BIOTROPIA Vol. 30 No. 2, 2023: 158 - 170 DOI: 10.11598/btb.2023.30.2.1778

IDENTIFICATION OF THE MOLUCCAN MEGAPODE (*Eulipoa wallacei*) NATURAL HABITAT IN HARUKU ISLAND, INDONESIA AND ITS VEGETATION COMPOSITION

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Received 7 July 2022 / Revised 9 April 2023 /Accepted 11 April 2023

ABSTRACT

The characteristics of island vegetation greatly influence the activities of endemic birds in island areas, such as the Moluccan endemic megapodes (*Eulipoa wallacei*) on Haruku Island. Therefore, it is essential to identify the specific location of the habitat utilized by individual birds for their daily activities on Haruku Island and to analyze the composition of the vegetation and the variety of plant species. Identification of bird habitat locations using radio-tracking on four newly hatched chicks and four adult birds. A total of 330 individual tracking points were recorded during the study period. The vegetation sample used a total of 420 plots for seedlings, saplings, poles, and trees which were then analyzed for importance value index (*IVI*), diversity, evenness, and similarity. We found that the Tanjung Maleo forest was their nesting habitat, while the Marunimei and Lalean forests were their daily habitats. A total of 91 plant species and 60 plant families were discovered with the vegetation diversity value of the three habitats was moderate (H'_{mean} = 3.07) and tended to be dominated by air plant (*Kalanchoe pinnata***)**, sword fern (*Nephrolepsis exalta*), cogongrass (*Imperata cylindrica*), coco-grass (*Cyperus rotundus*), Indian camphorweed (*Pluchea indica*), and lanzone (*Lansium domesticum*) (E_{mean} = 0.88), and have a relatively low level of species similarity between habitats (SI_{mean} = 38.30%). We found that the daily habitat of the Moluccan megapode on Haruku Island was around their nesting sites and has a complex structure because it was composed four vegetation strata. Therefore, for conservation purposes, habitat management must prioritize preserving forest habitats around the bird nesting sites.

Keywords: Diversity, evenness, moluccan scrubfowl, momoa, maleo, similarity, vegetation composition

INTRODUCTION

The Maluku Islands, Indonesia, located in the Wallacea region, support endemic bird species, such as the Moluccan megapode, through various habitat types (Yuni & Yuda 2020). Tropical forests provide complex habitats rich in composition and structure of vegetation for shelter, foraging, roosting or sheltering, and breeding (Baldeck *et al.* 2012; Bu *et al.* 2014; Velasques-Trujillo *et al.* 2021). Therefore, the composition and diversity of habitat vegetation support the diversity of endemic, rare, threatened, and endangered wild birds (Sodhi *et al.* 2011; Rocha *et al.* 2015; Devenish-Nelson *et al.* 2019; Feng *et al.* 2020). The structure of a bird's habitat, which includes vertical structure and floristic composition, is an essential component of its habitat. Vegetation structure and floristic composition have been used to predict the presence and diversity of bird species for a long time. Some bird taxa are influenced by vegetation structural factors (e.g., the complexity of stand configuration or architecture), while

others are influenced by vegetation composition factors (e.g., vegetation type) (Tews *et al.* 2004; Tassicker *et al.* 2006; Gao *et al.* 2014; Rutten *et al.* 2015; Melo *et al.* 2020; Moudry *et al.* 2021). Island bird species in the tropics are threatened by several environmental challenges, including habitat change and destruction (Duncan & Blackburn 2007; Taylor & Kumar 2016; Radley *et al.* 2020; Dri *et al.* 2021). Habitat destruction causes changes in the structure and composition of vegetation in bird habitats, thus affecting the survival and reproduction of bird populations (Ruiz-Gutierrez *et al.* 2008; Matthews *et al.* 2015; Tulloch *et al.* 2016; Tchoumbou *et al.* 2020; Atikah *et al.* 2021).

One of the native and endemic bird species in the Maluku Islands is the Moluccan megapode (*Eulipoa wallacei*), which is only found in northern Maluku and central Maluku. Like other megapodes, the Moluccan megapode is super-precocial and classified as a terrestrial bird (Colar *et al.* 1994; Argeloo & Dekker 1996; Dekker *et al.* 2000; Heij & Rompas 2011). Moluccan megapodes inhabit coastal areas through tropical rain forests of more than 750 m asl (Dekker *et al.* 1995; Heij *et al.* 1997; Heij 2001; Heij & Rompas 2011; BirdLife International 2022). The occurrence of the birds in coastal areas is related to their nesting behavior, which involves digging holes in the sand substrate to lay their eggs (Dekker *et al.* 1995; Jones *et al.* 1995; Dekker *et al.* 2000; Heij *et al.* 1997; Heij & Rompas 2011). The population of Moluccan megapodes has been decreasing due to habitat destruction and egg harvesting (Colar *et al.* 1994; Argeloo & Dekker 1996; Dekker *et al.* 2000; Heij & Rompas 2011), so it has been designated as a vulnerable species by the IUCN since 1994 (BirdLife International 2016). Studies in 1997 by Heij *et al.* (1997) confirmed that habitat destruction caused the Moluccan megapode to become rare on several large islands, such as Seram Island and Bacan Island, and smaller islands, such as Ambon Island and Ternate Island. Likewise, several nesting sites have been abandoned and are no longer used by birds due to the destruction of their nesting habitat. The effect of habitat destruction on the decline of the Moluccan megapode indicates that habitat quality and composition play an essential role in the bird populations. Adult Moluccan megapodes use vegetation around their nesting site for perching before and after nesting activities. Meanwhile, newly hatched chicks require vegetation cover as shelter from predators (Heij *et al.* 1997; Heij & Rompas 2011).

In Central Maluku, one of the largest nesting sites of the Moluccan megapode is Tanjung Maleo in Haruku Island (Heij *et al.* 1997; Heij & Rompas 2011). Until recently, information about the habitat used by Moluccan megapodes on Haruku Island has been scarce and limited to habitats around bird nesting sites (Heij *et al.* 1997; Heij & Rompas 2011; Sjafani *et al.* 2015), while daily habitat use studies have never been reported. Better knowledge of the specific habitats used by Moluccan megapodes allows conservation managers to carry out appropriate engineering to protect bird habitats from expanding settlements near nesting habitats or opening new agricultural fields in their daily habitats. Habitat protection engineering can be carried out by delimiting habitat boundaries, maintaining the composition of vegetation strata, or providing corridors for the distribution of chicks and pathways for adult birds to and from their nesting habitat in Tanjung Maleo. This study investigated habitat use by Moluccan megapodes on Haruku Island. We also analyze the composition of the vegetation and the diversity of plant species in these habitats to understand the influence of habitat on birds' daily activity patterns.

MATERIALS AND METHOD

Study Area

The study was conducted on Haruku Island in Central Maluku District (3.567°S, 128.483°E) (Figure 1). Haruku Island has an area of 274 km^2 and a topography of mountains and hills, with the highest point reaching 554 meters above sea level. The climate on Haruku Island is locally influenced by tropical marine climate and monsoon climate (Aldrian & Dwi Susanto 2003; Wirjohamidjojo & Swarinoto 2010) with relatively high rainfall of 224.58 mm per year in 2021 (BPS Propinsi Maluku 2022).

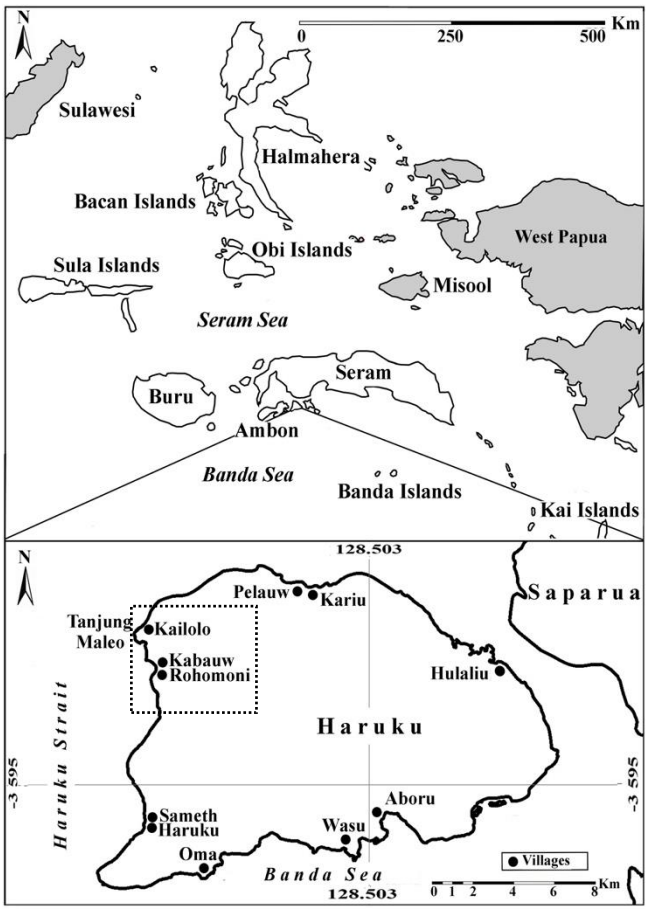

Figure 1 Study sites used to identify natural habitats and analyze the composition and diversity of the vegetation of the Moluccan megapode (*Eulipoa wallacei*) habitat in Haruku Island, Indonesia [dotted line boxes indicate the location of daily bird habitats].

Identification of Bird Habitat

Bird habitat identification was conducted by using radio-tracking. During 40 days of observation from December 2020 until January 2021, 330 points of bird presence were recorded. Individual females and chicks were tracked from their nesting sites to collect data on the relationship between nesting habitats and daily foraging habitats. This study did not use adult males because only adult females carried out nesting activities at nest sites in Tanjung Maleo, while adult males remained in their daily habitat (Heij *et al.* 1997; Heij & Rompas 2011). Adult male birds were challenging to catch in their daily habitat because of their camouflage amidst the surrounding understory vegetation. Eight birds were utilized, including four newly hatched chicks and four adult females. Chicks and adult females were caught using a hand capture technique (De Beer *et al.* 2001; Bloom *et al.* 2007; Whitworth *et al.* 2007; Busse & Meissner 2015) during nesting and when the chicks emerged from their nesting holes. For tracking purposes, the Sirtrack V8009 transmitter was utilized for chicks, and the Sirtrack P04347 transmitter for the adult birds. Using Loctite cyanoacrylate (Bowman *et al.* 2002; Diemer *et al.* 2014), the transmitter was attached to the base of the wing. The movement and position of individual birds were tracked using Biotrack Sikka VSR 04, receiver, Yagi antennae, and GPS Garmin 64S. The birds were tracked every day on foot (ground tracking). The position of the Universal Transverse Mercator coordinate for each bird was plotted on a map of the study site to determine the area used by birds using ArcGIS 10.3 and ArcMap 10.3.

Vegetation Sampling

Intensive floristic inventory and plot-based vegetation survey (Krebs 1998; Colwell 2009) was conducted at forest sites on Haruku Island that were used by individual Moluccan megapodes, specifically in Tanjung Maleo, Marunimei, and Lalean. Vegetation sampling was carried out at the same time as bird habitat identification. Twelve transect lines measuring 500 and 1000 meters were utilized, and the distance between transects was 250 meters. The distance between plots was 100 meters. The plot sizes were 1 m x 1 m (seedlings), 5 m x 5 m (saplings), 10 m x 10 m (poles), and 20 m x 20 m (trees) (Barbour *et al.* 1987; Woodward *et al.* 2009; Rahman *et al.* 2016; Kusmana 2017; Peng *et al.* 2018). The observed variables for each stage were as follows: (i) seedling stage: germinated seeds to < 1.5 m in height, (ii) sapling stage: height >1.5 m to a diameter at breast height (dbh) < 10 cm, (iii) pole stage: 10 cm < dbh < 20 cm (Barbour *et al.* 1987; Woodward *et al.* 2009; Kusmana 2017). There were 84 plots in Tanjung Maleo, 168 in Marunimei, and plots in Lalean. Vegetation parameters included species name, number of species, number of individual species, and diameter at breast height (dbh). Plant species were identified using a collection of identification guides (Whitmore 1978; Soerianegara & Lemmens 1994; Lemmens *et al.* 1995; Llamas 2003; Gunawan *et al.* 2019).

Data Analysis

All coordinate positions of bird presence points were plotted onto the Haruku Island land cover map to obtain the Moluccan megapode habitat land cover type. The land cover map of the bird habitat area was determined using a 2021 Haruku Island land cover map combined with 2021 Google Earth imagery data, a 1:50,000 scale map of Haruku Island in 2021, and a 2020 Landsat 5 TM image (composite color band 4 - band 3 - band 2) with a spatial resolution of 30 meters. Land cover types on bird habitats were created using ArcMap 10.3. The land cover classification was based on the Indonesian National Land Cover Standards Agency (National Standardization Agency of Indonesia 2010). Vegetation structure and floristic composition were determined based on the analysis of the importance value index (*IVI*) (Bendre & Kumar 2010), species diversity (Shannon – Wiener index) (Shannon & Weaver 1963; Odum 1983), species evenness (Pielou index) (Odum 1983), and species similarity (Sorensen index) (Sorensen 1948). The importance value index (*IVI*) is the sum of relative frequency, density, and dominance values.

The species diversity was calculated by using the Shannon-Wiener index:

$$H' = -\sum p_i \ln p_i$$

where:

p_i = proportion of individuals of the *i*-th species to individuals of all species found.

The species evenness index was calculated by using the Pielou index:

$$E = H'/\ln (S)$$

where:

H' = Shannon-Wiener diversity indeks;
S = total number of species in the sample;
E = 1 if all species are represented equally in the sample, and E is close to zero if one species predominates strongly.

The species similarity index (*SI*) between sites was calculated using the Sorensen index:

$$SI = (2C/(A+B)) \times 100\%,$$

where:

C = standard number of species at the two sites;
A = number of species at site *A;*
B = the total number of species at site *B*.

The F test was conducted using one-way ANOVA to compare the composition of vegetation growth strata between bird habitat forests.

RESULT AND DISCUSSION

Habitat of Moluccan Megapode

The radio-tracking record of individual chicks and adult females of Moluccan megapodes on Haruku Island indicated that bird activity occurred in forest areas near their nesting sites. Birds were active in their nesting

site at Tanjung Maleo, Marunimei, and Lalean forests. Marunimei Forest is ± 1.60 km northeast of Tanjung Maleo, and Lalean Forest is ± 2.50 km southeast of Tanjung Maleo. The Moluccan megapodes habitat was classified as moor-farm-field and dryland forest based on the land cover type. The type of land cover around the bird's nesting site in Tanjung Maleo was classified as a development area because it was adjacent to a residential area. However, around the bird nesting site in Tanjung Maleo, there were still various types of vegetation specially guarded by the community as part of the bird's nesting habitat. Meanwhile, the Marunimei forest, as the bird's daily habitat, was classified as a moor-farm field, while the Lalean forest was classified as a dry land forest (Figure 2).

These results confirm previous research indicating that Moluccan megapodes could survive and thrive in various habitat types ranging from secondary forests to open beaches, lowland forests, and tropical rain forests (Dekker *et al.* 1995; Heij *et al.* 1997; Heij 2001; Heij & Rompas 2011). In contrast to their diverse daily habitats, bird nesting habitats were always found in coastal areas, specifically open beach areas surrounded by forest areas (Dekker *et al.* 1995; Jones *et al.* 1995; Dekker *et al.* 2000; Heij *et al.* 1997; Heij & Rompas 2011). Megapode species in island areas are known to be more active in tropical forests and use coastal areas for breeding. Therefore, both habitat types are essential for survival (Goth & Vogel 1995; Jones *et al.* 1995; Dekker *et al.* 2000; Pangau-Adam & Brodie 2019; Paguntalan *et al.* 2021). The daily activities of the Moluccan megapode within a radius of ± 2.50 km from their egg-laying locations in Tanjung Maleo indicated that most of their daily activities are not far from their egg-laying locations. Several studies of other bird species also show that most of the birds' daily activities occur in areas not far from their nesting sites (Ryan & Jamieson 1998; Yaremych *et al.* 2004; Bosch *et al.* 2010; Rechetelo *et al.* 2016).

Adult female Moluccan megapode used the forest in Tanjung Maleo for perching before starting nesting activities or as a perch after nesting, before flying away from the nest site (Heij *et al.* 1997; Heij & Rompas 2011). For chicks, the forest around their nesting site in Tanjung Maleo was used as a shelter from the moment they hatch (Heij *et al.* 1997; Heij & Rompas 2011) because of their super-precocial nature (Colar *et al.* 1994; Argeloo & Dekker 1996; Starck & Ricklefs 1998; Dekker *et al.* 2000). Consequently, vegetation around the nesting site was crucial to the chick's survival. It has been reported that Moluccan megapode chicks immediately moved to nearby vegetation after hatching (Heij *et al.* 1997; Heij & Rompas 2011). The use of vegetation around the hatchery as a shelter for chicks has also been reported among the Australian brush-turkey chicks (*Alectura lathami*) (Goth & Jones 2001; Goth & Vogel 2002; Goth & Vogel 2003; Goth & Evans 2005).

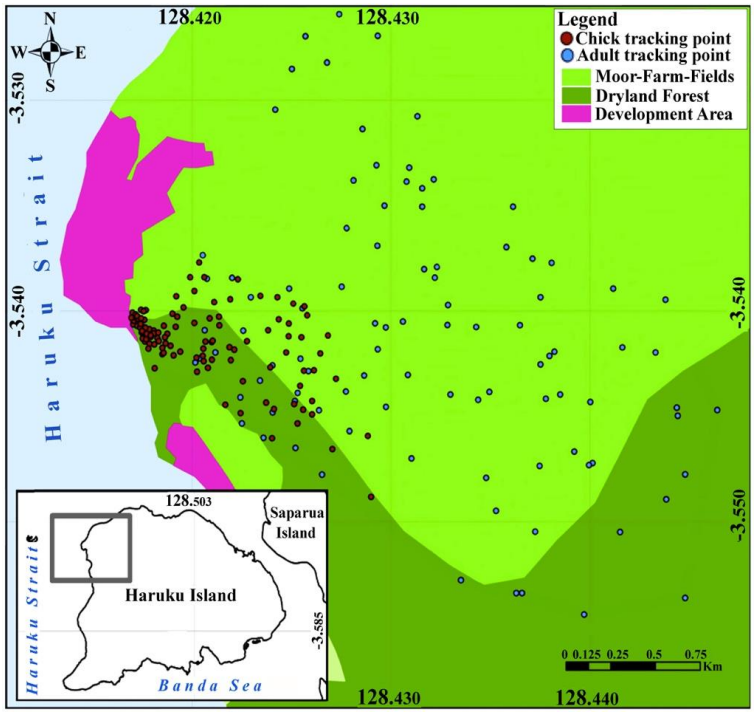

Figure 2 The point of presence of individual Moluccan megapodes (*Eulipoa wallacei*) in Haruku Island based on radio-tracking results.

Vegetation Structure and Floristic Composition

Of the three forest locations used by the Moluccan megapodes, the Marunimei forest has the highest number of plant species (48 species). In contrast, the Tanjung Maleo forest has the most diminutive plant species (14) (Table 1). The number of plant species in the Tanjung Maleo forest is currently fewer than the study results in 1997. In 1997, approximately 20 species were found in the Tanjung Maleo forest (Heij *et al.* 1997; Heij & Rompas 2011). These results indicated that in the twenty-four years since 1997, the number of plant species in the Tanjung Maleo forest has decreased. Because Tanjung Maleo's forest was close to the villages, it was believed that the expansion of the residential area was responsible for the decline in species. The number of plant species in the Maluku megapod habitat on Haruku Island from this study was higher than the results of a survey conducted by Ahmad (2014) around bird nesting sites on Halmahera Island, which only found as many as 13 to 17 plant species.

This study also found that the highest number of plant families was found in the Marunimei forest area (30 families), and the lowest was in the Tanjung Maleo forest area (14 families) (Table 1, Figure 3). No dominant plant species families were found in the Tanjung Maleo forest; each family only consisted of one species. In contrast, in Marunimei and Lalean forests, members of the Fabaceae family dominated the vegetation. The current number of plant families in the Tanjung Maleo forest is the same as the 1997 study by Heij *et al.* (1997) and Heij & Rompas (2011), but in 1997 the Fabaceae family had more than one species.

Table 1 The number of species, individual species, and plant families in forest habitats utilized by Moluccan megapodes (*Eulipoa wallacei*) in Haruku Island

Forest areas	Species (*n*)	Individual species (*n*)	Family (*n*)
Tg. Maleo	14	49	14
Marunimei	48	1401	29
Lalean	28	345	16
Total	91	1795	60

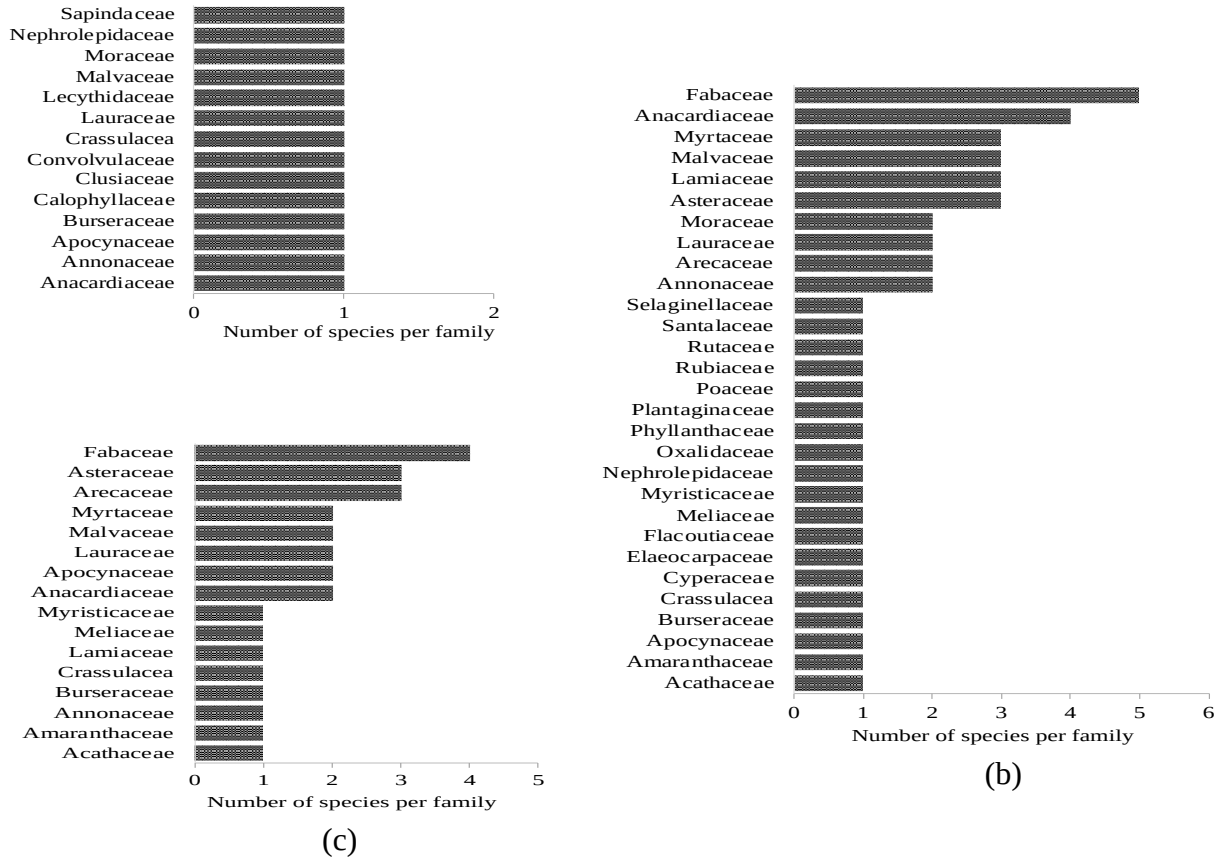

Figure 3 Comparison of the number of plant species per family in three forest areas used by Moluccan Megapodes (*Eulipoa wallacei*) in Haruku Island (a) Tanjung Maleo, (b) Marunimei, and (c) Lalean

Table 2 Comparison of vegetation structural composition in three forest areas used by Moluccan megapodes (*Eulipoa wallacei*) in Haruku Island

Forest areas	Vegetation growth stratum							
	Tree		Pole		Sapling		Seedling	
	Number of individuals (*n*)	Percentage (%)	Number of individuals (*n*)	Percentage (%)	Number of individuals (*n*)	Percentage (%)	Number of individuals (*n*)	Percentage (%)
Tg Maleo	34	69.39	4	8.16	2	4.08	9	18.37
Marunimei	605	43.18	226	16.13	165	11.78	405	28.91
Lalean	109	31.59	69	20.00	14	4.06	153	44.35
Average	249		100		60		189	

The strata of vegetation growth in the three Moluccan megapodes habitat forest areas included trees, poles, saplings, and seedlings (Table 2). The tree strata dominated the forest area in Tanjung Maleo (63.39%) and Marunimei (43.18%), while the seedling strata dominated the Lalean forest area (44.35%). The F test showed that the vegetation's composition significantly differs between habitat forests (F_{count} = 8.82 > F_{table} = 4.26).

This study showed that the forest regions surrounding bird nesting sites were classified as having complex vegetation because they contain four growth strata: trees, poles, saplings, and seedlings. The Moluccan megapode habitat on Halmahera Island also consists of four growth strata (Ahmad 2014). Studies of several megapode species show that their habitat tends to be dominated by tree strata compared to other growth strata (Goth & Vogel 1995; Khairuddin & Yamin 2019; Pangau-Adam & Brodie 2019; Paguntalan *et al.* 2021; Dhafir *et al.* 2022). However, several species of megapodes, such as the Australian brush turkey (*Alectura lathami*) (Goth & Vogel 2003), the wattle brush turkey (*Aepypodius arfakianus*) (Pangau-Adam &

Brodie 2019), and the orange-footed scrubfowl (*Megapodius reindwartii*) (Khairuddin & Yamin 2019) are also found in a sapling or seedling strata. Complex vegetation contributes to the survival of wild species populations by providing a suitable microclimate, shelter, and a place to rest and reproduce (Baldeck *et al.* 2012; Bu *et al.* 2014; Bergner *et al.* 2015). In Tanjung Maleo, the percentage of tree strata is currently higher than in 1997. In this study, the tree strata in the Tanjung Maleo forest reached 70 percent, whereas the 1997 study found only 67 percent (Heij *et al.* 1997; Heij & Rompas 2011). Likewise, tree strata dominated the Marunimei forest. On the other hand, the seedling layer dominated the Lalean forest. Tree strata in the Tanjung Maleo forest function as perching for birds when they come to the nest or leave their nesting sites, while the strata of seedlings and saplings serve as protection for the chicks after hatching (Heij *et al.* 1997; Heij & Rompas 2011). Observations in the study area show that the Moluccan megapodes also use trees in their habitat as perching to move between habitats or escape from predators. Individual birds used the tree layers in their habitat as perches, resting spots, and shelters. Moluccan megapodes' activity primarily occurs on the forest floor (Mackinnon & Wind 1980; del Hoyo *et al.* 1994; Strange 2012) and causes variations in vegetation strata to be essential for the survival of individual birds (Bucklin *et al.* 2015; Walther & Pirsig 2017; Velasques-Trujillo *et al.* 2021).

Species Composition and Diversity

Based on the importance value index (*IVI*), the dominant species in each forest area were different (Table 3). The dominant species in the Tanjung Maleo forest were air plants (*Kalanchoe pinnata*) (*IVI* = 67.96) and sword ferns (*Nephrolepsis exalta*) (*IVI* = 61.47). Marunimei forest was dominated by cogongrass (*Imperata cylindrica*) (*IVI* = 36.80) and coco-grass (*Cyperus rotundus*) (*IVI* = 32.59), and the Lalean forest was dominated by Indian camphorweed (*Pluchea indica*) (*IVI* = 24.23) and lanzones (*Lansium domesticum*) (*IVI* = 18.30). The dominant plant species in the Tanjung Maleo forest differed from the dominant species around the Moluccan megapodes nesting site on Halmahera Island in North Maluku. The vegetation around the nesting site at Galela on Halmahera Island was dominated by more varied species, namely bay hops (*Ipomoea pescrapae*), clover (*Marsilea creanata*), mangrove (*Rhizophora* sp), and tropical almond (*Terminalia catapa*) (Sjafani *et al.* 2015). These results indicated that plant species around bird nesting sites did not significantly affect bird arrivals for nesting. Dominant plant species in both forest areas adjacent to nesting sites (Marunimei and Lalean forests) act as shelters and support the daily activities of Moluccan megapodes on Haruku Island.

Table 3 The vegetation composition of the nine most abundant plant species in three forest areas used by Moluccan megapodes (*Eulipoa wallacei*) in Haruku Island

No	Forest areas					
	Tanjung Maleo		Marunimei		Lalean	
	Species name	% INP	Species name	% INP	Nama Ilmiah	% INP
1	*Kalanchoe pinnata*	21.93	*Imperata cylindrica*	12.27	*Pluchea indica*	8.08
2	*Nephrolepsis exaltata*	20.34	*Cyperus rotundus*	10.86	*Lansium domesticum*	6.10
3	*Planchonia valida*	9.91	*Nephrolepsis exaltata*	8.49	*Amaranthus spinosis*	6.07
4	*Cananga odorata*	7.58	*Selaginella doederleinii*	4.04	*Tectona grandis*	5.61
5	*Alstonia scholaris*	6.08	*Ficus benjamina*	3.84	*Leucaena leucocephala*	4.82
6	*Ipomoea pes caprae*	5.72	*Lannea grandis*	3.51	*Durio zibethinus*	4.58
7	*Garcinia bancana*	5.34	*Durio zibethinus*	3.23	*Calameae* sp	4.56
8	*Eusideroxylon zwageri*	4.06	*Cocos nucifera*	3.21	*Myristica fragrans*	4.55
9	*Mangifera indica*	3.69	*Artocaphus heterophyllus*	3.07	*Cocos nucifera*	3.94
10	Others (6 species)	15.36	Others (39 species)	47.47	Others (19 species)	51.70
	Total percentage	100.00		100.00		100.00

The highest diversity of plant species in the three forest areas around the Moluccan megapodes site was in the Marunimei forest (*H'* = 3.87), while the lowest was in the Tanjung Maleo forest (*H'* = 2.27) (Table 4a). In terms of diversity, the plant species diversity in

the three forest regions was categorized as moderate. In addition to its diversity, species abundance distribution in the three forest areas, as measured by an evenness index, was close to one. The Lalean forest had the most notable species distribution equality (*E* = 0.92) (Table 4a). The evenness index indicates that the distribution of plant species abundance in the three locations tends to be relatively even and does not indicate the dominance of one or more species. Nevertheless, according to the importance value index, each type of bird habitat contains several dominant plant species. Tanjung Maleo forest has a greater variety and more even distribution of plant species than Halmahera Island's forest (Sjafani *et al.* 2015). The diversity and evenness of plant species in the Moluccan megapode habitat were higher than the orange-footed scrubfowl habitat on Moyo Island, West Nusa Tenggara (*H'* = 2.42 dan E = 0.86) (Khairuddin & Yamin 2019).

Table 4 Comparison of ecological index values between the three forest areas used by Moluccan megapodes (*Eulipoa wallacei*) in Haruku Island

a. Species diversity and evenness index between forest areas

Forest areas	Shannon-Wiener Index *(H')*	Pielou Index *(E)*
Tg. Maleo	2.27	0.86
Marunimei	3.87	0.86
Lalean	3.06	0.92

b. Similarity and dissimilarity between forest areas

Forest areas	Similarity (%)	Dissimilarity (%)
Tg. Maleo – Marunimei	25.81	74.19
Tg. Maleo – Lalean	28.57	71.43
Marunimei – Lalean	60.53	39.47
Average	38.30	61.70

This study found that from the three forest areas, the similarity of plant species between Tanjung Maleo forest, a bird nesting site, with the other two forests was low (*IS* = 25.81% and *IS* = 28.57%). On the other hand, the similarity of plant species between Marunimei and Lalean forests was high (*IS* = 60.53%) (Table 4b). Therefore, the dissimilarity of plant species between the bird's nesting site in Tanjung Maleo and the other two forest areas indicates the difference in vegetation between the bird's nesting and daily habitats. The difference in species diversity between the forests surrounding bird nesting sites on Haruku Island and Halmahera Island indicates that the habitat types of Moluccan megapodes were diverse and not influenced by specific plant species. The low average similarity between the three forests (SI_{mean} = 38.30 percent) reflects the diversity of vegetation in the forest surrounding the Haruku Island bird nesting site. However, the similarity index between the three bird habitats revealed vegetation type differences between nesting habitats and the habitat of the Moluccan megapodes on Haruku Island.

CONCLUSION

This study enhances our understanding of the habitat conditions of Moluccan megapodes on Indonesia's Haruku Island. It was determined that the Moluccan megapodes on Haruku Island were active in the forest area approximately 2.50 kilometers from their nesting sites. Based on the distance from the nesting site, the forest area in Tanjung Maleo serves as a bird nesting habitat. In contrast, the other two forests (Marunimei and Lalean) are a bird's daily habitat. Haruku Island's bird habitat consists of four layers of vegetation that support the activities of chicks and adult birds during nesting, foraging, and perching. Variations in plant species diversity among the three habitats indicate Moluccan megapodes' ability to occupy diverse habitat types. Regarding plant species diversity, nesting habitats and daily habitats of

birds differ by more than 70% of plant species, indicating differences in vegetation between nesting habitats and daily habitats of birds. An important finding from this study was that conservation efforts for the Moluccan megapodes on Haruku Island should prioritize nesting and daily habitats in the forest area around the bird's nest sites.

ACKNOWLEDGMENTS

Special thanks to D. Usemahu and Kailolo Village for their assistance and cooperation during fieldwork, R. Huda, and International Animal Rescue Indonesia Foundation for providing a tracking receiver and a Yagi antenna and School of Life Science and Technology, Institut Teknologi Bandung for supporting facilities during the study. This research was funded by the Directorate General of Higher Education, Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia as a scholarship and doctoral research grant to the first author.

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