DIVERSITAS HAYATI
Volume 2, Number 1, June 2024
Pages: 11-16

ISSN: 3025 - 2237

Analysis of Sumatran Orangutan (*Pongo abelii*) Food Tree Species Based on Variations in Altitude at Ketambe Research Station

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Manuscript received: 13 May 2024. Revision accepted: 31 May 2024.

Abstract. Orangutans are a key species in biodiversity that is vital for ecosystem balance. However, the Sumatran Orangutan (*Pongo abelii*) population is declining due to habitat loss and the reduction of important food trees. This study aims to identify the types of food trees and tree parts consumed by Sumatran Orangutans based on height. Conducted at Ketambe Research Station, the results of the study are presented in the form of posters and teaching materials for reference. Exploratory survey method using line transects at three altitude strata (300-600 masl, 600-900 masl, and 900-1100 masl) with purposive sampling based on the presence of food trees and slope conditions. Data were collected through observation sheets and analyzed descriptively. The findings showed 50 species of food trees at 300-600 masl (60.24%), 34 species at 600-900 masl (40.96%), and 38 species at 900-1100 masl (45.78%). Tree parts consumed include fruits (81.9%), seeds (7.2%), young leaves (1.2%), flowers (1.2%), and various combinations of tree parts. This study is expected to broaden the understanding of Sumatran orangutan food tree species at various altitudes and provide important data for the management of Ketambe Research Station.

Keywords: Food Tree Species, Altitude, Exploratory Survey Method, Sumatran Orangutan, Ketambe Research Station

Abbreviations (if any): All important abbreviations must be defined at their first mention there. Ensure consistency of abbreviations throughout the article.

INTRODUCTION

Indonesia, an archipelago with rich biodiversity, is an endemic habitat for the Orangutan, the only great ape found in Asia, with populations restricted to the islands of Sumatra and Borneo [1]. There are three recognized species of Orangutan: Sumatra (*Pongo abelii*), Borneo (*Pongo pygmaeus*), and Tapanuli (*Pongo tapanuliensis*). As a key species in the ecosystem, Orangutans play an important role in maintaining environmental balance [2].

However, the Orangutan population has experienced a significant decline, estimated to have decreased by 30-50% in the last decade, due to habitat destruction caused by illegal logging, forest fires, and hunting. This environmental damage has resulted in the loss of habitat and important food sources for Orangutans. The decline in the number of trees due to human activities is also a major threat to the survival of the Sumatran Orangutan [3].

According to Law No. 5 of 1990 on the Conservation of Living Natural Resources and Ecosystems, orangutans are protected and may not be traded or kept as pets [4]. Surah Al-A'raf verse 56 in the Qur'an underlines the prohibition against environmental damage, including to animals and trees, and encourages environmental conservation [5].

Ketambe Research Station in Gunung Leuser National Park (GLNP) is one of the main research centers for Sumatran Orangutans, with a significant wealth of fauna and flora [6]. This area, which is one of the largest national parks in Indonesia and recognized as the Tropical Rainforest Heritage of Sumatra by UNESCO, serves as an important site for conservation and research on Orangutan food trees [7].

Food trees are a crucial habitat component for Orangutan conservation, as food provides the energy necessary for their survival. The types of food trees used by Orangutans vary from location to location. Faesal's research on the feeding ecology of Orangutans in Batang Toru, North Sumatra, showed that Orangutans not only consume fruit, but also other parts such as flowers, leaves, and bark [8]. In addition, research by Muhammad Alzaqi and Prayogo in the PT Kayung Agro Lestari Conservation Forest Area, Ketapang Regency, revealed that Orangutans utilize various parts of plants besides fruit, including bark, seeds, roots, and umbu [9].

Wastoni's research in the Cakra Conservation Estate of PT Rea East Kalimantan showed that altitude affects the availability of food for orangutans (*Pongo pygmaeus*), with abundant food sources at altitudes below 100 masl and not found at altitudes above 400 masl. Lowlands have denser vegetation than hilly areas, which has an impact on food availability [10].

However, little research has been found on the relationship between altitude and food availability for Sumatran orangutans. Therefore, this study focuses on

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identifying Sumatran orangutan (*Pongo abelii*) food tree species based on altitude at Ketambe Research Station to contribute to conservation and understanding of orangutan food ecology.

MATERIALS AND METHODS

The research was conducted at Ketambe Research Station, Southeast Aceh Regency, which was carried out in March 2023. The research location point can be seen in Figure 1.

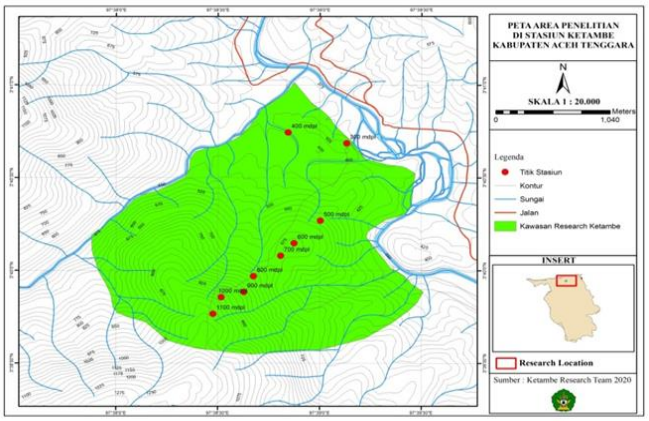

Figure 1. Map of Research Location at Ketambe Research Station

This study used an *exploratory survey* method, namely *direct observation* at the research site. Data collection was conducted using the *line transect* method at three different height strata to identify the types of food trees of Sumatran orangutans (*Pongo abelii*). Samples were taken using *purposive sampling* method, based on the presence of food trees and sloping land conditions at each predetermined altitude stratum [11].

The population of this study included all Sumatran Orangutan (*Pongo abelii*) food tree species at Ketambe Research Station, Southeast Aceh Regency. Samples in this study were Orangutan food tree species within the *line transect* path at each predetermined height stratum [3].

Research Procedure

- Initial Preparation

The initial stage included a literature study and information gathering from the manager of Ketambe Research Station through direct interviews and surveys.

- Data Retrieval Technique

Data collection of Orangutan food trees at Ketambe Research Station was carried out by making 9 transects based on altitude, each transect measuring 100 m long and 20 m wide. The transects were divided into 3 altitude ranges: 300-600 masl, 600-900 masl, and 900-1100 masl, with 3 transects in each range. Parameters measured included Orangutan food tree species, number of individual trees, tree diameter, as well as physical and chemical factors such as soil moisture, soil pH, air humidity, temperature, and light intensity [12].

- Sample Identification of Food Tree Types

Each Orangutan food tree species found was morphologically identified at the research site using identification books and other literature studies, and documented with photographs. Information recorded included elevation, tree species, tree strata, parts of the tree eaten by Orangutans, family, and local and scientific names.

- Research Instruments

The research instrument for food tree species based on altitude used an observation sheet to record the name of the tree species, family, trunk circumference, and parts eaten by orangutans. Physical and chemical factors measured included soil moisture, air humidity, temperature, soil pH, and light intensity.

Data Analysis

This study used descriptive qualitative data analysis techniques to describe the types of orangutan food trees in each altitude stratum at Ketambe Research Station, Gunung Leuser National Park (GLNP). Data is presented in the form of tables, graphs, and images.

RESULTS AND DISCUSSION

Food Tree Species of Sumatran Orangutan (*Pongo abelii* Lesson, 1827) at Ketambe Research Station

Research at Ketambe Research Station identified 83 Sumatran orangutan (*Pongo abelii*) food tree species from 35 families at various heights. Complete data on these food tree species are presented in Table 1.

Table 1: Food tree species of Sumatran orangutans (*Pongo abelii*) at Ketambe Research Station.

No.	Regional Name	Scientific Name	Family
1	King's Acid	*Dracontomelon dao*	Anacardiaceae
2	Bintangur Mancang	*Magnifera laurina*	
3	Small Banitan Leaves	*Pseudovaria reticulata*	Annonaceae
4	Banitan Leaf Width	*Polyalthia laterifolia*	
5	The Smell of Heaven	*Cyathocalyx sumantranus*	
6	Lengen	*Canangium odorata*	
7	Rutih	*Alstonia scholaris*	Apocynaceae
8	Aren Trees	*Arenga pinnata*	Arecaceae
9	Dempok	*Neesia* sp.	Bombacaceae
10	Risung	*Canarium denticulacum*	Burseraceae
11	Lelegen	*Gironniera* sp.	Cannabaceae
12	Pepadi	*Gironniera subaequalis*	

13	Dangla	*Crataeva magna*	Capparidaceae
14	Keranji	*Siphonodon celastrinus*	Celastraceae
15	Meranti Petimah	*Lophopetalum javanicum*	
16	Peder Acid	*Garcinia* sp.	
17	Forest Mangosteen	*Garcinia celebica*	Clusiaceae
18	Peradah	*Garcinia dioica*	
19	Regular Banitan	*Mastixia trichotoma*	Cornaceae
20	Entap	*Parashorea lucida*	Dipterocarpceae
21	Charcoal Wood	*Diospyros clavigera*	Ebenaceae
22	Prone Look	*Elaeocarpus* sp.	Elaeocarpaceae
23	Medang Lede	*Elaeocarpus glaber*	
24	Rubber Wood	*Elateriospermun tapos*	
25	Pepoa	*Mallotus philipensis*	
26	Rambe Kekura Kecil	*Mallotus* sp.	
27	Rumpi Rawan	*Mallotus sphaerocarpus*	
28	Selupik	*Sapium baccatum*	
29	Looks	*Blumeodendron tokbrai*	
30	Tampu Tapak Gajah	*Macaranga triloba*	Euphorbiaceae
31	Ure Tenge Benge	*Chepalomappa malloticarpa*	
32	Tampu Balik Angin	*Macaranga hypoleucea*	
33	Ordinary Lamp	*Macaranga tanarius*	
34	Tampu Licin	*Macaranga diepenhorstii*	
35	Tingkam	*Bischofia javanica*	
36	Geseng Batu	*Lithocarpus* sp.	
37	Flower Buckle	*Lithocarpus wrayii*	Fagaceae
38	Buckle Horn	*Lithocarpus* sp.	
39	Bintangur Beringi	*Calophyllum saigonense*	Guttifereae
40	Medang Kunyit	*Beilescihamiedia* sp.	
41	Medang Licin	*Litsea* sp.	
42	Medang Nangka	*Phoebe grandis*	Lauraceae
43	Medang Pisang	*Litsea robusta*	
44	Medang Sawa	*Phoebe elliptica*	
45	Dukut Dasih	*Planconia vallida*	Lecythidaceae
46	Bungur	*Lagerstroemia* sp.	Lytharaceae
47	Reverse the Oath	*Aglaia argentea*	
48	Setur Badak	*Aglaia speciosa*	
49	White Rhino Setur	*Dysoxylum excelsum blume*	Meliaceae
50	Setur Gajah	*Aglaia odoratissima*	
51	Setur Padi	*Aglaia korthalsii*	
52	Ipoh	*Antiaris toxicaria*	
53	Regular Gala-Gala	*Ficus racemosa*	Moraceae
54	Gala-Gala Rawu	*Ficus variegata*	
55	Gerupel Prone	*Artocarpus* sp.	
56	Bleeding	*Knema cinerea*	
57	Small leaf hemorrhage	*Knema* sp	Myristicaceae
58	Leaf Width	*Knema laurina*	
59	Forest Nutmeg	*Myrisctica* sp.	
60	Kemong wood	*Ardisia* sp.	
61	Child Fence Kerakah	*Ardisia lanceolata*	Myrsinaceae
62	Water Guava	*Eugenia densiflora*	
63	Forest Guava	*Egenia grandis*	Myrtaceae
64	Splint Wood	*Eugenia* sp.	
65	Banitan Keleton	*Strombosia zeylanica*	Olacaceae
66	Bergang Gajah	*Baccaurea deflexa*	
67	Bergang Piat	*Baccaurea bracteata*	Phyllanthaceae
68	Pakam Prone	*Aporosa lunata*	
69	Rambe Kekura	*Baccaurea racemosa*	
70	Male Size	*Carallia brachiata*	Rhizophoraceae
71	Jerik Kawa	*Plecetronia didyma*	
72	Tamarind Wood	*Plectronia horrida*	Rubiaceae
73	Nanglit	*Nuclea cyrtopoda*	
74	Tenggulun	*Flacourcia rukam*	Salicaceae
75	Skinny Pig	*Elatoostachys* sp.	
76	Pakam	*Pometia pinnata*	Sapindaceae
77	Rambutan Biawak	*Nephelium rambutanake*	
78	Mayang Wood	*Payena lucida*	Sapotaceae
79	Chicken Feathers	*Sterculia* sp.	Sterculiaceae
80	Ivory Wood	*Symplocos fasciculata*	Symplocaceae
81	Bangsok	*Villebrunea rubescens*	
82	Latang Rusa	*Dendrocinide stimulants*	Urticaceae
83	Latong Gajah	*Laportea sinuata*	
Total			**35**

Based on Table 1, 83 Sumatran orangutan (*Pongo abelii*) food tree species from 35 families were found at Ketambe Research Station, with a total of 314 individuals at various heights. The most dominant species was *Elateriospermun tapos* from the Euphorbiaceae family (32 individuals), followed by *Diospyros clavigera* (17 individuals), *Nephelium rambutanake* (17 individuals), *Chepalomappa malloticarpa* (15 individuals), as well as *Plectronia horrida*, *Egenia grandis*, and *Parashorea lucida* which were found as many as 10 individuals each.

These results are important because they show the diversity of food trees that sustain Sumatran orangutans (*Pongo abelii*), which is influenced by altitude and the type of vegetation available. Several other studies have also emphasized the importance of these tree species in the Leuser ecosystem, particularly in supporting orangutan populations that are vulnerable due to deforestation and habitat change [13].

Sumatran Orangutan (*Pongo abelii* Lesson, 1827) Food Tree Types Based on Altitude at Ketambe Research Station

Research at Ketambe Research Station categorized Sumatran orangutan (*Pongo abelii*) food tree species based on altitude into three strata: stratum I (300-600 masl), stratum II (600-900 masl), and stratum III (900-1100 masl). Data on the types of food trees in each stratum can be seen in table 4.2.

Table 2. Sumatran orangutan (*Pongo abelii*) food tree species based on altitude at Ketambe Research Station**.**

Family Name	Number of Species by Altitude (masl)		
	300-600 meters above sea level	600-900 meters above sea level	900-1100 meters above sea level
Anacardiaceae	1	1	1
Annonaceae	2	1	2
Apocynaceae	1	-	1
Aracacea	1	-	-
Bombacaceae	-	-	1
Burseraceae	1	-	1
Cannabaceae	-	2	2
Capparidaceae	1	-	-

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Celastraceae	1	1	1
Clusiaceae	-	2	2
Cornaceae	1	-	-
Dipterocarpceae	1	1	1
Ebenaceae	-	1	-
Elaeocarpaceae	2	-	1
Euphoebiaceae	9	3	4
Fagaceae	1	1	3
Guttifereae	-	1	-
Lauraceae	1	1	2
Lecythidaceae	1	-	1
Lythraceae	-	1	1
Meliaceae	5	1	2
Moraceae	2	1	1
Myristicaceae	-	1	2
Myrsinaceae	2	1	2
Myrtaceae	3	1	2
Olacaceae	1	-	-
Phyllanthaceae	3	2	-
Rubiaceae	1	2	2
Rhizophoraceae	1	-	-
Salicaceae	-	1	-
Sapindaceae	2	3	2
Sapotaceae	-	1	-
Sterculiaceae	-	1	1
Symplocaceae	-	1	-
Urticaceae	3	1	-

Based on table 2. at an altitude of 300-600 masl found 50 species of Sumatran Orangutan (*Pongo abelii*) food trees from 24 families with a total of 121 individuals, dominated by the Euphorbiaceae family (9 species). Table 4.3 shows that at an altitude of 600-900 masl there are 34 species from 25 families with a total of 125 individuals, dominated by the Sapindaceae and Euphorbiaceae families (3 species each). At 900-1100 masl, 34 species from 22 families with a total of 68 individuals were found, dominated by the Euphorbiaceae family (4 species). The total number of food trees found in the three altitude strata can be seen in Figure 3.

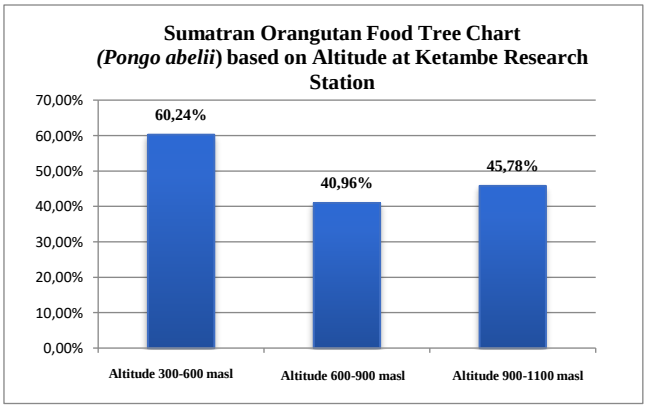

Figure 3: Graph of the number of food trees of Sumatran orangutans (*Pongo abelii*).

Based on Figure 2, the graph shows that research on the food trees of Sumatran orangutans (*Pongo abelii*) at various altitudes shows that the distribution of these tree species varies according to altitude. At an altitude of 300-600 meters above sea level (masl), food trees accounted for 60.24% of the total, while at 600-900 masl and 900-1100 masl, the percentages were 40.96% and 45.78%, respectively.

These results are in line with other studies showing that the type and availability of food vegetation is highly dependent on environmental conditions, including altitude. These conditions are important for conservation as food trees play an important role in supporting orangutan populations in their habitat [13]. Several studies have also linked changes in vegetation distribution to the challenges faced by orangutans due to deforestation and climate change, which can alter the composition and availability of food trees at various altitudes [14]. This emphasizes the importance of maintaining habitat diversity at various altitudes to support orangutan survival in Sumatra.

Food Tree Parts Eaten by Sumatran Orangutans (*Pongo abelii* Lesson, 1827) Based on Altitude at Ketambe Research Station

Observations at Ketambe Research Station showed that Sumatran orangutans (*Pongo abelii*) more often eat tree parts such as fruit, young leaves, flowers, seeds, young shoots, bark, and tree sap, with variations based on altitude. Details of the parts eaten can be seen in Figure 2.

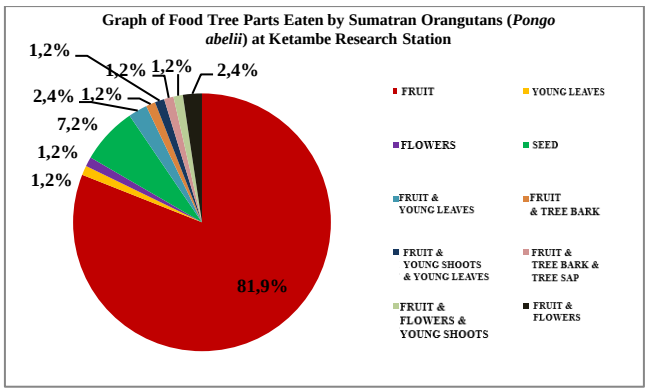

Figure 2. graph of food tree parts eaten by Sumatran orangutans (*Pongo abelii*) at Ketambe Research Station.

The graph shows that Sumatran orangutans (*Pongo abelii*) consume various parts of the food tree, with fruits being the most dominant (68 types, 81.9%). Other parts consumed included seeds (7 species, 7.2%), young leaves, flowers, and a combination of different tree parts, with the percentage of each varying from 1.2% to 2.4%.

Research related to the diet of Sumatran orangutans (*Pongo abelii*) shows that fruit is the main component preferred by orangutans, almost more than 80% of the tree species consumed are fruits. In addition to fruit, other parts of the tree such as seeds, young leaves, flowers, and a combination of various parts of the tree are also consumed in smaller percentages. This is in line with the finding that fruit dominates orangutan diets, especially when fruit is abundant. However, when fruit availability decreases, they

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switch to consuming seeds, young leaves, and other parts of the tree as alternative food [15].

Physical-chemical Environmental Factors at Ketambe Research Station, Southeast Aceh District

Research related to physical and chemical environmental factors in the habitat of Sumatran Orangutan (*Pongo abelii*) food trees shows that environmental conditions such as temperature, air humidity, light intensity, soil pH, and soil moisture can significantly affect the growth and distribution of food trees which are the main food source for orangutans. The physico-chemical environmental factors that include soil moisture, air humidity, air temperature, light intensity, soil pH and research coordinates, can be seen in table 3.

Table 3. Physical-Chemical Environmental Factors based on altitude at Ketambe Research Station.

Research Location	Soil moisture (%)	Soil pH	Air humidity (%)	Air Temperature (°C)	Light Intensity (Cd)
Elevation Stratum 300 - 500 masl	70%	5,9	81%	28,1	165,4
Elevation Stratum 600-900 masl	50%	6,5	73%	27,2	170,3
Elevation Stratum 900-1100 masl	61%	6,4	72%	25	150,5

Based on table 3. physical and chemical environmental factors in the study of Sumatran Orangutan (*Pongo abelii*) food trees at Ketambe Research Station showed the following average values: stratum 300-600 masl has an air temperature of 28.1 ºC, air humidity 81%, light intensity 165.4, soil pH 5.9, and soil moisture 70%; while stratum 600-900 masl has an air temperature of 26.8 ºC, air humidity 71%, light intensity 155.1, soil pH 6.5, and soil moisture 56%; and for stratum 900-1100 masl has an air temperature of 25 ºC, air humidity 72%, light intensity 150.5, soil pH 6.4, and soil moisture 61%.

At various altitudes at Ketambe Research Station, variations in environmental conditions were found to influence the type and number of individual food trees found. For example, air temperature and soil moisture tended to decrease with increasing altitude, while soil pH increased slightly. These variations may affect the distribution of certain tree species favored by orangutans, especially at different altitudes [16]. The results of this study can help in species conservation efforts by maintaining optimal environmental conditions, especially for the growth of orangutan food trees.

CONCLUSION

Research at Ketambe Research Station showed that there were variations in the species of Sumatran orangutan (*Pongo abelii*) food trees based on altitude, with a total of 50 species at 300-600 masl, 34 species at 600-900 masl, and 34 species at 900-1100 masl. The Euphorbiaceae family dominated at all altitudes. Fruit was the most eaten part of the tree by Orangutans, with a percentage of 81.9%, followed by seeds, young leaves, flowers, and a combination of other parts with smaller percentages.

ACKNOWLEDGEMENTS

This research was supported by the Orangutan Information Center (OIC) and the Leuser Conservation Forum (FKL). The authors would like to thank the FKL Chief Coordinator of Ketambe Leuser Research Station and the OIC for sponsoring this research.

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