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RESEARCH ARTICLE

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Food diversity of the Tapanuli Orangutan (*Pongo tapanuliensis*) in the Tapanuli Orangutan Research Station Plan, North Sumatra, Indonesia

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ABSTRACT

The Tapanuli orangutan (*Pongo tapanuliensis*) is found only in the Tapanuli area. This species includes protected and endangered animals and has a very limited distribution. An important component of animal management is feed availability. This study aims to assess the diversity of food in the Tapanuli orangutan at the Tapanuli Research Station Plan, Batu Satail, Sipirok District. Research was carried out in November 2021 by conducting a vegetation analysis on 3 predetermined paths. The results showed that in this area, there were 91 plant species from 42 families, of which 29 species (31.87%) were orangutan food. However, the highest plant importance index value is dominated by non-food plants.

Introduction

Tapanuli orangutan (*Pongo tapanuliensis*) is a new orangutan species that was identified in 2017. *Kementerian Lingkungan Hidup dan Kehutanan* (KLHK) made the Tapanuli orangutan the third orangutan species based on the publication results of [1]. *P. tapanuliensis* as a new species is characterized by enormous genetic differences among the three types of orangutans, as stated in Rianti [2]. Since being identified as a new species, the Tapanuli orangutan has been included in protected animals based on the government through No. P.106/MENLHK/SETJEN/KUM.1/12/2018 Concerning Types of Plants and Animals That Are Protected and Included in Critically Endangered Animals which is the highest threat of extinction status according to the IUCN Red List. This is because of the low population and limited distribution area.

The population of the Tapanuli orangutan based on *Strategi dan Rencana Aksi Orangutan* (SRAK) 2019–2029, ranges from 577 to 760 individuals in a habitat of 1,051.32 km^2 spread across two metapopulations. Meanwhile, Wich et al. [3] divided it into three blocks, namely the East Block (162 individuals), West Block (581 individuals), and *Cagar Alam Sibual-Buali* (24 individuals), so that the total population is 767 individuals. Kuswanda [4] stated that he is under pressure due to forest conversion, human activities, and development. Population declines because their habitat has been damaged by forest fires, illegal logging, and high poaching [5]. Ecologically, the Tapanuli orangutan has a role as an "umbrella species" which plays an important role in dispersing the seeds from the plants they consume. Therefore, the absence of orangutans in tropical rainforests can result in the extinction of plant species [6].

The distribution of the Tapanuli orangutan in terms of area function is in 7% of Nature Reserves, whose management is carried out by *Balai Besar Konservasi Sumber Daya Alam* (BBKSDA) of North Sumatra Province, 64% in protected forests, and 4% in production forests, whose management is carried out by *Kesatuan Pengelolaan Hutan* (KPH) X Padangsidempuan and Region XI Pandan, and the remaining 25% are in other areas managed by the district government and the community [7]. The threat of extinction of

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orangutans is increasing because their habitats are found only in the provinces of Aceh and North Sumatra, especially orangutans that live outside conservation areas [8]. The high percentage of the distribution of the Tapanuli orangutan in other use areas is of particular concern because the function of the area is not wildlife protection, so the district government and the community as managers must be involved in efforts to conserve the Tapanuli orangutan.

Habitat conditions research of the Tapanuli orangutan is very scarce and includes limited sites [9–11]. Information describing feed plants and vegetation composition on a landscape scale is not yet available. It is very important to update information on the habitat characteristics of the massive forest conversions taking place in the Batang Toru Landscape because one of the important elements for preserving the Tapanuli orangutan is food availability. Feed is an important component for the survival of orangutans. Feed is a limiting factor affecting the growth and development of animals [12]. Feed is a fundamental resource that strongly influences individual primates, groups, populations, and various species in ways that vary in their behavior [13]. Orangutans are selective eaters in large numbers owing to their body size. Orangutans are large primates that tend to eat fruit or are frugivorous and prefer fruits with soft pulp [14]. In addition, orangutans eat young leaves and shoots, seeds, shoots, flowers, inner bark, lianas, small amounts of insects, and soil minerals [15]. Orangutans are usually solitary but sometimes congregate around abundant food sources.

Feeding activity is the activity with the largest percentage of orangutan activities [16–18] and is influenced by weather and fruiting season [18]. The highest percentage of orangutan food types are fruit, flowers, stems, and leaf pith [17]. The availability of orangutan food will affect orangutans' daily roaming to obtain food. Orangutans are often seen eating the community's garden produce during the season when the community's plants bear fruits such as durian, *petai*, *jengkol*, sugar palm, rattan/jernang, and bananas in villages that buffer the conservation area, such as around *Cagar Alam Dolok Sipirok* and *Cagar Alam Dolok Sibual-Buali* [7]. Orangutans make nests in forests with trees that produce fruit as their main food source. Therefore, food distribution, quantity, and quality according to a certain time and place are the main determining factors for movement behavior and population density, ultimately determining social organization [8].

Food availability is the most important ecological factor in orangutan population management. Activities to monitor the availability of natural food and habitat improvement through the maintenance of regeneration of natural food plants can ensure the preservation of orangutans in their habitat [19]. Orangutan diets vary according to ecological factors, including differences in feed species composition, productivity, and annual seasonality, which shape the potential for diverse feed availability [20]. The objective of this study was to assess the diversity of orangutan diets. The more varied the types of food, the better the orangutans. The aim of this study was to identify the diversity of tapanuli orangutans (*P. tapanuliensis*) in the tapanuli orangutan research station plan, Batu Satail Village, Sipirok District, South Tapanuli District.

Material and Method

Study Area

The research was conducted at the Candidate Site of the Tapanuli Orangutan Research Station, Batu Satail Village, Siipirok District, South Tapanuli Regency, Sumatra Province, with an area of 32 ha (Figure 1). The research was carried out in November 2021. Vegetation data was collected by the path method, a combination of squared plots and lines with 3 tracks. Route determination is carried out by looking at site conditions with a length of line 1,298 m, line 2,187 m, and line 3,252 m with a distance between lines 286 m. Establish a transect line in the direction of cutting/perpendicular to the high line (contour). In the study area, the number and direction of the transect are determined by considering the representativeness of the type of vegetation community studied (each different community must be sampled).

Tools and Materials

Equipment used in survey activities includes a Global Positioning System (GPS) to determine the coordinates of the observation area, a camera as a documentation tool, newsprint for handling specimens (in the form of leaves or other plant parts) that have not been identified in the field, tally sheets to recapitulate data field, laser rangefinder to measure diameter tape to measure tree diameter, tree height, measuring tape to measure growth level of poles and stakes, hanging labels to mark specimens, writing tools, and plastic to store specimens. The material used is methanol as a preservative for specimens collected in the field.

Procedures

On each transect, observation plots were determined systematically with random starts (Figure 2). From each plot, tree species, the number of individuals of each species was counted and the circumference/diameter and tree height were measured for the tree stage (diameter > 20 cm); for pole-level vegetation (10 to 20 cm in diameter); for saplings (saplings with a height of > 1.5 m; diameter up to 10 cm) and seedlings (saplings that have just grown to saplings with a height of up to 1.5 m) only the number of individuals of each species is counted.

Data Analysis

The data taken form the research plots were analyzed to obtain Important Value Index (IVI). This index was used to determine species composition and dominance of a species in a stand. The INP value is calculated by adding up *Frekuensi Relatif* (FR), *Kerapatan Relatif* (KR), and *Dominansi Relatif* (DR) values [21–23]. Species diversity was calculated using the Shannon-Wiener species diversity index [24,25]. According to Magurran [26], the value of the Species Diversity Index (H') relates to species richness and species abundance distribution with a value of H' = 1 including low diversity and a value of 1 = H' = 3 including moderate diversity and moderate community stability and H' > 3 including high diversity. The formula from Hill index was using to calculated the abundance of plant species in a community (forest cover) [25]. Samples from each type are then made into a herbarium for further identification. Identification of food plant process is carried out by bringing plant samples to *Lembaga Ilmu Pengetahuan Indonesia* (LIPI) Plant Center, Bogor. Determining which plants are included in the type of orangutan food is carried out by studying the literature in previous research, namely the list of types from the [7].

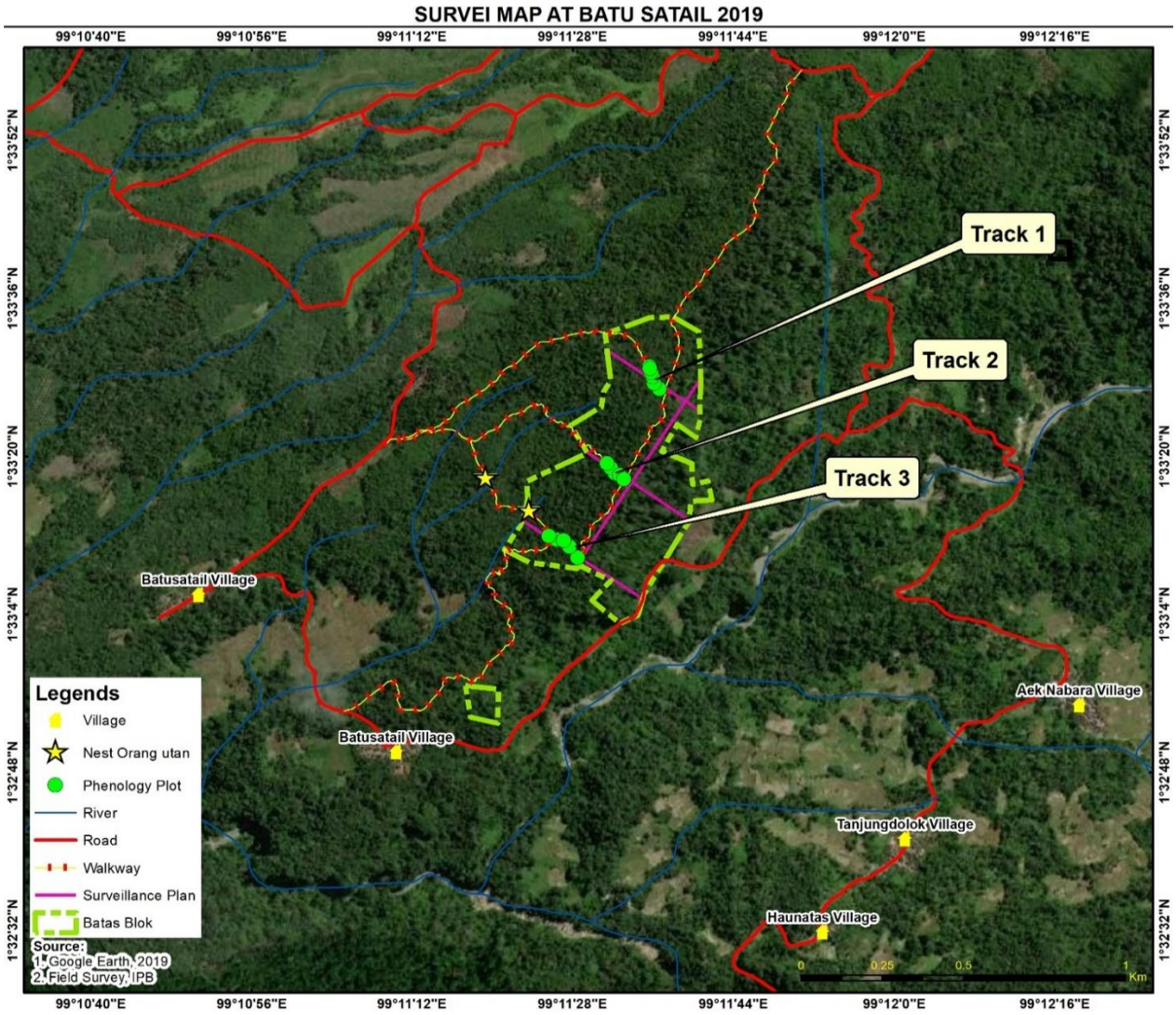

Figure 1. Research sites.

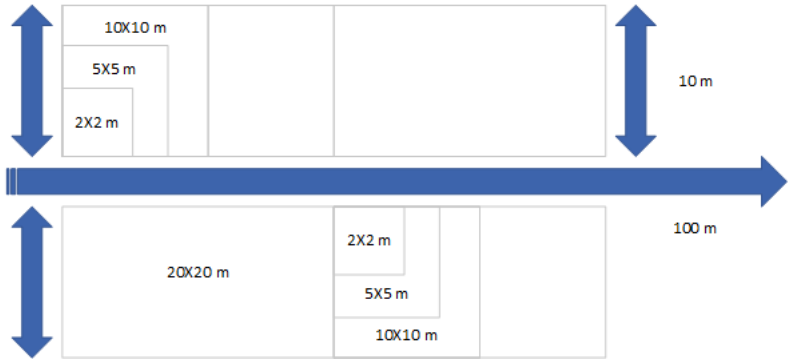

Figure 2. Vegetation observation measure plots.

Result and Discussion

General Conditions of Research Locations

According to Minister of Forestry Regulation No P. 50/Menhut-II/2009 Concerning Affirmation of Status and Functions of Forest Areas (Figure 3), *Tapak Calon Stasiun Riset Orangutan* (TCSRO) is a forested area of 32 hectares with *Areal Penggunaan Lain* (APL) status. Forest encroachment and clearing for plantations, settlements, agriculture, other development facilities, and infrastructure [27,28], as well as illegal logging, has resulted in the area and quality of the Tapanuli orangutan's habitat continuing to decrease.

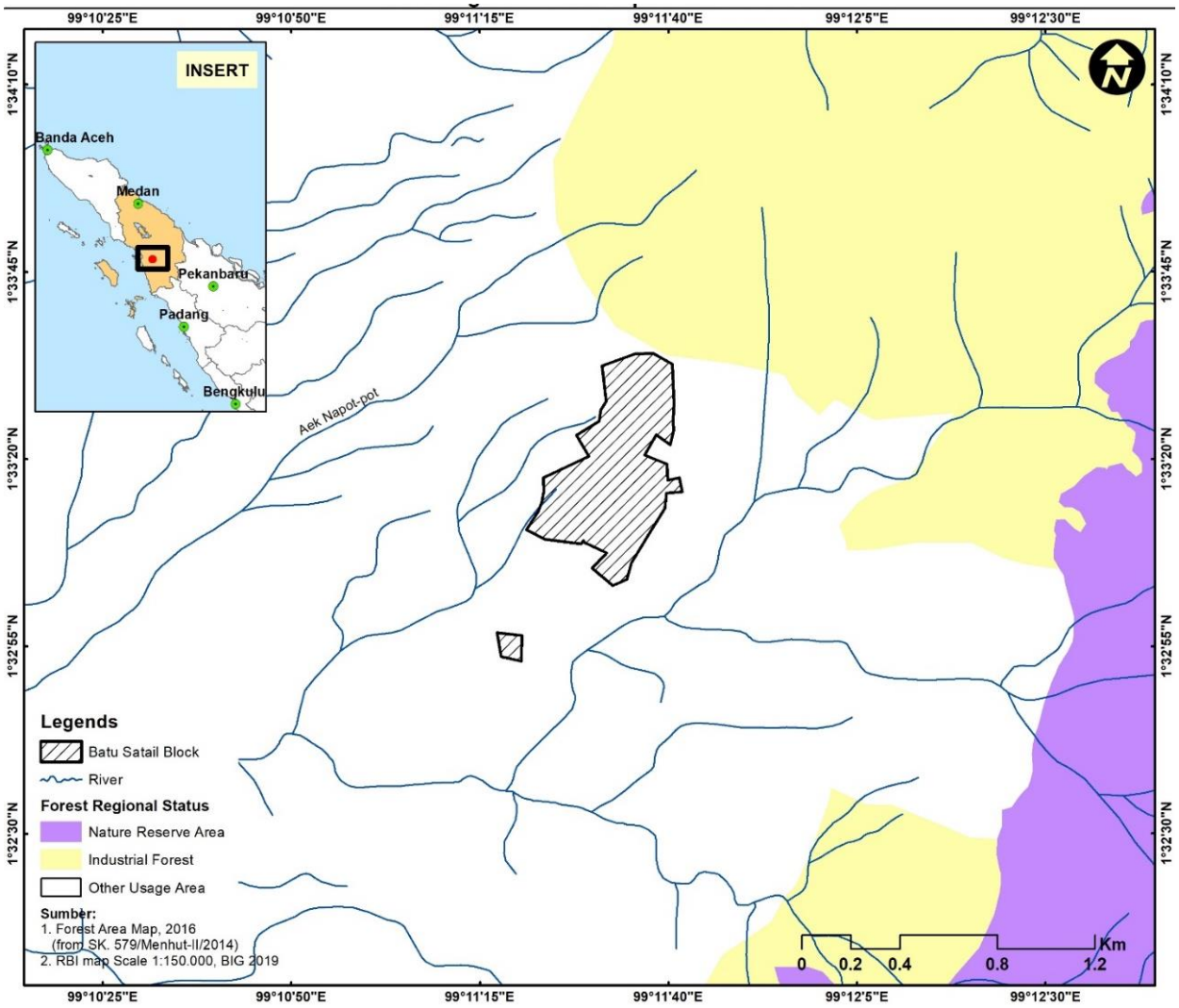

Figure 3. Regional function map.

This land is located at an altitude of 600 to 900 m above sea level (Table 1). Based on Tengku et al. [29] the Malesia region (Peninsula Malaysia, Sumatra, Java, Kalimantan, Sulawesi, and Papua New Guinea) is included in the tropical zone (1 to 1,000 m asl), and the range of 500 to 1,000 m asl is included in the range zone Colline. The same thing was conveyed by Kuswanda [8], who stated that low areas are areas with an elevation of 0 to 1,000 m asl (above sea level) and topography that ranges from flat land, undulating land to hilly and mountainous land, various wetland ecosystems and ecosystems can be found dry land. The conditions of TCSRO are very suitable as an orangutan habitat because, according to Laumonier et al. [30], the distribution of *P. tapanuliensis* is currently almost entirely confined to mid-altitude hills and submontane forest (300 to 1,300 m asl).

Table 1. Site Topography of the tapanuli orangutan research station plan in Batu Satail Village, Sipirok District, South Tapanuli Regency, North Sumatra Province.

No	Elevation (m asl)	Wide (ha)
1	600–700	0.03
2	700–800	6.11
3	800–900	15.93
4	900–1000	10.16
	Total	32.22

The slope of the location in the TCSRO based on the results of the 30 m The Shuttle Radar Topography Mission (SRTM) Digital Elevation Model analysis and field observations can be categorized into two slope classes, namely flat-sloping and very steep slope classes. Flat to gentle slopes are generally found on the west side, and steep slopes above 40% can generally be found on the east side. Especially for steep areas on the southeast side, the average slope of the field is very extreme, between 133% (600) to 189% (850). TCSRO slope conditions can be seen in Table 2.

Table 2. The slope of the prospective site for an Orangutan Research Station in Batu Satail Village, Sipirok District, South Tapanuli Regency, North Sumatra Province.

No	Slope	Wide (ha)
1	0–8%	0.55
2	8–15%	2.25
3	15–25%	6.24
4	25–40%	9.82
5	>40%	13.37
	Total	32.22

This area is among the areas of human activity around Batu Satail Village, Sipirok District, Padang Sidimpuan Regency, North Sumatra Province. This area is also surrounded by roads, both asphalt paved roads (from Bulu Mario Village and Marancar Julu Village) and makadam (crushed stones) with a width up to the shoulder of the road ±4 meters. This area includes fertile land as in Sipirok District due to the still active Mount Sibualbuali. The main livelihood in Sipirok is farming, with farming techniques that are still simple or traditional. Most of the population in Sipirok District work in the agricultural sector either as farm laborers or as farmers themselves. In addition to the agricultural sector, there are handicrafts, trade, service, and other industrial sectors.

Agriculture in Sipirok District is adapted to the topographical conditions of the villages in Sipirok District. If the topography is flat, they will farm in the fields; if the topography is hilly, the farm will be made into fields. Agricultural commodities obtained by farmers are rice, vegetables, fruits, and coffee plants. Besides working in agriculture, many people in Sipirok District are involved in industry, especially those working in manufacturing traditional woven fabrics of the Sipirok community. The land cover around the site of the rubber plantation includes oil palm, mixed gardens (durian, *jengkol*, petai, mango, jackfruit, candlenut, coffee, etc.), a farm, paddy fields, and shrubs (Figure 4). On the southwest side, there is also the Batu Satail Village community settlement, which has a population of 300 households.

In general, the plant communities in TCSRO were divided into two types: 1) community ex-sector forest plant communities, which were generally found on flat to steep in the northwest, and 2) secondary forest plant communities on the southeast side which were generally in the form of areas with steep to very steep slopes with an average slope of land varying between 133 to 189% (60–85 degrees). Based on the results of field observations and interviews with the community, it was known that in flat areas the intensity of use was higher than in steep/very steep areas because these flat areas were former fields indicated by the presence of community cultivated plant species such as kweni (*Mangifera odorata*), coffee (*Coffea sp.*), jackfruit (*Artocarpus heterophyllus*), chocolate (*Theobroma cacao*), cempedak (*Artocarpus integer*), nutmeg (*Myristica sp*), candlenut (*Aleurites moluccana*), *jengkol* (*Archidendron pauciflorum*), durian (*Durio zibethinus*), *petai* (*Parkia speciosa*), etc. as well as the high abundance of pioneer tree species.

Figure 4. Land cover conditions.

Based on the results of the vegetation analysis, there were 91 species consisting of 42 families at the study site (Figure 5). The area where orangutans were often found around Batu Satail Village has a relatively open canopy cover with relatively low tree density. Several plant species can be found in the area; one of the pioneer species is ambogol (*Macaranga sp.*), mahang (*M. triloba*), sapot (*Macaranga tanarius*), sitarak (*M. lowii*) and cultivated trees such as rubber (*Hevea brasiliensis*), coffee (*Coffea sp.*), and candlenut (*A. moluccana*). The most dominant family is Lauraceae, which has 12 species (Figure 6).

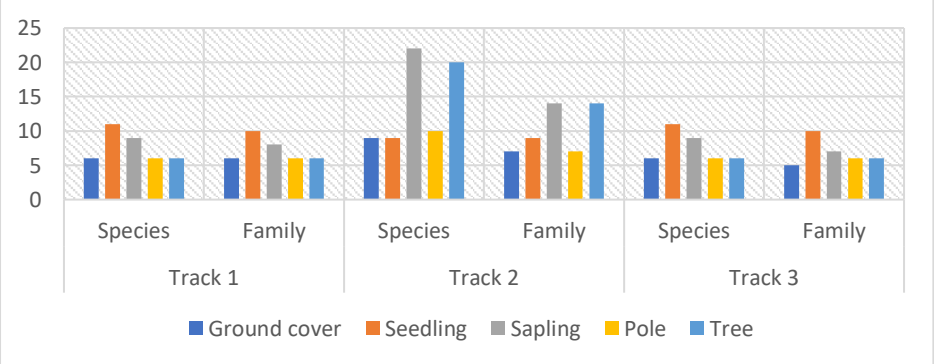

Figure 5. Number of species and families in each line.

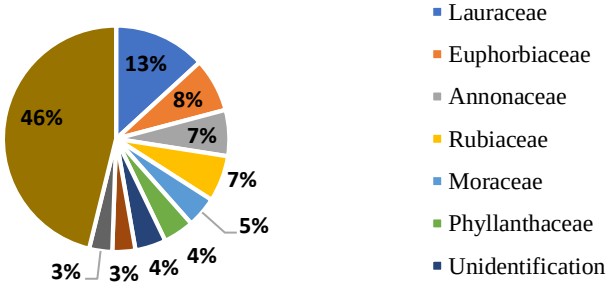

Figure 6. Composition of plant species by family.

There are 3 species of rare/protected plants according to the IUCN red list, but not according to Government Regulation No. 106 of 2018 concerning protected plants and animals and CITES. These rare/protected species include *hayundolok* (*Syzygium zeylanicum*) with Endangered (EN) status, *hoteng bunga* (*Quercus maingayi*), and aek wood (*Mezzettia umbellate*) with vulnerable (VU) status (Figure 7). In contrast, with Least concern (LC) status, there are 7 species, namely *A. moluccana, Cyclosorus interruptus, Dichapetalum gelonioides, Ficus lepicarpa, M. tanarius, Myristica fatua,* and *Polyosma integrifolia*. Based on the results of vegetation analysis, Track 1: found 38 plant species belonging to 22 families, Track 2: as many as 58 species belonging to 33 families, and Track 3: as many as 36 species belonging to 22 families. The diversity of plants in each track can be seen in Table 3. Based on Table 4, diversity at all growth levels is included in the medium category.

Table 3. Conservation status of plant species.

No	Species	Famili	IUCN status
1	*A. moluccana*	Euphorbiaceae	LC
2	*C. interruptus*	Pteridophyta	LC
3	*D. gelonioides*	Dichapetalaceae	LC
4	*F. lepicarpa*	Moraceae	LC
5	*M. tanarius*	Euphorbiaceae	LC
6	*M. umbellata*	Annonaceae	VU
7	*M. fatua*	Myristicaceae	LC
8	*P. integrifolia*	Escalloniaceae	LC
9	*Q. maingayi*	Fagaceae	VU
10	*S. zeylanicum*	Myrtaceae	EN

Table 4. Diversity of plant species for each route.

Station	Tree	Pole	Sapling	Seedling	Under growth
1	1.78	1.75	2.14	2.34	1.58
2	2.91	2.29	2.94	1.72	2.3
3	2.68	2.37	1.43	1.86	1.90

Hayundolok 3 (*S. zeylanicum*)

Hoteng Bunga (*Q. maingayi*)

Figure 7. Protected/rare flora species.

Feed Orangutan

The identification results show that there are 91 species at the study location, of this number 29 are orangutan food (Table 5). Or equivalent to 15.18% of the forage plants in toru stems, totaling 191 species [7]. Four of these species are endangered/protected according to the IUCN, namely *hayundolok* (*S. zeylanicum*) with Endangered (EN) status, *hoteng bunga* (*Q. maingayi*) with vulnerable (VU) status, and *M. tanarius* and *P. integrifolia* Least Concern (LC) status. The number of families that have the potential to be used as orangutan food is 19 families. The most preferred species as orangutan food successively belong to the families Euphorbiaceae, Annonaceae, Moraceae, Anacardiaceae, and Fagaceae (Figure 8).

Table 5. Species diversity for orangutan food potential.

No	Local name	Scientific name	Famili	Track		
				1	2	3
1	*Attumbus*	*Campnosperma auriculatum*	Anacardiaceae		√	
2	*Rengas*	*Gluta Aptera*	Anacardiaceae			√
3	*Hoteng Andihit*	*Mezzettia* sp.	Annonaceae		√	
4	*Kayu aek*	*M.* umbellata	Annonaceae		√	√
5	*Handiket*	*Canarium kunstleri*	Burceraceae		√	
6	*Medang berbulu*	*Gironniera nervosa*	Cannabaceae		√	
7	*Tinggiran*	*Garcinia lateriflora*	Clusiaceae		√	
8	*Jungjung guit*	*Elaeocarpus stipularis*	Elaeocarpaceae	√	√	√
9	*Modang merah*	*P. integrifolia*	Escalloniaceae	√	√	
10	*Hoteng turi-turi*	*Lithocarpus conocarpus*	Fagaceae	√	√	√
11		*Q. maingayi*	Fagaceae			
12	*Hoteng batu*	*Nothaphoebe umbelliflora*	Lauraceae	√	√	√
13	*Rambutan hutan*	*Aphanamixis* sp.	Meliaceae		√	
14	*Tappang*	*Ficus fitulosa*	Moraceae		√	√
15	*Sibodak-bodak*	*Ficus* sp.	Moraceae		√	
16	*Modang putih*	*Ficus* sp.	Moraceae	√		√
17	*Hayundolok 3*	*S. zeylanicum*	Myrtaceae		√	
18	*Huni batu*	*Antidesma* sp.	Phyllanthaceae	√		
19	*Modang putih 2*	*Lasianthus cyanocarpus*	Rubiaceae	√		√
20	*Api-api*	*Nephelium* sp.	Sapindaceae		√	√
21	*Hayundolok 2*	*Payena leerii*	Sapotaceae		√	
22	*Gagat harimau*	*Ampelocissus thysiflora*	Vitaceae	√		
23	*Hayundolok*	*Syzigium lineatum*	Myrtaceae	√	√	√
24	*Modang pokat*	*Baccurea lanceolata*	Moraceae		√	
25	*Jambu-jambuan*	*Syzigium sp*	Myrtaceae	√	√	√
26	*Modang landik*	*Litsea machilifolia*	Moraceae	√	√	√
27	*Dong-dong*	*F. lepicarpa*	Moraceae	√		
28	*Modang merah*	*P. integrifolia*	Moraceae	√		
29	*Hoteng barangan*	*Mezzetia sp.*	Fagaceae			√
30	*Hoteng*	*Mezzetia sp.*			√	

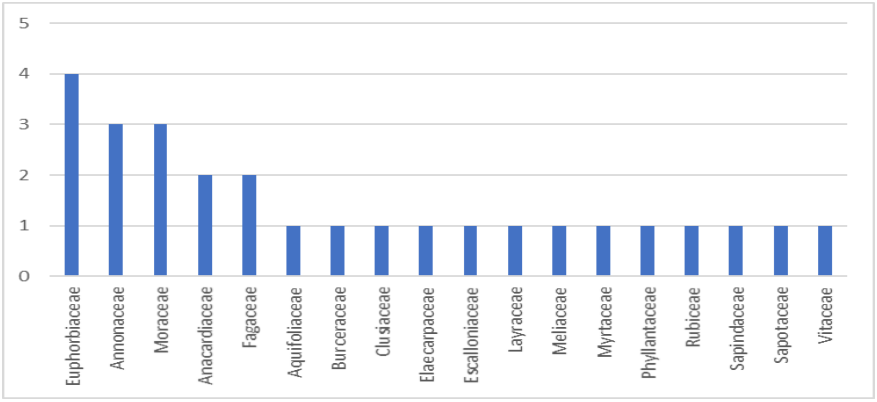

Figure 8. Orangutan food potential based on family.

Based on the Table 5, it can be seen that track 2 is the route with the most forage plants (21 species), while lanes 1 and 3 have the same number of types of feed, namely 10 species. The two highest plant IVIs in each pathway can be seen in Table 6, 7, 8. The IVI of plant species in a community is one of the parameters that shows the role of the plant species in the community. The greater the IVI of a species, the greater the level of control over the community and vice versa. Types with an important role (dominance) will have a high IVI. Table 6, 7, 8 shows that the growth process corresponds to the natural forest density curve. However, there are differences in density between the lanes, especially the density of the seedlings and saplings. This shows that differences in land openness directly or indirectly affect plant growth. Cultivation activities in the past also affected the abundance and distribution of seedling plants.

Table 6. Species diversity for orangutan food potential on track 1.

No	Local name	Scientific name	Famili	IVI	Orangutan food
A	Seedling				
1	*Hayundolok*	*Syzygium lineatum (DC.) Merr. & L.M.Perry*	*Myrtaceae*	39.7	-
2	*Jambu-jambuan*	*Syzygium sp.*	*Myrtaceae*	16.0	-
3	*Huni Batu*	*Antidesma sp.*	*Phyllanthaceae*	16.0	√
4	*Modang Merah*	*Polyosma integrifolia Blume*	*Escalloniaceae*	16.0	√
5	*Pala Hutan*	*Myristica fatua*	*Myristicaceae*	16.0	-
6	*Arsam*	*Cyclosorus sp.*	*Thelypteridaceae*	16.0	-
7	*Bambu*	*Bambusa sp.*	*Poaceae*	16.0	-
8	*Barodong*	*Cryptocarya ferrea Blume*	*Lauraceae*	16.0	-
9	*Gagat Harimau*	*Ampelocissus thysiflora Planch.*	*Vitaceae*	16.0	√
10	*Modang Putih*	*Ficus sp.*	*Moraceae*	16.0	√
11	*Simartolu*	*Mastixia rostrata Blume*	*Nyssaceae*	16.0	-
B	Sapling				
1	*Nali-nali*	*Ardisia sanguinolenta Blume*	*Primulaceae*	44.4	-
2	*Kopi*	*Coffea liberica*	*Rubiaceae*	24.4	-
3	*Modang Putih*	*Ficus sp.*	*Moraceae*	24.4	√
C	Pole				
1	*Modang Merah*	*Polyosma integrifolia Blume*	*Escalloniaceae*	72.0	√
2	*Attarsa*	*Litsea cubeba (Lour.) Pers.*	*Lauraceae*	66.9	-
3	*Kemenyan*	*Stytrax benzoin*	*Styracaceae*	48.7	-
D	Tree				
1	*Kemenyan*	*Stytrax benzoin*	*Styracaceae*	66.8	-
2	*Kemiri*	*Aleurites moluccana*	*Euphorbiaceae*	52.1	-
4	*Hoteng Turi-Turi*	*Lithocarpus conocarpus Rehder*	*Fagaceae*	49.5	√
5	*Tapak Kuda*	*Scaphium velutinosum Kosterm.*	*Sterculiaceae*	49.5	-

Table 7. Species diversity for orangutan food potential on track 2.

No	Local name	Scientific name	Famili	IVI	Orangutan food
A	Seedling				
1	*Habo*	*Callerya atropurpurea (Wall.) Schot*	*Leguminosae/Fabaceae*	42.4	-
2	*Modang Landik*	*Litsea machilifolia Gamble*	*Lauraceae*	23.6	-
3	*Siala*	*Unidentification*	*Zingiberaceae*	23.6	-
4	*Paku-pakuan*	*Asplenium normale D. Don*	*Aspleniaceae*	23.6	-
B	Sapling				
1	*Hayundolok*	*Syzygium lineatum (DC.) Merr. & L.M.Perry*	*Myrtaceae*	33.8	-
2	*Habo*	*Callerya atropurpurea (Wall.) Schot*	*Leguminosae/Fabaceae*	19.9	-
C	Pole				
1	*Hayundolok 2*	*Payena leerii Kurz*	*Sapotaceae*	38.5	√
2	*Modang Pasir*	*Litsea sp.*	*Lauraceae*	33.3	-
3	*Hayundolok*	*Syzygium lineatum (DC.) Merr. & L.M. Perry*	*Myrtaceae*	33.3	-
D	Tree				
1	*Modang Kuning*	*Neolitsea sp.*	*Lauraceae*	36.9	-
2	*Tappang*	*Ficus fitulosa*	*Moraceae*	24.3	√

Table 8. Species diversity for orangutan food potential on lane 3.

No	Local name	Scientific name	Famili	INP	Orangutan food
A	Seedling				
1	*Hayundolok*	*Syzygium lineatum (DC.) Merr. & L.M. Perry*	*Myrtaceae*	53.6	-
2	*Jambu-jambuan*	*Syzygium sp.*	*Myrtaceae*	41.1	-
B	Sapling				
1	*Hayundolok*	*Syzygium lineatum (DC.) Merr. & L.M.Perry*	*Myrtaceae*	92.9	-
2	*Habo*	*Callerya atropurpurea (Wall.) Schot*	*Leguminosae/Fabaceae*	34.3	-
C	Pole				
1	*Modang Kuning*	*Neolitsea sp.*	*Lauraceae*	46.1	-
2	*Hoteng Batu*	*Nothaphoebe umbelliflora Blume*	*Lauraceae*	31.1	√
D	Tree				
1	*Rengas*	*Gluta Aptera*	*Anacardiaceae*	44.0	√
2	*Modang Kuning*	*Neolitsea sp.*	*Lauraceae*	33.7	-

Availability of food is a very important thing to note in orangutan conservation. The availability of food will affect the orangutan's daily roaming area. Based on the Table 8, it can be seen that the growth of orangutan food vegetation at the study site follows the normal distribution curve, which means good regeneration occurs. However, when viewed from the tree regeneration rate, the tree growth rate is still very limited because it only ranges from 5 to 10 trees. Apart from food in nature, orangutans also in some cases get food from the gardens of the surrounding community. Several cases occurred in the villages of *Cagar Alam Dolok Sipirok* and *Cagar Alam Sibual-Buali*.

Orangutans eat community garden products during the fruiting season, some of which are durian, *petai, jengkol*, sugar palm, rattan/jernang and bananas [7]. Several cases later became conflicts between the community and orangutans due to the increasing area of community plantation land [31]. Expulsion of orangutans occurs when orangutans enter agricultural and plantation areas on the outskirts of the forest during the durian fruit season [8]. Economic losses due to this conflict can reach IDR 888,600,000.00 as a result of 414 damaged durian stems experienced by 21 farmers in Aek Nabara Village, Batu Satail Village, Bulu Mario Village, and Sitandiang Village, South Tapanuli Regency in a study by Siregar et al [32]. Meanwhile, based on Yullyanto [33], there have been orangutan conflicts in the villages of Aek Batang Paya and Bulu Mario reaching IDR 1,287,266,600.

Conclusion

In general, the plant communities in TCSRO are divided into two types: 1) community ex-sector forest plant communities which are generally found on flat to steep in the northwest and 2) secondary forest plant communities on the southeast side. The results showed that in this area, there were 91 plant species from 42 families, of which 29 species (31.87%) were orangutan food. Based on the importance value index, for each pathway and growth level, not all of them are dominated by orangutan food plants.

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