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Vegetation Analysis of Target Species for Feeding Lesser Yellow Bird of Paradise (Paradisaea minor jobiensis Rothschild, 1897) in the Imbowiari Forest Area of Barawai Village, Yapen Islands District, Papua Province, Indonesia

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A R T I C L E I N F O

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A B S T R A C T

The research aims to determine the plant species, structure, and composition of the food sources of *P. minor jobiensis* in the Imbowiari Barawai forest area, Yapen Islands Regency. The method used in this research the method of observation, interviews, documentation, literature, and the checkered line method. Data analysis techniques used are density, dominance, frequency, relative density, relative dominance, relative frequency, important value index, and diversity index. The results of the study found 6 species of plants as food for *P. minor jobiensis* and spread at the level of seedlings, poles, saplings, and trees namely *Elaeocarpus sphaericus*, *Ficus benjamina*, *Gnetum gnemon*, *Syzygium sp.*, *Myristica sp.*, and *Palaquium ambounense*

INTRODUCTION

Indonesia is a country that has high biodiversity and has so much natural potential. The natural potential is in the form of flora and fauna which are mostly found in tropical forests. Indonesia's tropical forest is one of the largest wet tropical natural forests and the richest in the diversity of flora and fauna. Around 25,000 – 30,000 species (species) of flowering and seed plants are found in Indonesia's natural forests and around 4,000 species are trees, namely woody plants (Lekitoo, 2008).

Papua's tropical rain forest is one of the formations of the Indomalaya tropical rain forest which is rich in unique species, genera, and families and cannot be found in other areas in Indonesia. According to Jhon (1997) in Lekitoo (2008) the number of Papuan flora is estimated at 20,000 - 25,000 species with 1,465 genera and at least 142 genera are endemic, of which 50 - 90% are endemic species, both endemic on a limited and wide scale (Lekitoo, 2008).

Yapen Islands is one of the districts that contribute to biodiversity wealth for Papua. Yapen Islands Regency also has forest areas that are classified as tropical rainforest types with various potential resources for the diversity of flora and fauna contained therein. The potential wealth of forest resources is still high and very varied with various characteristics. The Imbowiari forest area with an area of ± 100 ha is used as a forest for the protection of the habitat of birds of paradise. The results of analysis of the structure and composition of vegetation and its benefits show that there are 20 species in 14 families for the seedling level with a diversity of 2.71%; 25 species in 15 families at the sapling level with a diversity of 2.47%; 26 species in 17 families at the pole level with a diversity of 3.07%; 37 species in 24 families with a diversity level of 2.80% Raunsay (2014).

The Barawai people have several forms of local wisdom related to the community-based conservation of *P. minor jobiensis* birds such as the limited use of *P. minor jobiensis* birds for ritual and cultural activities, hunting regulated by customary norms, and through modern conservation concepts with the presence of self-help conservation organizations community known as the Dorei Jaya group (Raunsay & Koirewoa, 2019). The Dorei Jaya group has the task of each member taking turns taking care of the *P. minor jobiensis* bird and the *P. minor jobiensis* bird habitat from various kinds of disturbances (Raunsay E. K., 2014).

The research is limited to the number of plant species, the structure, and composition of the target species for bird feed *P. minor jobiensis* (Rothschild, 1897) in the forest area of Imbowiari, Barawai Village, Yapen Islands Regency, Papua Province.

LITERATURE REVIEW

Biodiversity in nature is very influential for living things, such as the diversity of plant species. From various types of plants, there are types of flowering plants that produce fruit, both simple fruit, aggregate fruit, and compound fruit. Plants that produce fruit have a very important role in the forest ecosystem. Apart from forming a microclimate and providing ecological niches, the fruits of these plants are the main source of food for various types of animals (Nugroho, Anis, & Ulfah, 2015).

According to Nugroho, Anis, & Ulfah, (2015), animals that use fruit as a food source include various types of birds. Most herbivorous birds use fruit as a food source, both fresh and dry fruit or seeds and nectar. Fruiting plants that are used as a

food source are very important for the survival of animals, this can be seen through the density of vegetation and the diversity of vegetation types that can affect the abundance of *P. minor jobiensis* birds.

According to Raunsay (2014) states that to maintain and restore the *P. minor jobiensis* bird population, it is necessary to have the role and participation of the community. One form of the community's role that can be carried out is the development of *P. minor jobiensis* bird habitat in natural forests by protecting and maintaining its habitat so that the availability of food in nature can be guaranteed (Raunsay K. E., 2020; Raunsay & Koirewoa, 2019).

METHODOLOGY

Study Site

This research was conducted in the Imbowiari forest area of Kampung Barawai, Yapen Islands Regency, Papua Province in July - August 2018.

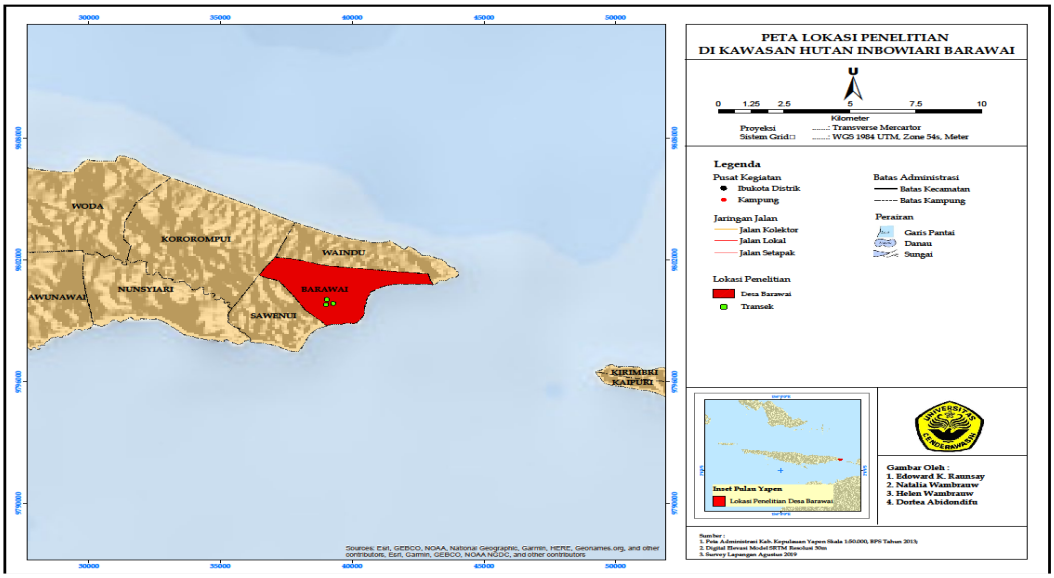

Figure 1. Map of Research Locations

Population and Research Sample

The population in this study were all residents and vegetation, while the sample was selected as informants and vegetation as food sources in the observation plot plots in the Imbowiari forest area.

Tools and Materials

The equipment used in this study were pencils, ballpoints, rulers, notebooks, field boards, tape measure (50 m) and digital cameras, GPS (Global Position System), and herbarium equipment such as labels, sacks, newsprint, cardboard presses, and ropes. ratchet straps, knife/cutter, scissors, hanging labels, and plastic samples. Materials used include plants which are a source of feed and 70% alcohol.

Data Collection

Type and Data Source Type

The data used in this study are primary data and secondary data. Primary data were obtained from interviews with several key informants, complementary and complementary keys who had an understanding of the types of vegetation as food sources in the Imbowiari forest area, and secondary data were obtained through literature studies. Data in this study were also obtained from the field through vegetation analysis using the grid line method, where 3 transects were made, each transect using 5 plots measuring 20 m x 20 m (trees), 10 m x 10 m (poles), 5 m x 5 m (stakes) and 2 m x 2 m (seedlings).

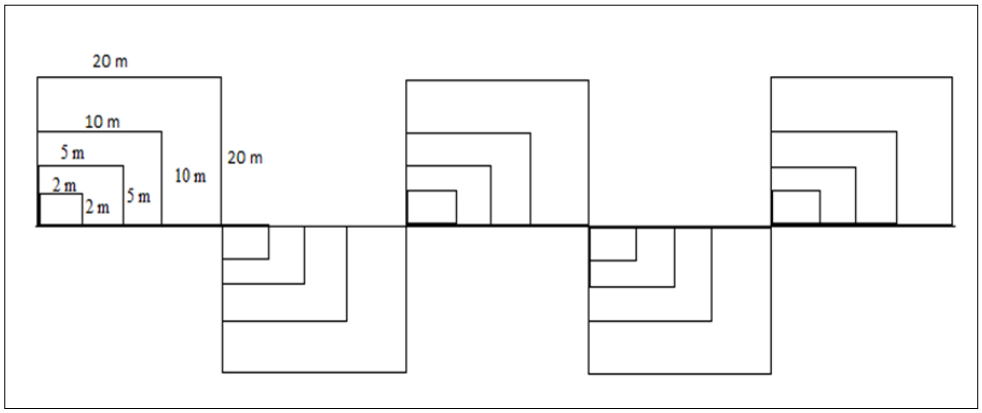

Figure 2. Grid design with grid line method

Data collection technique

The methods used in data collection are observation method, which is used to find out and directly see each type of vegetation as a food source for *P. minor jobiensis* found in the Imbowiari forest area. Interview method, semi-structured interviews were used to obtain data on the types of vegetation as food sources for *P. minor jobiensis* in the local community. Documentation method, documentation was carried out by directly photographing the types of vegetation sources of feed taken from each plot at the research location. Literature study method, literature study using books and sources relevant to the research title.

Research Procedure

1. Make observations at the research site
2. Conducting interviews directly with the local community to find out the types of plants used as food sources for *P. minor jobiensis*.
3. Prepare all the equipment used in the research location
4. Determine the sampling area. The sampling location is the Imbowiari forest area, in the sampling area boundaries are made on areas that have different altitudes and coordinate points.
5. Then in the boundary area, a grid line is made, which is done by drawing a 100 m long transect line with a total of 3 transects. On each transect, there are 5 plots with sizes 20 m × 20 m, 10 m × 10 m, 5 m × 5 m, and 2m × 2m.
6. Sampling and documentation of plant species as food sources in the form of photographs.
7. Making an herbarium of *P. minor jobiensis* feed sources.

8. Identification, preserved food sources of *P. minor jobiensis* were sent for identification by Herbarium Manokwariensis

Data Analysis

Analysis was carried out to obtain the structure and composition of the vegetation at the study site. Measurements by path/transect can be analyzed by looking at Density, Relative Density, Frequency, Relative Frequency, Dominance, Relative Dominance, and Importance Value Index. To determine the diversity of plant species used the Shannon-Wiener Diversity Index (Indriyanto, 2006).

RESEARCH RESULT

There were six types of plants as food for *P. jobiensis* at the location and spread at the Seedling, Pole, Stake, and Tree levels. The six plant species are *Elaeocarpus sphaericus*, *Ficus benjamina*, *Gnetum gnemon*, *Syzygium sp*., *Myristica sp*., and *Palaquium ambounense*.

Table 1. Plants For Seedling Feed Sources

Species	Local Name	Seedling						
		∑	D	RD (%)	F	RF (%)	IVI	H’
Elaeocarpus sphaericus	Mora	15	0.11	11.03	0.11	11.11	22.14	0,08
Ficus benjamina	Asere	5	0.04	3.68	0.22	22.22	25.90	0,03
Gnetum gnemon	Marapipi	25	0.18	18.38	0.22	22.22	40.60	0,12
Myristica sp	Pala-palaan	21	0.15	15.44	0.17	16.67	32.11	0,01
Palaquium ambounense	Kamorin	20	0.15	14.71	0.17	16.67	31.37	0,10
Syzygium sp	Jambu-jambuan	50	0.37	36.76	0.11	11.11	47.88	0,19
		136	1.00	100	1	100	200	0.7

Source: Vegetation Analyzed in 2018

Based on the results of the study in Table 1, the highest IVI and H' of the seedling level vegetation at the study site were *Syzygium sp* with IVI = 47.88 and H'= 0.19. From these results when compared to Raunsay (2014) who got *Syzygium sp* with IVI = 29.42 and H'= 0.30, the value of IVI and plant diversity increased. Indriyanto (2006) states that the importance value index at the seedling level is the result of the sum of the relative values of the two parameters (relative density and relative frequency) that have been measured previously. In general, the species that have the highest density also have the highest frequency values for each type of forest vegetation, so it can be concluded that these species have the highest IVI.

Gunawan, Basuni, Indrawan, Prasetyo, & Soedjito (2011) stated that the sustainability of vegetation growth from the seedling level to the next growth level is strongly influenced by the adaptability of vegetation types. Seedlings are one of the initial support levels of forest potential that will develop and contribute to forming future stands if there are no disturbances or obstacles. This large number of seedlings is an indication that the forest has provided a source of seedlings for forest restoration. The number of seedlings is influenced by the fruiting season of each tree as well as the seeds or fruit that fall to the ground to be able to sow requires sufficient light and moisture, so the number of plant species as food sources at high seedling levels greatly affects the availability of feed.

Table 2. Plant Feed Sources At The Sapling Level

Species	Local Name	Sapling						
		∑	D	RD (%)	F	RF (%)	IVI	H'
Gnetum gnemon	Marapipi	3	0.09	9.09	0.3	30	39.86	0,09
Ficus benjamina	Asere	20	0.61	60.61	0.3	30	91.37	0,30
Myristica sp	Pala-palaan	7	0.21	21.21	0.23	23	44.28	0,16
Syzygium sp	Jambu-jambuan	3	0.09	9.09	0.15	15	24.475	0,09
		33	1	100	1	100	200	0.46

Source: Vegetation Analyzed in 2018

Table 2 shows the highest IVI and H' of sapling-level vegetation at the study site, namely *Ficus benjamina* with IVI = 91.37 and H' = 0.30. According to Gunawan, Basuni, Indrawan, Prasetyo, & Soedjito (2011), the types of vegetation at the seedling level that have the highest IVI will grow into the vegetation at the sapling level, this is inversely proportional to the results of research at the seedling level where *Ficus benjamina* has an IVI of 25.90 while *Syzygium sp* had IVI = 47.88 at the seedling level and IVI = 24.475 at saplings.

According to Suyana (2003), *Ficus* is the type of plant with the highest IVI value. This shows that the Ficus species is the dominant type. The ability of *Ficus* to occupy part of the study sites shows that these plant species can adapt to the physical environmental conditions of the entire area.

Table 3. Plant Feed Sources At The Pole Level

Species	Local Name	Pole								
		∑	D	RD (%)	F	RF (%)	Dm	RDm (%)	INP	H'
Gnetum gnemon	Marapipi	6	0.29	28.57	0.2	28.57	0.28	28	85.14	0,10
Ficus benjamina	Asere	4	0.19	19.05	0.07	28.57	0.19	19	66.62	0,07
Myristica sp	Pala-palaan	10	0.48	47.62	0.27	21.42	0.47	47	116.04	0,14
Palaquium ambounense	Kamorin	1	0.05	4.76	0.07	21.42	0.04	4	30.18	0,03
		21	1	100	0.61	100	1	100	300	0.51

Source: Vegetation Analyzed in 2018

The ability of certain types of vegetation to grow to reach the pole level illustrates the higher adaptability of vegetation types in an ecosystem. The results showed that the pole level of the *Myristica sp* plant species had IVI = 116.04 and H'= 0.14. From these results when compared to Raunsay (2014) who obtained *Myristica sp* with H'= 0.15 the results showed a decrease in the diversity of these plant species. this is due to low productivity (Restu, 2022).

Table 4. Plant food sources at the tree level

Species	Local Name	Tree								
		∑	D	RD (%)	F	RF (%)	D m	RDm (%)	IVI	H'
Gnetum gnemon	Marapi	3	0.5	3.23	0.02	30.76	0.5	50	83.99	0,06
Ficus benjamina	Asere	1	5	32.26	0.01	30.76	0.16	16	79.02	0,03
Palaquium ambounense	Kamorin	1	5	32.26	0.01	23.07	0.16	16	71.33	0,03
Elaeocarpus sphaericus	Mora	1	5	32.26	0.01	15.38	0.16	16	63.64	0,03
		6	15.5	100	1,00	100	1	100	300	0.54

Source: Vegetation Analyzed in 2018

Based on the research results, the plant species *Gnetum gnemon* has IVI = 83.99 and H' = 0.06. A high IVI value means that a species is dominant and has better adaptability than other species (Hidayat, 2017). Plant diversity describes the overall structure and composition of vegetation in the study area. LOW diversity indicates that productivity is lacking, ecosystem conditions are unstable and ecological pressure is high. The results of the analysis of the vegetation forage sources showed that the four levels of diversity were low, namely H'= 0.7 seedlings, H'= 0.46 saplings, H'= 0.51 poles, and H' trees = 0.54.

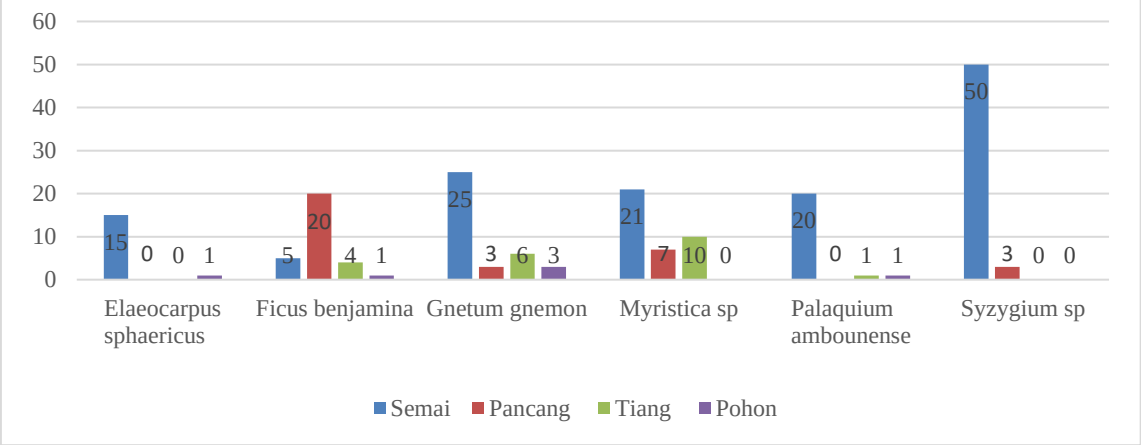

Figure 3. Graph of The Distribution of The Number of Plant Species as Feed At The Vegetation Level.

The results of the research on the graph show that the number of plant species *Sysygium sp* has a higher number at the seedling level, this is because the density value of a type of vegetation indicates the number of individual types of vegetation in question in a certain unit area, so the density value is an illustration of the number of

types of vegetation in each type of forest ecosystem or vegetation type Gunawan (2011).

Table 5. Comparison of Forage Vegetation

Species	Wambrauw (2018)	Hasil Penelitian Terdahulu				
		Raunsay (2014)	Setio*et al.*(1998)	Beehler & Dumbacher (1996)	Maturbongs *et al.* (1994)	Beehler (1983)
Gnetum gnemon	+	0	0	0	0	0
Ficus benjamina	+	+	+	+	+	0
***Myristica* sp.**	+	0	+	+	+	+
Palaquium ambounense	+	+	0	0	0	0
Elaeocarpus sphaericus	+	0	0	0	0	0
***Syzygium* sp**	+	+	0	0	0	0
***Pometia pinnata* #**	+	0	0	0	0	0
Ficus glandulifera	0	+	+	+	+	0
***Ficus variegata* Bl.**	0	+	+	+	+	0
Pticosperma macarturri	0	+	0	0	0	0
***Pandanus* sp**	0	0	0	0	0	+
***Eugenia* sp.**	0	+	0	0	0	0
***Celtis latifolia* Planch.**	0	0	0	0	+	0
***Dysoxylum* sp.**	0	0	+	0	0	+
***Endospermum* sp.**	0	0	0	0	+	+
***Pandanus* sp**	0	0	0	0	0	+
***Eugenia* sp.**	0	+	0	0	0	0
***Aglaia* sp.**	0	0	0	0	0	+
***Sterculia* sp.**	0	0	0	0	0	+
Podocarpus mereifolius	0	0	0	+	0	0
Chissocheton lasiocarpus	0	0	0	+	0	0
Disoxylum pettigrewianum	0	0	0	+	0	0
***Aglaia* sp.**	0	0	0	0	0	+

Sources: Beehler 1983; Maturbongs et al. 1994; Beehler and Dumbacher 1996; Setio et al. 1998; Raunsay 2014.

Note: (+) Discovered by Different Researchers; (0) Not Found; (#) Species Observed Directly

DISCUSSION

The feed source vegetation found at the study site turned out to have several types of them that had significant differences from previous studies, but some of them had similarities. The types that tend to be the same as previous studies are *Ficus benjamina* and *Myristica sp*.

According to Raunsay (2014); Raunsay (2020); Raunsay, Akobiarek, Matani, Ramandei, & Simbiak (2022) stated that the types of *Ficus benjamina* and *Myristica sp* have very good ecological distribution or can grow in various ecological areas so that the availability of these species as food can be found at any time for wild animals such

as *P. minor jobiensis*. According to Beehler & Dumbacher (1996), *Ficus benjamina* has small fruit, all parts of the fruit can be directly used by birds because it does not have a protective layer, is a wet fruit group, simple fruit type, and has one or more seeds, superior ovary properties, some or the entire fruit skin remains wet until ripe, *Ficus benjamina* fertilization is not based on the fruiting season so this plant does not affect the availability of feed. while *Myristica sp* is a fruit that is rich in nutrients because it is protected by an outer layer (fruit with a capsule type), the part used for food is stored on the inside so that birds require more effort to use it and the fruit has a nutritional content of fat (75%), protein (6%) and carbohydrates (1.9%).

The results showed that there were several different species from previous studies. The different species indicated that these species had a narrow ecological distribution or could not grow in various ecological types and had a unique pollination system so that they could only grow in certain areas which affected the species distribution. Another factor as a differentiating indicator is the species that were previously consumed but are currently not available due to existing environmental conditions or other factors so these animals switch to consuming different types of fruit. This is evidenced by the results of research which found several types of plant sources of food, namely *Gnetum gnemon* found in observation plots, these plants can be found in dry to tropical areas, and do not require highly nutritious soil or special climates. They can also adapt to a wide temperature range. area, *Gnetum gnemon* fruit also contains high protein (9-10%) so it can be a food source for *P. minor jobiensis* (Partomihardjo, 2004). Apart from *Gnetum gnemon*, one of the feeds directly observed being consumed by *P. minor jobiensis* was also found, namely *Pometia pinnata*. *Pometia pinnata* can grow in areas where the soil conditions are dry (not flooded) and in climates with high rainfall. This plant easily adapts to both hot and cold conditions, *Pometia pinnata* fruit is in the form of an oval or capsule, which is the preferred form of fruit for *P. minor jobiensis.* morphology, namely (1) fig shape (F) like dates, (2) drop shapes (D) like berries or nutmeg, and (3) capsule shape (C).

Based on the results of previous research by Raunsay (2014) the vegetation type *Elaeocarpus spahericus* is a nest for birds *P. minor jobiensis*. In contrast to the results of the study showing *Elaeocarpus spahericus* as one of the feeds. In the Central Maluku region, the parts of this plant that are used as food are fruit, seeds, and nectar by several bird species such as the parrot species, namely *Eos bornea* and *Trichoglossus haematodus*, which eat the nectar of *Elaeocarpus sphaericus* (Widodo, 2009).

The results of the research attached to Table 5 show that *P. minor jobiensis* also consumes plants of the *Palaquium ambounense* and *Syzygium sp* species. fruit as food by birds is influenced by several factors in the fruit, namely attractive color, appropriate size, ease of obtaining, and nutritional content.

P. minor jobiensis is classified as a frugivore bird that is very dependent on the presence of plant sources of food in the form of fruit or seeds. Putri (2015) states that the abundance of frugivores is influenced by the abundance and availability of fruit.

Availability of feed greatly affects the population of *P. minor jobiensis*, so the presence of various types of food source plants that can provide feed continuously throughout the year is very important for the preservation and existence of *P. minor jobiensis* in the Imbowiari Barawai forest area. According to Putri (2015) monitoring the presence of food-source plants, especially in forest areas that are often disturbed by

logging or timber theft, is an important thing to do to preserve the existence and existence of birds. Apart from monitoring feed-producing plants, other steps are also important to take. is the enrichment of plant sources of food and the rehabilitation of areas where the number and diversity of tree species forage is lacking.

CONCLUSIONS AND RECOMMENDATIONS

There are 6 types of food source plants in the Imbowiari Barawai forest research location, including *Elaeocarpus sphaericus*, *Ficus benjamina*, *Gnetum gnemon*, *Syzygium sp*., *Myristica sp*., and *Palaquium ambounense*. There is also 1 type of food source plant that was directly observed being consumed by *P. minor jobiensis*, namely *Pometia pinnata*. The diversity of plant sources of feed for the level of seedlings, saplings, poles and trees (H'< 1) is in the LOW category.

Based on the vegetation analysis carried out to determine the presence of plants as a source of food for *P. minor jobiensis* birds at the study site, it was shown that the presence of available plant species was still very low when viewed from the number of species diversity. Therefore, it is necessary to have species enrichment including planting or maintaining existing species and carried out by various relevant stakeholders, especially the Dorei Jaya group. It is hoped that there will be further studies on the bird feed plant *P. minor jobiensis*.

ADVANCED RESEARCH

Vegetation analysis of the target species for bird-of-paradise yellow has been carried out as an illustration of the availability of feed for seedlings, saplings, poles and trees. Apart from that, another study that is very important as a continuation is related to feed morphology. This feed morphology study was not only for the Lesser Yellow Bird of Paradise but also for the feed for the King Bird of Paradise, Dead Wire Bird of Paradise and Sickle-billed Bird of Paradise.

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