* as the technical implementer, who oversees figures such as *Tomalale* (leader of the *Kamalangngikam* forest ritual), *Tomantara* (manager and collector of funeral wood from the *Pasaram* forest), and *Tomakbalomba* (accompanist for death ceremonies). The *Sando* figure has a dual role as a traditional and spiritual healer, while *Kuntutuk dapok* is responsible for providing food during traditional ceremonies. Meanwhile, *Randangan puduk* or the general public are not merely passive participants but also have the right to participate in traditional consultations.

Table 1. Customary forest categories, ritual functions, utilization rules, and sanctions in the Mappurondo community in Malatiro Village, Mamasa District, West Sulawesi, Indonesia

Types of forests	Primary function	Types of utilization	Main restrictions	Customary/social sanctions
<i>Kamalangngikam</i> forest	Sacred area for women's purification rituals	No direct use, only for ritual activities	No cutting, burning, or clearing of land	Verbal warning → Fine (betel nut/chicken/pork) → Expulsion
<i>Pasaram</i> forest	Traditional burial grounds and sources of wood for coffins	Wood is only for making coffins	It is prohibited to take wood for purposes other than rituals.	Verbal warning → Fine (betel nut/chicken/pork) → Expulsion
Forests outside customary areas	Protected/production forests (state-owned) for household needs	Firewood, non-timber forest products (NTFPs), limited building materials, and ritual items	It is prohibited to take excessive amounts, damage the ecosystem, or violate customary norms/laws.	Community reprimands, healing rituals, and informal social exclusion

Table 2. Rules and criteria for wood selection for the construction of Mappurondo traditional houses in Malatiro Village, Mamasa District, West Sulawesi, Indonesia

Wood selection rules	Reason/explanation
Use of <i>Quercus argentata (palli)</i> and <i>Rhus taitensis (siretom)</i> wood is prohibited.	This wood is believed to bring sadness to the homeowner, affecting health and comfort.
Do not use wood with epiphytes such as <i>Drynaria sparsisora (loak)</i> and <i>Asplenium nidus (karrak)</i> .	It is believed that the house will often be hit by calamities, and the occupants will be sickly.
Do not use wood with lianas wrapped around the trunk	It is considered bad because it is believed to invite snakes into the house.
Can use clean wood, some lianas creep parallel to the branches	Symbolizes blessings and sustenance (likened to the rope binding the buffalo, a symbol of sustenance from God).

Source: Results of interviews and FGDs with respondents, 01 September to 30 November 2024

Table 3. Types and utilization of NTFPs by the Mappurondo community in Malatiro Village, Mamasa District, West Sulawesi, Indonesia

Scientific name	Local name	RR	TM	Food	BM	HA	Fuel
<i>Areca catechu</i> L.	<i>Kalosi</i>	✓					
<i>Piper betle</i> L.	<i>Baulu</i>	✓					
<i>Bambusa multiplex</i> (Lour.) Raeusch. ex Schult.f.	<i>Balo</i>	✓		✓	✓	✓	
<i>Saurauia elegans</i> (Choisy) Fern.-Vill.	<i>Najak</i>	✓					✓
<i>Ficus septica</i> Burm.f.	<i>Lebannu</i>	✓					
<i>Calathea</i> sp.	<i>Daum lappak</i>	✓					
<i>Pandanus tectorius</i> Parkinson ex Du Roi	<i>Nase</i>	✓				✓	
<i>Calamus</i> sp.	<i>Ube</i>			✓	✓	✓	
<i>Metroxylon sagu</i> Rottb.	<i>Rombia</i>		✓	✓	✓	✓	
<i>Equisetum ramosissimum</i> Desf.	<i>Pune</i>	✓					✓

Note: RR: Ritual/Religious, TM: Traditional Medicine, BM: Building Materials, HA: Home Appliances/Crafts. Source: Results of interviews and FGDs with respondents, 01 September to 30 November 2024

Table 4. The institutional structure of Mappurondo community in Malatiro Village, Mamasa District, West Sulawesi, Indonesia

Position	Main roles and responsibilities
<i>Tomatua tondak</i>	The highest traditional leader leads rituals, maintains social order, and provides guidance on forest use.
<i>Tomalanto</i>	Deputy traditional leader; assists with technical implementation in the field.
<i>Tomalale</i>	Leading a Thanksgiving ritual in the <i>Kamalangngikam</i> forest.
<i>Tomantara</i>	Making coffins and being the only one allowed to take wood from the <i>Pasaram</i> forest.
<i>Tomakbalomba</i>	Accompanying the funeral ceremony with musical instruments (drums) can represent the traditional leader.
<i>Sando karua</i>	Assisting traditional leaders in healing rituals and caring for sacred plants (such as bamboo and banyan trees).
<i>Kuntutuk dapok</i>	Responsible for the kitchen during traditional ceremonies and providing food.
<i>Sando olo bakba</i>	Family healer, assisting with the slaughter of sacrificial animals and prayers.
<i>Randangan puduk</i>	The general public follows customary rules, preserves forests, and can provide customary input.

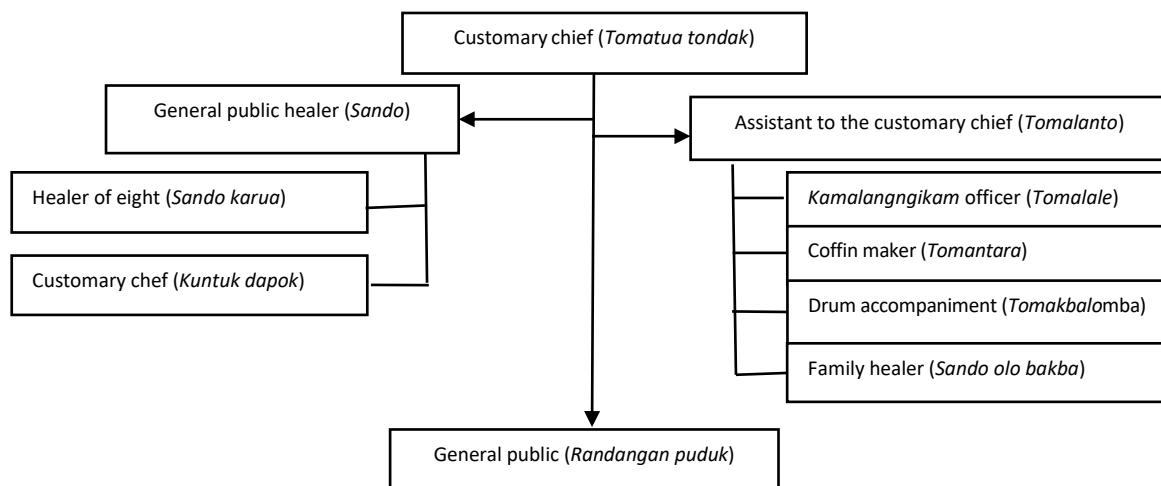


Figure 4. Customary institutional structure of Mappurondo community in Malatiro Village, Mamasa District, West Sulawesi, Indonesia. Source: Results of interviews and FGDs with respondents, 01 September to 30 November 2024

The traditional institutional structure of Mappurondo in Malatiro Village functions as a community-based forest management system that supports sustainable management. *Tomatua tondak*, as the highest leader, regulates forest use through customary decisions and ritual supervision, supported by *Tomalanto* and technical figures such as *Tomalale* and *Tomantara*, who manage limited access to forest resources for sacred purposes. Spiritual figures such

as *Sando karua* maintain sacred plants and spiritual-ecological balance, while *Randangan puduk* or the general public are involved in compliance with norms and customary deliberations. This division of roles creates an effective system of social oversight and control of utilization, in line with the principles of community-based conservation (Ananda et al. 2023; Akalibey et al. 2024). This collective function proves that customary institutions

are an important instrument in biodiversity conservation, maintaining ecosystem functions, and strengthening local legitimacy in sustainable forest management (Djafar et al. 2023; Zoungrana et al. 2023). This model supports formal recognition of the rights of indigenous knowledge as stipulated in the Minister of Environment and Forestry Regulation No. 21/2019.

Discussion

Sustainability practices

The utilization of customary forests by the Mappurondo community in Malatiro Village reflects a system of ecological ethics rooted in customary rules, prohibitions, and graduated sanctions. This framework, which includes verbal warnings, fines in the form of livestock or agricultural products, and even expulsion, functions as a social mechanism to regulate access and ensure sustainability. Similar to the practices of the Ammatoa Kajang community, which establishes sacred prohibition zones and enforces binding customary sanctions (Nisa et al. 2024), the Mappurondo community restricts forest resource use primarily to ritual purposes, thereby minimizing exploitation. The restriction of both timber and non-timber extraction reflects the alignment between indigenous knowledge and contemporary principles of sustainable forest management (Iriyani et al. 2024). By prohibiting extensive utilization and allowing access only within customary regulations, the Mappurondo community contributes to maintaining ecological balance, biodiversity, and forest functions that extend beyond cultural identity into ecological resilience.

A central element of sustainability in this system is the preservation of the *Kamalangngikam* customary forest, which is strictly maintained as a sacred space without human intervention. By allowing ecological processes such as natural regeneration and succession to occur, this forest functions as a reservoir of biodiversity and ecosystem services, in line with the argument of Angelstam et al. (2021) that natural cycles are critical for ecological sustainability. Likewise, the *Pasaram* customary forest, designated as a burial ground, indirectly supports ecological functions by conserving soil and water systems and providing habitat for various flora and fauna. The limited use of forests and forest products demonstrates sustainable resource management practices, reinforcing the role of these forests as important refuges for biodiversity (Venn 2023). This ecological role resonates with findings on *Kaombo* in Buton District, which simultaneously serve historical and ecological purposes (Mardan and Ramadhan 2022), and with sacred forests in Manggarai and Flores that provide water sources and biodiversity protection while being threatened by extractive industries such as mining (Steni et al. 2025). The Mappurondo case, therefore, illustrates that customary prohibitions are not merely cultural practices but are simultaneously mechanisms for ecological protection consistent with sustainable forest management principles.

Sustainable practices are also evident in the community's timber utilization. Wood selection is governed by strict customary criteria that indirectly conserve

associated ecosystems. For instance, trees hosting epiphytes such as *D. sparsisora* and *A. nidus* are not harvested, ensuring the survival of epiphytic species and maintaining habitats for birds and other fauna. The ritual use of *M. vrieseana*, considered the origin of human life, demonstrates cultural symbolism while simultaneously regulating the selective extraction of this species. Similarly, prohibitions on cutting *Q. argentata* and *R. taitensis* help maintain natural forest regeneration processes. These restrictions illustrate a species-specific conservation ethic that parallels scientific approaches to biodiversity preservation. Through such rules, the Mappurondo community demonstrates an understanding of ecological interdependence and the importance of maintaining species diversity as part of their cultural practice.

In addition to timber, the management of NTFPs strengthens sustainability by reducing extraction pressure on primary forests while supporting daily subsistence and ritual life. A wide range of species are utilized, including *A. catechu*, *P. betle*, *B. multiplex*, *S. elegans*, *F. septica*, *Calathea* sp., *P. tectorius*, *Calamus* sp., *M. sago*, and *E. ramosissimum*. These plants fulfill multiple functions, spanning ritual activities, handicrafts, food, medicine, and energy sources. For example, *B. multiplex* is indispensable in death ceremonies, *P. tectorius* leaves are woven into household crafts, rattan stems (*Calamus* sp.) are shaped into ceremonial tools, and sago (*M. sago*) is processed into a staple food. Such multifunctional use reflects a diversified subsistence strategy that integrates ecological sustainability with cultural continuity. By linking NTFPs with rituals and cultural taboos, the Mappurondo community ensures controlled utilization while simultaneously safeguarding ecological functions such as biodiversity conservation, water regulation, and soil fertility (Sarfo-Adu et al. 2022). In sum, the sacred restrictions, species-specific regulations, and ritual-linked practices of the Mappurondo community demonstrate how indigenous knowledge systems function as an adaptive framework for sustainable forest management, balancing ecological protection with cultural resilience (Angelstam et al. 2021; Mardan and Ramadhan 2022; Nisa et al. 2024; Steni et al. 2025).

Indigenous resilience

The resilience of the Mappurondo customary law community in Malatiro Village is rooted in the integration of cosmological beliefs with ecological practices. Unlike subsistence-oriented forest use, the *Kamalangngikam* and *Pasaram* customary forests are maintained primarily as sacred spaces, functioning as loci for ritual communication with God Almighty and as arenas for cultural identity reproduction. The *Kamalangngikam* forest, associated with women's purification rituals, embodies cosmological origins that render it inviolable, while the *Pasaram* forest serves as the final resting place of ancestors, thereby linking living generations with their heritage. Such perceptions parallel the sacred forest of the Kajang community in South Sulawesi, regarded as the dwelling of God and maintained through ritual offerings (Samad et al. 2024), and the sacred forest of the Cerekang people,

preserved due to its cosmological significance in linking human existence to the past (Akhmar et al. 2022). In this sense, Mappurondo resilience emerges not from economic productivity but from the preservation of spiritual landscapes that ensure both cultural continuity and ecological stability.

The rules and prohibitions that govern these forests demonstrate a culturally embedded mechanism of resilience. Logging, land clearing, or any exploitation beyond ritual purposes is strictly forbidden, with violations addressed through sanctions that escalate from symbolic to social exclusion. Nemogá et al. (2022) stated that those prohibitions simultaneously safeguard biodiversity and reaffirm cultural identity. Allowing *Kamalangngikam* to regenerate naturally sustains its sacred function while contributing to ecosystem renewal, whereas *Pasaram*, as a burial ground, reinforces ancestral traditions and simultaneously provides ecological services such as water regulation and erosion control. This dual role illustrates what scholars describe as socio-ecological resilience, whereby sacred cosmology and ecological integrity are inseparable (Mardan and Ramadhan 2022; Steni et al. 2025). Similar sacred sites across Indonesia function as cultural anchors that resist external pressures, thereby ensuring long-term resilience of both ecosystems and cultural systems under conditions of rapid change.

Resilience is further reflected in species-specific cultural practices. Certain plants and trees are safeguarded not solely for their ecological roles but for their symbolic and ritual importance. For instance, *A. catechu* and *P. betle* are indispensable in ritual offerings, symbolizing the spiritual link between humans and divinity. Similarly, *F. septica* is venerated as a sacred species, while *A. dammara* provides resin that supports both traditional medicine and community livelihoods. These species-specific practices embody a system of selective conservation that reinforces cultural meaning while ensuring ecological balance. Moreover, cultural adaptation is visible in contemporary handicraft practices. The use of bamboo and sago to produce traditional plates, now promoted as environmentally friendly alternatives to plastic, reflects the community's ability to reinterpret ancestral knowledge to meet modern challenges. By aligning ecological values with livelihood opportunities, such practices highlight the adaptive resilience of indigenous traditions in addressing contemporary environmental and economic pressures.

Institutional resilience plays a crucial role in sustaining these practices. The Mappurondo customary structure assigns clear responsibilities to leaders and ritual specialists: the *Tomalale* oversees rituals in *Kamalangngikam*, while the *Tomantara* manages the exclusive right to collect wood for coffins from *Pasaram*. The central authority of the *Tomatua Tondak*, supported by assistants and ritual specialists, ensures compliance with customary rules and reinforces social cohesion. This institutional design not only maintains the functionality of sacred forests but also strengthens collective identity and solidarity. Comparable systems are documented in other indigenous contexts, such as the Kajang community in South Sulawesi, where customary authorities enforce

conservation through sacred law (Samad et al. 2024), and among West African groups where customary chiefs mediate ecological governance (Mintah et al. 2024). These parallels confirm that customary institutions remain pivotal in fostering resilience by linking ritual, ecology, and social order. Thus, the resilience of the Mappurondo community emerges from the interplay of sacred cosmology, ritual regulation, species-specific practices, adaptive livelihoods, and strong customary institutions. Collectively, these dimensions constitute a holistic system that safeguards ecological functions, sustains cultural identity, and fortifies social cohesion in the face of external pressures.

Integration with formal policy and REDD+

Reducing Emissions from Deforestation and Forest Degradation Plus (REDD+) is a global mechanism aimed at reducing greenhouse gas emissions through efforts to prevent deforestation and forest degradation, promote sustainable forest management, and enhance forest carbon stocks (Morita and Matsumoto 2023). The management of customary forests by the Mappurondo community in Malatiro shows that cultural norms function as ecological instruments. The separation of the *Kamalangngikam* and *Pasaram* zones, strict regulations on utilization, and a tiered system of sanctions not only preserve ritual functions but also limit excessive exploitation and maintain ecosystem sustainability. This practice is in line with national policy directions that have begun to recognize the role of customary law communities, especially after Constitutional Court Decision No. 35/PUU-X/2012, which confirmed that customary forests are not part of state forests, and was reinforced through technical regulations such as Minister of Environment and Forestry Regulation No. 8/2021. In the context of REDD+, the Mappurondo practice represents a form of local wisdom that has the potential to be integrated into the national climate change mitigation strategy, as the system of prohibitions and taboo zones de facto supports carbon and biodiversity conservation. Thus, the Mappurondo practice is not only relevant locally but also has strategic implications for Indonesia's forestry policy within the REDD+ framework, which emphasizes respect for the rights of indigenous peoples and the principle of sustainability.

Mappurondo practices can be seen as an important asset within the REDD+ framework, demonstrating how customary norms can work in harmony with climate mitigation goals. Customary rules such as the prohibition on cutting trees in the sacred *Kamalangngikam* forest or restrictions on the use of forest products in *Pasaram* actually produce ecological functions equivalent to formal conservation mechanisms. This practice shows that customary systems can provide instruments for sustainable forest management outside of state policy intervention, in line with the REDD+ principle that emphasizes not only reducing emissions from deforestation, but also protecting non-carbon values such as biodiversity, ecosystem services, and the socio-ecological resilience of local communities (Do and van Noordwijk 2023). Mappurondo wisdom can therefore be positioned as a social and cultural safeguard that strengthens the legitimacy of REDD+ implementation

at the local level. This approach is parallel to global findings, for example, in the Amazon, where recognition of customary forests has been shown to reduce deforestation and increase carbon storage (Garcia et al. 2021). In Indonesia, similar practices can also be found in the Ammatoa Kajang community in South Sulawesi, which protects the borong karama area as a protected forest, and in the Baduy community in Banten, which has designated a protected forest (*leuweung kolot*) as an absolute protection zone (Nisa et al. 2024; Iskandar and Iskandar 2021). This comparison shows that customary norms consistently play a cross-location conservation role that can be aligned with the REDD+ framework. In line with previous studies, recognition of the role of indigenous peoples in protecting forests shows that the success of REDD+ is largely determined by the extent to which local norms can be formally integrated into national conservation policies (Dirgantara 2021). This indicates that customary practices such as Mappurondo have the potential to strengthen the effectiveness of REDD+ through a combination of interrelated ecological, social, and cultural benefits, and can serve as a replicable model for other regions in Indonesia in supporting national emission reduction targets.

Mappurondo practices show unique characteristics and similarities with other indigenous communities in Indonesia. The Dayak Iban in West Kalimantan, for example, preserve the *Tembawang* forest as a heritage area that cannot be converted and has been proven to store significant carbon reserves (Leo et al. 2022). In Maluku, the *Sasi* practice also establishes periods during which the use of marine and terrestrial resources is prohibited as a mechanism for ensuring sustainability (Sahusilawane et al. 2024). An important difference in Mappurondo lies in its strong customary institutions with clear role structures, ranging from *Tomatua tondak* to *Randangan puduk*, which ensure effective social oversight. Other studies show that strong customary institutions increase the chances of successful integration with national programs such as REDD+, provided they are supported by legal recognition and technical capacity building (Gatto and Sadik-Zada 2024). However, as reported in cases in various provinces, the threat of overlapping forestry business permits and land conversion remains a major obstacle. Thus, the policy implications of Mappurondo's findings are the need to accelerate the administrative recognition of customary areas, technical assistance to meet MRV (Measurement, Reporting, and Verification) standards, and fair benefit-sharing mechanisms. These steps enable Mappurondo's customary practices to not only preserve local cultural and ecological identities but also make a tangible contribution to the national climate mitigation strategy through REDD+.

In conclusion, the study demonstrates that the Mappurondo community's indigenous forest management system represents a culturally embedded model of ecological sustainability. Through customary laws, rituals, and sanctions, the community regulates forest access, maintains biodiversity, and reinforces collective responsibility for resource stewardship. The *Kamalangngikam* and *Pasaram* forests are preserved through binding prohibitions and sanctions based on

spiritual cosmology, ensuring natural regeneration, biodiversity conservation, and the provision of essential ecosystem services. Outside these sacred zones, resource use is highly selective, limited to ritual, medicinal, and craft purposes, and regulated through species-specific rules that reinforce ecological sustainability. These traditional practices embody principles of balance, respect, and intergenerational equity that parallel contemporary frameworks for sustainable forest management. Recognizing and integrating the Mappurondo's indigenous system into formal social forestry policies can support national and global commitments to biodiversity conservation, climate adaptation, and community-based resource governance.

ACKNOWLEDGEMENTS

The author would like to thank the West Sulawesi Provincial Government, Indonesia, for providing a study assignment through a master's degree scholarship in forestry at Universitas Hasanuddin, Indonesia.

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