

Diversity and use of wild edible fruits in the Bukit Rimbang-Bukit Baling Wildlife Reserve, Kampar, Riau, Indonesia

SYAMSUARDI^{1,*}, ERIZAL MUKHTAR¹, NURAINAS¹, ADI BEJO SUWARDI²

¹Department of Biology, Faculty of Mathematics and Sciences, Universitas Andalas. Jl. Unand, Kampus Limau Manis, Padang 25163, West Sumatra, Indonesia. *email: syamsuardi@sci.unand.ac.id, adi.mipa@gmail.com

²Department of Biology Education, Faculty of Teacher Training and Education, Universitas Samudra. Langsa 24416, Aceh, Indonesia

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Abstract. Syamsuardi, Mukhtar E, Nurainas, Suwardi AB. 2022. Diversity and use of wild edible fruits in the Bukit Rimbang - Bukit Baling Wildlife Reserve, Kampar, Riau, Indonesia. *Biodiversitas* 23: 5035-5042. The Bukit Rimbang-Bukit Baling Wildlife Reserve is a protected area with a diverse ecosystem and vegetation. The area provides many ecosystem services that are critical to life, particularly for humans. The aim of this study is to document wild edible fruits and their use by the community surrounding the Bukit Rimbang-Bukit Baling Wildlife Reserve. The study was carried out in eight villages of Kampar district, Riau province, namely Tanjung Belit, Tanjung Belit Selatan, Gema, Kota Lama, Muara Bio, Muara Selayah, IV Koto Setingka, and Sungai Rambai. This study was based on field surveys, plant collection, and interviews with the local people. Interviews were performed with 334 respondents selected by using the random sampling technique. A total of 67 wild edible fruit plant species, consisting of 29 families, have been documented in the study area. *Artocarpus integer*, *Mangifera odorata*, *Mangifera foetida*, *Nephelium maingayi*, *Durio oxleyanus*, *Syzygium polyanthum*, *Pometia pinnata*, *Baccaurea deflexa*, *Garcinia xanthochymus*, and *Bellucia pentamera* were among the plants recognized and frequently harvested by respondents. Local communities use wild edible fruits as food, either eaten raw or processed into candy, snacks, or vegetables. About 54% of the respondents reported traditional knowledge linked to wild edible fruits is transferred from the parents/grandparents to the next generations in the study area. The expansion of agricultural lands and the decline in traditional knowledge are the main threats to the sustainability of wild edible fruits in the study area.

Keywords: Biodiversity, fruit, traditional uses, Bukit Rimbang-Bukit Baling

INTRODUCTION

Bukit Rimbang-Bukit Baling is one of the prioritized conservation areas in Indonesia and was considered a Wildlife Reserve region by the Forestry Minister (Decree No. SK.3977/Menhut-VII/KUH/2014) in 2014 is located in two districts, namely Kampar and Kuantan Singingi, Riau Province. This area is known for its high biodiversity and serves as a vital conservation center for Sumatran Tigers (*Panthera tigris sumatrae*), which is a long-term priority area in Tiger Conservation Landscapes (TCL) (Widodo et al. 2017). The Bukit Rimbang-Bukit Baling Wildlife Reserve provides many ecosystem services that are critical to life, particularly for humans. Wild edible fruits are one of the non-timber forest products that are used by local communities around the forest on a regular basis (Suwardi et al. 2022). Because of their nutritional and medicinal value (Biswas et al. 2018), wild edible fruits have played an important role in the livelihoods of rural communities in developing countries (Mwema et al. 2012; Mabaya et al. 2014; Murni et al. 2016; Khrumo and Deb 2018). Wild edible fruits provide vitamins and minerals that are necessary for human health (Elfrida et al. 2020; Navia et al. 2021a). Proximate analysis of some wild edible fruits reveals that, in many cases, their nutritional quality is comparable to, if not superior to, that of domesticated varieties (Hegazy et al. 2013; Peduruhewa et al. 2021; Suwardi et al. 2022) and can provide macro and

micronutrients for healthier and more nutritionally secure people (Nadal and Bhardwaj 2015). Furthermore, for rural communities, wild edible fruits are important sources of traditional beverages, food, oil, medicines, fodder, firewood, building materials, and traditional ceremonies (Elfrida et al. 2021; Sutrisno et al. 2020; Navia et al. 2021b; Sutrisno et al. 2021; Suwardi et al. 2021; Ramaidani and Navia 2022; Syamsuardi et al. 2022).

Local communities are known to have excellent knowledge of the use of local plants for food and other purposes, such as supporting health conditions (Nunes et al. 2018; Adnan et al. 2022; Haruna et al. 2022). This community group has different perceptions and conceptions of biological resources in their environment (Azevêdo et al. 2022), including the use of wild edible fruits. The community has traditionally possessed local wisdom, which has the potential and strength for forest conservation (Kumsapa and Indanon 2016). However, the potential and utilization of wild edible fruits in the Bukit Rimbang-Bukit Baling Wildlife Reserve have not been fully explored. The Bukit Rimbang-Bukit Baling Wildlife Reserves, on the other hand, are under increasing threat from rapid population growth in the villages surrounding the Bukit Rimbang-Bukit Baling Wildlife Reserve. As a result of the increased demand for land for agriculture and settlements, it is suspected that population growth is a major factor contributing to the high conversion of primary forests into residential and plantation areas. On the other

hand, various studies have shown a decline in public interest in wild forests, particularly among the younger generation (Sujarwo et al. 2014), including wild edible fruits. This condition may result in the loss of community traditional knowledge about the use of wild resources, as well as the long-term extinction of various wild species in nature, including wild edible fruits. The aim of this study is to document wild edible fruits and their use by the community surrounding the Bukit Rimbang-Bukit Baling Wildlife Reserve.

Study area

The Bukit Rimbang-Bukit Baling Wildlife Reserve is a protected area with a diverse ecosystem and vegetation. In central Sumatra, the area serves as a major water catchment area (Widodo et al. 2017). The Ministry of Environment and Forestry recently inaugurated Bukit Rimbang Bukit Baling as a Conservation Forest Management Unit (CFMU) in 2016 to ensure ecosystem function and better management of the area (based on Environment and Forestry Minister Decision Letter No. SK.468/Menlhk/Setjen/PLA.0/6/2016). Bukit Rimbang-Bukit Baling has a tropical lowland forest ecosystem. Administratively, this area is divided into two districts, namely Kampar and Kuantan Singingi, Riau Province. The study was carried out in eight villages in Kampar district, namely Tanjung Belit, Tanjung Belit Selatan, Gema, Kota Lama, Muara Bio, Muara Selayah, IV Koto Setingkai, and Sungai Rambai (Figure 1).

Lama, Muara Bio, Muara Selayah, IV Koto Setingkai, and Sungai Rambai (Figure 1).

Sample size and informant selection

Eight study villages, i.e. Tanjung Belit, Tanjung Belit Selatan, Gema, Kota Lama, Muara Bio, Muara Selayah, IV Koto Setingkai, and Sungai Rambai (Fig. 1), were selected based on recommendations of local authorities. The sample size was determined using Cochran's sample size formula, as presented by Bartlett et al. (2001).

$$n = N / (1 + N(e)^2)$$

where n is the study sample size, N is the total number of households in selected villages, e is the maximum variability or margin of error of 5% (0.05), whereas 1 is the probability of the event occurring. As a result, a total sample size of:

$$n = 2,038 / (1 + 2,038(0.05)^2), n = 334$$

The proportion of households (HH) in each village was used to calculate the sample size for each village. Tanjung Belit, for example, has a total of 288 households, yielding a total of 47 ($n = 288 \times 334 / 2,038 = 47$). Table 1 shows the results of the same calculation for the other villages.

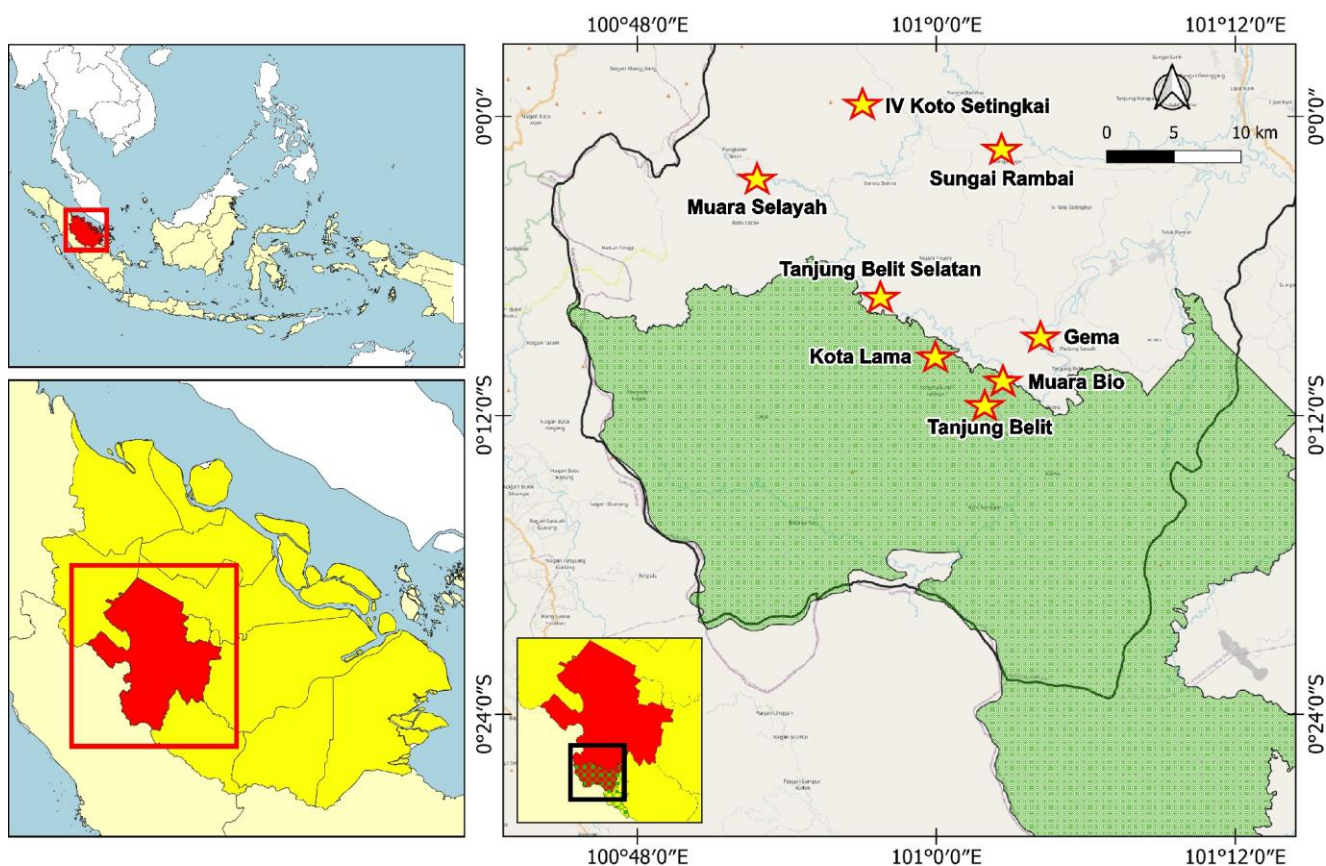


Figure 1. Map of Bukit Rimbang-Bukit Baling Wildlife Reserve, Kampar, Riau, Indonesia, (★) showing the study area

Table 1. The sample size of respondents of the selected villages

Name of village	Area in km ²	No. of population	No. of households	No. of respondents involved in the study
Tanjung Belit	35	828	288	47
Tanjung Belit Selatan	16	671	201	33
Gema	28	1,312	402	66
Kota Lama	84	635	203	33
Muara Bio	36	121	39	7
Muara Selayah	164.5	665	219	36
IV Koto Setingkai	53	1,368	404	66
Sungai Rambai	37.64	942	282	46
Total	454.14	6,542	2,038	334

Ethnobotanical data collection

Plant collection and data documentation were part of the fieldwork. All respondents gave formal written consent, including permission for publication, before the interviews. A total of 334 respondents were selected by using the random sampling technique and divided into six age groups: (1) 11-20, (2) 21-30, (3) 31-40, (4) 41-50, (5) 51-60, and (6) 61-70. During the interview, a semi-structured questionnaire about the names of wild edible fruit species, their uses, and local conservation was used. All respondents were asked to rate the top ten preferred wild edible fruits base on taste quality. All interviews were conducted in the respondent's native language with the help of native translators, and the data was then translated into English.

Species documentation and identification

Plant specimens were collected during a field survey. The voucher specimens were identified at ANDA herbarium, Universitas Andalas, West Sumatra, Indonesia. Plants of the World Online (<https://powo.science.kew.org/>) was used to update the botanical name.

Data analysis

Descriptive statistics, relative frequency citation index, preference ranking, and priority ranking were used to analyze the data. Mann-Whitney tests and Spearman's rank correlation were used to investigate the relationship between variables, with a confidence level of 95%.

Relative Frequency Citation Index

The ethnobotanical data were quantitatively analyzed using a relative frequency citation index (RFC) (Vitalini et al. 2013):

$$RFC = FC/N \quad (0 < RFC < 1)$$

where: FC is the number of respondents mentioning the use of the species, and N is the total number of respondents participating in the survey (N), without considering the use categories.

Preference ranking

The wild edible fruit plant preference ranking was conducted. In terms of taste quality, all respondents were asked to rank the top ten preferred wild edible fruits on a scale of 1-5 (most preferred). Finally, the total scores were

added and ranked to determine which wild edible fruit plant was the most preferred.

Ranking of threatening factors

To determine the most threatening factors in the study area, priority ranking was used to determine threats of wild edible plants based on their level of destructive effects. Based on their knowledge and experience, respondents were asked to rate the impact of each threat on wild edible fruits on a scale of 0 to 4, and a spider chart was used to interpret the mean risk value for each threat (Dejene et al. 2020).

RESULTS AND DISCUSSION

Socio-demographic of the respondents

A total of 334 informants were interviewed during this study; most of them were women (54.4%) between the ages of 31 and 40 years. The majority of them had a Junior level of education (30.5%), while the percentages of other levels (Elementary school, Senior High School, Junior High School, no education, and University) were 28.7%, 25.7%, 8.4%, and 6.6%, respectively (Table 2).

Diversity and use of wild edible fruits

The study was conducted in eight selected villages to document the diversity and use of wild edible fruits. A total of 67 wild edible fruit plant species were from 29 families (Table 3).

Table 2. Socio-demographics of respondents

Variable		Total	Percentage
Gender	Women	182	54.5
	Men	152	45.5
Age	11-20	62	18.6
	21-30	78	23.4
	31-40	86	25.7
	41-50	54	16.2
	51-60	12	3.6
	61-70	28	8.4
Education	No education	28	8.4
	Elementary School	96	28.7
	Junior High School	102	30.5
	Senior High School	86	25.7
	University	22	6.6

Table 3. List of wild edible fruits

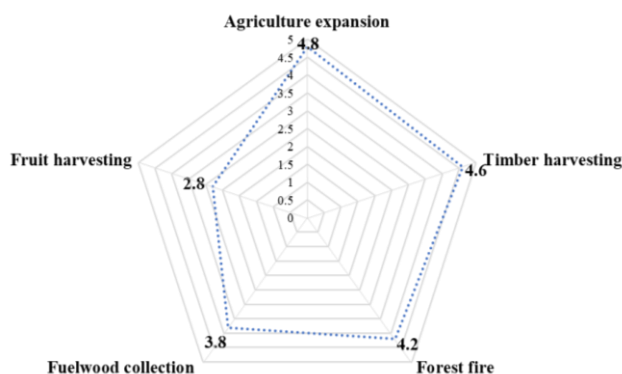
Family, botanical name	Vernacular name	Plant part edible	Use(s)	RFC
Anacardiaceae				
<i>Bouea macrophylla</i> Griff.	Dandoriah	Fruit	The fruit is eaten raw	0.054
<i>Mangifera foetida</i> Lour.	Bacang	Fruit	The fruit is eaten raw, made into drinks, and sometimes pickled to be served with curries	0.985
<i>Mangifera laurina</i> Blume	Pauh	Fruit	The fruit is eaten raw	0.563
<i>Mangifera odorata</i> Griff.	Kuini	Fruit	The fruit is eaten raw, made into drinks, and sometimes pickled to be served with curries	0.988
<i>Mangifera similis</i> Blume	Asam	Fruit	The fruit is eaten raw, made into drinks, and sometimes pickled to be served with curries	0.114
<i>Solenocarpus philippinensis</i> (Elmer) Kosterm.	Siurie	Fruit	The fruit is eaten raw	0.036
<i>Spondias pinnata</i> (L.f.) Kurz	Kedondong hutan	Fruit	The fruit is eaten raw	0.173
Annonaceae				
<i>Cananga odorata</i> (Lam.) Hook.f. & Thomson	Kenanga hutan	Fruit	The fruit is eaten raw	0.054
Apocynaceae				
<i>Voacanga foetida</i> (Blume) Rolfe	Tampa Badak	Fruit	The fruit is eaten raw	0.084
Arecaceae				
<i>Eleiodoxa conferta</i> (Griff.) Burret	Asam kelubi	Fruit	The fruit is eaten raw or further processed as candy	0.036
Burseraceae				
<i>Santiria oblongifolia</i> Blume	Kedondong hutan	Fruit	The fruit is eaten raw	0.162
Clusiaceae				
<i>Garcinia atroviridis</i> Griff. ex T.Anderson	Gelugur	Fruit	The fruit is used as a spice	0.922
<i>Garcinia xanthochymus</i> Hook.f. ex T.Anderson	Kandis	Fruit	The fruit is used as a spice	0.952
Ebenaceae				
<i>Diospyros sumatrana</i> Miq.	Unknown	Fruit	The fruit is eaten raw	0.096
Euphorbiaceae				
<i>Mallotus philippensis</i> (Lam.) Müll.Arg.	Balik Angin	Seed	The seeds are consumed after boiling, baking, roasting, or frying	0.027
Fabaceae				
<i>Archidendron bubalinum</i> (Jack) I.C.Nielsen	Kabau	Fruit	The fruit is eaten raw	0.620
<i>Dialium platysepalum</i> Baker	KerANJI	Fruit	The fruit is eaten raw	0.114
Fagaceae				
<i>Castanopsis acuminatissima</i> (Blume) A.DC.	Mempening	Seed	The seeds are consumed after boiling, roasting, or frying	0.066
<i>Castanopsis costata</i> (Blume) A.DC.	Mempening	Seed	The seeds are consumed after boiling, roasting, or frying	0.087
<i>Castanopsis argentea</i> (Blume) A.DC.	Mempening	Seed	The seeds are consumed after boiling, roasting, or frying	0.054
<i>Castanopsis inermis</i> (Lindl.) Benth. & Hook.f.	Mempening	Seed	The seeds are consumed after boiling, roasting, or frying	0.083
<i>Lithocarpus lucidus</i> (Roxb.) Rehder	Mempening	Seed	The seeds are consumed after boiling, roasting, or frying	0.057
<i>Quercus argentata</i> Korth.	Mempening	Seed	The seeds are consumed after boiling, roasting, or frying	0.036
Lamiaceae				
<i>Vitex pinnata</i> L.	Laban	Fruit	The fruit is eaten raw	0.018
Lauraceae				
<i>Litsea umbellata</i> (Lour.) Merr.	Medang	Fruit	The fruit is eaten raw	0.012
Lecythidaceae				
<i>Planchonia valida</i> (Blume) Blume	Putat	Fruit	The fruit is eaten raw	0.126
Malvaceae				
<i>Boschia griffithii</i> Mast.	Durian burung	Seed	The seeds are consumed after boiling, roasting, or frying	0.018
<i>Durio lowianus</i> Scort. ex King	Durian hutan	Fruit	The fruit is eaten raw	0.323
<i>Durio oxleyanus</i> Griff.	Durian daun	Fruit	The fruit is eaten raw	0.982
Melastomataceae				
<i>Bellucia pentamera</i> Naudin	Jambu monyet	Fruit	The fruit is eaten raw	0.931
<i>Melastoma malabathricum</i> L.	Siduduk	Fruit	The fruit is eaten raw	0.922

Meliaceae					
<i>Aglaia tomentosa</i> Teijsm. & Binn.	Unknown	Fruit	The fruit is eaten raw		0.096
<i>Dysoxylum alliaceum</i> (Blume) Blume ex A.Juss.	Unknown	Fruit	The fruit is eaten raw		0.084
Moraceae					
<i>Artocarpus anisophyllus</i> Miq.	Unknown	Fruit	The fruit is eaten raw		0.098
<i>Artocarpus elasticus</i> Reinw. ex Blume	Torop	Seed	The seeds require initial roasting		0.036
<i>Artocarpus integer</i> (Thunb.) Merr.	Cempedak	Fruit, seed	The ripened fruit is consumed raw, while the fresh forms are used as vegetables, and the seed is eaten after boiling, roasting, or frying		0.994
<i>Artocarpus rigidus</i> Blume	Unknown	Fruit, seed	The fruit is eaten raw		0.087
<i>Ficus altissima</i> Blume	Ara	Fruit	The fruit is eaten raw		0.036
<i>Ficus fistulosa</i> Reinw. ex Blume	Ara	Fruit	The fruit is eaten raw		0.024
<i>Ficus globosa</i> Blume	Ara	Fruit	The fruit is eaten raw		0.039
<i>Ficus lepicarpa</i> Blume	Ara	Fruit	The fruit is eaten raw		0.111
<i>Ficus racemosa</i> L.	Ara	Fruit	The fruit is eaten raw		0.126
<i>Ficus virens</i> Aiton	Ara	Fruit	The fruit is eaten raw		0.036
Myrtaceae					
<i>Syzygium cumini</i> (L.) Skeels	Jambu	Fruit	The fruit is eaten raw		0.144
<i>Syzygium polyanthum</i> (Wight) Walp.	Salam	Leaf, fruit	The leaf is used as a spice, while the fruit is sometimes eaten raw		0.982
<i>Syzygium pycnanthum</i> Merr. & L.M.Perry	Jambu kelelawar	Fruit	The fruit is eaten raw		0.623
Myristicaceae					
<i>Knema furfuracea</i> (Hook.f. & Thomson) Warb.	Pala hutan	Fruit	The fruit is used as a spice		0.051
<i>Knema latericia</i> Elmer	Pala hutan	Fruit	The fruit is used as a spice		0.054
<i>Myristica elliptica</i> Wall. ex Hook.f. & Thomson	Pala hutan	Fruit	The fruit is used as a spice		0.036
Olacaceae					
<i>Scorodocarpus borneensis</i> (Baill.) Becc.	Kulim	Fruit	The fruit is eaten raw		0.054
Passifloraceae					
<i>Passiflora foetida</i> L.	Markisa hutan	Fruit	The fruit is eaten raw		0.862
Phyllanthaceae					
<i>Baccaurea brevipes</i> Hook.f.	Rambai hutan	Fruit	The fruit is eaten raw		0.132
<i>Baccaurea deflexa</i> Müll.Arg.	Tungau	Fruit	The fruit is eaten raw		0.961
<i>Baccaurea lanceolata</i> (Miq.) Müll.Arg.	Empaung	Fruit	The fruit is eaten raw		0.841
<i>Baccaurea macrocarpa</i> (Miq.) Müll.Arg.	Tampoi nasi	Fruit	The fruit is eaten raw		0.904
<i>Baccaurea macrophylla</i> (Müll.Arg.) Müll.Arg.	Tampoi	Fruit	The fruit is eaten raw		0.632
<i>Baccaurea sumatrana</i> (Miq.) Müll.Arg.	Mata rusa	Fruit	The fruit is eaten raw		0.542
Rosaceae					
<i>Rubus moluccanus</i> L.	Beri hutan	Fruit	The fruit is eaten raw		0.308
Rubiaceae					
<i>Aidia racemosa</i> (Cav.) Tirveng.	Unknown	Fruit	The fruit is eaten raw		0.335
Rutaceae					
<i>Micromelum minutum</i> (G.Forst.) Wight & Arn.	Unknown	Fruit	The fruit is eaten raw		0.012
Sapindaceae					
<i>Dimocarpus longan</i> Lour.	Lengkeng hutan	Fruit	The fruit is eaten raw		0.321
<i>Pometia pinnata</i> J.R.Forst. & G.Forst.	Kasai	Fruit	The fruit is eaten raw		0.964
<i>Xerospermum noronhianum</i> (Blume) Blume	Rambutan biawak	Fruit	The fruit is eaten raw		0.901
<i>Nephelium maingayi</i> Hiern	Rambutan	Fruit	The fruit is eaten raw		0.992
Salicaceae					
<i>Flacourtia rukam</i> Zoll. & Moritzi	Rukam	Fruit	The fruit is eaten raw		0.348
Sapotaceae					
<i>Palaquium obovatum</i> (Griff.) Engl.	Unknown	Fruit	The fruit is eaten raw		0.033
Urticaceae					
<i>Debregeasia longifolia</i> (Burm.f.) Wedd.	Unknown	Fruit	The fruit is eaten raw		0.024

Table 4. Preference ranking of top ten wild edible fruits by their taste quality (1: least, 2: less, 3: good, 4: very good, and 5: excellent)

Wild edible fruits	Respondents (N=334)								Total Score	Rank
	TB	TS	GM	KL	MB	MS	KS	SR		
<i>Nephelium maingayi</i>	5.0	4.8	5.0	4.8	5.0	5.0	5.0	5.0	39.6	1 st
<i>Artocarpus integer</i>	5.0	4.8	4.8	4.8	5.0	5.0	5.0	5.0	39.4	2 nd
<i>Mangifera odorata</i>	4.8	4.6	5.0	4.8	5.0	5.0	4.8	5.0	39.0	3 rd
<i>Mangifera foetida</i>	5.0	5.0	4.8	5.0	4.8	4.6	4.8	4.8	38.8	4 th
<i>Baccaurea macrocarpa</i>	5.0	5.0	4.8	4.6	5.0	4.2	5.0	4.6	38.2	5 th
<i>Baccaurea deflexa</i>	5.0	4.4	5.0	4.2	5.0	5.0	4.8	4.6	38.0	6 th
<i>Durio oxleyanus</i>	4.8	4.2	4.8	5.0	4.8	4.8	4.8	4.8	38.0	7 th
<i>Pometia pinnata</i>	4.6	4.8	4.8	4.6	4.8	4.6	4.8	4.8	37.8	8 th
<i>Dimocarpus longan</i>	4.8	4.2	4.8	4.6	4.6	5.0	4.8	4.8	37.6	9 th
<i>Bellucia pentamera</i>	4.8	4.6	4.8	4.4	4.2	4.2	3.8	4.8	35.6	10 th

Note: TB: Tanjung Belit; TS: Tanjung Belit Selatan; GM: Gema; KL: Kota Lama; MB:Muara Bio; MS: Muara Selayah; KS: IV Koto Seting kai; SR: Sungai Rambai

**Figure 2.** Ranking of factors threats to wild edible fruits

The dominant family is Moraceae, with 10 reported species, followed by Anacardiaceae (7), Fagaceae and Phyllantaceae (6 each), and Sapindaceae (4), while the rest of the families were represented with 1 to 3 species. *Artocarpus integer*, *Mangifera odorata*, *Mangifera foetida*, *Nephelium maingayi*, *Durio oxleyanus*, *Syzygium polyanthum*, *Pometia pinnata*, *Baccaurea deflexa*, *Garcinia xanthochymus*, and *Bellucia pentamera* were among the plants recognized and frequently harvested by respondents. Other species, such as *Vitex pinnata*, *Boschia griffithii*, *Litsea umbellata*, and *Micromelum minutum*, were unfamiliar to less than 20% of respondents and were rarely consumed.

Preference for wild edible fruits

The majority of respondents across all villages cited *N. maingayi* as the most popular wild edible fruits due to their pleasant taste (preference ranking; Table 4).

During the discussion, local communities stated that they prefer to consume wild edible fruit harvested from the forest due to its sweet and delicious taste. Furthermore, plant species that are frequently harvested are species with economic potential. During the fruit season, these plants are harvested not only for personal consumption but also to be sold in traditional markets across the village. Consequently, in addition to providing nutritional benefits,

the availability of wild edible fruits also provides economic benefits to people living near the forest. This study is in line with the report by Suwardi et al. (2020) in Aceh Tamiang, Indonesia.

Transfer traditional knowledge

The majority of information about the use of wild edible fruits was obtained from family/friends/neighbors. During an interview, 54% of respondents said they learned about the use of wild edible fruits from their parents and grandparents, 31% from friends/neighbors, and 15% from formal education. The average number of species reported as edible by each age group of the respondent ranged from 14.3 ± 1.31 (11-20 years) to 66.2 ± 3.11 (60-70 years). While, for each educational status, the mean number of species recognized varied from 18.1 ± 3.12 (University) to 64.24 ± 2.11 (No education). This study discovered that there were differences in knowledge and use of wild edible fruits in the area between gender and age groups. According to the Mann-Whitney statistical analysis results, women are more knowledgeable about wild edible fruit species than men ($p = 0.001$; $n = 334$), demonstrating that women have a significant role in knowledge transfer. The Spearman's rank correlation between age and the number of citations of wild edible fruits also showed was significant ($r = 0.761$; $p < 0.001$) for the individuals studied. This demonstrates that the older generation understands the species and uses of wild edible fruits better than the younger generation, and there is an indication of traditional knowledge degradation between generations. Traditional knowledge loss is influenced by the small proportion of elders who used to transfer their traditional knowledge to the younger generation, as many of them kept the knowledge secret (Okui et al. 2021). Furthermore, modernization is believed to reduce the younger generation's interest in wild food, including wild edible fruits, resulting in a loss of traditional knowledge among them. Rapid technological advancements, particularly the internet, have resulted in the erosion of traditional knowledge among the younger generation (Sujarwo et al. 2014; Navia et al. 2021).

Threats to wild edible fruits and their habitats

Several threats to wild edible fruits in the study area were identified, including land use and habitat destruction. Agriculture expansion, timber harvesting, forest fire, fruit harvesting, and fuelwood collection were all severely depleting the wild edible fruits in the study area. Among these issues, the majority of respondents believed that agricultural expansion was the primary threat to wild edible fruits (Figure 2).

Field observations showed that forest cover in the study area has decreased as a result of anthropogenic factors, particularly agricultural expansion. The expansion of agriculture is the greatest threat to wild edible fruits in the Bukit Rimbang - Bukit Baling Wildlife Reserve. According to respondents, agricultural expansion for cultivation has increased in recent years as the number of people living near the forest has increased. Timber harvesting was rated as the second greatest threat to the survival of a variety of useful plant species, including wild edible fruit. Timber forest products are thought to have significant economic impacts on the world's rural population (Kawarty et al. 2020). Overharvesting of wild edible fruit trees such as *Durio lowianus*, *Castanopsis acuminatissima*, *Castanopsis costata*, *Castanopsis argentea*, *Castanopsis inermis*, *Litsea inermis*, *Lithocarpus lucidus*, and *Quercus argentata* for house construction purposes, on the other hand, is exacerbating the species loss. Unsustainable fruit harvesting methods are also a threat to wild edible fruits. According to respondents, fruit harvesting methods, such as cutting down trees, will lead to the extinction of the species in the future. Habitat destruction, introduced species, over-harvesting, and species homogeneity in agriculture all contribute to biodiversity loss (Hussein 2022).

Conservation strategies

The sustainable use of biodiversity, including wild edible fruits, is regarded as extremely important and urgent, as this wealth is under threat of extinction and necessitates the cooperation of multiple stakeholders. As a result of increasing human needs, pressure on forest ecosystems has increased in recent years, resulting in the extinction of several useful plant species. Local people in the study area, on the other hand, have placed admirable efforts to promote wild edible fruits available by incorporating traditional knowledge into wild edible fruit plant management. During the discussion, they affirmed to conserve of wild edible fruits by (1) using non-destructive harvesting methods to avoid the death of fruit trees, (2) extracting small quantities of wild edible fruit from each location and plant individually, and (3) not cutting down fruit-producing trees during the opening of new agricultural land. Several studies suggest the conservation and protection of wild plants, as well as the enhancement and incorporation of traditional knowledge into management strategies (Ca'mara-Leret et al. 2014; Sosnowska et al. 2015). Sixty percent of respondents stated that the main issue with the protection of wild edible fruits and promotion of their uses is a change in the local community's lifestyle, particularly among young people, who prefer to consume imported fruit such

as apples or grapes rather than local fruit. Furthermore, the increased conversion of forests to agricultural land in recent years poses a threat to the sustainability of wild edible fruits. However, the local community in the study area has taken conservation action to increase the availability of wild edible fruits by planting several species in their orchards, home gardens, or farmlands. Several of the wild edible fruits documented in this study, including *N. maingayi*, *A. integer*, *M. odorata*, *M. foetida*, *B. deflexa*, *D. oxleyanus*, and *P. pinnata*, are candidates for domestication. Domestication of wild edible fruits is critical not only as a source of food and nutrients for local communities but also as a source of income. The consumption of these fruits may be responsible for overcoming nutrient deficiency, food scarcity, and chronic malnutrition among people living in remote and rural areas (Shah et al. 2020).

Overall, the large number of wild edible fruits mentioned by local communities indicated significant local knowledge in the study area. For food, local communities consumed 67 wild edible fruit plant species from 29 families. *Nephelium maingayi* was the most popular and harvested by local communities, with a frequency citation index of 0.992. However, initiatives to promote and conserve wild edible fruits must be strengthened, in particular among the younger generation. This is necessary to ensure the future availability of wild edible fruit as well as the preservation of traditional knowledge.

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