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Plant species composition and diversity in traditional agroforestry landscapes on Siberut Island, West Sumatra, Indonesia

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Abstract. *Indra G, Mukhtar E, Syamsuardi, Chairul, Mansyurdin. 2024. Plant species composition and diversity in traditional agroforestry landscapes on Siberut Island, West Sumatra, Indonesia*. *Biodiversitas 25: 1286-1296.* The research conducted on Siberut Island, situated in the western part of Sumatra, focuses on traditional communities practicing an agroforestry land management system. This study aimed to identify the plant species within agroforestry land, their respective uses, and techniques for adapting these species to the landscape in two villages, Matotonan in South Siberut District and Bojakan in North Siberut District, Mentawai Islands. Data collection involved direct observation, unstructured interviews for plant species utilization, and transects with a 10m width along contour lines for landscape data. The findings revealed that Siberut's traditional agroforestry land, known as "Pomunean," is divided into Tinugglu and Mone categories based on land slope, proximity to riverbanks, and planted species. Plant species in agroforestry land served nine primary purposes, including staple and additional food, construction, furniture, medicine, firewood, traditional rituals, and commercial activities. Tinugglu land exhibited a higher Landscape Utilization Value Index (LUVI) at 57% compared to Mone land (43%). Regarding specific plant types, *Metroxylon sago* (Bojakan) and *Durio zybethinus* (Matotonan) had the highest LUVI values. These findings shed light on the vital role that traditional ecological knowledge and sustainable land management play in maintaining the delicate balance between human livelihoods and the preservation of natural ecosystems.

Keywords: Ethnobotany, landscape adaptation, land management, sustainable agriculture, traditional ecological knowledge

INTRODUCTION

In light of the current ecological crisis, the relationship between land use and biodiversity has become a central concern in landscape planning, ecosystem management, and ecological restoration. Agroforestry systems, found in various biogeographic regions and managed in different ways, have consistently shown high levels of biodiversity (Baliton et al. 2020). According to research, one factor influencing this biodiversity is agroforestry's structural complexity compared to traditional agricultural systems. Trees are crucial for terrestrial ecosystems, and forests offer various benefits to both rural and urban communities. When forests are cleared for development or agriculture, these benefits can be sustained by integrating trees into agricultural systems, a practice known as agroforestry (Pantera et al. 2021). Agroforestry has been used worldwide since early human development as a sustainable land use practice (Purnawan et al. 2021; Santos et al. 2022).

Agroforestry is a unique land-use approach that creates forest-like structures and incorporates diverse plant species to optimize growth. It aims to maximize positive interactions while minimizing negative ones among trees, crops, and animals within a single land management unit. This practice offers numerous advantages, including enhanced soil fertility, extended harvest seasons, improved product quality, and increased income (Molla et al. 2023). Agroforestry systems contribute to higher productivity, biodiversity, and social, economic, and ecological benefits than conventional agriculture and forest tree production. They also have the potential to maintain greater levels of biodiversity and biomass, addressing challenges related to land use change and food security (Yasin et al. 2023).

Traditional agroforestry, practiced for centuries across diverse cultures worldwide, has been instrumental in sustaining rural livelihoods, ensuring food security, and maintaining ecosystem stability. Despite the prominence of modern agricultural methods, traditional agroforestry remains of immense ecological and socio-economic importance. These time-tested systems blend specialized knowledge and skills, using trees as sources of products and environmental benefits within a sustainable rural production approach (Molla and Kewessa 2015). Recent scientific data increasingly supports the benefits associated with agroforestry, confirming its role in providing ecosystem services and economic benefits within multifunctional landscapes (Wondimenh 2023).

Social forestry programs are one of the Indonesian Government’s measures addressing forest management. The programs are carried out through rehabilitation activities applying several techniques, such as agroforestry, continuous assistance, and institutional development of social forestry groups (Nurbaya et al. 2022). Traditional forestry practices are multifaceted and contribute to biodiversity and ecological health through controlled burning, pest management, genetic diversity promotion, landscape connectivity enhancement, and cultural significance. Biodiversity in traditional agroforestry practices encompasses the diversity of life forms within integrated farming systems, positively impacting

biodiversity (Baliton et al. 2020). These holistic approaches create interconnected ecosystems, supporting various species and genetic diversity while preserving cultural and ecological heritage. Traditional agroforestry provides benefits such as enhanced biodiversity, carbon sequestration, and resilience to environmental changes, making it relevant and valuable in contemporary sustainable agriculture (Nath et al. 2021; Vyamana et al. 2023).

Siberut Island, located 100 km west of Padang and divided by the Mentawai Strait, has distinct natural and cultural features as a result of its long isolation. The Mentawai Islands' unique evolutionary process has resulted from their isolation from Sumatra, influencing their flora and fauna. Siberut's land and forest use patterns are therefore very different from those of other areas. The island's traditional society notably differs from conventional farming and fishing methods. Their means of subsistence instead depends on harvesting forest resources. This research aims to document the variety of plant species found on Siberut Island, clarify the advantages of each kind, and examine the land-cover patterns of these traditional communities.

MATERIALS AND METHODS

Study area

The research was carried out in two villages in the interior of Siberut Island, including Matotonan Village, South Siberut District (01°33'13" S, 099°01'14" E, 44-60 m above sea level) and Bojakan Village, North Siberut District (01°14'44" S, 098°52'56" E; 22-136 m above sea level), Mentawai Islands District, West Sumatra, Indonesia. Both villages directly border the Siberut National Park which is also a buffer zone for the National Park. The agroforestry landscape in Siberut Island features riverbanks with steep gradients, with heights reaching up to nine meters from the river's surface. This variation is a result of the highly fluctuating river water levels.

Procedures

The aspects studied are the diversity of plant species in traditional agroforestry land as well as its benefits and patterns of adapting planting species to topography (landscape). Biodiversity data was collected by direct observation of the community's traditional agroforestry lands at the research location (Rugayah et al. 2004). Each landscape type encountered is collected and identified. The plants were classified according to their species, habits, and other characteristics, including whether they were planted or growing naturally and the social advantages they provided. The plants were classified according to their species, habits, and other characteristics, including whether they were planted or growing naturally and the social advantages they provided.

Data collection on the use of plant species found in agroforestry land was carried out by conducting unstructured interviews with traditional communities from various circles and professions. Siberut Island has a hilly and riverine terrain. Most of the region is most likely steep in terrain, and the island is dotted with rivers that provide drainage patterns and impact the local ecology. To collect landscape data, transects with a width of 10 m were made in the direction of cutting contour lines starting from the river bank to the forest boundary. In the transect, a sub-plot with a size of 10x10 meters is created. In each plot, the data parameters collected are in the form of the height of the location every 5 meters, the number of species is calculated, the position of the individual in the plot based on from the data, a profile diagram of the agroforestry land will be obtained (Chakkour et al. 2023).

Data analysis

Data analysis was carried out qualitatively and quantitatively. Quantitative analysis was carried out by calculating the Important Value Index (IVI), while quantitative analysis was carried out by calculating the Local User's Value Index (LUVI).

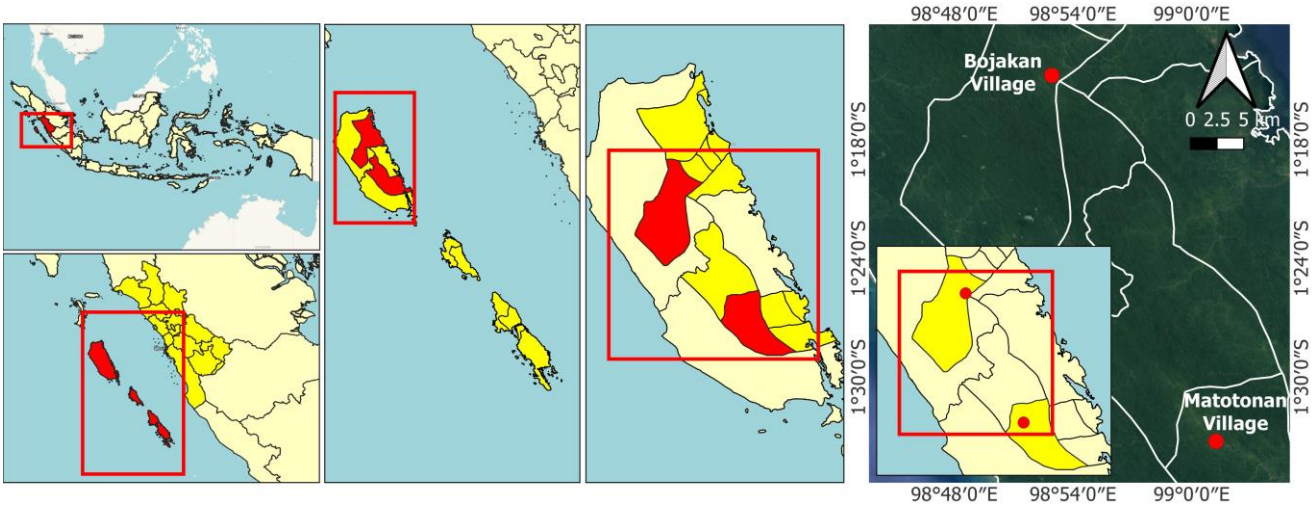

Figure 1. Research locations map in Siberut Islands, West Sumatra, Indonesia

The Importance Value Index (IVI) is a metric that defines a plant species' dominance or importance within a vegetation community. It was calculated as follows (Legendre and Legendre 2012):

Importance Value Index (IVI) = Relative density + Relative Dominance + Relative Frequency

The species indices diversity that showed the Diversity index values were calculated using the Shannon-Wiener Diversity Index (H') (Legendre and Legendre 2012):

$$H' = - \sum(Pi \times \log Pi)$$

Criteria for diversity index values are as follows: H'<1 (Low diversity), H' = 1-3 (Moderate diversity), H'>3 = High diversity (Chakkour et al. 2023).

Local User's Value Index (LUVI)

Interview data was collected and described descriptively to understand the ecological benefits of Pumonean land for the traditional community of Siberut. LUVI analysis includes importance values obtained from all PDM (Pebble Distribution Method) results based on land function, benefits, and the level of importance of each plant type.

This LUVI index value indicates the importance value of a plant species from the perspective and preferences of local people. It is analyzed using the formula as follow (Zenderland et al. 2019):

$$LUVI = Gij = \Sigma category = jGij = RWj \times Rwij$$

Where:
i : A species
j : A type of use
Gij : An individual value
RWj : The relative score given to the use of a plant as a food ingredient compared to other kinds of service
Rwij : The relative score for a food plant species compared to other food plant species

RESULTS AND DISCUSSION

Stand characteristics of traditional agroforestry

The indigenous Mentawai people of Siberut Island in Indonesia practice a traditional agroforestry land management system known as "Pumonean." This system involves the integration of various components, such as forest plants, agricultural crops, and commercial crops, within a landscape that preserves the essential functions and characteristics of the forest. The *Pumonean* land is divided into two types based on topography, *Tinugglu*, and *Mune*, as indicated in Figure 2 and Figure 3, which provide side view and top view profiles of the system. This sustainable and harmonious approach to land management reflects the deep connection between the Mentawai people and their natural environment, contributing to both their livelihoods and the conservation of the region's biodiversity.

Tinugglu land type is characterized by its location in relatively flat or marshy areas, typically situated right at the banks of the main river. This type of land is commonly used for the cultivation of vegetables, herbaceous plants, and other staple food crops. Additionally, people establish their residential houses and livestock shelters on Tinugglu land. Tinugglu land extends from flat terrains to positions near the river's edge. In areas with flat terrain, houses are often constructed on elevated platforms or stilts, as depicted in Figure 4A. This land use practice reflects a unique adaptation to the environmental conditions of riverside and marshy areas, where the risk of flooding is a significant concern.

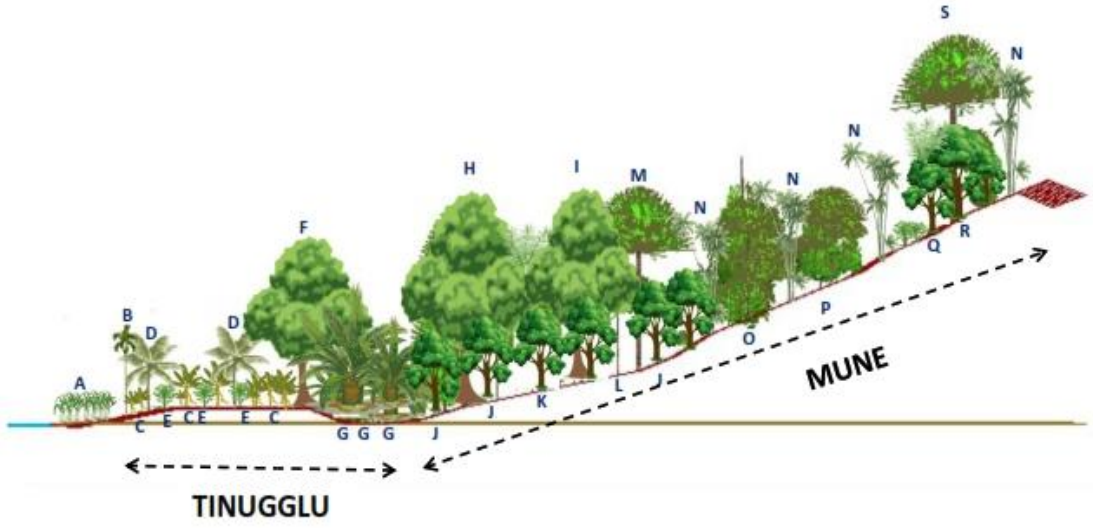

Figure 2. Side view profile diagram of Siberut Island Traditional Agroforestry, West Sumatra, Indonesia. Note: A. *Etlingera elatior*, G. *Metroxylon sagu*, M. *Shorea pauciflora*, B. *Areca catechu*, H. *Durio lowiyanus*, N. *Oncosperma tigilaria*, C. *Musa paradisiaca*, I. *Durio malaccensis*, O. *Artocarpus elasticus*, D. *Cocos nucifera*, J. *Baccaurea racemose*, P. *Polyalthia flagellaris*, E. *Theobroma cacao*, K. *Mangifera indica*, Q. *Eugenia cymosa*, F. *Durio zibethinus*, L. *Nephelium cuspidatum*, R. *Artocarpus integer*, S. *Dipterocarpus crinitus*

Table 1. Land type, slope and distance from the river of traditional agroforestry land on Siberut Island, West Sumatra, Indonesia

Land type	Slope (%)	Distance from the river (m)
River cliff	>45 (Very steep)	0-3
Flat dry land	0-8 (Flat)	4-35
Overdraft in the form of a swamp	8-15 (Sloping)	36-50
Sloping dry land	8-25 (gentle to slightly steep)	51-80
Steep dry land towards the top of the hill	20-40 (moderately steep to steep)	81-135

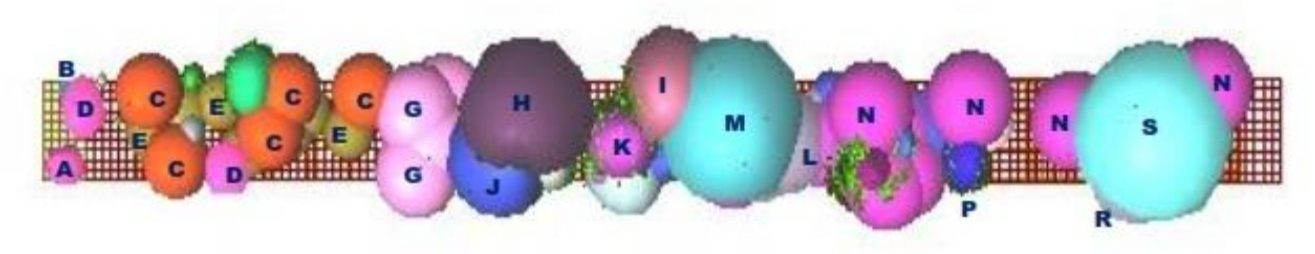

Figure 3. Top view profile diagram of traditional island community agroforestry. The abbreviation is the same as Figure 2

A **B**

Figure 4. A. Tinugglu type on traditional agroforestry land on Siberut Island, West Sumatra, Indonesia. B. Mune type on traditional agroforestry land

The *Mone* land type is situated on slopes extending to hilltops and tends to be relatively dry. Mone land is characterized by a mix of woody plants and palms, with a dominance of fruit-bearing trees and plants. This land type provides for various needs, including medicines, additional food sources (fruit), furniture, construction materials, and commercial crops. Mone land is typically found on moderately sloped to steep and hilly terrain, culminating at hill peaks, as indicated in Table 1.

Notably, not all native trees are cut down on this type of land, with valuable species allowed to grow. Mone represents a blend of domestication and semi-domestication, serving as a nexus of economic and cultural value. It boasts high biodiversity, with a vertical structure akin to that of mature secondary forests, featuring a dense canopy resembling a natural forest. The strategic placement of timber species on sloped land is a conservation effort. The "Mone" land type is depicted in Figure 4B. In essence, Mone land type showcases the sustainable and intricate relationship between the indigenous Mentawai people and their environment, encompassing a rich blend of economic, cultural, and ecological values.

Plant composition

The traditional agroforestry lands of Siberut Island are home to a remarkable diversity of plant species, ranging from wild shrubs, legumes, fruit-bearing plants, woody trees, to various palm species. The plant composition comprises a total of 63 different species found within the Tinugglu and Pumonean lands, belonging to 46 genera and 26 families. Out of these, 28 species, which accounts for 44.44% of the total, are cultivated plants, including both indigenous and introduced species, while the remaining 55.56% are wild plants that naturally thrive in these areas. A more detailed can be found in Table 2.

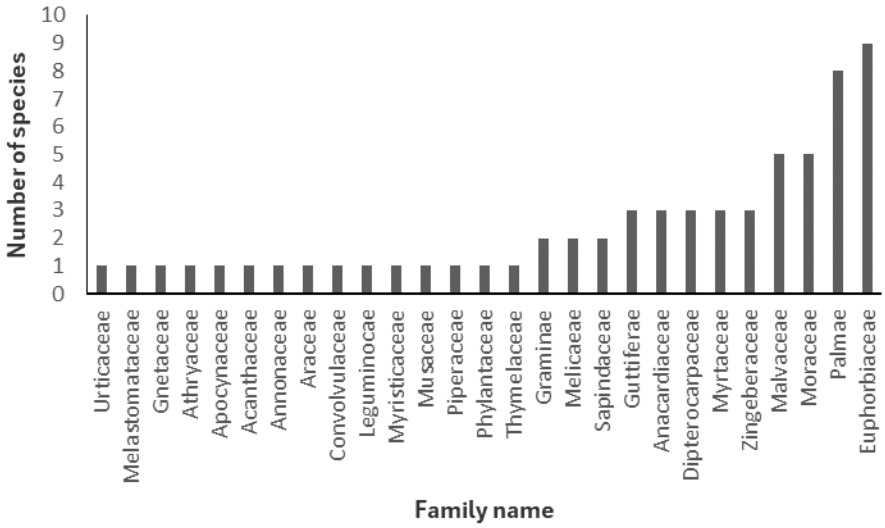

Figure 6. Number of species in each family found in siberut traditional agroforestry land

When considering the number of species within each plant family, it's worth noting that the Euphorbiaceae and Palmae families are the two families with the highest number of species. Following closely are the Leguminosae and Moraceae families, which also feature a significant diversity of plant species. This rich array of plant life within traditional agroforestry lands on Siberut Island demonstrates the intricate interplay between cultivated and wild plants, contributing to the sustainability and biodiversity of this unique ecosystem (Figure 6).

Vegetation structure

Based on the vegetation analysis of agroforestry lands in North Siberut, at the tree level, the species with the highest Importance Value Index (IVI) are staple food plants, specifically *Metroxylon sagu*, *Musa paradisiaca*, and *Durio lowiyanus* (refer to Figure 7). These plants are the dominant tree species within the agroforestry landscape. In addition to these staple food plants, there are also dominant palm species, such as *Oncosperma tigillaria* and *Arenga obtusifolia. Oncosperma tigillaria* grows in the form of large clumps and is extensively utilized for both construction and household furniture.

To elaborate further, here is a breakdown of the significant findings: (i) Staple Food Plants: *Metroxylon sagu, Musa paradisiaca* (banana or plantain), and *Durio lowiyanus* (a type of durian) are identified as the most significant tree species. These plants play a crucial role in providing essential food resources to the local community, reflecting their importance in the traditional diet and livelihood of the people. (ii) Dominant Palm Species: *Oncosperma tigillaria* and *Arenga obtusifolia* are prevalent palm species within the agroforestry system. *Oncosperma tigillaria* is particularly noteworthy for its large clumping growth pattern, making it a valuable resource for constructing homes and crafting household furniture. This underscores the multi-purpose nature of these palm species in the daily life of the indigenous communities.

These findings highlight the ecological and cultural significance of these tree species in the traditional agroforestry practices of North Siberut. The prominence of staple food plants and the versatile use of palm species underline the sustainability and richness of this unique agroforestry system in supporting both the livelihoods and the environment of the region.

The vegetation analysis of agroforestry lands in two different areas, Bojakan in North Siberut and Matotona in South Siberut, (Figure 7) reveals distinct dominant tree species and their uses:

Bojakan, North Siberut: Staple Food Plants: In Bojakan, North Siberut, the tree level is primarily dominated by essential staple food plants. *Metroxylon sagu* has the highest Importance Value Index (IVI) at 55.12%, followed by *Musa paradisiaca* (banana or plantain) with an IVI of 28.86%, and *Durio lowiyanus* with an IVI of 22.27%. Dominant Palm Species: Other prominent tree species include palm trees, particularly *Oncosperma tigillaria* with an IVI of 45.71% and *Arenga obtusifolia* with an IVI of 28.4%. *Oncosperma tigillaria* grows in large clumps and is left to thrive in the Pumonean land because it is widely used for construction and household furniture, emphasizing its multiple uses in the daily lives of the local community.

Matotona, South Siberut: Staple Food Plants: In Matotona, South Siberut, the tree structure is characterized by the dominance of staple food plants, similar to Pumonean land in North Siberut. *Metroxylon sagu* remains the most dominant species with an IVI of 64.93%. Other Dominant Species: Additional dominant species in this area include *D. zibethinus* (durian), Tok tuk *Durio lowiyanus*, and Peigu *Artocarpus integer*, with IVIs of 42.31%, 38.99%, and 27.31%, respectively.

Table 2. Plant composition in traditional agroforestry on Siberut Island, West Sumatra, Indonesia

Species	Family	Local name	Main uses	Wild/cultivated
Graptophyllum pictum (L.) Griff.	Acanthaceae	*Aileleppet*	Medicine	Cultivated
Mangifera indica L.	Anacardiaceae	*Tambojo*	Fruit	Cultivated
Mangifera odorata Griff.	Anacardiaceae	*Abbangan*	Fruit	Cultivated
Camnosperma auriculatum (Blume) Hook.fil.	Anacardiaceae	*Tumu*	Construction	Wild
Polyalthia flagellaris (Becc.) Airy Shaw	Annonaceae	*Tengleu*	Construction	Wild
Alstonia spatulata Blume	Apocynaceae	*Gitte*	Construction	Wild
Colocasia esculenta (L.) Schott	Araceae	*Gettek*	Food	Cultivated
Diplazium esculentum (Retz.) Sw.	Athyriaceae	*Paku*	Food	Wild
Ipomoea batatas (L.) Lam.	Convolvulaceae	*Sipuseket*	Food	Cultivated
Hopea sangal Korth.	Dipterocarpaceae	*Karai*	Construction	Wild
Shorea pauciflora King	Dipterocarpaceae	*Katuka*	Construction	Wild
Dipterocarpus crinitus Dyer	Dipterocarpaceae	*Kokha*	Construction	Wild
Baccaurea racemosa (Reinw.) Müll.Arg.	Euphorbiaceae	*Kapundung*	Fruit	Cultivated
Baccaurea polyneura Hook.f.	Euphorbiaceae	*Elak Mata*	Fruit	Cultivated
Baccaurea glabrifolia Pax. & K.Hoffm.	Euphorbiaceae	*Ongang*	Fruit	Wild
Baccaurea parviflora (Müll.Arg.) Müll.Arg.	Euphorbiaceae	*Ololosit*	Construction	Wild
Codiaeum variegatum (L.) Rumph. ex A.Juss.	Euphorbiaceae	*Surak*	Ritual	Wild
Endospermum diadenum (Miq.) Airy Shaw	Euphorbiaceae	*Alibagbag*	Furniture	Wild
Glochidion sp.	Euphorbiaceae	*Onam Mamagri*	Arrow poison	Wild
Hancea griffithiana (Müll.Arg.) S.E.C.Sierra, Kulju & Welzen	Euphorbiaceae	*Ungla*	Construction	Cultivated
Manihot utilissima Pohl	Euphorbiaceae	*Gobi*	Fruit	Cultivated
Gnetum gnemon L.	Gnetaceae	*Bake/Tojet*	Food	Cultivated
Sacharum officinarum L.	Graminae	*Kole*	Food	Cultivated
Gigantochloa heterostachya Munro	Graminae	*Manggeak*	Food	Wild
Garcinia cowa Roxb.	Guttiferae	*Sangkla*	Fruit	Cultivated
Garcinia mangostana L.	Guttiferae	*Lakopak Sareu*	Fruit	Wild
Garcinia sp.	Guttiferae	*Lakopak*	Fruit	Wild
Archidendron ellipticum (Blume) I.C.Nielsen	Leguminosae	*Mamagri*	Medicine	Cultivated
Durio zibethinus Murray	Malvaceae	*Doriat*	Fruit	Cultivated
Durio carinatus Mast.	Malvaceae	*Tok tuk*	Fruit	Cultivated
Durio malaccensis Planch. ex Mast.	Malvaceae	*Kinoso*	Fruit	Wild
Pentace triptera Mast.	Malvaceae	*kaboi*	Construction	Cultivated
Theobroma cacao L.	Malvaceae	*Coklat*	Fruit	Wild
Melastoma malabathricum L.	Melastomataceae	*Eruk Teinu*	Medicine	Cultivated
Lansium parasiticum (Osbeck) K.C.Sahni & Bennet	Meliaceae	*Mabulu*	Fruit	Cultivated
Lansium parasiticum (Osbeck) K.C.Sahni & Bennet	Meliaceae	*Tolu Gokgok*	Fruit	Cultivated
Artocarpus integer (Thunb.) Merr.	Moraceae	*Peigu*	Fruit	Wild
Artocarpus elasticus Reinw. ex Blume	Moraceae	*Baiko*	Construction	Wild
Artocarpus lanceifolius Roxb.	Moraceae	*Tapeiki*	Construction	Wild
Ficus variegata Blume	Moraceae	*Karamangra*	Medicine	Wild
Ficus sp.	Moraceae	*Tepu Tepuk*	Medicine	Wild
Horsfieldia brachiata (King) Warb.	Myristicaceae	*Roan*	Construction	Cultivated
Eugenia sp.	Myrtaceae	*Kalumajak*	Firewood	Cultivated
Eugenia cymosa Sieber ex C.Presl, 1828	Myrtaceae	*Ribbu*	Firewood	Cultivated
Syzygium aqueum (Burm.fil.) Alston	Myrtaceae	*Jambu*	Fruit	Wild
Musa x paradisiaca L.	Musaceae	*Bago*	Fruit	Wild
Areca catechu L.	Palmae	*Pinang*	Construction	Cultivated
Areca sp.	Palmae	*Nempeu*	Construction	Wild
Arenga obtusifolia Mart.	Palmae	*Poula*	Furniture	Wild
Calamus manan Miq.	Palmae	*Bebegen*	Food	Cultivated
Calamus javensis Blume	Palmae	*Pelege*	Furniture	Wild
Cocos nucifera L.	Palmae	*Toitet*	Construction	Cultivated
Metroxylon sagu Rottb.	Palmae	*Sagu*	Food	Cultivated
Oncosperma tigillarium (Jack) Ridl.	Palmae	*Ariribuk*	Furniture	Wild
Piper aduncum L.	Piperaceae	-	Medicine	Wild
Aporosa sp.	Phyllanthaceae	*Sipuloi*	Firewood	Wild
Nephelium cuspidatum Blume	Sapindaceae	*Bailongkan*	Fruit	Cultivated
Nephelium sp.	Sapindaceae	*Para Batti*	Fruit	Wild
Aquilaria malaccensis Lam.	Thymelaeaceae	*Simoitek*	Construction	Cultivated
Elatostema repens (Lour.) Hallier fil.	Urticaceae	*Sireureu*	Medicine	Wild
Etlingera elatior (Jack) R.M.Sm.	Zingiberaceae	*Totonan*	Medicine	Wild
Hedychium coronarium J.Koenig	Zingiberaceae	*Simakaino*	Medicine	Wild
Globba sp.	Zingiberaceae	*Sikukuet*	Medicine	Wild

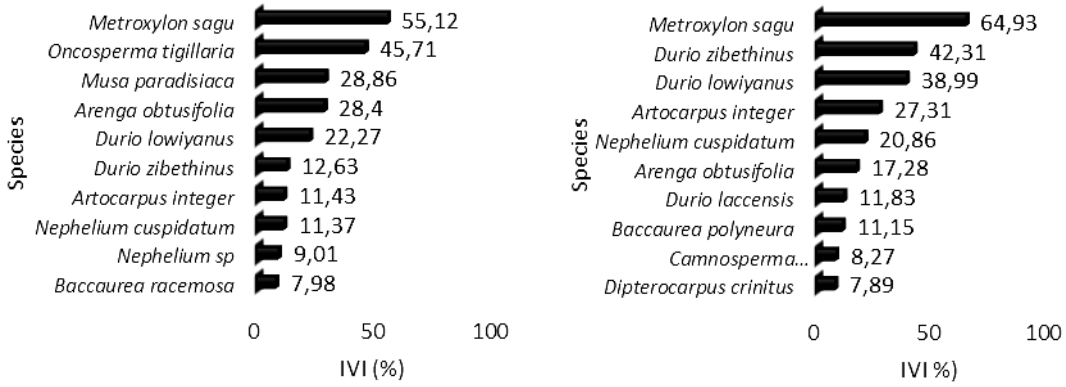

Figure 7. Important value index at tree level (dbh≥10 cm) on traditional agroforestry land in Siberut Island, West Sumatra, Indonesia. Bojakan (left) and Matotoba (right)

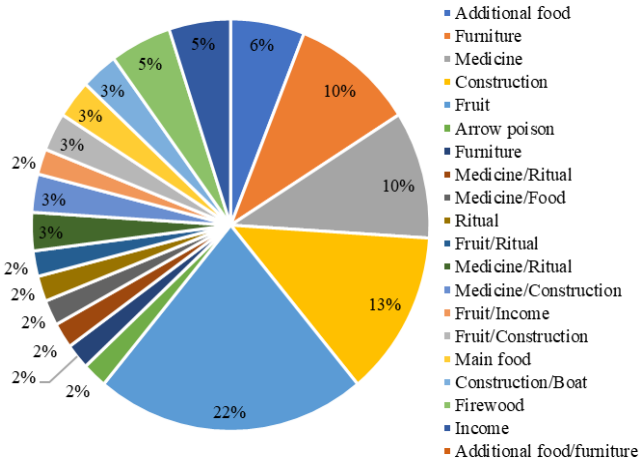

Figure 8. Percentage of plant type utilization on agroforestry land in Siberut Islands, West Sumatra, Indonesia

Utilization of plant species

In both Tinugglu and Pumonean lands, fruit-bearing trees are the most abundant, followed by plants used for medicinal purposes, staple foods, supplementary foods, construction materials, and ritualistic practices. Many of these tree species have dual functions; not only are their fruits consumed, but their wood is also utilized for construction, as well as for dietary and medicinal purposes. The detailed breakdown and utilization of plant species can be further explored in Figure 8. These findings highlight the central role of various tree species in supporting the diverse needs of the indigenous communities in these regions, emphasizing their rich and sustainable agroforestry practices. The placement of plant species in Tinugglu land is guided by traditional knowledge that has been passed down through generations. Herbaceous plant species are typically chosen for cultivation in Tinugglu land due to several key considerations.

Adaptability of herbaceous plants

Herbaceous plants are known for their flexibility, and they do not immediately wither or collapse during floods, which are a frequent occurrence with high fluctuations in this region. Even if these plants are uprooted or knocked over by floods, they don't significantly obstruct the river's transportation routes. This practice aligns with the concept of land conservation, as it helps maintain the stability of river flow.

Source of plant species

The plant species in agroforestry lands come from both cultivated and wild sources, including those that were naturally present in the area or grew wild. An analysis of these species reveals that 29 species (44%) are cultivated plants, while 36 species (56%) are wild plants.

Significance of fruit-bearing plants

Among the diverse plant species found, 17 species, accounting for 26.56% of the total, are fruit-bearing plants. Fruits are a fundamental component of the local diet on Siberut Island, alongside staples like sago and taro. Of these fruit-bearing plant species, 11 are the result of domestication from the island's native flora or are indigenous species. Preserving these native species and continuing their cultivation is a conservation effort aimed at safeguarding species diversity and preventing their extinction.

In essence, the selection of herbaceous plants in Tinugglu land is a practical response to the region's frequent floods and the need to maintain river stability. The presence of a variety of cultivated and wild species, including fruit-bearing plants, is not only essential for sustaining the local diet but also contributes to the conservation of native species and the preservation of biodiversity. This traditional approach to land use demonstrates the harmonious relationship between the indigenous communities and their environment on Siberut Island.

Local user's value index

Local User's Value Index (LUVI) is the relative importance of a species determined from the score given by the respondent for its use as a food source (compared to other use categories, such as medicinal plants, traditional and religious plants, etc.) and the score for the cultivated status (wild versus cultivated).

Table 3. Types of indigenous plants on traditional agroforestry land on Siberut Island, West Sumatra, Indonesia

Species	Local name	Location	
		Bojakan	Matotonan
Artocarpus integer (Thunb.) Merr.	*Peigu*	+	+
Baccaurea polyneura Hook.f.	*Elak Mata*	+	+
Durio malaccensis Planch. ex Mast.	*Kinoso*	+	+
Durio lowianus Scort. ex King	*Tok Tuk*	+	+
Garcinia sp.	*Lakopak*	+	+
Lansium parasiticum (Osbeck) K.C.Sahni & Bennet	*Seccet*	+	+
Lansium parasiticum (Osbeck) K.C.Sahni & Bennet	*Telu Toru Gokgok*	+	+
Mangifera indica L.	*Tambojo*	+	-
Nephelium cuspidatum Blume	*Bailongkan*	+	+
Nephelium sp.	*Para Batti*	-	+

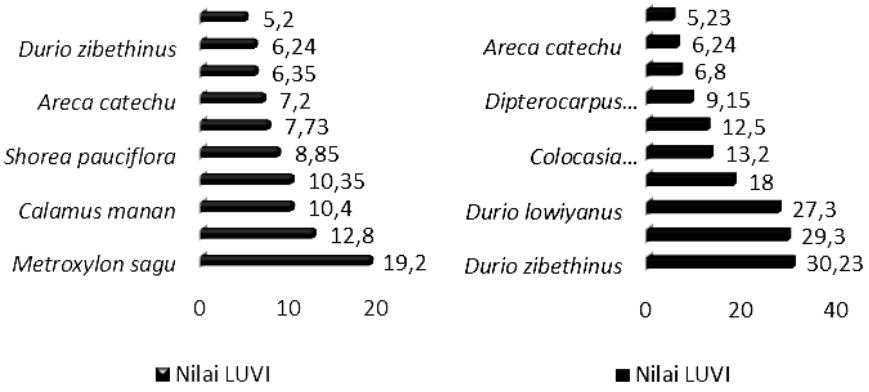

Figure 9. LUVI on traditional agroforestry land in Siberut Island, West Sumatra, Indonesia. Bojakan (left) and Matotonan (right)

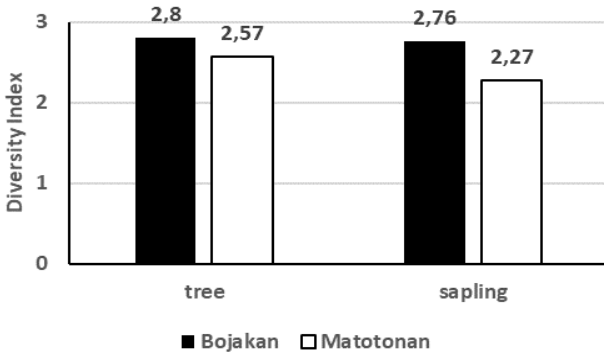

Figure 10. Traditional agroforestry land diversity index in Siberut Island, West Sumatra, Indonesia

The analysis of the tree-level vegetation structure in traditional agroforestry lands in South Siberut reveals that all the dominant species are staple food plants. Among these dominant species, the most prominent ones are the same as those found in Pumonean land in North Siberut. These dominant species include: (i) *Metroxylon sagu* (Sago Palm): *Metroxylon sagu*, commonly known as the sago palm, is a vital source of staple food for the indigenous communities. It is primarily cultivated for its starchy pith, which is processed into sago, a significant component of their diet. (ii) *Durio zibethinus* (Durian): *Durio zibethinus*, the durian tree, is famous for its large, distinctive, and pungent-smelling fruit. Durian is highly prized as a source of both sustenance and income. (iii) *Durio lowiyanus* (Wild Durian): This is another species of durian and is also considered a vital food source. (iv) *Artocarpus integer* (Breadfruit): *Artocarpus integer*, known as breadfruit, produces large, starchy fruits that are an important source of carbohydrates in the local diet.

These dominant species play a central role in the traditional agroforestry system, serving as fundamental sources of sustenance for the indigenous communities in South Siberut. The consistency of these dominant species with those found in North Siberut's Pumonean land reflects the significance of these staple food plants in the lives of the Mentawai people across the region. These trees are not only a source of food but also represent cultural and economic value within the local communities.

Diversity index

The results of the diversity index analysis indicate that the level of plant species diversity in traditional agroforestry lands on Siberut Island falls within the category of moderate category of diversity index, as per the Shannon-Wiener diversity index ($1<H'>3$). The diversity index for plant species in the agroforestry lands in Bojakan was higher compared to the Matotonan region. The data presented in Figure 10 illustrates distribution differences in diversity index between tree stages and sapling states in two villages. Despite noticeable distinctions between saplings and mature trees, the diversity index values remain relatively high.

Different traditional agroforestries have different plant diversity indices. According to Prastiyo et al. (2020), the species diversity of the agroforestry land use of the Ciliwung riparian area was, on average, moderate category, with H'=1.5. In other parts of Central Sulawesi, specifically in Sigi District (H' = 1.5) (Lestari et al. 2019) and Banggai Regency (H'=2.5) (Pitopang et al. 2021), agroforestry land was also discovered to have the similar condition. Furthermore, varied conditions discovered a low diversity index on agroforestry land in Lampung, H'=0.98 (Heryandi et al. 2022). The diversity index on agroforestry land varies in many other topical agroforestry places, such as Central Nepal, H'=1.21 (Pandey et al. 2021) and Cameron, which were intermediate categories, H'=2.86 (Todou et al. 2022), South-Cental Ethiopia, H'=2.1 (Molla et al. 2023) and in Peru were low categories, H'=1.45 (Goñas et al. 2022) but high in North Morocco, H'=3.04 (Chakkour et al. 2023).

Discussion

The results of our research found that there are two types of land use such as the Tinugglu and Mone types. Each type of land has different types and structures of plants planted. It was found that the Mone land had a wide tree canopy and functioned more as a conservation area, whereas the Tinugglu land was used for short-lived agriculture. Research by Nurainas et al. (2020) in several Siberut forest locations also showed that the highest LUVI was also found in the *Metroxylon sago, Durio zibethinus* and *Arthocarpus integer* types. Furthermore, Nopiansyah et al. (2016), findings indicate that the traditional communities on Siberut Island continue to rely on forest resources, even though their utilization practices have evolved in recent times, incorporating new technologies. It's worth noting that some of these new technologies could potentially have detrimental effects on forest resources in the future.

Traditional agroforestry techniques in various regions of Ethiopia have proven to enhance the livelihoods of farmers. These practices, such as fruit and coffee production, offer a multifaceted array of benefits, including food, wood, fodder, fuel, medicine, fencing material, compost, and income generation. Agroforestry also contributes to improved soil health, organic matter, fertility, and carbon storage, making it a valuable strategy for mitigating climate change. According to the explanation given above, the process of plant regeneration in an agroforestry ecosystem will lead to the development of an ecological technology. However, the adoption of agroforestry in Ethiopia is influenced by various factors such as socioeconomic conditions, education, landholding size, distance from urban centers, gender, age, and access to training. To expand agroforestry systems, it is crucial to raise awareness, provide education, share experiences, improve market access, develop infrastructure, and enact supportive land use policies. These measures are vital for scaling up agroforestry practices and reaping their extensive benefits (Wondimenh 2023).

The study's findings highlight the significant role of traditional agroforestry practices in conserving Ethiopia's native woody species, including endemic species like *Syzygium guineense* and *Juniperus procera*, as well as critically endangered species like *Cordia africana* and *C. macrostachyus*. While the study primarily focused on assessing woody species diversity within traditional agroforestry practices, it underscores the importance of conducting comprehensive assessments across all natural habitats to fully understand the status of these native species. To safeguard valuable tree species, the study recommends raising awareness at the grassroots level about responsible woody species utilization. It also suggests that governmental and non-governmental organizations should promote various agroforestry practices to conserve indigenous woody species through in-situ conservation efforts. These measures are crucial for the preservation of Ethiopia's unique and endangered tree species (Mola and Kewessa 2015).

Commercial agroforestry in India, particularly in the Eastern Indian Himalayan Region (EIHR), is on the rise due to increased demand from the pulp and paper industries. This growth is significant because it builds upon a longstanding tradition of location-specific agroforestry systems, such as traditional home gardens and Piper-betel based agroforestry, deeply embedded in the region's culture and vital for local livelihoods. Additionally, the unique agroforestry system involving tea cultivation under tree canopies covers a substantial 0.5 million hectares in the EIHR. These developments underscore the enduring importance of agroforestry in the region, providing a sustainable and economically viable way to meet the needs of the pulp and paper industries while supporting local communities and preserving the area's environmental and cultural heritage (Nath et al. 2021).

The developments of study on Indonesian agroforestry were highly related with the role of local or indigenous people. Almost all of the traditional agroforestry in Indonesia was initiated by opening natural forests, followed by crop cultivation for two to four years, and continued with forest -tree and fruit-tree planting (Budiadi et al. 2021; Harun et al. 2023). Some of indigenous agroforestry in different locations in Indonesia established in secondary forest ecosystem e.g., dusung (in the Mollucas), tembawang and simpukng (in Kalimantan) (Roslinda et al. 2017; Harun et al. 2023) and *repong damar* and rubber agroforestry (in Sumatra) (Istiawati et al. 2020). In Java Island, taungya systems give opportunity to farmers to intercrop prior to canopy closure of the trees. Traditional agroforestry in private land in Java aims to provide food and cash crops for farmers, and timber that managed in traditional selection system (Prastiyo et al. 2020; Mulyoutami et al. 2023).

In Siberut Island, the agroforestry type bears similarities to agroforestry areas in the rest of Indonesia, but with a unique utilization pattern. The local community in Siberia prioritizes sloping land (Mone type), preserving its condition by allowing large tree species to grow without disturbance or cutting. This distinctive approach reflects the community's environmental priorities and sustainable land management practices. The comparison with agroforestry practices in other parts of Indonesia showcases the diverse adaptations and localized strategies within the broader framework of traditional agroforestry, emphasizing the importance of considering regional nuances in sustainable land use. Further research and collaboration with local communities can contribute to a deeper understanding of these practices and

inform sustainable agroforestry development in diverse ecosystems.

In conclusion, the ecosystem of agroforestry that has been detailed is proof of the community's rich biodiversity and sustainable practices. This harmonic interaction of varied flora is exemplified by the coexistence of 65 plant species, representing 27 families and including cultivated, wild, and indigenous forms. Among the key tree species, *Metroxylon sago* is particularly noteworthy. *Baccaurea polyneura* and *Theobroma cacao* also play important roles during the sapling stage, demonstrating a complex and dynamic plant community. The practical relevance of this botanical diversity is shown by the variety of uses for which plants are employed, especially the vital role that fruit-bearing plants play in indigenous everyday life. The Landscape Unit Value Index (LUVI) indicates that 57% of the land is tinugglu land, which is strategically significant. This highlights the need of understanding land usage in a nuanced way in order to protect local ecosystems. Further demonstrating the ecological and cultural significance of agroforestry landscapes are the significant contributions made by *Durio zibethinus* and *Metroxylon sago*. The main subject illustrates comprehensive and interwoven relationship between nature and human activity by highlighting the crucial connection between plant biodiversity and the sustainable practices of indigenous communities. Overall, this research underscores the significance of traditional agroforestry practices for sustaining biodiversity and promoting the coexistence of various plant species. These practices are essential for preserving Siberut Island's unique ecosystems, supporting the well-being of its inhabitants, and serving as a model for sustainable land use and conservation efforts.

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