Media Konservasi Vol.28 No.2 August 2023: 227-234 **ISSN: 0215-1677**
DOI: 10.29244/medkon.28.2.227-234 **E-ISSN: 2502-6313**

ETHNOBIOPROSPECTING OF THE MALAY COMMUNITY IN LINGGA SUB-DISTRICT, LINGGA DISTRICT, RIAU ISLAND

DWI PUTRI WULANDARI [1*)], ERVIZAL A.M. ZUHUD [2)], AND SISWOYO [2)]

[1)] *Department of Forest Resources Conservation and Ecotourism, Faculty of Forestry and Environment, IPB University,Bogor, 16680, Indonesia*
[2)] *Division of Bioprospecting and Sustainable Use of Wildlife, Department of Forest Resource Conservation and Ecotourism, Faculty of Forestry and Environment, IPB University,Bogor, 16680, Indonesia*

**Email: dwiputriwulandari@apps.ipb.ac.id*

Accepted November 19, 2022 / Approved July 18, 2023

ABSTRACT

The life of the Malay community in Lingga District cannot be separated from the very close interaction with the natural resources around it, namely interactions related to the use of plants and animals. The knowledge of the Malay community in the Lingga sub-district in the use of plants and animals is important to be studied and documented so that the knowledge of the community can be sustainable for posterity. This study aimed to identify and describe the ethnobioprospecting of plant and animal species based on utilization by the Malay community in Lingga District. Data were collected using in-depth interviews, analysis of vegetation to determine the potential of plants, and field observations using exploratory surveys to determine the potential of animals. The number of plant species from the results of vegetation analysis in several forest ecosystems in Lingga District was obtained as many as 110 species from 60 families. The utilization of plants by the Malay community in the Lingga sub-district can be categorized into 11 categories with the most species, namely plants as food (111 species) with the most families, namely Fabaceae (36 species). The use of animals can be categorized into six categories, most of which are food sources. Thus, the utilization of plants and animals by the Malay Community in the Lingga Subdistrict has been fulfilled from their natural resources.

Key words: *animals, Malay society, plants, utilization*

INTRODUCTION

One of the challenges the Indonesian state will face in the future is related to biodiversity management. That is caused by the abundance of biodiversity in Indonesia, which needs to be optimally managed and utilized. Management and utilization of biological resources sustainably can be done by harmonizing biodiversity and culture without damaging the environment. Traditional culture has an important role in optimizing the management and utilization of biodiversity. Walujo (2014) explains that the fading of cultural diversity can reduce the knowledge of biodiversity beneficial to life.

Plants and animals traditionally play a role in meeting the needs of clothing, food, shelter, and medicine. The needs in the form of resources obtained from the environment around where local people live are utilized by searching and experimenting on these resources, which is a form of traditional bioprospecting activities or can be known as etnobioprospecting. Etnobioprospecting comes from the two words ethnobiology and bioprospecting (Zuhud et al. 2022). Ethnobiology as a scientific study of the dynamics of the relationship between people, biota and their natural environment, which has existed since the past until now is locally specific, compact, unique, sustainable and hereditary. (Anderson et al. 2011); while bioprospecting is the systematic search, classification, and investigation for purposes commercial sources of new chemical compounds, genes, proteins, microorganisms, and other products with the actual and potential economic values found in biodiversity (Reid et al. 1993). Thus, etnobioprospecting is the study of the search and utilization of biological products derived from natural resources that are beneficial to humans, utilized based on traditional knowledge and culture, and have commercial purposes.

Currently, it is known that there is still much knowledge about the traditional use of plants and animals that has not been documented and the rampant practice of the negative side of bioprospecting, namely biopiracy. According to Santoso (2016), biopiracy is exploiting natural resources and community knowledge about their nature without permission and sharing benefits from other countries with the patent process. The opportunity for biopiracy in Indonesia is even more significant because the rules related to how access to SDGs and traditional knowledge in Indonesia and the profit-sharing scheme for the utilization of SDG / PT are not very clear (Yayasan KEHATI SITH ITB 2020). Therefore, local communities that closely relate to utilizing natural resources in their area need to be optimally utilized and preserved.

One community group still closely related to traditional culture is the Malay Community in Lingga District, Riau Archipelago Province. The Linga Malay

people still use plants for medicine, food, decoration, animal feed, essential oil producers, building and construction materials, firewood producers, rituals, and crafts in their daily lives. Not only in terms of plant utilization, but the Lingga Malay community also uses animals for consumption needs, traditional medicine, and others. Based on research by Qasrin et al. (2020) reported that the use of medicinal plants by the people of Singkep Island, Lingga is 102 species belonging to 53 families, meanwhile regarding the use of animals in Indonesia, such as the Kanayatn Dayak tribe has used as many as 17 species which are used as a source of food and medicine, as well as economic resources based on research by Sitinjak et al. (2021). Knowledge of local communities about the management and utilization of plant and animal resources needs to be documented and studied further to determine their relationship and role in people's lives. Further studies of these resources in Lingga District provide new information and data regarding plant and animal species that have yet to be utilized by the Malay community. Based on this background, the study aimed to identify and describe the ethnobioprospecting of plant and animal species based on utilization by the Malay community in Lingga District.

RESEARCH METHOD

The research was conducted in June-August 2022 in Lingga Subdistrict, Lingga Regency, Riau Islands Province, Indonesia. Geographically, Lingga District is located between 00°03'00" - 02°21'00" South Latitude and 104°22'00" - 105°22'00" East Longitude. Administratively, Lingga Subdistrict is located in Lingga Regency, Riau Islands Province. The topography of the Lingga District is very varied, from flat to hilly and mountainous. The level of rainfall in the Lingga District has an average of 216.7 mm throughout the year. Data were collected using in-depth interviews with the Malay Community in Lingga District, vegetation analysis, and exploratory survey observations.

Vegetation analysis was carried out to identify the potential for plant regeneration in several forest ecosystems in Lingga District. Exploratory survey observations were carried out to identify potential animals around Lingga District. During the interview, it was conducted using the Kipling 5W1H method, which contains elements of the question words what, where, when, who, why, and how to respondents who are believed to know the utilization of plants and animals by the Malay community in Lingga District such as the village head.

Data collection by vegetation analysis using the single plot method developed by Nahlunnisa et al. (2016), with a plot size for trees (diameter above 19 cm) of 113.14 x 113.14 m^2, while for saplings (diameter <10 cm, height > 1.5 m) 40x40 m^2 (Figure 1).

This method is used to analyze the vegetation of lowland and sago forest ecosystems, where the size of each plot is adjusted according to its growth rate. In the mangrove ecosystem, vegetation was also analyzed with three plots. The plot area used was 10 m x 10 m at the tree level, 5 m x 5 m at the sapling level, and 1 m x 1 m at the seedling level. Plots were determined using a purposive sampling method by selecting locations with potential for plants and representing forest ecosystems in Lingga District.

Vegetation analysis was carried out to obtain species composition data by calculating the Important Value Index (IVI) for undergrowth, seedlings, saplings, poles, and trees. The amount of INP shows how important the role of a species is in its ecosystem (Soerianegara and Indrawan 2008). The calculated vegetation parameters include the following:

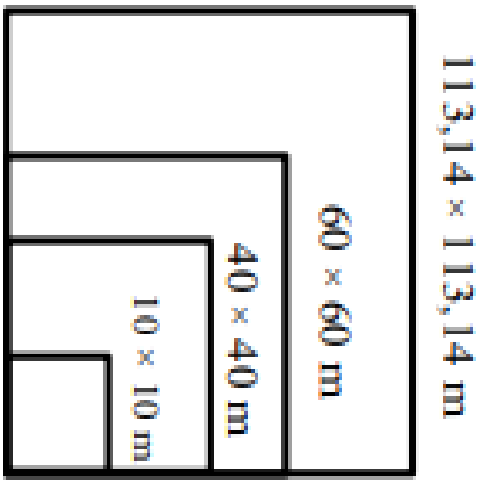


Figure 1. Illustration of observation plot

a. Density = $\frac{\text{The number of individuals of a species}}{\text{Sample plot area}}$

b. Relative density = $\frac{\text{The density of a species}}{\text{Number of plots found for a species}} x\ 100\%$

c. Frequency = $\frac{\text{Number of plots/points where the species occurs}}{\text{Total number of plots}}$

d. Relative frequency = $\frac{\text{Frequency of a species}}{\text{Frequency sum of all species}} \times 100\%$

e. Dominance = $\frac{\text{Basic area of a species}}{\text{Sample plot area}}$

f. Relative dominance = $\frac{\text{Dominance of a species}}{\text{All species dominance}} \times 100\%$

g. Important Value Index (IVI) = Relative density + Relative frequency (undergrowth, seedlings and saplings)

h. Important Value Index (IVI) = Relative density + Relative frequency + Relative dominance (poles and trees)

Based on the formula above, if the vegetation analysis uses a single plot, it is not necessary to calculate the relative frequency because there is only one sample plot in the vegetation analysis, so IVI is obtained from the sum of relative density and relative dominance. Analysis of plant utilization is divided into several calculation methods, including family percentage, habitus percentage, partly used, status in nature, and distribution location.

RESULT AND DISCUSSION

1. Plant Dominance in Several Forest Ecosystems

Lingga sub-district consists of various forest ecosystems, namely lowland, sago, and mangrove forests. The results of the analysis of vegetation in all forest types that have been carried out in Lingga District found 110 species found consisting of 60 families. The level of species dominance in a community is calculated using the important value index (IVI). Important value index (IVI) is one of the quantitative parameters that can describe the role of plant species in the community or at the research site (Sundarapandian and Swamy 2000). A plant species can be known to play a role or influence in a community if the growth rate of seedlings and undergrowth has an IVI value of 10% (Rosalia 2008). Its dominance is also high if a plant species has a high IVI value. Vegetation analysis was carried out on several forest ecosystems: lowland, sago, and mangrove (Figure 2).

A lowland forest is a forest that grows at an altitude of 0-1000 meters above sea level and forms the largest part of the forest, covering the largest area in Indonesia. The results of calculating the largest lowland forest IVI at all growth rates are presented in Table 2.

Lowland forests are mostly found in every village in Lingga District. The results of IVI calculations in each village have different dominant species in their lowland forest. The dominant understorey plants in Musai Village are: *A. disticha*; Nerekeh Village: *S. willdenowii*; and Panggak Darat Village: *M. malabathricum*; seedling level in Musai Village: *P. gutta*, Nerekeh Village: *Litsea* sp.; and Panggak Darat Village: *L. petiolata*; staking level in Musai Village: *V. rassak*; Nerekeh Village: *Daemonorops* sp.; and Panggak Darat Village: *A. elliptica*; pole level in Musai Village: *C. ferrugineum*; Nerekeh Village: *A. malayana*; and Panggak Darat Village: *L. petiolata*; and tree level in Musai Village: *C. lanceolatum*; Nerekeh Village: *P. gutta*; and Panggak Darat Village: *P. gutta*.

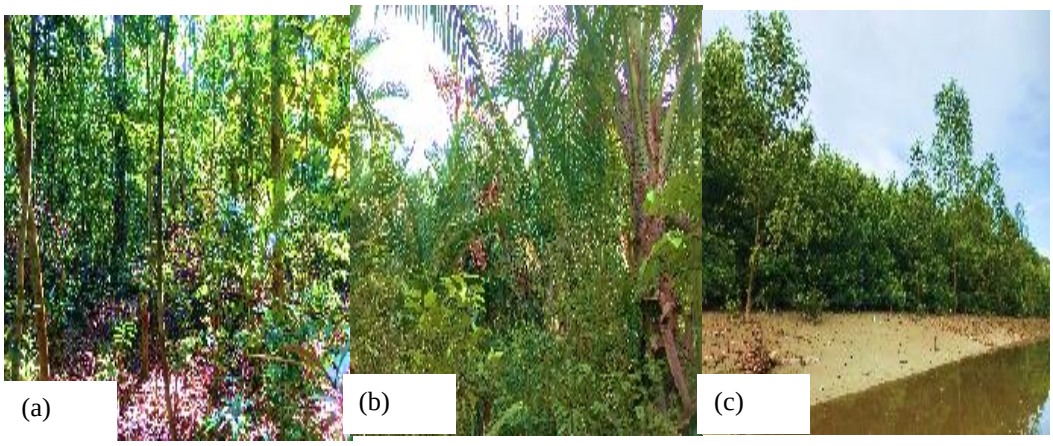


Figure 2 Forest ecosystem in Lingga District: (a) lowland forest; (b) sago forest; (c) mangrove forest

Gemilang et al. (2018) stated that Lingga Island is one of the areas where sago has been introduced since 1842 and utilized by the community. Lingga District has a sago forest ecosystem, some of which are in Musai Village and Nerekeh Village. The existence of sago forests in Lingga District includes forests that have been managed since ancient times and were passed down from generation to generation. The results of calculating the IVI of sago forests in each village are presented in Table 3.

Based on the results of Table 3, it is known that the two villages, namely Musai Village and Nerekeh Village, are dominated by *M. sago* species; this is by the function of the forest type being analyzed, namely sago forest. The results of IVI calculations at the growth rate of Musai Village showed that the plants that dominated the undergrowth stage were Caladium at 27.92%, *P. echinata* dominated the seedling level at 23.59%, *D. conferta* dominated the sapling level at 20.91%, *A. scholaris* dominated the pole level by 65.21%, and *A. scholaris* also dominated the tree level by 84.48%. The plants that dominate at each growth stage in Nerekeh Village are plants that dominate the understorey stage, namely *A. bullata* at 35.14% at the understorey stage, *P. echinata* at 19.97% at the seedling stage, *R. cinerea* at 22 .53% at the sapling level, *A. scholaris* by 56.84% at the pole level, and *S. claviflorum* by 42.64% at the tree level.

Mangrove forests are forests along the coast or rivers affected by sea tides. One of the mangrove forests in Lingga District is in Nerekeh Village. A mangrove forest ecosystem exists in the coastal area, and this is due to the fact that, geographically, Lingga District, Lingga Regency is located in an archipelago. The results of calculating the IVI of mangrove forests are presented in Table 4.

The IVI obtained based on the results of calculations in mangrove forests was obtained at the growth rate of seedlings dominated by *R. mucronata* plants at 37.18%, *R. stylosa* plants dominated the sapling level at 43.70%, and the sapling level and trees were dominated by *S. alba* of 41.99%. Based on the IVI values obtained in several forest ecosystems in the three villages, it is explained that the species that dominate at one growth level do not always dominate at the next growth level, and some plant species are only found at a certain growth level. Dendang and Handayani (2015) stated that not all vegetation types are always found at every growth level. That can be expected because the ecosystems of lowland forests, sago forests, and mangrove forests are no longer natural due to forest disturbance, such as the felling of trees and poles for use; these activities affect the process of plant regeneration, a decrease in plant species in the area. It can even damage the ecosystem if done excessively without being cultivated.

2. Utilization of plants by the Malay Community in Lingga Districts

Based on the results of the interviews, around 312 species from 97 families were identified, and as many as 298 species have been known for their uses. The family with the highest number of species was Fabaceae, with 36 species, while the family used the least (1 species) was from the Agavaceae, Balsaminaceae, and others. The use of plants by the Malay Community in Lingga District is grouped into 11 utilization categories (Figure 3).

The utilization of plants by the Malay Community in Lingga District in fulfilling their daily needs uses all parts of the plant, from the roots to the leaves. The most used part was the stem of 88 species (27%), and the least was the bark and sap of 2 species (1%) (Figure 4).

Table 4 Calculation results of IVI plants in mangrove forests at all growth stages

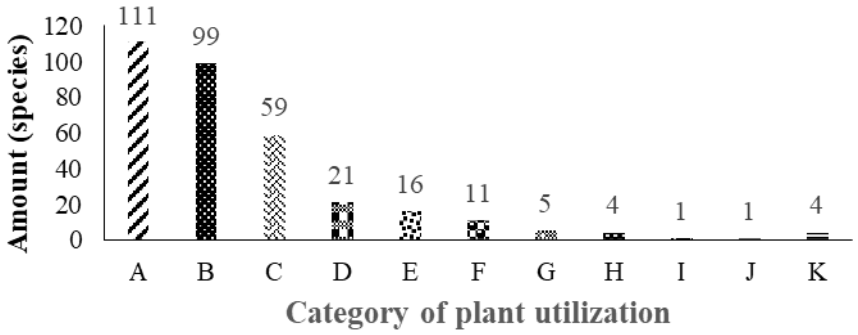
Growth rate	**Local name**	**Scientific name**	**IVI (%)**
Seedlings	Bakau	*Rhizophora mucronata*	37,18
Saplings	Bakau	*Rhizophora stylosa*	43,7
Poles and Trees	Perepat	*Sonneratia alba*	41,99

Table 2 Calculation results of lowland forest IVI at all growth stages

Village Name	**Growth rate**	**Local name**	**Scientific name**	**IVI (%)**
Musai Village	Undergrowth and seedlings	Isol-isol betina	*Anisophyllea disticha*	22,55
		Getah merah	*Palaquium gutta*	17,19
	Saplings	Resak	*Vatica rassak*	25,72
	Poles	Bintangur	*Calophyllum ferrugineum*	50,58
	Trees	Resak Bukit	*Cotylelobium lanceolatum*	40,85
Nerekeh Village	Undergrowth and seedlings	Paku selemah	*Selaginella willdenowii*	15,96
		Medang	*Litsea* sp.	12,52
	Saplings	Rotan	*Daemonorops* sp.	11,32
	Poles	Saga	*Adenanthera malayana*	29,82
	Trees	Getah merah	*Palaquium gutta*	28,54
Panggak Darat Village	Undergrowth and seedlings	Senduduk	*Melastoma malabathricum*	13,73
		Medang perawas	*Litsea petiolate*	11,02
	Saplings	Mempenai	*Ardisia elliptica*	10,87
	Poles	Medang perawas	*Litsea petiolate*	25,27
	Trees	Getah merah	*Palaquium gutta*	22,68

Table 3 Calculation results of sago forest IVI at all growth levels

Village Name	Growth rate	Local name	Scientific name	IVI (%)
Musai Village	Undergrowth and seedlings	Keladi	*Caladium*	27,92
		Sagu	*Metroxylon sagu*	27,48
	Saplings	Sagu	*Metroxylon sagu*	70,36
	Poles	Sagu	*Metroxylon sagu*	96,53
	Trees	Sagu	*Metroxylon sagu*	94,16
Nerekeh Village	Undergrowth and seedlings	Kemunting buluh	*Allomorphia bullata*	35,14
		Sagu	*Metroxylon sagu*	69,14
	Saplings	Sagu	*Metroxylon sagu*	66,77
	Poles	Sagu	*Metroxylon sagu*	103,78
	Trees	Sagu	*Metroxylon sagu*	94,19



Information: A = Food-producing plants; B = Medicinal plants; C = Plants producing building materials; D = Ornamental plants; E = Firewood-producing plants; F = Plants producing rope, webbing and handicrafts; G = Essential oil producing plants; H = Fodder producing plants; I = Plant dyes and tannins; J = Plants for traditional and religious rituals; K = Other.

Figure 3 Recapitulation of plant utilization categories

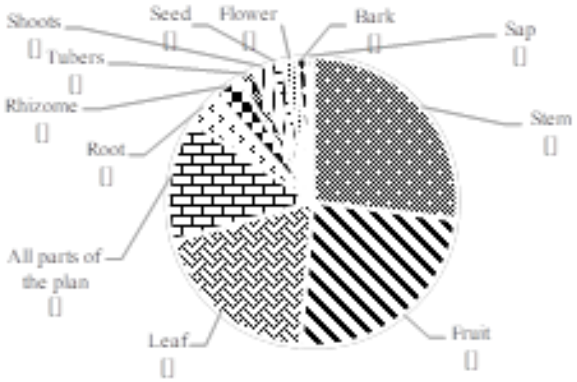


Figure 4 The part of the plant that is used

There are three classifications of plant use groups that are often used by the Malay community in Lingga District, namely:

1. Food-producing plants: there are 111 species, some of which are sago (*M. sago*), breadfruit (*A. altilis*), and durian (*D. zibethinus).*
2. Medicinal plants: there are 99 species, some of which are the root of kangkong valve (*B. semibifida*), Balek adab (*M. pubescens*), and Patawali (*T. crispa*).
3. Plants as building materials: there are 59 species, some of which are Bintangur batu (*C. pulcherrimum*), Jurung (*V. vinosa),* Medang (*N. zeylanica*).

Based on the percentage of status in nature, it is divided into three statuses: wild forest plants, wild plants outside the forest, and cultivated plants. Cultivated plants have received treatment in their growth cycles, such as planting, maintenance, harvesting, and post-harvest handling (Adelia 2010). Meanwhile, wild plants grow naturally without getting any treatment in their growth cycle (Rini *et al*. 2018). The most widely used plants were wild forest plants, with 183 species (51%), followed by cultivated plants, with 97 species (27%), and wild plants outside the forest, used as many as 80 species (22%) (Figure 5).

Based on the type of distribution, most of them came from the forest, with as many as 269 species (76%), and a few were found in paddy fields, with as many as three species (1%) (Figure 6).

The use of plants originating from within the forest area in Lingga District shows that there has been an interaction, namely, interaction in the form of plant utilization. However, this interaction is relatively high, so if the plants are not cultivated, the plants in the forest will slowly become extinct. They can damage the balance of the forest ecosystem.

3. *Utilization of animals by the Malay Community in Lingga District*

Based on the knowledge and practice of using them among the Malay community in Lingga District, the use of animals by the community is grouped into 6 (six) utilization categories (Figure 7). From the results of research in the field, it was recorded that there were 124 animal species used by the Malay Community in Lingga District with a status in nature consisting of wild animal species (both in the forest, river, and sea) found as many as 112 species (90%) and animals that have been cultivated (livestock) found as many as 12 species (10%) (Figure 8).

The three categories of animal use that are often used by the Malay community in Lingga District are as follows:

1. Animals as a source of food: there are 62 species, some of which are the mouse deer (*T. kanchil*), Gonggong (*S. Canurium*), and stingrays (*Dasyatis* sp.)
2. Wild animals (balance forest ecosystem): there are 47 species, some of which are lemurs (*C. variegatus*), fireflies (*P. lucicrescens*), and crocodiles (*C. porosus*).
3. Pets for pleasure: there are 13 species, some of which are ninja hummingbirds (*L. sperata*), nine fish (*P. canius*), and green cucak birds (*C. sonnerati*).

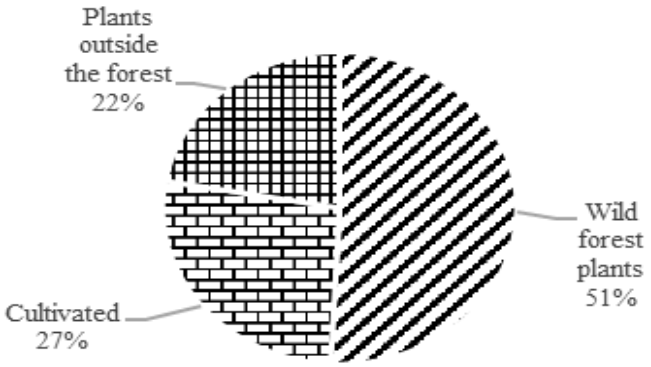


Figure 5 Status of plants in nature

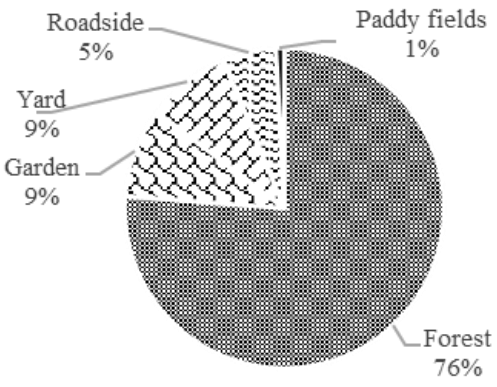
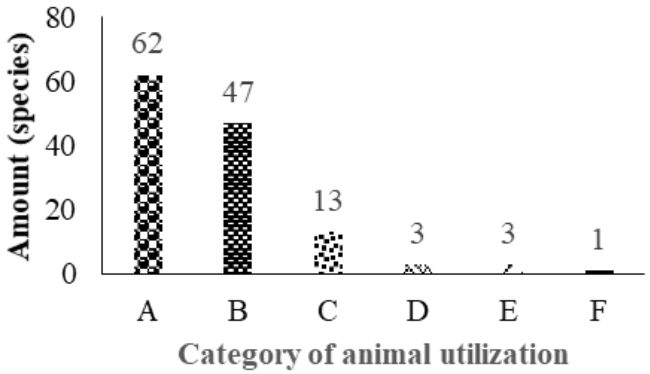


Figure 6 Location of distribution of plant habitat



Information: A = Animals as a source of food; B = Wild animals (balance forest ecosystem); C = Pets for fun; D = Animals as medicine; E = Human nuisance animal; F = Animals that play a role in myth

Figure 7 Recapitulation of the categories of animals used Malay Community in Lingga District

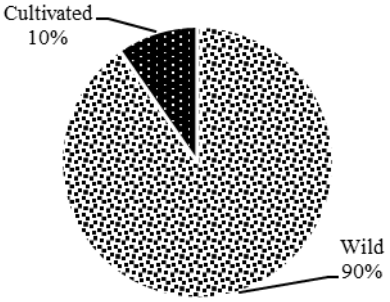


Figure 8 Status of animals in nature

The use of animals by the Malay community in Lingga District shows that there is an interaction between the community and animals in daily life and also that the community's knowledge of their benefits and uses is relatively good, as well as knowing which animals are allowed to eat and which are not allowed to be eaten.

4. Development of local resources of the Malay Community in Lingga District

Lingga Regency is dubbed the "Mother of the Malay Land." That shows that Lingga Regency is one area with a myriad of Malay cultural wisdom. One Malay community group that still applies the wisdom of Malay culture is in Lingga District. Based on the results of interviews that have been conducted, it is known that the characteristics of the Malay community in the Lingga Subdistrict are open and still adhere to cultural customs. That is considered a positive value as social capital in developing the Malay Community in Lingga District. An example of the community's application of cultural wisdom is the use of sago. Sago has an important value for the Malay community in Lingga District. The use of sago has been carried out since the 1800s in the form of cultivation by Sultan Sulaiman Badrul Alamsyah II, as evidenced by the Sultan's Grant (letter).

The availability of sago has met the daily needs of the Malay community in Lingga District. Even though the Malay community in Lingga District still adheres to Malay cultural wisdom, there has been a shift in their social life. Among the three villages studied, independence in the use of local resources by the Malay community in Lingga District has decreased. The criteria for independence in the context of an independent village community have several rules that must be met, one of which is the fulfillment of food needs (Satria et al. 2011). The solution that can overcome the reduced food self-sufficiency of the Malay Community in Lingga District, namely the need for a proactive role from local leaders (Village Heads) by involving the role of Higher Education through intensive assistance to develop the village. Thus, it is hoped that it will create a Malay Community in Lingga District that is more independent, prosperous, and has the character of being wise and prudent in environmental management and the sustainable use of biological resources.

Food self-sufficiency in the Lingga District area must also be directed at developing forms of etnobioprospecting activities in each village (KEHATI 2020). There is a statement from the PERPRES No. 18/2020 document on the 2020-2024 National Medium-Term Development Plan to encourage the development of regional local resources, which contains that the utilization of biodiversity through etnobioprospecting activities can meet the needs of medicinal raw materials, clothing, food, spices, animal feed, resin producers, dyes, and others. In addition, the diversification of medicinal

plant primary products into secondary products have a high economic added value (RPJMN 2020-2024: 38). Based on that statement, and it has been mentioned that each region must develop and implement the concept of entobioprospecting or forms of biodiversity utilization in targets, programs, and strategic plans.

CONCLUSION

Ethnobioprospection of plant and animal species from various forest ecosystems in Lingga District, including lowland forest, sago forest, and mangrove forest. Ethnobioprospection based on utilization can be seen from the high potential of plant species in various forest ecosystems in Lingga District utilized by the community, namely 312 species from 97 families with 11 utilization categories. The highest utilization category is food-producing plants (111 species), while the animal potential is 124 species consisting of 6 utilization categories. The utilization of animals by the community is 90 species consisting of 8 animal classes, with the highest utilization in the category of animal utilization as a food source (62 species).

REFERENCES

Adelia N. 2010. Pengetahuan tradisional tentang pemanfaatan tumbuhan obatan oleh masyrakat Suku Lom di Dusun Air Abik Desa Gunung Muda Kecamatan Belinyu Bangka [skripsi]. Sungai Liat: Universitas Bangka Belitung.

Anderson EN. 2011. Ethnobiology: Overview of a Growing Field. Anderson EN, Pearsal DM, Hunn ES, Turner JN. 2011. Editor. *Ethnobiology*. Published by John Wiley & Sons, Inc., Hoboken, New Jersey.

Dendang B, Handayani W. 2015. Struktur dan komposisi tegakan hutan di Taman Nasional Gunung Gede Pangrango, Jawa Barat. Pros Sem Nas Masy BiodivIndon. 1(4).

Gemilang R, Irwanto RR, Dwiartama A. 2019. Studi etnobotani pemanfaatan sagu (*Metroxylon sagu* Rottb.) di Pulau Lingga, Kepulauan Riau. Di dalam: Seminar Nasional Biolog2019: Pemanfaatan Biodiversitas dan Bioteknologi untuk Pelestarian Lingkungan. 2019 Apr 25; Bandung, Indonesia. Bandung: hlm 36-43.

keh[KEHATI] Policy Brief: Arah Pengembangan Bioprospecting di Idonesia. 2020.

Nahlunnisa H, Zuhud EAM, Santosa Y. 2016. Keanekaragaman spesies tumbuhan di areal nilai konservasi tinggi (NKT) perkebunan kelapa sawit Provinsi Riau. *Jurnal Media Konservasi*. 21(1): 91-98.

Qasrin U, Setiawan A, Yulianti, Bintoro A. 2020. Studi etnobotani tumbuhan berkhasiat obat yang dimanfaatkan masyarakat Suku Melayu Kabupaten Lingga Kepulauan Riau. *Jurnal Belantara*. 3(2): 139-152.

Reid WV, Laird SA, Meyer CA. 1993. *Biodiversity Prospecting: Using genetic resources for sustainable development*. World Resources Institute.

Rini R, Fakhrurrozi Y, Akbarini D. 2018. Pemanfaatan daun sebagai pembungkus makanan tradisional oleh masyarakat Bangka (studi kasus di Kecamatan Merawang). *Jurnal Penelitian Botani, Zoologi, dan Mikrobiologi*. 2(1):20-32.

Rosalia N. 2008. Penyebaran dan karakteristik tempat tumbuh pohon tembesu (*Fragaea fragrans* Roxb.) (Studi kasus di kawasan Taman Nasional Danau Sentarum Kapuas Hulu Kalimantan Barat) [tesis]. Bogor: IPB University.

[PERPRES] Peraturan Presiden Nomor 18 Tahun 2020 Tentang Rancangan Pembangunan Jangka Menengah Nasional 2020-2024. 2020.

Santoso WY. 2016. Signifikansi preventive expenditures valuation dalam bioprospelsi sumberdaya genetik di Indonesia. *Jurnal Pengelolaan Sumberdaya Alam dan Lingkungan*. 6(1):86-96.

Satria A, Rustiadi E, Purnomo AE, editor. 2011. *Menuju Desa 2030*. Yogyakarta: Pohon Cahaya.

Sitinjak AP, Anwari MS, Ardian H. 2021. Etnozoologi masyarakat Dayak Kanayatn untuk diperdagangkan di Desa Pancaroba Kecamatan Sungai Ambawang Kabupaten Kubu Raya. *Jurnal Hutan Lestari*. 9(3): 347-353.

Soerianegara I, Indrawan A. 2008. *Ekologi Hutan Indonesia*. Bogor: Fakultas Kehutanan Institut Pertanian Bogor.

Sundarapandian SM, Swamy PS. 2000. Forest ecosystem struktur dan competition along an altitudinal gradient in the western ghats, South India. *Journal of Tropicical Forest Science* 12 (1): 104-123.

Walujo EB. 2014. Research ethnobotany in Indonesia and the future perpectives. *Biodiversitas.* 9(1): 59-63.

Yayasan KEHATI SITH ITB. 2020. *Menyusun Cetak Biru: Bioprospecting di Indonesia*. Bandung: ITB Press.

Zuhud EAM, Manar PA, Adiyaksa IK. 2022. *Pengembangan Etno-Bioprospeksi sebagai Pondasi Kedaulatan Bangsa*. Alikodra HS, Sudarmonowati, editor. Potensi Bioprospeksi Indonesia Bagi Pembangunan Ekonomi NKRI. Bogor: IPB Press.