Jurnal Manajemen Hutan Tropika, *31*(3), 288–299, September 2025
EISSN: 2089-2063
DOI: 10.7226/jtfm.31.3.288

Scientific Article
ISSN: 2087-0469

Forest Conservation by Conserving Socio-cultural Aspects: A Lesson from the Sougb Tribe in Teluk Bintuni, West Papua Province

Nimrod Agustinus Andyratnah Rumayomi[1], Agustinus Murdjoko[2,4*], Antoni Ungirwalu[2], Mulyadi[3], Nithanel Mikael Hendrik Benu[5], Dony Aristone Djitmau[2]

[1]Post Graduate Program of Environmental Science, Papua University, Gunung Salju Road, Amban, Manokwari, Indonesia 98314
[2]Faculty of Forestry, Papua University, Gunung Salju Road, Amban, Manokwari, Indonesia 98314
[3]Faculty of Animal Husbandry, Papua University, Gunung Salju Road, Amban, Manokwari, Indonesia 98314
[4]Research Center for Biodiversity, Papua University, Gunung Salju Road, Amban, Manokwari, Indonesia 98314
[5]Center for Implementation of Environmental and Forestry Instrument Standards, Inamberi Susweni Road, Manokwari, Indonesia 98311

Received February 20, 2025/Accepted August 27, 2025

Abstract

The forest has been an integral part of the lives of local people, such as the Sougb Tribe, for generations, during which time they have applied their traditional knowledge. However, the local government has been conducting development for decades with less local knowledge involved. Hence, this research was designed to examine the traditional knowledge used during forest utilization by the Sougb Tribe in Teluk Bintuni, West Papua Province. The data were collected through interviews using the snowball method in the subdistricts of Bintuni, Bintuni Timur, Manimeri, Tuhiba, and Tembun. Then, the study revealed that the Sougb Tribe, originally part of the Arfak Tribe, has inhabited the Teluk Bintuni area for generations, migrating from the highlands to the lowlands due to various factors like marriage and conflict. They still maintain customary rights while managing the land through traditional organizations. This tribe relies profoundly on forest resources for sustenance, practicing sustainable agriculture and traditional hunting methods. Despite facing challenges in forest utilization, they emphasize the importance of biodiversity and traditional knowledge in local conservation efforts. Thus, it is vital to integrate this local wisdom into regional development that can enhance sustainability and cultural preservation, fostering community engagement and ecological balance.

Keywords: *customary right, ecosystem service, ethnoecology, traditional knowledge, sustainable forest management*

**Correspondence author, email*: *agustinus.murdjoko.papua@gmail.com*

Introduction

Papua, located in eastern Indonesia, is scientifically renowned for its remarkable biodiversity, encompassing diverse ecosystems such as tropical rainforests (Murdjoko et al., 2021a; 2021b; 2021c), mangroves (Kasihiw et al., 2023; 2024; Asmuruf et al., 2024), savannahs, and coral reefs (Legra et al., 2008). Recognized as a global biodiversity hotspot, it is home to approximately 20,000 plant species (Cámara-Leret et al., 2020), many endemic species, and over 700 bird species, including the unique birds of paradise (Heads, 2001). The region's marine biodiversity is equally impressive, particularly in the Coral Triangle, which boasts the highest marine diversity globally, with over 600 coral species and thousands of fish species, notably in the Raja Ampat archipelago (Dirhamsyah, 2013). Indigenous communities have historically maintained a harmonious relationship with the environment by utilizing traditional knowledge for sustainable management of their ecosystems. However, modern threats such as deforestation, mining, and agricultural expansion jeopardize these ecosystems (Gaveau et al., 2021; Tawer et al., 2021; Parsch et al., 2022). Conservation efforts must integrate local customs and involve indigenous participation to ensure sustainability. Despite its ecological significance, Papua faces challenges such as illegal logging and land use change, necessitating collaborative efforts among governments, NGOs, scientists, and local communities. Thus, protecting Papua's biodiversity as part of a global area is crucial not only for the region but also for global ecological conditions.

In Papua, local communities maintain a profound relationship with their surrounding forests, which serve as vital resources for their livelihoods, and are connected to several key activities. Subsistence living relies heavily on the forest for food, medicine, and materials for shelter, with indigenous groups practicing sustainable hunting and gathering practices. Moreover, traditional medicine is derived from the diverse medicinal plants found in these forests, and knowledge of their uses is passed down through generations, reinforcing cultural identity. Furthermore, economic activities provide essential income for commu-

Jurnal Manajemen Hutan Tropika, *31*(3), 288–299, September 2025
EISSN: 2089-2063
DOI: 10.7226/jtfm.31.3.288

Scientific Article
ISSN: 2087-0469

nities while promoting sustainable resource management (Murdjoko et al., 2017; Sillanpää et al., 2017). The forests hold significant cultural value, often regarded as sacred spaces integral to spiritual beliefs, where rituals and ceremonies are conducted (Sonbait et al., 2021; Saiba et al., 2023). Indigenous peoples are recognized for their effective environmental stewardship, having developed sustainable practices that contribute to biodiversity conservation and carbon storage. Their role in managing forests responsibly is increasingly acknowledged on global platforms, highlighting the importance of their traditional knowledge and practices in addressing contemporary environmental challenges. Overall, the relationship between local communities and forests is multifaceted, encompassing subsistence, health, economy, culture, and environmental stewardship (Cámara-Leret et al., 2014; Pattiselanno et al., 2019; Jenkins, 2022; Sagrim, 2022).

As part of ecosystem services, forests play a crucial role in local communities worldwide, serving as a source of cultural identity, livelihoods, and traditional practices (Joa et al., 2018). For many indigenous peoples, forests can be considered sacred spaces rich in spiritual significance, often featured in folklore and rituals. They can also provide essential resources such as food, medicine, and materials, with traditional knowledge about sustainable harvesting and ecosystem management passed down through generations (Fraser et al., 2016). Cultural values guide sustainable forest utilization, with practices such as rotational farming and selective logging aligning human needs with ecological health. For instance, agricultural systems and preserved sacred groves exemplify how cultural traditions can promote biodiversity and sustainability. However, this relationship faces significant challenges from deforestation, commercial exploitation, and land-use changes driven by global economic pressures, which threaten both livelihoods and cultural connections (Carrasco et al., 2014; Laurance, 2015). The erosion of traditional knowledge, exacerbated by urban migration, economic processes, and modern lifestyles, further weakens communities' capacity for sustainable forest management.

Teluk Bintuni District has been one of the regional establishments in Papua since 2002, as established under Law Number 26/2002. Moreover, this district encompasses a diverse range of natural resources, from aquatic to terrestrial ecosystems, and local people who comprise seven tribes, including the Sougb. Recently, the Teluk Bintuni district has undergone significant development, with most areas located in the subdistricts of Bintuni, Bintuni Timur, Manimeri, Tuhiba, and Tembun, where customary rights are held by the Sougb Tribe (Rumayomi et al., 2024). The pronunciation of this tribe varied in many documents, with variations including Sougb, Souk, or Sougb. However, we referred to scientific papers that subsequently use the term Sougb (Sonbait et al., 2021; Saiba et al., 2023). These local people have utilized natural resources, such as forests, for generations, interacting with them through traditional cultivation, hunting, and other activities. Besides the local people's activities, the company's logging concessions have been operating for decades, even before this district was established. Hence, some primary forests have been ecologically altered as a consequence of these activities, resulting in the establishment of secondary forests (Rumayomi et al., 2024). Some forests have been converted during development in these subdistricts, such as areas where infrastructure is located, which belong to the Sougb Tribe, the focus of this research. Sustainable forest management has been a key component of the government's commitment, including that of Teluk Bintuni District. While the Sougb Tribe has traditional knowledge of forest utilization, it remains poorly understood. To address these challenges, policymakers, including those from Teluk Bintuni District, must engage with local communities, particularly the Sough Tribe, to incorporate cultural practices into forest management strategies. Collaborative initiatives, such as community-based forest management, can empower local populations, promoting both environmental sustainability and cultural preservation. Ultimately, understanding the intricate relationship between culture and forest utilization is crucial for ensuring that forests continue to sustain and inspire future generations, underscoring the need for a holistic approach that balances ecological integrity with cultural heritage.

This research aims to address a gap in understanding how traditional knowledge can be effectively integrated into modern development programs. Despite ongoing governmental initiatives, there is a lack of research on local communities' perceptions of forest function, which hinders sustainable and culturally sensitive development. Documenting and analyzing the local knowledge is crucial for creating a framework that ensures meaningful integration into regional development, ultimately leading to economically viable and ecologically and socio-culturally sustainable outcomes. Thus, this research selected the Sougb Tribe in Teluk Bintuni District because they have customary rights to the northern part of the terrestrial area in this district. Moreover, the development of this district primarily occurred in the area belonging to the Sougb Tribe, based on customary land distribution rights. Hence, the research aimed to describe the interaction between the local people of the Sougb Tribe and the forest as a natural resource and subsequently to determine the extent of traditional knowledge involved in this interaction. Then, understanding could be implemented to connect forest management and traditional knowledge. Assuming the conservation of the socio-culture of the Sougb Tribe could positively impact forest conservation.

Methods

Study area This research was conducted in Teluk Bintuni District, West Papua Province, specifically in areas belonging to the Sougb Tribe. As a tribe in Papua New Guinea, the Sough Tribe engages in forest utilization, with ownership rights attributed to them. For instance, during traditional cultivation, they employ traditional techniques, relying on the shade provided by existing trees and natural decomposition for crop nourishment, thereby eschewing the use of chemical fertilizers. Indigenous groups have cultivated traditional crops such as swidden for generations, preserving some vegetation during agricultural activities to enhance biodiversity. This method facilitates a secondary successional process during fallow intervals, resulting in the development of secondary forests after more than ten years

Jurnal Manajemen Hutan Tropika, *31*(3), 288–299, September 2025
EISSN: 2089-2063
DOI: 10.7226/jtfm.31.3.288

Scientific Article
ISSN: 2087-0469

(Rumayomi et al., 2024).

Furthermore, local communities also participate in hunting and gathering, exhibiting limited vegetation clearance relative to slash-and-burn techniques. Specific forest regions are classified as protected zones based on the traditional concept of restricted areas, which prohibits resource exploitation and allows the forest to develop undisturbed, thereby attaining the status of primary or old-growth forests (Rumayomi et al., 2024). This sustainable technique exemplifies the tribes' profound relationship with their surroundings.

Sampling and procedures We conducted interviews to gather qualitative data on traditional knowledge and forest resource use. Hence, this process was to explore the nuances of community practices, uncovering cultural beliefs and management strategies. This method fosters dialogue, revealing insights into resource rights, knowledge transmission, and conflict resolution, ultimately supporting sustainable development and conservation efforts, as both formal and informal methods were employed (Maryudi & Fisher, 2020). The study included 30 key informants intentionally chosen to represent the Sougb Tribe, where they were from 7 different villages (Argosigemerai, Atibo, Beimes, Iguriji, Kali Kodok, Tubi Steirira, and Wesiri), as this tribe has a traditional structure, like head of villages, religious leaders, and community leaders, as in Papua, local people indicate them using family names (Fatem et al., 2018; Ungirwalu et al., 2019; 2025). They have been officially stated in the Appendix of Regional Regulations Number 1 of 2019 concerning the Recognition and Protection of Traditional Legal Communities in Teluk Bintuni District (Ibori, Iba, Towansiba, Tuhumenaw, Yettu (Pjettu), Tiri, Teinom, Imeri, and Onyou). They subsequently engaged in semi-structured interviews to gather socio-demographic information, including age group, gender, occupation, education, family status, and monthly income. The selection of the initial informant was based on observation and categorized as either a tribal figure or the village head in each village as a trusted informant. Then, the next informant was selected using the snowball method, where the previous informant was asked to identify a potential informant. This was a non-probability sampling technique used in social research to access hard-to-reach populations. We followed the stages of defining the target population, identifying initial participants, conducting initial interviews, requesting referrals, recruiting referred participants, and repeating the referral process until either a predetermined sample size was reached or saturation occurred (Goodman, 1961; Nzau et al., 2020). Data collection and analysis involve collecting qualitative or quantitative data based on the research design and identifying patterns, themes, and insights related to the research question. Ethical considerations are crucial, including ensuring informed consent and protecting participants' privacy and confidentiality at all stages of recruitment and data collection. The research aimed to understand the perception of informants regarding forest management, clarifying residents' understanding of the benefits of forests, including local wisdom, biodiversity, development, community assistance, financial incentives, company operations, and NGO advocacy. As previously indicated, all locations in the subdistricts were assessed, and the villages within each district were deliberately chosen based on various criteria, including the characteristics of the local people.

Data analysis Interviews and firsthand observations of the research subjects and people were used to gather data. To conduct interviews, facts and information were input into a pre-made list of questions. To find the percentages of socio-demographic data, we divided the total number of informants by the number of categories. This was done as part of the data analysis, using descriptive statistics to present the percentage in tabular form. The following variables were age group, gender, occupation, education, family member, and monthly income.

Furthermore, the study employed the following method to determine the composition of perception, expressed as percentages, for each of the following categories: local knowledge, biodiversity, development, community aid, financial incentives, company operations, and NGO advocacy (Sagrim, 2022). We also included a photovoice analysis, which involved taking pictures of local individuals as they engaged in various activities (Castleden et al., 2008; Peterson et al., 2019). Then, the analysis's findings were presented descriptively in tables (percentages) and figures.

Results

The Sougb Tribe has been living in the Teluk Bintuni area for generations, initially alongside Hatam, Meyah, and Moile as part of the Arfak Tribe. Historically, the people of Sougb migrated from the highlands in the Arfak Mountains to the lowland areas, including the northern part of Teluk Bintuni, creating a civilization due to various reasons, such as the wedding system and internal conflict. Hence, the Sougb Tribe has inhabited areas in Teluk Bintuni, particularly in lowland areas, which contrasts with their original place. The story of their movement has been passed through generations by oral delivery. However, they have customary rights in the part of Teluk Bintuni District where most of the areas are in lowland areas. The right has been acknowledged by other tribes in Teluk Bintuni as being part of the seven tribes. They have traditional agreements among the tribes, including within families, to delineate the borders of their respective areas. They manage the use of the area under traditional organization (*Lembaga Masyarakat Adat*, LMA), where the people elect their own leaders. It means that the area in this district located in the northern part belongs to the Sougb Tribe. Hence, the use of the terrestrial landscape has been dominantly conducted by the Sougb Tribe as part of the focus of this research.

In this research, the snowball method was employed to recruit informants through an interview with one of the village leaders. Then, the following information was recommended and identified based on their understanding of the area's utilization. Ultimately, we observed and selected informants from seven villages through interviews. This tribe is primarily distributed in the Teluk Bintuni District, primarily in lowland areas adjacent to the Arfak Mountains, including the subdistricts of Bintuni, Dataran Beimes,

Jurnal Manajemen Hutan Tropika, *31*(3), 288–299, September 2025
EISSN: 2089-2063
DOI: 10.7226/jtfm.31.3.288

Scientific Article
ISSN: 2087-0469

Tuhiba, and Tembuni. The villages inhabited by the Sougb people are Tubi Steirrira, Argosigemerai, Wesiri, Atibo, Tihibo, Botai, Tirasai, and Sibena. This community migrated to Teluk Bintuni and lived there for generations, after which the tribe established subtribes as part of its cultural process. For example, they are grouped as Sougb, Sougb Moskona, Sougb Bohon, and Sougb Rouw. The tribal leader has traditionally been chosen based on trust and experience, as each clan has its leader. Moreover, to accommodate the leader among the clans, they have established traditional organizations (LMA). The LMA plays a role in protecting local rights within the social dynamic of Teluk Bintuni District. The administration area is located in Teluk Bintuni District, even though the Sougb Tribe also exists in another district, such as Manokwari Selatan. The regulations of the Sougb Tribe have not been written, but the points have been agreed upon and accepted by tribal leaders as a means to enforce traditional regulations.

Traditional knowledge of natural resources has been passed down and applied for generations. Their lives depend on natural resources, mainly forests, because they have come to understand that the forest is the source of their needs. Hence, in the Sougb language, they have words to describe the forest as an ecosystem. For example, the words for the original forest, or what can be described as the primary forest are "*sremehna*"; the land to plant and grow or the area, is "*sinoko ejan tow tow*"; the forest that has been cultivated and left for the remaining forest to regrow naturally, or technically like the secondary forest, is "*mhe sinoko saromech*"; the mangrove area is "*sinjeri*"; and the grass area is "*rukespes*" (Figure 1). Furthermore, they hunt wildlife such as *mambruk* (*Goura cristata*), *lao-lao* (*Dorcopsis luctuosa*), *rusa* (*Rusa timorensis*), and *babi hutan* (*Sus scrofa*). Then, they bring them to the traditional kiosk, which is usually located close enough to the hunting location as the selling location. If the location of hunting is far from the selling place, they will process the animal using a simple method to make smoked meat, as shown in Figures 2. Currently, they have a hunting system that has been in place for generations, which they believe meets their needs in the forest. They only hunt within their designated area, based on customary rights, and there are certain areas that they are not allowed to utilize, including for hunting purposes.

We described here the socio-demographic condition based on the informants using the variables (Table 1). The informants showed that the highest number of age groups was distributed between 31 and 60 years, while the lowest numbers were found in the groups below 30 years and above 60 years, respectively. The male informants were higher than the female informants, and more informants work in the private sector than in farming or as civil servants. Furthermore, more than half of the informants had graduated from senior high school, and a quarter had pursued higher education. The informants, on the other hand, had the least education, with 6.7% having passed primary school and 6.7% having passed junior high school. The informants have an average of 7 family members, with 70% having more than 7 family members and the remaining 30% having fewer than 7 family members. On average, the monthly income of informants is IDR6,030,000, with approximately 60% of informants earning a monthly income below the average.

The area in Teluk Bintuni is dominated by primary forest, although some areas of the forest have been utilized by logging companies for decades. Most people of the Sougb Tribe have come to understand the local wisdom that has been passed down for generations, realizing that its implementation can help preserve the area. This research revealed that the people of Sougb understand biodiversity, particularly in the forest, as they believe the forest comprises vegetation and wildlife. Biodiversity provides shared benefits, such as food and medicinal needs, by offering them in the forest. In contrast, they hold the perspective that development has altered the forest's function, which could contribute to deforestation and forest degradation. As shown in Table 2, the participants agreed on the need for development, particularly regarding infrastructure that supports their activities, such as roads and power expansion. Thus, they asked for community assistance, along with financial incentives, to support their lives. For instance, they can access education, health facilities, and markets. They have also received support from some NGOs as part of their assistance. More than half of the informants have received less benefit from the companies (logging concessions) because they require community advocacy concerning their customary rights. The logging companies have been exploiting the forest in this area for decades. However, local people did not fully reap the economic benefits; instead, they experienced the indirect advantage of the companies through the use of roads to access the forest and villages.

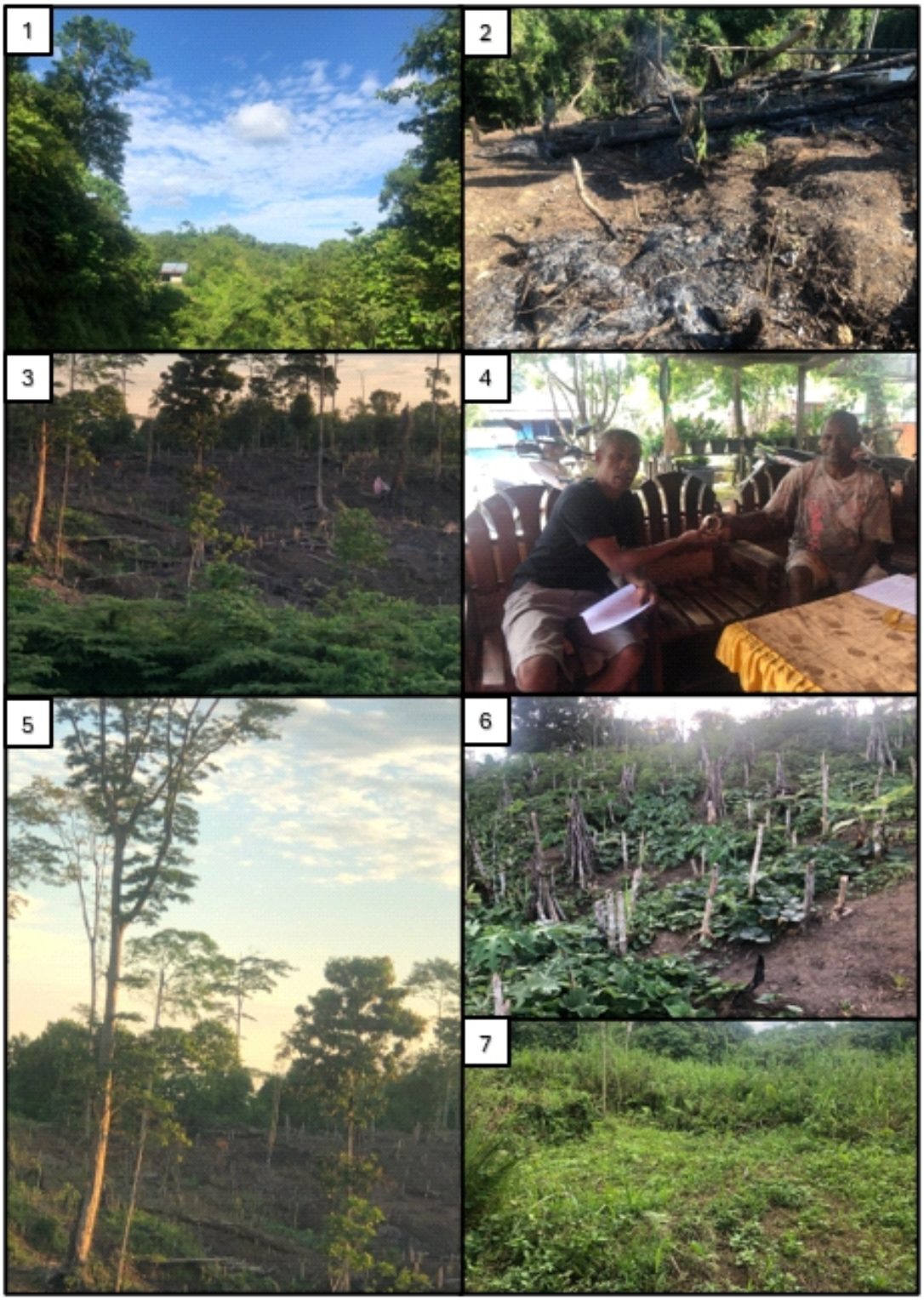
Discussion

Traditional knowledge as the link between people and nature This study has investigated the relationship between the socio-cultural aspects of the Sougb Tribe and the traditional management during the use of forests as part of their livelihood. This tribe lives and has activity mainly in the northern part of Teluk Bintuni District since this district was established definitively in 2002 under Law Number 26/2002 on the formation of Sarmi District, Keerom District, Sorong Selatan District, Raja Ampat District, Pegunungan Bintang District, Yahukimo District, Tolikara District, Waropen District, Kaimana District, Boven Digoel District, Mappi District, Asmat District, Bintuni Bay, and Wondama Bay District in Papua Province. This tribe has been part of the seven tribes under the administration of Teluk Bintuni District, as outlined in the Regional Regulation of Teluk Bintuni District Number 1/2019, which concerns the Recognition and Protection of Traditional Legal Communities in Teluk Bintuni District. Although this tribe was initially associated with the Arfak Tribe, they have moved from the Arfak Mountains to the lowland area, where they currently reside. It is unclear when they moved to this area, but informants said they have lived in Teluk Bintuni District for generations. Some research mentioned the factors why they moved, such as education facility, marriage, job, internal conflict, and church activity during evangelization (de Wilde de Ligny et al., 1963; Ruinard, 1964; Saiba et al., 2023). Hence, nowadays this tribe has the customary right in the lowland of Teluk Bintuni District among seven tribes, as they live mainly in the northern part of this district.

Although there are a variety of occupations within this tribe, most people are engaged in forest utilization, such as

Jurnal Manajemen Hutan Tropika, *31*(3), 288–299, September 2025
EISSN: 2089-2063
DOI: 10.7226/jtfm.31.3.288

Scientific Article
ISSN: 2087-0469



(Photo credit: Nimrod Agustinus Andyratnah Rumayomi)

Figure 1 (1) old-growth forest as in Sougb Tribe is locally pronounced as "*sremehna*". (2) The process of burning vegetation debris during the area clearing. (3) The area of traditional cultivation. (4) The interview with the local people (on the right). (5) The large trees in the cultivation area. (6) The crops among the stump of vegetation. (7) The fallow land that regrows naturally is known as the secondary forest where the Sougb described using their language as "*mhe sinoko saromech*".

Jurnal Manajemen Hutan Tropika, *31*(3), 288–299, September 2025
EISSN: 2089-2063
DOI: 10.7226/jtfm.31.3.288

Scientific Article
ISSN: 2087-0469

Table 1 Socio-demographic information with the number of informants and its portion (%)

Demographic variable	Number of informants	Proportion (%)
Age group		
Above 60	2	6.7
51–60	8	26.7
41–50	9	30.0
31–40	7	23.3
21–30	4	13.3
Gender		
Female	10	33.3
Male	20	66.7
Occupation		
Farmer	8	26.7
Civil servant	8	26.7
Private	14	46.7
Education		
Higher education	7	23.3
Senior high school	19	63.3
Junior high school	2	6.7
Primary school	2	6.7
Family member		
Above average	9	30.0
Below average	21	70.0
Monthly income		
Above average	10	33.3
Below average	20	66.7

Table 2 Perception of informant based on forest management (%)

Perception	Management						
	Local wisdom	Biodiversity	Development	Community assistance	Financial incentive	Company operation	NGO advocacy
Agree	100.0	100.0	0.0	100.0	100.0	43.3	100.0
Neutral	0.0	0.0	0.0	0.0	0.0	3.3	0.0
Disagree	0.0	0.0	100.0	0.0	0.0	53.3	0.0

farmers, who open and clear part of the forest by cutting vegetation, then burn it and cultivate the land. They engage in activities similar to those of people in Papua, practicing shifting cultivation or slash-and-burn agriculture, as they do not use fertilizers. Each area is managed by a family as landowners to sustain traditional agriculture. As a result, the area is not too large, and they do not cut all vegetation in the field, as some large trees are left to grow. This procedure is similar to that of other tribes in Papua (Murdjoko et al., 2022). Ecologically, this system can influence the process of secondary succession, which, from the perspective of biodiversity, can increase the species richness of vegetation, as the alteration of forests has changed the ecological conditions. Consequently, particular species, such as pioneers or ruderal species, colonize the area. As a result, they are growing beside the original species (Klanderud et al., 2010; Kukla et al., 2019; Marwa et al., 2024). In terms of the traditional conservation view, local people have conserved certain areas of the forest because they believe these forests are sacred and have been traditionally protected for generations. Although most Sougb people have a religion dominated by Christian churches, local people here still have occultism, where nature, including the forest, has power. For example, they belief that the demon, disguised as a human in the Sougb language, is locally mentioned as a "*suler*". Another example is that some forests are said to possess supernatural powers, and people are restricted from entering them. This traditional knowledge has been passed down for generations, as stated in their myths.

They employ traditional hunting methods, using traps or local weapons, to capture wildlife such as deer and wild boar. In Papua, many local people rely on traditional tools to catch wildlife, and they apply traditional knowledge by refraining from excessive wildlife collection, as they understand that wildlife can regenerate (Fatem et al., 2023). Thus, they have implemented traditional sustainable management in hunting systems (Pattiselanno & Lubis, 2014; Pattiselanno & Krockenberger, 2021). Most people of the Sougb Tribe conduct the hunting of wildlife to be consumed, and a few are sold, as the local people here implement the subsistence system during hunting. Furthermore, the local people rarely farm to support their livelihood. However, they have understood the sustainability of the wildlife stock in the forest. Hence, based on their knowledge that the forest must be conserved as a place for wildlife, they knew that the forest is a legacy of treasure for future generations. As mentioned previously, in addition to the traditional concept of conservation in that area, the sacred forests play a crucial role in preserving organisms and all aspects related to the forest. That is why some informants disagreed regarding company

Jurnal Manajemen Hutan Tropika, *31*(3), 288–299, September 2025
EISSN: 2089-2063
DOI: 10.7226/jtfm.31.3.288

Scientific Article
ISSN: 2087-0469

(Photo credit: Nimrod Agustinus Andyratnah Rumayomi)

Figure 2 (1) The selling place of animals hunted by Sougb Tribe. (2) the location of the traditional kiosk is close to the market. (3) The animals are placed in the traditional kiosk. (4) The smoked meat of deer is sold in the market.

activities; in their view, those have altered forest conditions, and they do not have the same level of access to the forest as they did before the company's involvement.

As the research showed that most people have engaged in forest utilization as part of their activity, such as farming and hunting, it indicated that interaction between the Sougb Tribe and the forest is very tight, as shown by many studies that language is part of the culture established during the activities in nature (Fraser et al., 2016; Kik et al., 2021). In certain conditions, they also welcome modernization, as evidenced by the academic achievements of some individuals who have pursued higher education. However, they still hold to the traditional understanding during their activities, as evidenced by their language, which includes words to describe objects as natural phenomena, indicating a relationship between people and nature, such as a forest. For instance, they explained that the forest plays a role as a mother who provides their needs, whereas in the Sougb language, they say "*lomesmes edag mamim*". Hence, they have traditional knowledge to maintain the forest, especially old-growth forests, as their mother. Consequently, the local people have established and conducted local knowledge, which supports the government's conservation program. This local knowledge can be integrated into the regional program, in which the local government of Teluk Bintuni has issued regional regulations to acknowledge the customary rights of tribes, including the Sougb Tribe. Administratively, this tribe is part of the Teluk Bintuni District. To comply with local regulations, the LMA has operated under an agreement among the tribes. However, local people have trusted tribal leaders, such as local figures from clans associated with the church, referred to in the local language as "*pamudes*".

Traditional concepts to harmonize the development program This study found that local knowledge, encompassing local wisdom, plays a crucial role in ensuring the success and sustainability of government programs during the development process. Hence, the concept of the Sougb Tribe's forest utilization is potentially applicable to corporations in regional development. By incorporating traditional knowledge, cultural values, and community practices into policy planning and implementation, governments can create initiatives that are both contextually relevant and widely accepted by local populations. Through

Jurnal Manajemen Hutan Tropika, *31*(3), 288–299, September 2025
EISSN: 2089-2063
DOI: 10.7226/jtfm.31.3.288

Scientific Article
ISSN: 2087-0469

discussions with LMA, the local government can gather information related to traditional knowledge and then sort it so it can be included in district programs, particularly those related to natural resource management. This approach fosters greater community engagement, enhances trust between citizens and authorities, and ensures that development efforts align with the unique needs and aspirations of the people they aim to serve. Moreover, leveraging local wisdom can help identify innovative, cost-effective solutions to challenges while preserving cultural heritage and promoting inclusivity, such as the culture of the Sougb Tribe. Ultimately, the fusion of local insights into government strategies strengthens the foundation for long-term development and fosters a sense of shared responsibility among stakeholders. This agreement can be officially recorded in the regional development documents, where those programs, under one condition, can support the mitigation of deforestation and forest degradation in regional areas as part of the main goals of sustainable development. The legal document has consequences that are controlled by the government itself and provides financial support for the collaboration program, as seen in other areas worldwide (Jackson et al., 2025). For instance, as mentioned in the Manokwari Declaration, forest areas in Tanah Papua will be conserved at a minimum of 70% and protect the rights of indigenous people, including the Sougb Tribe, who are part of the local population in Papua (Cámara-Leret et al., 2019). Furthermore, as global efforts to combat environmental challenges emphasize local wisdom, especially in Indigenous communities, in forest conservation, the integration of traditional concepts in local development promotes sustainable, culturally inclusive solutions (Parrotta & Agnoletti, 2007; Cámara-Leret et al., 2014; Benner et al., 2021; Sagrim, 2022; Saiba et al., 2023). Moreover, local knowledge, particularly from Indigenous peoples, is rooted in centuries of interaction with forest ecosystems. For example, the forest church in Ethiopia has been legally accommodated as part of forest conservation efforts, where the forest is depicted as a sacred space, resulting in people maintaining the forest (Haile et al., 2025). Hence, the local knowledge can be used to implement sustainable practices that prioritize ecological balance and resource conservation, as the Sougb Tribe does.

On the contrary, despite the potential benefits, integrating local wisdom into regional development faces several hurdles. A significant challenge is the lack of formal recognition and documentation of traditional knowledge, which is often passed down through oral tradition. For example, the consequences of social dynamics, including the tribal system and leadership authority, can change (Ungirwalu et al., 2025), leading to a disconnect between local practices and scientific methodologies. Additionally, rapid urbanization and globalization threaten to erode traditional lifestyles, making it challenging for younger generations to connect with their cultural heritage (Tang & Gavin, 2016; Lhoest et al., 2020). Another challenge is the potential misalignment between local practices and national or international conservation goals. While local wisdom emphasizes sustainability, it may not always align with standardized approaches established by global agreements.

To effectively incorporate local wisdom into regional development plans in Teluk Bintuni District, a collaborative and inclusive approach is essential. Here are several strategies that can facilitate this integration, as outlined in the following statements. Participatory decision-making, involving local communities in the planning and implementation of forest conservation projects, is crucial. Engaging community leaders and stakeholders ensures that traditional knowledge is respected and incorporated into decision-making processes, fostering a sense of ownership and accountability. Documentation and research are crucial, as systematically documenting traditional practices and their ecological benefits is vital. Collaborations between researchers, local communities, and NGOs can help bridge the gap between traditional knowledge and scientific understanding, creating valuable resources for policymakers. Education and capacity building are essential, as they involve educating both local communities and government officials about the value of traditional knowledge. Capacity-building programs can empower communities to adapt their practices while preserving their cultural heritage, and training policymakers can enhance their understanding of local wisdom. Policy integration, as it relates to regional development plans, should explicitly incorporate provisions for utilizing local wisdom in forest conservation. This may involve revising land-use policies, providing incentives for sustainable practices, or creating legal frameworks that recognize and protect traditional knowledge systems. Promoting sustainable livelihoods by supporting alternative livelihoods that are both proper and culturally appropriate can help alleviate the economic pressures driving deforestation. Initiatives such as ecotourism, non-timber forest product harvesting, and community-based forestry can generate income while conserving forest ecosystems. Regular monitoring, as well as evaluation, is crucial for assessing the effectiveness of integrating local wisdom into conservation efforts.

The Sougb Tribe is one of the tribes in Papua that practices traditional knowledge, particularly in the management natural resources likes forests. Nowadays, this tribe still holds the belief that forests are integral to their livelihood, providing essential needs such as food and medicine. This condition supports the understanding of how forests as ecosystem services benefit local people. Then, by utilizing the traditional knowledge of the Sougb Tribe to manage forest utilization, it can be integrated into government programs. Hence, it is necessary to study more about its culture, and then conserving the socio-cultural aspects of the Sougb Tribe could have a positive impact on the conservation of forests, benefiting both cultural and ecological features. As we can make the slogan "buy one get more", meaning that "buy one" is the program of the socio-cultural aspect, then "get more" is the benefit of that program resulting in local people managing wisely and conserving the forest as part of natural resources, or in other words, the conservation of the Sougb Culture supports conservation of the nature. Thus, the local district has been involved in recognizing the customary rights of seven tribes, and it should intensify its documentation of traditional knowledge over time and record it in official records during the development process. Incorporating traditional knowledge into forest management is crucial for developing sustainable programs that respect local

communities and their cultural values, as demonstrated in countries in Asia (Laumonier et al., 2008). Development initiatives can promote biodiversity, enhance ecosystem health, and ensure long-term ecological stability by understanding forest functions, which is crucial for forest resilience in the face of climate change (Charnley et al., 2007; Singh et al., 2018). Additionally, utilizing local knowledge fosters a balance between ecological protection and economic development, as traditional practices support sustainable harvesting of both timber and non-timber products, thereby strengthening local economies. Empowering communities through participatory management plans cultivates a sense of ownership and responsibility, ensuring that economic activities are culturally appropriate and socially just, ultimately leading to successful conservation and development outcomes.

Conclusion

The study of the Sougb Tribe reveals the intricate relationship between their socio-cultural practices and forest management, emphasizing the tribe's reliance on traditional agriculture, sacred beliefs, and hunting methods. Their deep-rooted connection to the forest is not only vital for their livelihood but also offers ecological benefits, showcasing the importance of local knowledge in conservation efforts. The tribe's traditional practices can significantly enhance government conservation programs by fostering community engagement and aligning development initiatives with local needs. However, challenges such as inadequate recognition of local wisdom, urbanization, and potential conflicts with broader conservation goals hinder effective integration. To overcome these obstacles, a collaborative approach is essential, incorporating participatory decision-making, systematic documentation, and capacity building. By recognizing and valuing the tribe's cultural heritage, regional development can promote inclusivity and sustainability while preserving ecological integrity. Ultimately, integrating local wisdom into policy planning and implementation supports the conservation of forests and enriches the cultural landscape, ensuring that both the environment and the tribe's identity thrive together. This holistic approach can lead to innovative solutions that benefit both the community and the ecosystem, underscoring the importance of a balanced relationship between development and conservation.

Acknowledgment

We thank Siprianus Manibuy (*Kepala UPTD Kesatuan Pengelolaan Hutan Produksi Unit XV Bintuni, Dinas Kehutanan Provinsi Papua Barat*) and Yoris Saiba (*Dinas Lingkungan Hidup Kabupaten Manokwari Selatan*) for giving the permit and fruitful information. We are also grateful to the anonymous reviewer(s) for improving the manuscript.

References

Asmuruf, A., Holle, Y., Murdjoko, A., Benu, N., & Djitmau, D. (2024). Species richness and diversity of Klawalu Mangrove, Doberai Peninsula, Indonesian New Guinea. *Annals of Silvicultural Research*, *49*(2), 44–52. https://doi.org/https://doi.org/10.12899/asr-2483

Benner, J., Nielsen, J., & Lertzman, K. (2021). Using traditional ecological knowledge to understand the diversity and abundance of culturally important trees. *Journal of Ethnobiology*, *41*(2), 209–228. https://doi.org/10.2993/0278-0771-41.2.209

Cámara-Leret, R., Paniagua-Zambrana, N., Balslev, H., Barfod, A., Copete, J. C., & Macía, M. J. (2014). Ecological community traits and traditional knowledge shape palm ecosystem services in northwestern South America. *Forest Ecology and Management*, *334*, 28–42. https://doi.org/10.1016/j.foreco.2014.08.019

Cámara-Leret, R., Schuiteman, A., Utteridge, T., Bramley, G., Deverell, R., Fisher, L. A., McLeod, J., Hannah, L., Roehrdanz, P., Laman, T. G., Scholes, E., de Fretes, Y., & Heatubun, C. (2019). The Manokwari declaration: Challenges ahead in conserving 70% of Tanah Papua's forests. *Forest and Society*, *3*(1), 148–151. https://doi.org/10.24259/fs.v3i1.6067

Carrasco, L. R., Nghiem, T. P. L., Sunderland, T., & Koh, L. P. (2014). Economic valuation of ecosystem services fails to capture biodiversity value of tropical forests. *Biological Conservation*, *178*, 163–170. https://doi.org/10.1016/j.biocon.2014.08.007

Castleden, H., Garvin, T., & First Nation, H. (2008). Modifying photovoice for community-based participatory Indigenous research. *Social Science and Medicine*, *66*(6), 1393–1405. https://doi.org/10.1016/j.socscimed.2007.11.030

Charnley, S., Fischer, A. P., & Jones, E. T. (2007). Integrating traditional and local ecological knowledge into forest biodiversity conservation in the Pacific Northwest. *Forest Ecology and Management*, *246*, 14–28. https://doi.org/10.1016/j.foreco.2007.03.047

de Wilde de Ligny, H. J., Moll, H. W., & Vollema, J. S. (1963). Experiences with hevea rubber in West New Guinea. *Netherlands Journal of Agricultural Science*, *11*(4), 237–249. https://doi.org/10.18174/njas.v11i4.17540

Dirhamsyah. (2013). The community-based and co-management concept for coral reef management in the Raja Ampat Islands. *Australian Journal of Maritime and Ocean Affairs*, *5*(2), 65–73. https://doi.org/10.1080/18366503.2013.10815734

Fatem, S. M., Awang, S. A., Pudyatmoko, S., Sahide, M. A. K., Pratama, A. A., & Maryudi, A. (2018). Camouflaging economic development agendas with forest conservation narratives: A strategy of lower governments for gaining authority in the re-centralising Indonesia. *Land Use Policy*, *78*, 699–710. https://doi.org/10.1016/j.landusepol.2018.07.018

Fatem, S. M., Runtuboi, Y. Y., Fisher, M. R., Sufi, Y., Maryudi, A., & Sirimorok, N. (2023). Conservation policy, indigeneity, and changing traditional hunting practices in West Papua. *Forest and Society*, *7*(2),

359–379. https://doi.org/10.24259/fs.v7i2.27420

Fraser, J. A., Diabaté, M., Narmah, W., Beavogui, P., Guilavogui, K., de Foresta, H., & Junqueira, A. B. (2016). Cultural valuation and biodiversity conservation in the Upper Guinea forest, West Africa. *Ecology and Society*, *21*(3). https://doi.org/10.5751/ES-08738-210336

Gaveau, D. L. A., Santos, L., Locatelli, B., Salim, M. A., Husnayaen, H., Meijaard, E., Heatubun, C., & Sheil, D. (2021). Forest loss in Indonesian New Guinea (2001–2019): Trends, drivers and outlook. *Biological Conservation*, *261*, Article 109225. https://doi.org/10.1016/j.biocon.2021.109225

Goodman, L. A. (1961). Snowball sampling. *The Annals of Mathematical Statistics*, *32*(1), 148–170. https://doi.org/10.1214/aoms/1177705148

Haile, A. A., Seid, A., Mekonnen, A. B., Wassie, W. A., Yemata, G., Yihune, E., & Mekuriaw, A. (2025). Human disturbances and their impact on woody species diversity in sacred church forests in West Gojjam Zone, Northwestern Ethiopia. *Trees, Forests and People*, *19*, Article 100776. https://doi.org/10.1016/j.tfp.2025.100776

Heads, M. (2001). Birds of paradise, biogeography and ecology in New Guinea: A review. *Journal of Biogeography*, *28*(7), 893–925. https://doi.org/10.1046/j.1365-2699.2001.00600.x

Jackson, C. M., Durowoju, O. S., Adelabu, S. A., & Adeniyi, S. A. (2025). An assessment of Kenya's forest policy and law on participatory forest management for sustainable forest management: Insights from Mt. Kenya Forest Reserve. *Trees, Forests and People*, *19*, Article 100770. https://doi.org/10.1016/j.tfp.2024.100770

Jenkins, D. (2022). Traditional ecological knowledge. In *Nature and bureaucracy* (pp. 222–233). Routledge. https://doi.org/10.4324/9781003297444-13

Joa, B., Winkel, G., & Primmer, E. (2018). The unknown known–A review of local ecological knowledge in relation to forest biodiversity conservation. *Land Use Policy*, *79*, 520–530. https://doi.org/10.1016/j.landusepol.2018.09.001

Kasihiw, P., Bawole, R., Marwa, J., Murdjoko, A., Wihyawari, A., Heipon, Y., Cabuy, R. L., Benu, N. M. H., & Hematang, F. (2023). Floristic richness and diversity of Bintuni mangrove, Bird's Head Peninsula, West Papua, Indonesia. *Biodiversitas Journal of Biological Diversity*, *24*(5), 2887–2897. https://doi.org/10.13057/biodiv/d240543

Kasihiw, P., Bawole, R., Marwa, J., Murdjoko, A., Wihyawari, A., Heipon, Y., Cabuy, R. L., Benu, N. M. H., Hematang, F., & Leftungun, N. Y. (2024). Mangrove distribution to support biodiversity management in Teluk Bintuni District, West Papua, Indonesia. *Biodiversitas, Journal of Biological Diversity*, *25*(2), 644–653. https://doi.org/10.13057/biodiv/d250223

Kik, A., Adamec, M., Aikhenvald, A. Y., Bajzekova, J., Baro, N., Bowern, C., Colwell, R. K., Drozd, P., Duda, P., Ibalim, S., Jorge, L. R., Mogina, J., Ruli, B., Sam, K., Sarvasy, H., Saulei, S., Weiblen, G. D., Zrzavy, J., & Novotny, V. (2021). Language and ethnobiological skills decline precipitously in Papua New Guinea, the world's most linguistically diverse nation. *Proceedings of the National Academy of Sciences*, *118*(22), Article e2100096118. https://doi.org/10.1073/pnas.2100096118

Klanderud, K., Mbolatiana, H. Z. H., Vololomboahangy, M. N., Radimbison, M. A., Roger, E., Totland, Ø., & Rajeriarison, C. (2010). Recovery of plant species richness and composition after slash-and-burn agriculture in a tropical rainforest in Madagascar. *Biodiversity and Conservation*, *19*(1), 187–204. https://doi.org/10.1007/s10531-009-9714-3

Kukla, J., Whitfeld, T., Cajthaml, T., Baldrian, P., Veselá-Šimáčková, H., Novotný, V., & Frouz, J. (2019). The effect of traditional slash-and-burn agriculture on soil organic matter, nutrient content, and microbiota in tropical ecosystems of Papua New Guinea. *Land Degradation and Development*, *30*(2), 166–177. https://doi.org/10.1002/ldr.3203

Laumonier, Y., Bourgeois, R., & Pfund, J. L. (2008). Accounting for the ecological dimension in participatory research and development: Lessons learned from Indonesia and Madagascar. *Ecology and Society*, *13*(1), Article 15. https://doi.org/10.5751/ES-02384-130115

Laurance, W. F. (2015). Emerging threats to tropical forests. *Annals of the Missouri Botanical Garden*, *100*(3), 71–79. https://doi.org/10.1007/978-1-4614-7161-5_5

Legra, L., Li, X., & Peterson, A. T. (2008). Biodiversity consequences of sea level rise in New Guinea. *Pacific Conservation Biology*, *14*(3), 191–199. https://doi.org/10.1071/PC080191

Lhoest, S., Fonteyn, D., Daïnou, K., Delbeke, L., Doucet, J. L., Dufrêne, M., Josso, J. F., Ligot, G., Oszwald, J., Rivault, E., Verheggen, F., Vermeulen, C., Biwolé, A., & Fayolle, A. (2020). Conservation value of tropical forests: Distance to human settlements matters more than management in Central Africa. *Biological Conservation*, *241*, Article 108351. https://doi.org/10.1016/j.biocon.2019.108351

Marwa, J., Ungirwalu, A., Imburi, C. S., Djitmau, D. A., Murdjoko, A., & Benu, N. M. H. (2024). Ecological perspective to sustainably manage the secondary forest in the lowland of Doberai Peninsula, Indonesia.

Biodiversitas, *25*(8), 2720–2732. https://doi.org/10.13057/biodiv/d250845

Maryudi, A., & Fisher, M. (2020). The power in the interview: A practical guide for identifying the critical role of actor interests in environment research. *Forest and Society*, *4*(1), 142–150. https://doi.org/10.24259/fs.v4i1.9132

Murdjoko, A., Brearley, F. Q., Ungirwalu, A., Djitmau, D. A., & Benu, N. M. H. (2022). Secondary succession after slash-and-burn cultivation in Papuan lowland forest, Indonesia. *Forests*, *13*(3), Article 434. https://doi.org/10.3390/f13030434.

Murdjoko, A., Djitmau, D. A., Sirami, E. V., Siburian, R. H. S., Ungirwalu, A., Mardiyadi, Z., Wanma, J. F., Mofu, W. Y., Marwa, J., Susanti, C. M. E., Tokede, M. J., Imburi, C. S., Sagrim, M., Mamboai, H., Sonbait, L. Y., Dwiranti, F., Salosa, Y. Y., Paembonan, J. B., Wiradyo, E. T., …, & Saragih, A. S. B. (2021a). Tree species diversity of Pegunungan Bintang, Papua, Indonesia as potency of wood supply. *Biodiversitas*, *22*(12), 5665–5675. https://doi.org/10.13057/biodiv/d221263

Murdjoko, A., Djitmau, D. A., Ungirwalu, A., Sinery, A. S., Herlina, R., Siburian, S., Mardiyadi, Z., Wanma, A. O., Wanma, J. F., Rumatora, A., Mofu, W. Y., Worabai, D., May, N. L., Jitmau, M. M., Alexander, G., Mentansan, F., Krey, K., Musaad, I., Manaf, M., …, & Kuswandi, R. (2021b). Pattern of tree diversity in lowland tropical forest in Nikiwar, West Papua, Indonesia. *Dendrobiology*, *85*, 78–91. https://doi.org/10.12657/denbio.085.008

Murdjoko, A., Marsono, D., Sadono, R., & Hadisusanto, S. (2017). Recovery of residual forest ecosystem as an impact of selective logging in South Papua: An ecological approach. *Biotropia*, *24*(3), 230–245. https://doi.org/10.11598/btb.2017.24.3.732

Murdjoko, A., Ungirwalu, A., Mardiyadi, Z., Tokede, M. J., Djitmau, D. A., & Benu, N. M. H. (2021c). Floristic composition of *Buah Hitam* habitats in lowland tropical mixed forest of West Papua, Indonesia. *Floresta e Ambiente*, *28*(3), Article e20210042. https://doi.org/10.1590/2179-8087-floram-2021-0042

Nzau, J. M., Gosling, E., Rieckmann, M., Shauri, H., & Habel, J. C. (2020). The illusion of participatory forest management success in nature conservation. *Biodiversity and Conservation*, *29*(6), 1923–1936. https://doi.org/10.1007/s10531-020-01954-2

Parrotta, J. A., & Agnoletti, M. (2007). Traditional forest knowledge: Challenges and opportunities. *Forest Ecology and Management*, *249*(1–2), 1–4. https://doi.org/10.1016/j.foreco.2007.05.022

Parsch, C., Wagner, B., Pangau-Adam, M., Nitschke, C. R., Kreft, H., & Schrader, J. (2022). Papua at the Crossroads: A plea for systematic conservation planning in one of the largest remaining areas of tropical rainforest. *Frontiers in Forests and Global Change*, *5*, Article 763131. https://doi.org/10.3389/ffgc.2022.763131

Pattiselanno, F., Apituley, J. R. M., Arobaya, A. Y. S., & Koibur, J. F. (2019). Short communication: Using wildlife for local livelihood-Experiences from the bird's head Peninsula, West Papua, Indonesia. *Biodiversitas*, *20*(7), 1839–1845. https://doi.org/10.13057/biodiv/d200708

Pattiselanno, F., & Krockenberger, A. (2021). Road development and indigenous hunting in tanah papua: Connecting the facts for future wildlife conservation agendas. *Forest and Society*, *5*(1), 181–189. https://doi.org/10.24259/fs.v5i1.12528

Pattiselanno, F., & Lubis, M. I. (2014). Hunting at the Abun regional marine protected areas: A link between wildmeat and food security. *HAYATI Journal of Biosciences*, *21*(4), 180–186. https://doi.org/10.4308/hjb.21.4.180

Peterson, D., Hanazaki, N., & Li, F. (2019). Understanding canoe making as a process of preserving cultural heritage. *Ethnobiology Letters*, *10*(1), 59–68. https://doi.org/10.14237/ebl.10.1.2019.1363

Ruinard, J. (1964). Cocoa research in West Irian (West New Guinea). *Netherlands Journal of Agricultural Science*, *12*(2), 89–112. https://doi.org/10.18174/njas.v12i2.17525

Rumayomi, N. A. A., Murdjoko, A., Ungirwalu, A., Mulyadi, M., & Benu, N. M. H. (2024). Species richness and diversity in secondary lowland forest, Bintuni, Bird's Head Peninsula, West Papua, Indonesia. *Jurnal Manajemen Hutan Tropika*, *30*(2), 295–304. https://doi.org/10.7226/jtfm.30.2.295

Sagrim, M. (2022). Traditional knowledge of land management in Maybrat District, West Papua Province, Indonesia: Implication for agriculture development. *Biodiversitas*, *23*(8), 4144–4151. https://doi.org/10.13057/biodiv/d230836

Saiba, Y., Ungirwalu, A., Murdjoko, A., Brearley, F. Q., Peday, M. H., Yowei, R. N., Imburi, C. S., Runtuboi, Y. Y., Djitmau, D. A., & Sa'diyah, S. H. (2023). Ethnobotany and conservation applications in the Noken making by the Sougb Tribe of West Papua, Indonesia. *Biodiversitas*, *24*(8), 4577–4583. https://doi.org/10.13057/biodiv/d240861

Sillanpää, M., Vantellingen, J., & Friess, D. A. (2017). Vegetation regeneration in a sustainably harvested mangrove forest in West Papua, Indonesia. *Forest Ecology and Management*, *390*, 137–146. https://doi.org/10.1016/j.foreco.2017.01.022

Singh, R. K., Hussain, S. M., Riba, T., Singh, A., Padung,

E., Rallen, O., Lego, Y. J., & Bhardwaj, A. K. (2018). Classification and management of community forests in Indian Eastern Himalayas: implications on ecosystem services, conservation and livelihoods. *Ecological Processes*, *7*(1). https://doi.org/10.1186/s13717-018-0137-5

Sonbait, L. Y., Manik, H., Warmetan, H., Wambrauw, Y. L. D., Sagrim, M., Djitmau, D. A., Wanggai, J., Rettob, B. B., & Murdjoko, A. (2021). The natural resource management to support tourism: A traditional knowledge approach in Pegunungan Arfak Nature Reserve, West Papua, Indonesia. *Biodiversitas Journal of Biological Diversity*, *22*(10), 4466–4474. https://doi.org/10.13057/biodiv/d221040

Tang, R., & Gavin, M. C. (2016). A classification of threats to traditional ecological knowledge and conservation responses. *Conservation and Society*, *14*(1), 57–70. https://doi.org/10.4103/0972-4923.182799

Tawer, P., Maturbongs, R., Murdjoko, A., Jitmau, M., Djitmau, D., Siburian, R., Ungirwalu, A., Wanma, A., Mardiyadi, Z., Wanma, J., Rumatora, A., Mofu, W., Sinery, A., Fatem, S., Benu, N., Kuswandi, R., Lekitoo, K., Khayati, L., & Tambing, J. (2021). Vegetation dynamic post-disturbance in tropical rain forest of bird's head peninsula of West Papua, Indonesia. *Annals of Silvicultural Research*, *46*(1), 48–58. https://doi.org/10.12899/ASR-2145

Ungirwalu, A., Awang, S. A., Suryanto, P., & Maryudi, A. (2019). Small scale ecology and society: Forest-culture of Papua Nutmeg. *Jurnal Ilmu Kehutanan*, *13*, 114–126.

Ungirwalu, A., Mansoben, J. R., Runtuboi, Y. Y., Fatem, S. M., Peday, M. H., Marwa, J., & Maryudi, A. (2025). The fall of the kings: Power relations and dynamics in Papua's indigenous community in forest resource management. *Forest Policy and Economics*, *172*, Article 103424. https://doi.org/10.1016/j.forpol.2025.103424