

# Ethnobotanical Aspects of Mentawai Traditional Agricultural System (*Pumonean*) and Its Implications for the Conservation of Local Germplasm in Siberut, Mentawai, Indonesia

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## ABSTRACT

Mentawai people have a unique agricultural tradition. The traditional agricultural system (mone) is adaptive, using the plants that are suitable for the landscape. Land clearing is carefully done without destroying the entire forest. We conducted ethnobotany studies to explore the composition and the structure of the plants used in the traditional plantation (Pumonean) as well as their values for the Mentawai people in the Siberut island. We surveyed the agricultural system employed by Mentawai people and conducted vegetation assessment in the study sites. The data on the plant species and land usages were gathered from interviews with key informants in the areas. We analyzed the data using Local User's Value Index (LUVI). The plants were collected to aid with species identification and were stored at the Andalas University Herbarium (ANDA), Padang. Throughout the study, we recorded 64 species in 27 families. Euphorbiaceae was the family with the highest species diversity. Sagu (*Metroxylon sago*) was the species with the highest LUVI. We categorized the land usage for the traditional plantation into four categories, consisting of wetland, the edge of wetland, mixed plantations (mone), and forests (leleu). The mixed plantation was the category with the highest LUVI. Beside the traditional agricultural system, the Mentawai people also developed a more modern agricultural system. For the traditional system, *Durio zibethinus* was the species with the highest importance indices, whereas for the more modern system *Theobroma cacao* was the species with the highest importance indices.

**Keywords:** *importance indices, LUVI, mone, Mentawai, Sumatra*

## 1. INTRODUCTION

*Pumonean* is a Mentawai's traditional forest management method of using the forest for plantation without leaving the function and characters of the forest. The plantations have commercial values for growing staple crops, fruits, vegetables, medicine, woods, and materials for building traditional canoes. However, since the introduction of community development programs, the Mentawai tribe have

increasingly moved toward cultivating forests for monoculture plantations.

The Siberut Island is the largest island in the Mentawai Archipelago, Regency of Mentawai, West Sumatra Province. The study showed that the Mentawai tribe had been on the island for 3000 years ago [1]. Nowadays, the island of Siberut is thought to be the only island on Mentawai Archipelago that still holds the traditional culture in their daily life. The mainlihood of the Mentawai tribe is mostly hunting,

forest gathering, and farming [2]. One of the local customs of the Mentawai tribe is adaptive farming methods by which they select the plants and grow them based on the land types. Commonly, plant grown are local species such as Mentawai Durian (Toktuk), Sago and Taro. For the Mentawai tribe, farming is not only for their everyday needs but also to support their family economics. Nowadays, Mentawai tribes have moved from the traditional agricultural system (*pumonean*) toward the modern agricultural system. A variety of non-local plants, such as cacaos, areca palms, nilam plants, teaks, cinnamons, cloves, and nugmets are commonly found in plantations in Mentawai [3].

Here, we study ethnobotany and ethnoecology of the traditional plantations of the Mentawai tribe on Siberut Island. We focus on species inventory, vegetation assessment, and plant structure on various land types in the traditional Mentawai tribe on the island. In addition, we also study modern plantations to understand the current trend of the agricultural system adopted by the Mentawai tribe on Siberut.

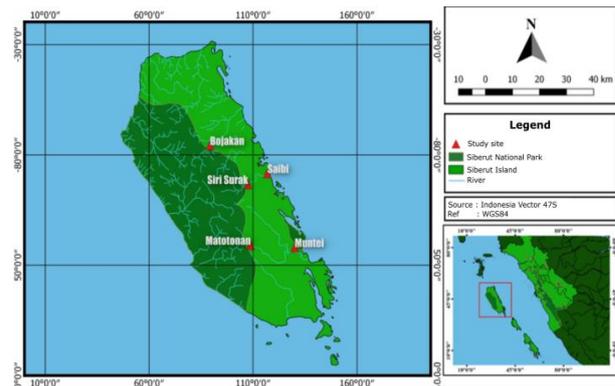
## 2. MATERIALS AND METHODS

### 2.1. Study sites

We conduct this study on five sites in three districts on Siberut Island, consisting of Bojakan village in Siberut Utara, Saibi Samokup and Sirisurak villages in Siberut Tengah, and Mototonan and Muntei villages in Siberut Selatan (Fig. 1). The study site selection purposely did by considering the existence of traditional and semi-modern plantation. The villages of Bojakan, Saibi, Sirisurak and Mototonan are dominated by the Mentawai tribe, where traditional farming is still found. Whereas Muntei is inhabited by more diverse community, most of the people are already semi-modern plantation.

### 2.2. Collection of Ethnobotanical data

We interviewed our informants using a questionnaire. The data were obtained through semi-structured interviews and direct observation. In-depth interviews were conducted with 6 informants. The informants were chosen in a purposive way who aged over 45 years with the consideration that they already had good local knowledge. We choose them based on recommendations from stakeholders in each site.



**Figure 1.** Map of the study sites on Siberut Island, Mentawai Island (see the legend for details). Inset: the map of West Sumatra province highlighting the position of Siberut island.

We collected the Local User's Value Index (LUVI) and the plant benefits based on the *Pebble Distribution Method* (PDM).

### 2.3. Collection of vegetation data

Vegetation data are needed to understand the structure of the *pumonean* plants. We employed vegetation plots to collect vegetational data following Kusmana [4].

### 2.4. Taxonomic Identification and voucher specimen

We identify the species to get the scientific names of the plants. The identification was based on comparison to herbarium specimens, relevant works of literature, figures, and illustrations available online through reputable websites, such as JSTOR, Plant List, and GBIF. We collected all the plants and processed them as herbarium specimens following Jain dan Rao [5]. All specimens were deposited at Herbarium Universitas Andalas (ANDA).

### 2.5. Data Analysis

We present all the ethnobotany data in the table and vegetation data in relevant matrices. To understand the benefits of the plants, we used LUVI based on the data collected using *Pebble Distribution Method* [6]. The values of the plant benefits were estimated from the values of a certain species based on the LUVI calculated from the interview results. We calculated IVI (Important Value Index) based on these variables: Relative Density, Relative Frequency and, and Relative Dominance following Mueller-Dombois dan Elenberg (1974) equation [7].

### 3. RESULT AND DISCUSSION

#### 3.1. Plant species and their uses in various land types in the traditional plantation in Mentawai

Based on the interview, we concluded that the Mentawai tribe categorized their land into four different land types, consisting of wetland, the edge of the wetland (riparian), mixed plantations, and forests. The species that cover each landscape had different compositions. The wetlands were used for growing *Colocasia esculenta* (talas) and *Metroxylon sago* (sago). At the edge of the wetlands, Mentawai tribe grew *Cocos nucifera* (coconuts) and *Musa* spp. (bananas). Mixed plantations (mone) were for growing various fruits, whereas forests (leleu) were used for logging and gathering rattans. LUVI analyses showed that mixed forests (mone) have the highest LUVI values compared to the other land types. Below are the species of plants found in four land types in the plantations on Siberut Islands (Figure 2).

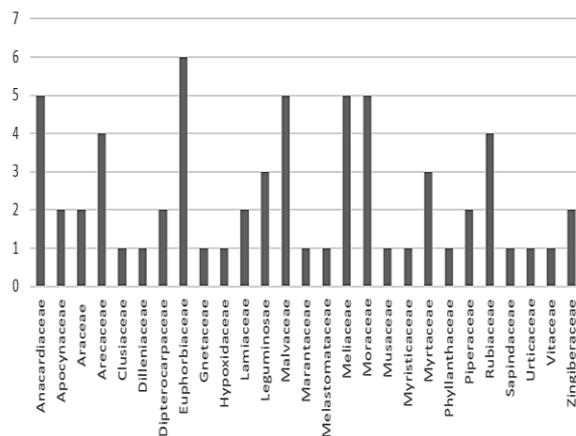


Figure 2. A bar plot showing the family of plants recorded in four land types in our study sites.

In four land types, we recorded 64 species in 27 families. The Euphorbiaceae family was the family with the highest number of species (6 species). The species were used for different purposes, such as *Glochidion* sp. 2 (Onam) and *Macaranga tanarius* (Pari-pari) were used as glue for arrows, *Manihot esculenta* (Gobik) as supplementary foods, *Hevea brasiliensis* (Karet) as a plant with commercial values, and *Endospermum diadenum* (Alibagbag) as materials for building canoe. Euphorbiaceae as the planted families for plantations in The existence of local plant species in mixed plantations is important as for germplasm reserve. In this study, we found several unique local variants of fruit plants. Among

them are langsats, durians, and cempedaks. Recorded 15 species of local plants in *pumonean* in Siberut Island [8].

The local communities in Siberut recognized at least five variants of langsats (*Lansium prasiticum*) with various morphological characters and the taste of the fruits. All the five variants of langsats were locally called *Lansat Padang*, *Attelu turugougou*, *Siamung*, *Elak mata*, and *Setcet*. Huda et al. state that there are five local germplasms of *Langsat* from Siberut and based on the phylogenetic trees showed that the accessions of langsats from Siberut Island were separated from accessions of Sumatran mainland [10]. While for durian's germplasm, Mentawai durian (*Durio lowianus*), locally called *Toktuk*, was different from durians found on the mainland Sumatra (*Durio zibethinus*). During flowering seasons, the Mentawai durians exhibit bright red flowers decorating local plantations on Siberut. Mentawai cempedak (*Artocarpus integer*) is locally known as *Peigu*. Although this species was the same species to the cempedak on mainland Sumatra, the size of the fruit was significantly larger than the fruits on mainland Sumatra with thick seed arylus and distinctive smell, making it one of the commonly planted plants in Mentawai. Based on genetical data, Cempedak Mentawai and Cempedak Sumatran mainland had the genetic variation among populations that were lower than inside of the population [9].

The uses of plant species by the communities were diverse and were used wisely. For example, high quality wood will be used for building materials. On the other hand, plants that were aimed for staple foods would be prioritized for staple foods.

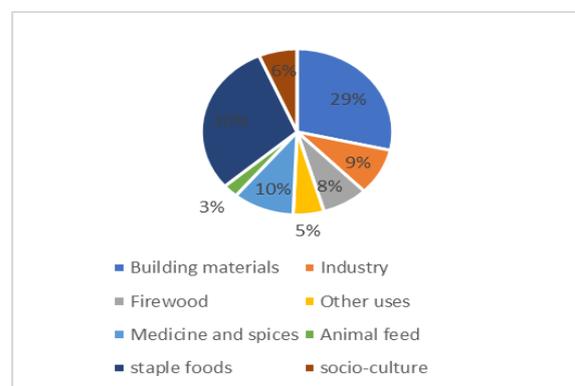


Figure 3. The percentage of the number of plants used by the Mentawai tribe based on usage categories.

This study recorded at least 20 forms of plant uses within the communities. We grouped them into eight usage categories, consisting of staple foods, building materials, medicines and spices, animal feed, industry, firewood, socio-culture, and other uses. Figure 3 compares the percentage of plant species used by the Mentawai tribe based on usage categories.

Food sources or the need for food were high in Mentawai. Hence, consumable plants were highly planted in their plantation. In addition to staple foods, such as sago, taro, and bananas, we also found supplementary foods, such as fruits in the families Moraceae, Meliaceae, Anacardiaceae, and Sapindaceae.

Benefit values at the species level were analyzed to understand the benefits among plant species for the Mentawai tribe. We analyzed LUVI values based on PDM results. Table 1 shows 10 species of plants with the highest LUVI.

**Table 1.** Ten species of plants with the highest LUVI.

Species	Local names	LUVI
<i>Metroxylon sago</i> Rottb.	Sagu	0.970
<i>Durio zibethinus</i> L.	Doriat	0.748
<i>Shorea pauciflora</i> King	Katuka	0.658
<i>Colocasia esculenta</i> (L.) Schott	Talas	0.520
<i>Nephelium cuspidatum</i> Blume	Babaet	0.415
<i>Calamus manan</i> Miq.	Bebegen	0.284
<i>Cocos nucifera</i> L.	Toitet	0.239
<i>Artocarpus integer</i> (Thunb.) Merr.	Peigu	0.170
<i>Theobroma cacao</i> L.	Cokelat	0.152
<i>Durio</i> sp.	Kinso	0.148

The result above shows that the species with the highest LUVI was *Metroxylon sago* (0.970). This value shows that sago plants were important for the community, particularly because they were consumed as a staple food. Before consumption, sago was prepared to produce food known as *kapurut* (roasted sago flour wrapped inside sago leaves and mixed with grated coconuts). Sago had been a staple food for the Mentawai tribe since their ancestors came to the island [3]. The plants typically grow in the wild and/or were planted in wetland by the Mentawai tribe. They were prepared using traditional methods, starting from opening the stem barks, then finely chopped the stem, and processed into sago flour.

### 3.2. Local User's Value Index in traditional plantation (*pumonean*) and new plantation (*monoculture*)

*Pumonean* is a mixed plantation with various kinds of plants. Plants that have benefits as staple foods, such as sago, taro, and bananas were planted in marshes and riverside, whereas other plants such as durians, langsats, cempedaks, and rambutans were planted on hills without destroying native plants.

However, there has been an increase in semi-moculture plantations. The Mentawai tribe has started to move from the traditional *mone* method to a more modern agricultural system hoping to have higher economic values in return. In addition, our survey showed that in Matotonan, Saibi, Sirisurak, and Muntei, the communities had planted big trees near residential areas, so they could cut down the trees easily when needed, whereas Bojakan communities still preferred to log the trees from nearby forests.

The plantation system during our study was either a traditional system (mixed plantation) or modern plantation (semi-monoculture). The traditional plantation is an agricultural system that has passed through generations from the ancestors of the Mentawai tribe on Siberut, whereas the semi-monoculture system was developed as they interact with the outside communities.

**Table 2.** Ten plant species with the highest local user's value index in semi-monoculture plantations in Mentawai communities on Siberut Islands

Species	RD (%)	RF (%)	RDo (%)	IVI (%)
<i>Theobroma cacao</i> L.	28.57	7.69	20.37	56.64
<i>Cocos nucifera</i> L.	11.43	7.69	19.91	39.03
<i>Areca catechu</i> L.	14.29	7.69	16.63	38.61
<i>Artocarpus elasticus</i> Reinw. ex Blume	5.71	7.69	11.02	24.42
<i>Archidendron ellipticum</i> (Blanco) I.C.Nielsen	2.86	7.69	10.06	20.61
<i>Syzygium aromaticum</i> (L.) Merr.	5.71	7.69	5.00	18.40
<i>Lansium parasiticum</i> (Osbeck) K.C. Sahni & Bannet "Siamung"	5.71	7.69	3.10	16.51
<i>Baccaurea parviflora</i> (Müll.Arg.) Müll.Arg	2.86	7.69	5.51	16.06
<i>Nephelium cuspidatum</i> Blume	5.71	7.69	2.77	16.17
<i>Durio zibethinus</i> L.	5.71	7.69	2.40	15.80

Note: RD=Relative Density ; RF=Relative Frequency ; RDo=Relative Dominance

We created the vegetation analysis plots in the traditional plantations in two different sites, so that we could compare the LUVI between traditional plantations and modern plantations. We chose Bojakan village to gather data on traditional plantations and Muntei village for modern plantations. We chose the two villages because they had different plantation systems. Bojakan village employed mix-plantation (*mone*) and Muntai village employed modern plantation (semi-monoculture). The Bojakan community planted different plants in the same plantations. Our analyses suggest that the two plantations had different vegetations with different LUVI.

Our analyses for the new plantations suggest that *Theobroma cacao* had the highest LUVI (56,64%). It suggests that the communities have moved from the traditional plantations to more modern plantations with a semi-monoculture system. The community grew industrial plants such as cacao and areca palm. Cacao was used to provide economic income by selling them to collectors. The communities chose cacao due to its shorter harvest time relative to other plants and was easy to sell (3).

In the traditional plantations, durian, *Durio zibethinus* (*doriat*), had the highest local user's index (57,39%). Based on the on-site interview, informants stated that *doriat* had many benefits for the community. Among those benefits were the fruits for foods, the stems as a substitute for boards, and the whole plants could be used as inheritance and dowry for marriage. It may be the reason we found many durians in our study sites. All those benefits have led the communities to grow durians in their plantations.

The open nature of Mentawai people and the entry of the market-based economy had changed the economic system in Mentawai. The traditional economy by which the people used the natural products for their daily needs, such as for foods and traditional ceremonies, had changed for compulsive needs. This can be seen from the products that were produced by the Mentawai tribe. They were products that could be sold well in the global market. The products from the plantations had been commodities to generate income for them.

The diversity of mixed plantations (*mone*) has begun to decrease due to the adoption of a new plantation system that grows similar plants in one land. The society influenced by the modern system believes that the modern system is more profitable. The introduction of the modern system into the Mentawai community has caused the collapse of the

traditional agricultural system. In addition, mostly Mentawai communities have changed their traditional lifestyle toward a modern lifestyle due to improvement in education and the increasing needs of the society.

#### 4. CONCLUSION

The land usage for the traditional agriculture categorized into four categories, consisting of wetland, riparian, mixed plantations (*mone*), and forests (*leleu*). The mixed plantation was the category with the highest LUVI value. We recorded 64 species in 27 families of plants in the plantations in Mentawai communities in Siberut and Euphorbiaceae had the highest number of species. Sago (*Metroxylon sago*) and Durian (*Durio zibethinus*) were the species with the highest LUVI in the traditional plantation (*mone*) and Cacao (*Theobroma cacao*) and palm nut (*Areca catechu*) with the highest LUVI in the modern plantations (semi-monoculture).

#### ACKNOWLEDGMENTS

Some parts of this research were funded by the Higher Education Excellence Grants Research, Andalas University, Padang on behalf by Prof. Dr. Mansyurdin. Our gratitude goes to the local communities of Matotonan, Muntei, Bojakan, Sirisurak and Saibi Samukop for their cooperation in this study. We thank Siberut National Park for providing permits and facilitating data collections in the field. We thank Dr. (cand.) Heru Andika and Dr. Heni Herwina for language correction and useful discussion.

#### REFERENCES

- [1] D.J. Whittaker, A conservation action plan for the Mentawai primates, *Primate Conservation* 20 (2006) 95–105. DOI: <https://doi.org/10.1896/0898-6207.20.1.95>
- [2] E. Erwin, Model Pemberdayaan Masyarakat Mentawai melalui Penguatan Kelembagaan Lokal di Pulau Siberut, *Sosio Konsepsia* 4(2) (2015) 1–14. [In Bahasa Indonesia]
- [3] Febrianto, E. Fitriani, Orang Mentawai: Peladang tradisional dan ekonomi pasar, *Humanus*, 11 (2) (2012), 119–133. DOI: <https://doi.org/10.24036/jh.v11i2.2897> [In Bahasa Indonesia]

- [4] Kusmana, Metode survey vegetasi, Penerbit Insitut Pertanian Bogor, 1997. [In Bahasa Indonesia]
- [5] S.K. Jain, R.R. Rao, Field and Herbarium methods, Today and Tomorrow Publishers, 1977.
- [6] Sheil, R.K. Puri, I. Basuki, M. Van Heist, M. Wan, N. Liswanti, Rukmiyati, M.A. Sardjono, I. Samsuedin, K. Sidiyasa, Chrisandini, E. Permana, E. M. Angi, F. Gatweiler, B. Johnson, A. Wijaya, Mengeksplorasi keanekaragaman hayati, lingkungan dan pandangan masyarakat lokal mengenai berbagai lanskap hutan: metode-metode penilaian lanskap secara multidisipliner, Center for International Forestry Research, 2004. [In Bahasa Indonesia]
- [7] Mueller-Dumbois, H. Ellenberg, Method of Vegetation Ecology, John Wiley and Sons, 1974.
- [8] G. Indra, Nurainas, Chairul, Mansyurdin, Species Diversity and Community Structure of Fruit Trees in Pumonean at Siberut Mentawai Islands Indonesia, International Journal of Current Research Bioscience and Plant Biology 4(11) (2017) 29–37. DOI: <https://doi.org/10.20546/ijcrbp.2017.411.005>
- [9] Fitria, Mansyurdin, D. Imelda, Genetic variation of Cempedak (*Artocarpus integer* (Thunb.) Merr.) in Pumonean Siberut and Limau Manis forest Padang based on RAPD, Diploma thesis, Universitas Andalas, 2018.
- [10] M. Huda, P. Murni, Syamsuardi, Nurainas, R. Maulidah, Genetic divergence landrace of langsung (Lansium parasiticum) from Siberut Island based on ITS and MatK markers, Indian Journal of Agricultural Research 53 (3) (2019) 338–342. DOI: [10.18805/IJArE.A-398](https://doi.org/10.18805/IJArE.A-398)