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Identification of spatial data and ecology of Javan hawk-eagle's nest (*Nisaetus bartelsi*) in the Kondang Merak Coastal, South Malang, East Java, Indonesia

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Abstract. *Iskandar RRD, Elfidasari D, Prawiradilaga DM. 2022. Identification of spatial data and ecology of Javan hawk-eagle's nest (*Nisaetus bartelsi*) in the Kondang Merak Coastal, South Malang, East Java, Indonesia. Biodiversitas 23: 3419-3428.* Ecological identification of the Javan hawk-eagle's habitat (*Nisaetus bartelsi*) is necessary to understand the support of its life, such as the spatial data in connection with its home range, nest location, and the use of nest trees. The species must choose a location that suits its needs. According to several studies, The Javan hawk-eagle's presence was only in highland forests. The new report of The Javan hawk-eagle occurrence in Merak Kondang coastal confirmed The Javan hawk-eagle's presence in lowland forest. The objective of this study was to identify the landscape characteristics that become the habitat preferences of The Javan hawk-eagle in Merak Kondang coastal, South Malang, East Java. Analysis used in this study included habitat suitability maps, plant vegetation, spatial analysis of tree canopy, and tree nest architecture analysis. The home range of the Javan hawk-eagle in the Kondang Merak coastal, South Malang, East Java, covered an area of 149.94 Ha. Most of the home range overlapped between Javan hawk-eagle individuals, including siblings and between an individual Javan hawk-eagle with other species of eagle. The Javan hawk-eagle used *Spondias pinnata* as nest trees with the architectural model Scarrone. It used 3 different tree species for perching, namely *Pterocymbium javanicum, Anthocephalus cadamba*, and *Alstonia angustiloba*. In the tree phase, the dominant vegetation type was *Spondias pinnata* (IVI) 43,16%, the pole phase that dominates was *Mallotus paniculatus* (IVI) 62.31%, the dominant vegetation of the stake phase was Garcinia forbesii, and the seedling phase was *Arenga obtusifolia* (IVI) 71.42%. The highest diversity index (H') was in the tree phase (H'=2,34), which was in the moderately abundant category and was at an elevation of 8% (flat).

Keywords: Habitat, Javan hawk-eagle, nest tree, *Nisaetus bartelsi*, spatial data

INTRODUCTION

The Javan hawk-eagle (*Nisaetus bartelsi*), like other living things, occupies space with other living and non-living things. Both the Javan hawk-eagle and other animals maintain their survival by interacting with each other and their environment. The system that is formed due to an interaction between living things and their environment is called an ecosystem, and the science that studies ecosystems is called ecology.

Ecological identification of the Javan hawk-eagle is needed to support its life. This is due to the relationship with home ranges, nest locations, and the use of nest trees to support their lives, so the Javan hawk-eagle must choose an appropriate location. In addition, the ecological identity of the Javan hawk-eagle can be used as a source of information for the tourism sector in the Kondang Merak coastal, South Malang, East Java, Indonesia. So that the local authority can decide the state of the location that should not be explored for the tourism sector.

The Javan hawk-eagle (*Nisaetus bartelsi*) is an endemic bird that lives in the area from near the coast to mountainous forests from West to East Java (van Balen et al. 1999). In the West Java region, it is recorded in several locations, including Ujung Kulon National Park, Gunung Halimun Salak National Park Area, Mount Salak, Mount Gede, Mount Pangrango, Mount Buleud, Mount Beser, Mount Hanjawar Timur I and Mayan Hills, Kuningan (van Balen et al. 2001; Gjershaugh et al. 2004; Prawiradilaga 2006; Azmi et al. 2016; Gunawan et al. 2016; Alfiyasin et al. 2018; Fahmi and Syartinilia 2020; Septiana et al. 2020; Suyitno and Syartinilia 2020). The distribution of the Javan hawk-eagle in Central of Java covers Gunung Merbabu National Park and Gunung Merapi National Park (Nurfatimah et al. 2017). The distribution of the Javan hawk-eagle in East Java covers various areas such as the Gunung Picis and Gunung Sigogor Nature Reserves, SPTN 1 Tegaldlimo, Alas Purwo National Park, Bromo Tengger Semeru National Park, and Mount Ijen (Nursamsi et al. 2018; Aji et al. 2019; Aryanti et al. 2021; Murad and Syartinilia 2021; Yuliamalia et al. 2021)

The Javan hawk-eagle population is threatened due to deforestation and habitat fragmentation, as well as poaching and illegal trade. There are about 5% of the 2471 diurnal raptors traded are the Javan hawk-eagle. The distribution of these raptors is outrageously narrow, that the

function of ecosystem indicators is limited only on a local scale (Cahyana et al. 2015). The Javan hawk-eagle acts as a population controller on its prey and sensitive to environmental changes. It becomes endangered as its population decreases over time (Azmi et al. 2016). The main cause of the Javan hawk-eagle population decline is deforestation on Java Island, which irritates the animal habitat (Nursamsi et al. 2018). In addition, a biological factor also contributes to determine Javan hawk-eagle population through its ability to lay only 1-2 eggs per mating season, which happens biannually (Azmi et al. 2016). The Javan hawk-eagle is categorized as critical species in the Red List established by the International Union for Conservation of Nature (IUCN) (Aji et al. 2019).

Spatial data analysis is known as the process of modeling, testing, and interpreting the results of the model. This is an output process activity or creating new information about the functions and parts of the surrounding geographic area. The spatial data analysis model is divided into two meanings; first, abstraction from the reality that exists on the surface of the earth, and second, the representation of real data. The spatial data analysis is arranged systematically as a series of rules and procedures to produce information that can be analyzed (Cahyana et al. 2015; Azmi et al. 2016).

MATERIALS AND METHODS

Study area

This research was conducted in the Kondang Merak coastal area, South Malang, East Java, Indonesia (Figure 1). the famous Kondang Merak Forest is geographically located at 08º24'15"-08º23'14" S and 112º27'54"-112º33'13" E. It is located in the province of East Java, Indonesia, which covers 2 villages Sumber bening and Srigonco. Kondang Merak Forest has an elevation or land height starting from 0-160 masl (meters above sea level). This area is divided into four classes, the class area is 0-50 masl with an area of 487.3 hectares or about 50.65% of the total area, the class area is 51-100 masl with an area of 392.4 ha or about 40.79% of the total area, the class area is 101-150 masl with an area of 82 hectares or about 8.52% of the total area and the class area is 151-200 masl with an area of 0.3 ha or about 0.03% of the total area.

Procedures

They were made by focusing on several data, such as the Java hawk-eagle habitat suitability map, which will be divided based on the type of forest. Analysis of general habitat conditions included climatic conditions, rainfall, land height, and distance of nest trees from settlements. These aimed to determine the characteristics of suitable habitats for the Javan hawk-eagle. Furthermore, mapping of the points where the Javan hawk-eagle was found and the frequency of its encounters with the Javan hawk-eagle in the forest area was carried out (Cahyana et al. 2015). After that, a map of the encounters was made as well as a map of the roaming area according to the division of the forest area. Then, the data is processed through several methods, such as descriptive explanation, quantitative, and map processing through ArcMap and Canva applications.

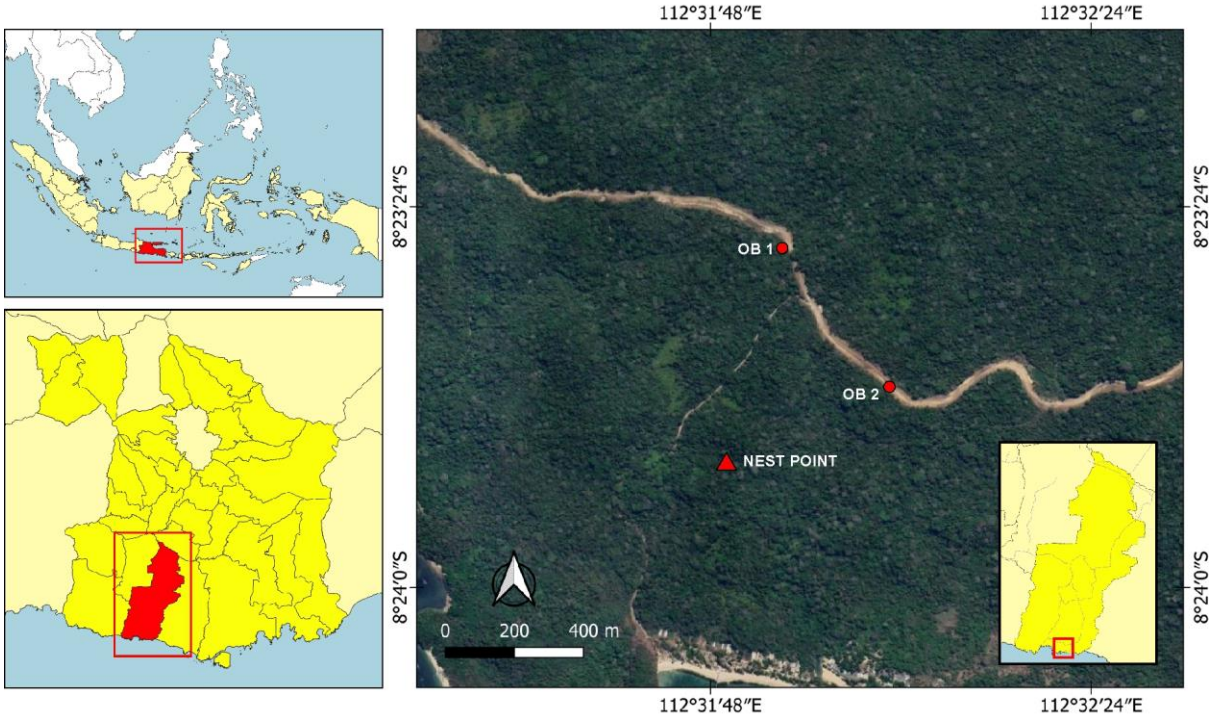

Figure 1. Map of research sites, nest, and observation location in the Kondang Merak coastal area, South Malang, East Java, Indonesia

Data analysis

To acknowledge the diversity of vegetation types in the Javan hawk-eagle habitat, it is necessary to analyze vegetation data which consists of Relative Density (RK), Relative Frequency (RF), Relative Dominance (RD) and Dominance. These variables are the components used to calculate Important Value Index (IVI) (Nuraina et al. 2018). The important value index is a parameter that states the level of centralized dominance or control of a species in a community or can be used as a guide to determine the dominant species in a place. The dominant group of species in a community might be centered in only one species, several species, or even many species.

According to Shannon-Wiener (Odum 1994) the magnitude of the species diversity index can be defined as follows: (i) The value of H>3 indicates that the species diversity on a transect is very abundant; (ii) The value of 1<H<3 indicates that species diversity on a transect is abundant; (iii) The value of H<1 indicates that the species diversity on a transect is small or low.

The objective of this study was to identify the landscape characteristics that become the habitat preferences of The Javan hawk-eagle in Merak Kondang coastal, South Malang, East Java. Observation and analysis were conducted around the spatial and ecological data of the Javan hawk-eagle's nest, which includes forest types, forest characteristics, tree species, tree characteristics, and tree vegetation analysis.

There were four types of vegetation components analyzed, including seedling vegetation (A), sapling vegetation (B), pole type vegetation (C), and tree species vegetation (D), with a total area of 20x20 m (Soerianegara dan Indrawan 1980). The measurement data was used to calculate the Important Value Index (IVI) and the Shannon-Wiener Diversity Index. The importance value index (IVI) is a quantitative parameter that can be used to express the level of dominance (mastery level) of species in a plant community (Soegianto 1994). The four components are then analyzed to obtain values, Density (K), Relative Density (RK), Frequency (F), Relative Frequency (RF), Dominance (D), Relative Dominance (RD), and Important Value Index (IVI). The function of the formula is as follows:

$$\text{Density (K)} = \frac{\text{Number of Individuals of Each Species}}{\text{Total Plot Area}}$$

$$\text{Relative Density (RK)} = \frac{\text{Density of A Species}}{\text{Density of All Species}} \; x\; 100\%$$

$$\text{Frequency (F)} = \frac{\text{Number pf Blocks Found Species}}{\text{Total of All Plots}}$$

$$\text{Relative Frequency (RF)} = \frac{\text{Frequency of A Species}}{\text{Frequency of All Species}} \text{ x } 100\%$$

$$\text{Dominance (D)} = \frac{\text{Base Area}}{\text{Sample Plot Area}}$$

$$\text{Relative Dominance (RD)} = \frac{\text{Dominance of A Species}}{\text{Dominance of All Species}} \text{ x } 100\%$$

Important Value Index (IVI) A = FK + RF + RF (pole and tree vegetation)

Important Value Index (IVI) B= RK + RF (Seedling and shrub vegetation)

The division of the tree canopy space is centered on the main tree trunk. It is divided into two spaces, vertically and horizontally. On the vertical, it is made into rooms I, II, and III, while horizontally, it is made into spaces A, B, and C, this is based on a tree architecture model and then analyzed descriptively (Sutisna et al. 1990). The analysis of the division of the tree canopy was to observe and determine the position of the Javan hawk-eagle's nest, resting behavior, stalking prey, and eating based on the distance of view, thus facilitating the movement of the Javan hawk-eagle. Finally, architectural analysis of the nest tree was carried out to distinguish one tree species from another because each type of tree has a unique character in the process of its growth series.

RESULTS AND DISCUSSION

The Javan hawk-eagle's nest area

Based on observations, the location of the Javan hawk-eagle's nest and its surroundings was divided into five grades of the slope, according to Agricultural Decree No. 837/Kpts/Um/11/1980. A slope of 0-8% (flat) has an area of ±148 ha, a slope of 8-15% (sloping) has an area of ±53 ha, a slope of 15-25% has an area of 159 ha, a slope of 25-45% 366 ha and a slope of >45% has an area of 250 ha. Based on observations on the map, the nest location was at an elevation of 0-8%, and the observation point was at an elevation of 8-15% (Figure 2).

Based on the Decree of the Ministry of Environment and Forestry in 2017, the Kondang Merak Protected Forest area has an area of 532 hectares and a production forest area of 430 hectares. The Protected Forest Area in the northern part is a permanent production forest area owned by Perhutani, which has a condition still like a protected forest with an area of 430 ha. The results of the observations showed that the home range of the Javan hawk-eagle has an area of 149.94 ha.

The Javan hawk-eagle's habitat

The Javan hawk-eagle population residing in Kondang Merak Beach utilizes *Spondias pinnata* as its primary tree to build a nest on and three other species as its perching tree (Table 1). The Javan hawk-eagle uses *Spondias pinnata* as an emergent tree because it has an open canopy which makes it easier for the Javan hawk-eagle to get in and out of the tree canopy and maintain the safety of its young (Table 1). Having large branches makes it easier for the Javan hawk-eagle to build a nest, target, and get its prey, and it has a strong trunk to support the mass of the nest.

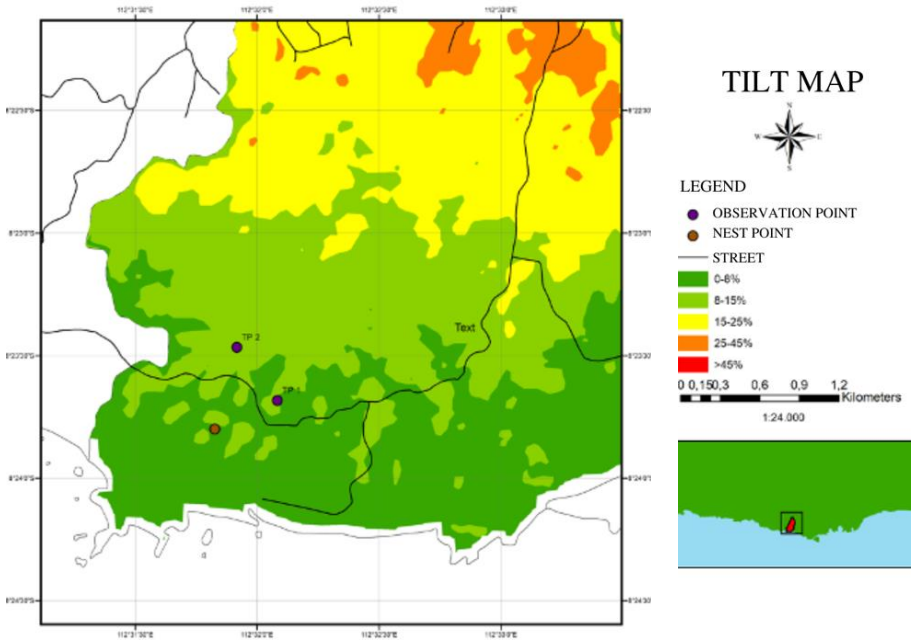

Figure 2. Map of land slope at observation point and location of the Javan hawk-eagle's nest in the Kondang Merak coastal area, South Malang, East Java, Indonesia

Table 1. Characteristics of the main tree habitat for the Javan hawk-eagle in Kondang Merak Coastal, South Malang, East Java, Indonesia

Category	Main Tree	
	Nest	**Perch**
Species of tree	*Spondias pinnata*	*Pterocymbium Javanicum*, *Anthocephalus cadamba*, and *Alstonia angustiloba*
Total	1 Tree	3 trees
Function	Nests tree	For monitoring nests, territories, predators and monitoring prey
Location	Located in a lowland forest, located near the Southern Crossing Route (SCR)	Located in a different area (near the road or in the forest)
Morphology	Emergent tree, Straight trunk, has few branches and has a strong main trunk	Straight trunk and branching slightly
Notes		Usually, use dead trees or have fallen leaves a lot, so as not to block the view of the Javan hawk-eagle

Discussion

The field observation indicated that the Javan hawk-eagle utilized 149.94 ha lowland Kondang Merak coastal area as a home range with an elevation 0-160 masl. According to van Balen et al. (1999), the Javan hawk-eagle can be found in natural forests with elevations of 0-3000 masl. The Javan hawk-eagle in Ujung Kulon National Park utilized lowland natural forests with elevations of 0-100 meters above sea level for hunting and nesting (Fahmi and Syartilinia 2020). In Alas Purwo National Park, The Javan hawk-eagle also uses of natural lowland forest as the main habitat and the birds distribute as equal (focused) at natural lowland forest (Sitorus and Hernowo 2017).

The chosen habitat of the Javan hawk-eagle is influenced by the habitat preferences of the Javan hawk-eagle itself. Most of the home range has overlapped between one individual and between an individual Javan hawk-eagle or with other species of eagles and between siblings. This is because there are similarities in their living needs, such as prey (Gjershaugh et al. 2004; Gunawan et al. 2016). After all, each eagle has almost the same prey specifications, so the process of foraging for food occurs in the same area (Jones and Dorward 2014; Zilio 2017; Peck et al. 2018; Teixeira et al. 2019)

The Javan Eagle's nest tree in Kondang Merak Coastal is located in a lowland forest. The nest tree used by the Javan hawk-eagle is *Spondias pinnata* or known in the local name as the 'forest kedondong' tree (Figure 3). The position of the nest tree is at 112º31'49,547" E-8º23'47,919" S and is only 321.9 m from the main road Jalur Lintas Selatan (JLS) (Figure 1). This location is in the vicinity of the Kondang Merak coastal forest area, southern Malang.

Figure 3. Diameter of the Javan hawk-eagle's nest at the *Spondias pinnata*

This result is different to the study of the other researchers. In Ujung Kulon, National Park, the Javan hawk-eagle nests were found in *kiara* trees (*Ficus gibbosa*) at locations with an elevation of 0-100 meters above sea level and slope of 3-8% (sloping) around the Cigenter tributaries and were included in the core zone (Fahmi and Syartilinia 2020). In other lowland forests, such as in Alas Purwo National Park, the Javan hawk-eagle nest was found in *Bendo* (*Artocarpus elasticus*) trees around Savana Sadengan with flat land conditions and an elevation of 72 meters above sea level (Murad and Syartilinia 2021). The Javan hawk-eagle in Gunung Halimun Salak National park used *Castanopsis argentea* or known locally as the Saninten tree, *Phoebe grandis*, *Toona sureni* and *Gluta renghas*, as a nest tree. This is because the main trunk is overgrown with lianas for nesting (Ridwan et al. 2014; Gunawan et al. 2016). Even though the nest trees from lowland forests and highland forests had various types of tree species, most of them had the same tree architecture, which had a half-round and open canopy (Barrientos and Arroyo 2014; McPherson et al. 2016; Sitorus and Hernowo 2017; Miranda et al. 2020).

The nest tree chosen by the Javan hawk-eagle in the Kondang Merak Coastal area is *Spondias pinnata* which is the highest among the surrounding trees or known as an emergent tree. The Javan hawk-eagle almost uses higher trees and higher branches. The *Spondias pinnata* has vegetation on the trunk slightly open to make it easier for the Javan hawk-eagle to get in and out of the nest and monitor nests from other trees. This tree is a type of herbal plant that is widely used as traditional medicine (Bora et al. 2014; Dwija et al. 2016; Li et al. 2020; Santoso et al. 2020). It is spread in various lowland and highland forests but is dominant in lowland forests.

The nesting tree *Spondias pinnata* in Kondang Merak coastal has a height of ±60 meters. To lay its nest in the forest, the Javan hawk-eagle seeks for tall trees with abundant food supplies. Similar to a research conducted by Septiana et al. (2020), the height of nesting trees identified in Gunung Halimun Salak National Park varies within 26 to 55 m, with its average height of 43 m. In addition, nearly one-third (30%) of tree populations are among 51-55 m high. Approximately 30% of nests were built on the branches in a height ranging from 31-35 m. All the nest trees found on the site shared the same character, they were emergent and protruded from the others, that it allowed the Javan hawk-eagle to have a wide view through its surrounding. The higher tree supports the eagles to prevent potential predators and intruders from harming its nest (O'Donnell and Debus 2012; Alfiyasin et al. 2018; Septiana et al. 2020). Furthermore, the height of a nest affects its safety against the risk of predator attack. Hence, the higher a nest is built, the lower risk it has (Kochert and Steenhof 2012; Coulton et al. 2013; Phillips and Hatten 2013; Watson et al. 2014).

The Javan hawk-eagle's nest in Kondang Merak coastal consists of tree branches, which are covered with fresh leaves as a base. The nest consists of tree twigs and green leaves, which are periodically replaced with fresh leaves when the leaves dry. The Javan eagle's nest in *Spondias pinnata* tree has a diameter of ±44.6 cm with a radius of ±22.3 cm a shape like an inverted cone (ellipsoid) (Figure 3). The nest is placed on the main branch because the main branch is sturdy, so it can withstand the load of the nest. The major function of a nest is to provide suitable habitat for the eagle to lay their eggs and take care of the juvenile (Phillips and Hatten 2013; Wiens et al. 2017; Peck et al. 2018; Withaningsih et al. 2019; Septiana et al. 2020).

The place of nesting suitability for a species will be different from other species because each species has different characteristics of habitat components to support its life. The risk of predation also influences the design of nests that are built above ground. Effective nest positioning reduces the threat of predation upon nests. In addition, a necessity to minimize the risks of predator attacks is the most influential factor to determine the nests' location as well as its physical structure (Mundahl et al. 2013; Phillips and Hatten 2013; Mainwaring et al. 2014; Lopez-Lopez et al. 2016; Khaleghizadeh and Anuar 2017; Zawadzki et al. 2020).

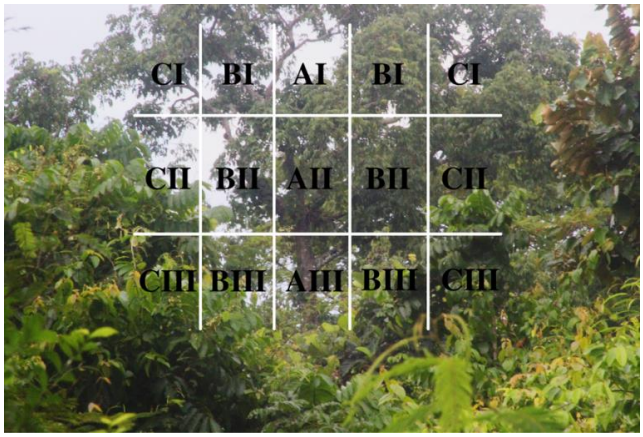

Figure 4. Analysis of tree canopy space of the Javan hawk-eagle's nest at *Spondias pinnata*

Figure 5. Analysis of the architectural model of the Javan hawk-eagle's nest tree (*Spondias pinnata*)

According to Azmi et al. (2016), the Javan hawk-eagle prefers to occupy primary and secondary tropical rainforest habitats with fairly high rainfall characteristics. Based on the data of the Meteorology Climatology and Geophysics Council (BMKG), the research location has a rainfall level of 193 mm, meaning that it has a medium to a high level of rainfall. Both habitats are used by the Javan hawk-eagle as an area for hunting and nesting. In this study, the Javan hawk-eagle used the canopy space in the main trunk position, namely A (I, II, and III), for the behavior of stalking prey, resting, and building a nest with the distribution of illustrations (Figure 4). This is because in the canopy space has a sturdy trunk that is more comfortable for Javanese hawk-eagle to rest and has wide space and visibility, making it easier for them to move around. An open nest aims to facilitate the Javan hawk-eagle gliding flight *(gliding)* or out of the nest trees without opening the wings and monitor the presence of prey and other individuals around the nest tree (Gjershaugh et al. 2004; Ridwan et al. 2014; Gunawan et al. 2016; Khaleghizadeh and Anuar 2017). Furthermore, building the nests on a tree canopy will ensure its safety from both the predator attack and rainfall (Mainwaring et al. 2014; Zuluaga et al. 2018; Chowdhury et al. 2021; Miranda et al. 2020).

The main trunk is shaded by a canopy, and the branches are not tightly covered by leaves and are strong to support the body of the Javan hawk-eagle. The type of tree chosen by the Javan hawk-eagle in this research location has an architectural model Scarrone. Scarrone is an architectural model with characteristics, namely, branching stems, polyaxial with several different axes, unequal vegetative axes with homogeneous shape, orthotropic, having monopodial branches with terminal inflorescences, in sympodial branches, it looks like modular construction, and stems have growths rhythmic height (Figure 5). This tree with the architectural model Scarrone has a wide and dense canopy so that it can withstand the wind is useful as a shade and shade, so this tree was chosen by the Javan hawk-eagle to place its nest, rest, and perch (Ekowati et al., 2017; Septiana et al. 2020; Murad and Syartinilia 2021). Several species of birds also use the tree with this architectural model to put the nest and perch (Echeverry-Galvis et al. 2014; Djemadi et al. 2015; Gonzalez et al. 2020)

The Javan hawk-eagle in Kondang Merak coastal occupies several different trees as perch trees, including, *Pterocymbium javanicum*, *Anthocephalus cadamba*, and *Alstonia angustiloba*. Each tree has a different distance from the nest tree. *Anthocephalus cadamba* tree is located at 08º23'42" S-112º32'18" E, at an elevation of 40 m and is 320 m from the nest tree. The next tree, *Pterocymbium javanicum*, is at the point 08º23'45" S-112º32'12" E, is at an elevation of 40 m with a distance from the nest tree, which is 350 m, and the third is *Alstonia angustiloba*, is at the point 08º23'43" S-112º32'22" E which is at an elevation of 30 m with a distance from the nest tree, which is 280 m. This *Alstonia angustiloba* tree is the tree closest tree to the Southern Cross Line (JLS) or the main road.

The three perch trees have similar characteristics, it has open vegetation. The condition supports the Javan hawk-eagle to easily observe both its surrounding area and nest trees. While Javan hawk-eagle mainly hunts for their prey in the forests, savanna, which has extensive grasslands and few trees, can also be a suitable alternative for hunting activities. The open view and tall trees provided by the savanna are likely favorable to raptors such as the Flores hawk-eagle to watch and hunt its prey. Ideal environments for hunting and perching were mainly vegetated areas with the presence of trees in various surface cover types (Aguiar-Silva et al. 2014; Larkin et al. 2020; Miranda et al. 2020; Syartinilia and Setiawan 2021).

The dominant vegetation in the nest tree area consists of seedlings, saplings, poles, and trees. In the tree phase, the dominant vegetation type is *Spondias pinnata*, with an Important Value Index (IVI) of 43.16%. In the pole phase, the dominant vegetation type is *Mallotus paniculatus*, with an Important Value Index (IVI) of 62.31%. In the sapling phase, the dominant vegetation type is *Garcinia forbesii* with an Important Value Index (IVI) of 44.44%, and in the seedling phase, the dominant vegetation type is *Arenga obtusifolia* with an Important Value Index (IVI) of 71, 42% (Table 2).

Table 2. IVI and H' of the tree, pole, sapling, and seeding phase in the tree nest area

Type of phase	Species	RK (%)	RF (%)	RD (%)	IVI (%)	H'
Three	*Spondias pinnata*	16.67%	16.67%	9.83%	43.16%	2.34
	Ficus callosa	16.67%	16.67%	9.28%	42.62%	
	Ficus retusa	11.11%	11.11%	13.11%	35.35%	
	Mischocarpus sundaicus	11.11%	11.11%	8.74%	30.96%	
	Arenga obtusifolia	11.11%	11.11%	8.74%	30.10%	
	Polyalthia lateriflora	5.55%	5.55%	10.40%	21.50%	
	Mitrephora polypyrene	5.55%	5.55%	9.28%	20.41%	
	Parkia roxburghii	5.55%	5.55%	8.19%	19.31%	
	Ficus balabencis	5.55%	5.55%	7.65%	18.76%	
	Mallotus paniculatus	5.55%	5.55%	7.65%	18.76%	
	Eugenia timosa	5.55%	5.55%	7.10%	18.21%	
Pole	*Mallotus paniculatus*	15.38%	15.38%	31.54%	62.31%	2.08
	Ficus balabencis	23.07%	23.07%	7.38%	53.53%	
	Artocarpus elasticus	7.69%	7.69%	31.54%	46.92%	
	Mitrephora polypyrena	11.11%	11.11%	8.74%	36.47%	
	Garcinia forbesii	11.11%	11.11%	8.74%	22.43%	
	Pterospermum javanicum	7.70%	7.70%	5.03%	20.41%	
	Vitex pubescens	7.70%	7.70%	4.36%	19.47%	
	Eugenia timosa	7.70%	7.70%	3.69%	19.07%	
	Polyalthia lateriflora	7.70%	7.70%	3.69%	19.07%	
Sapling	*Garcinia forbesii*	22.22%	22.22%		44.44%	1.88
	Alstonia angustiloba	22.22%	22.22%		44.44%	
	Ficus callosa	11.11%	11.11%		22.22%	
	Mallotus paniculatus	11.11%	11.11%		22.22%	
	Diospyros cauliflora)	11.11%	11.11%		22.22%	
	Artocarpus elasticus	11.11%	11.11%		22.22%	
	Polyalthia lateriflora	11.11%	11.11%		22.22%	
Seedling	*Arenga obtusifolia*	35.71%	35.71%		71.42%	0.36
	Mischocarpus sundaicus	28.57%	28.57%		57.14%	
	Ficus retusa	21.42%	21.42%		42.85%	
	Artocarpus elasticus	14.28%	14.28%		28.57%	

Based on observations and analyzes that have been carried out, it is shown that each phase of the vegetation has a different dominant plant. This is because the condition of the forest is still protected or categorized as a natural protected forest, even though the nesting habitat is close to the production forest belonging to Perhutani. Each phase of vegetation in both habitat preferences was significant to support the Javan hawk-eagle hunting and nesting activities. In addition, the presence of trees has an important role for both habitat preferences, in which they provide both food supplies and spaces that can be used by Javan hawk-eagle to eat and build a nest (Fahmi and Syartinilia 2020). Some bird species build their nests on branch rims on forks of trees that support their life (Ijeomah et al. 2013; Kane et al. 2015; Roshnath and Sinu 2017; Yadav et al. 2018; Medina 2019)

When viewed in the tree phase, the dominant vegetation is *Spondias pinnata*, with an IVI value of 43.16% (table 2). However, the results of this vegetation dominance have no relationship with the selection of nest tree species because the Javan hawk-eagle chose only based on three characteristics. This can be proven by the selection of different types of Javan hawk-eagle nest tree vegetation in each region, but there are similarities in characteristics in each region, one of which is the Emergent tree. The availability of various fruit trees provides food for the Javan hawk-eagle's prey, making it easier for them to hunt in the wild (Fahmi and Syartinilia 2020). Similar to other research focusing in many species of bird (Ferger et al. 2014; Djemadi et al. 2015; Ramos-Robles et al. 2016; Brumelis et al. 2020)

Pole vegetations provide extra food supplies for the Javan hawk-eagle. In National Ujung Kulon National Park, pole vegetation provided the Javan hawk-eagle's prey by the appearance of the drey of both black giant squirrel (*Ratufa bicolor*) and weasel *(Paradoxurus hermaphroditus*) (Fahmi and Syartinilia 2020). Aside from providing habitat for the Javan hawk-eagle's prey, stem and seedling vegetation will grow to trees within time, which supports the sustainability of the Javan hawk-eagle's habitat. In consequence, maintaining the balance of dominant group vegetation was important to the Javan hawk-eagle conservation attempt. The following graphic is a comparison of each dominant group of vegetation structures on each habitat preference in Ujung Kulon National Park (Fahmi and Syartinilia 2020).

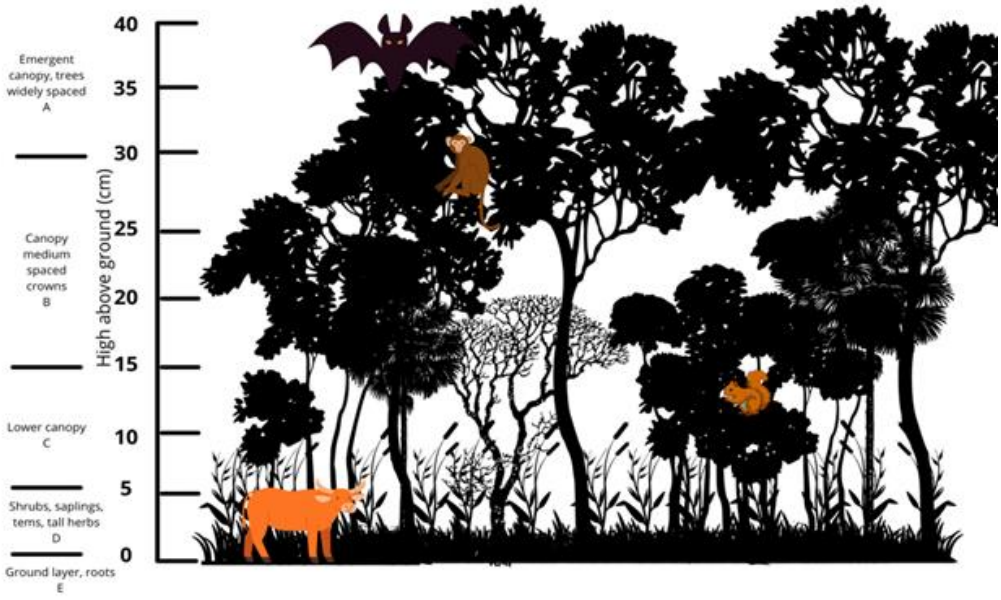

Figure 6. Strata analysis of the Javan hawk-eagle's nest tree (*Spondias pinnata*)

The results of the analysis and field observations showed that *Spondias pinnata* is vegetation with Strata A. Strata A is the tallest tree in the tropical rainforest. As depicted on Figure 6, the heights of the tree canopy roof are classified into Strata A, B, and C. Strata A tree, which refers to the characteristics of the tree with more than 30 m in height and a straight trunks make it easier for the Javan hawk-eagle to get in and out of the canopy, as well as facilitating the Javan eagle to observe their prey and care for its young.

As alternative the Strata A trees, the Javan hawk-eagle also uses Strata B trees. Trees classified as Strata B varies around 20-30 m in height, with a rounded or elongated canopy, and are not as wide as in strata A. The trees in strata B are *Anthocephalus cadamba* and *Alstonia angustiloba*, which the Javan-hawk eagle used to perch. It perches on the main trunk or on sturdy branches that are not covered by leaves. In general, tree branches that are perpendicular to the trunk are chosen by the Javan eagle for perching. The Javan hawk-eagle usually starts hunting in the morning because the weather is rather warm than hot. After hunting, the Javan hawk-eagle will spend most of its time resting around the nest tree (Gunawan et al. 2016; Nurfatimah et al. 2017; Alfiyasin et al. 2018; Fahmi and Syartinilia 2020).

It is proven that the existence of Javan hawk-eagle found in the lowlands, which have habitat characteristics almost similar to the highlands. Important factors for the existence of the Javan hawk-eagle's habitat are natural forest conditions and the characteristics of trees for nesting or perching habitats (Nurfatimah et al. 2017; Alfiyasin et al. 2018; Fahmi and Syartinilia 2020). In the Kondang Merak coastal, the Javan hawk-eagle was found at an elevation of 0-8% (flat). Furthermore, in order of dominance level (IVI), the habitat characteristics of the Javan hawk-eagle were dominated by pole, tree, sapling, and seedling phase vegetation. The pole phase was dominated by vegetation *Mallotus paniculatus.* The sapling phase was dominated by *Garcinia forbesii*. In the tree phase, it was dominated by *Spondias pinnata* and in the seedling phase, it is dominated by *Arenga obtusifolia*. The highest diversity index (H') was in the tree phase (H'=2,34), which was the moderately abundant category.

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