

# The use of forest canopy by various bird species in tropical forest montana zone, the Nature Reserve of Mount Tilu, West Java, Indonesia

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**Abstract.** Partasasmita R, Atsury ZIA, Husodo T. 2017. *The use of forest canopy by various bird species in tropical forest montana zone, the Nature Reserve of Mount Tilu, West Java, Indonesia. Biodiversitas 18: 453-457.* Availability of vertically or horizontally space on a habitat is needed by birds for their activities. Forest is the habitat that provides vertical space strata more numerous and tends to be inhabited by various species of birds more diverse. Strata of trees canopy provide the resources needed by various species of birds, therefore allowing each canopy strata is utilized by certain bird species. This research aimed to study the use of strata of trees canopy by various species of birds in a tropical forest montana zone, Mount Tilu Nature Reserve, West Java, Indonesia. Opportunistic spot observation of individual was used to study the activity and the use of space by birds. The results showed that the use of layers of the forest canopy by birds that Emergent: 4 species, Canopy: 29 species, Sub-canopy: 16 species, understorey: 25 species and Ground: 11 species. The use of space position on plants by birds was space on canopy by eight species, space at the edge of canopy by 33 species, space in canopy by 34 species, space under canopy by 19 species and on the ground by 11 species, with seven species capable of using three space positions on plants. The highest similarity index of canopy layers uses was between canopy and sub canopy layers, with percentage 57.63%. The highest similarity index of position uses was between position of space at the edge of canopy and space in canopy with percentage 53.73%.

**Keywords:** Bird, forest canopy layer, Mount Tilu Nature Reserve, space utilization

## INTRODUCTION

Although birds can be found in a variety of ecosystems and occupy various habitat types, at the level of species, bird show picking specific places for life (Partasasmita et al. 2009; Krebs and Davis 1978). This is because the birds require certain conditions to the needs of habitat, habitat that fit their needs and is safe from various disorders (Tortosa 2000; Wisnubudi 2009). The availability of food, as a shelter, nesting, material nest, where chirping, and a common sighting vegetation of the habitat are all factors influencing the habitat use by birds' (Welty and Baptista 1988; Wiens 1992; Miller and Cale 2000; Susanto et al. 2016). Birds in using space habitat are done either horizontally or vertically (Wisnubudi 2009; Partasasmita et al. 2010). Study habitat use by birds in the area have been carried subtropical forests (Peterson 1980; Anderson and Ohmart 1983), but the study of the use of space habitat by various species of birds in the tropical forests are still rare, particularly in the mountain forests of Indonesia.

The forest area in West Java, which has a high biodiversity and many species have protected status and is an area of endemic montane forests. Almost all animal species endemic to Java, including species of birds can be found in the mountain forests (Whitten et al. 1996), particularly in the area of the Nature Reserve of Mount Tilu, i.e. Waringin and Dewata block section as much as 79

species of birds (Atsury and Partasasmita 2016). In the forest, the birds use the space habitat, either vertically or horizontally, to move in meeting their needs (Anderson et al. 1979; Johnsingh and Joshua 1994). In the use of space by birds indicates that certain vegetation canopy layer birds use longer than other canopy layer, so that it can be said that the birds of the canopy layer. Peterson (1980) stated that the spread of bird vertically is indicated in the utilization by different species of birds in their entirety on a tree.

The condition of the vegetation shows that the appearance of vegetation structure associated with the presence of bird species within a habitat. The structure of vegetation is one of the key factors affecting bird species richness at the local level (Wiens 1992; Partasasmita et al. 2010, 2016). The structure of forest vegetation is still good in the mountain forests remaining in the area of West Java, one of which is a forest on Mount Tilu Nature Reserve. This study aims to determine the use of space in the forest canopy layer by various species of birds.

## MATERIALS AND METHODS

### Site of study

Forests in the Nature Reserve of Mount Tilu (CAGT) represents the ecosystem types highland rain forest and one

forest in West Java which is still relatively intact. The region is a mountainous area with an altitude of between 1,000 and 2,434 m above sea level. CAGT forest had an area of approximately 8,000 ha and designated as a nature reserve status based on the Minister of Agriculture No. 68/Kpts/Um/1978, dated February 7, 1978 (Siswoyo et al. 2005). The research location is situated in the area of Mount Tilu Nature Reserve namely in the area of Mount Dewata and Mount Waringin. Mountains of the Dewata has an altitude of 1,840 m above sea level, while Mount Waringin has an altitude of 2,035 m above sea level. The second location is the adjacent mountain and located north of the Chakra Dewata Co. Ltd. (PT. Chakra Dewata) tea plantation. This is located in the area CAGT. Mountain Dewata and Mount Waringin has the characteristics of an unspoiled as bird habitat in the mountainous areas.

### The procedures

The method used in this research was the field surveys. Point count method (Bibby et al. 2000) was used to capture data on the composition and diversity of bird species. Identification of species of birds made with reference to the Handbook Field Introduction The birds in Sumatra, Java, Bali, and Borneo (MacKinnon et al. 2000). Vegetation data retrieval is done by using the profile diagram (Mueller-Dombois and Ellenberg 1974). Collecting data on vegetation vertically usage by bird observations performed with the focus method individually (Holmes et al. 1979). This method is used for data collection that is both instantaneous (spontaneous) when the object was found, along with the collection of data on the number of bird

species in the point count. The pattern of data collection is done on an individual species that perform activities in a particular canopy layer is considered to represent other individuals within the same species or another species that is different but has the characteristics of the species (mixed-species flocks).

Categories of activities recorded are grouped into four categories (Anderson et al. 1979), namely: meal (gather, eat meals at the bottom vegetation, tree trunks, branches, leaves, flowers, fruits and included hunting or eating insects while flying on vegetation); voice (sound or chirp); move (migrate in sample plots); break (perch and other activities such as defecation and investigate). Then added also the miscellaneous category, which includes activities in addition to the four previous activity, such as intra and inter activity interactions with same species or other species. The data collected included height of the bird from the ground and the position of the bird in plants, as in the illustration Figure 2 and 3. Mechanical division of space used by birds was a modification of the use of space (I to V) by a bird on a vertical structure of vegetation (trees) conducted by Pearson (1971).

### Data analysis

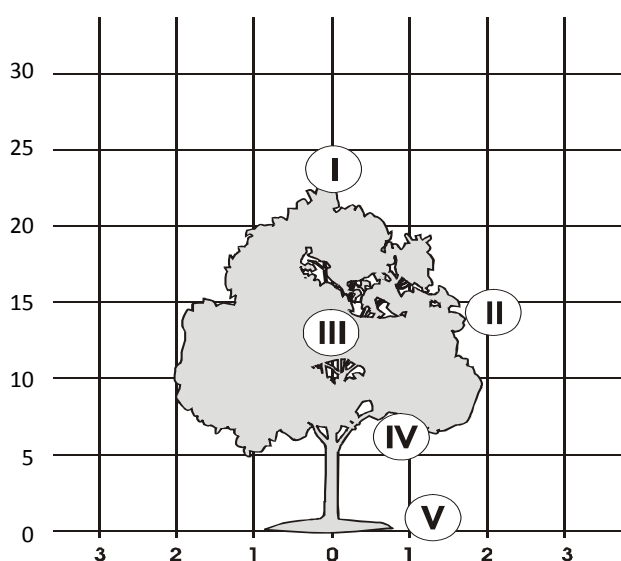
The data were analyzed by using a diversity of species diversity index of Shannon-Wiener (Magurran 1988), a community of species similarity index (Sorensen 1948). The use of space by virtue of the bird analyzed index (Natarajan and Jhingran 1961), and the use of selection space (Jacobs 1974).



**Figure 1.** Research area in the Mount Tilu Nature Reserve, West Java, Indonesia. Insert: PT. Chakra Dewata tea plantation



**Figure 3.** The space division layer of forest canopy in use by birds (Pearson 1971)



**Figure 2.** The space division of the tree canopy layer in its use by birds (Pearson 1971). Note: Axis X = wide canopy (m); Axis Y = canopy height (m); Position I: if the bird occupies the space at the top canopies; Position II: if the bird occupies the space at the outer edges of the canopy; Position III: if the bird occupies space in the interior of the canopy; Position IV: if the bird occupies the space at the bottom of the canopy; Position V: if the bird at the position in the main trunk or the ground surface

## RESULTS AND DISCUSSION

### Composition and bird diversity

Bird species found in the study site as many as 65 species of 24 families. The species most commonly found species from family Turdidae and Sylviidae as many as six

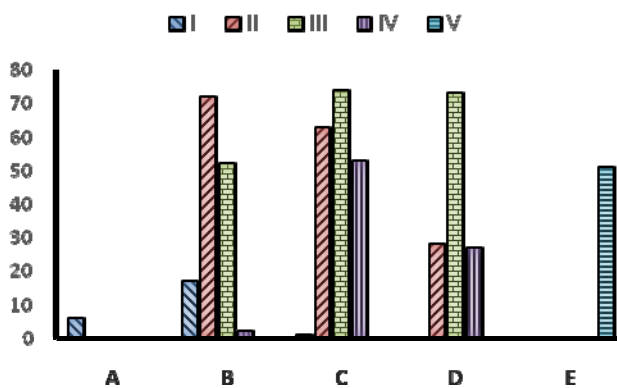
species, while the fewest species originating from Sittidae family, Laniidae, Corvidae, Chloropsidae, Bucerotidae, and Aegithinidae each of which consists of only one species. Many say the least species that can coexist in an ecosystem is closely related to their ecological role and availability of food in nature (Partasasmita 2009; Susanto et al. 2016).

Based on the categorization of Magguran (1988), that the diversity index of birds in the area Mount Dewata and Mount Waringin is moderate, it is because the value of diversity index ( $H'$ ) was in the range of 1.5-3.5. This is similar to the results of research Susanto et al. (2016), Widodo (2014) that the Forest Park Seblat Bengkulu, and the Galunggung forest has a value of bird diversity medium category. Meanwhile, the bird community similarity index (ISS) between the two regions was 64.58%. Based on the categorization by Sorensen (1948),  $ISS > 50\%$  suggests a commonality community is high.

Mountain Dewata and Mount Waringin differ from each other even though few in number. Several factors such as the complexity of the plant canopy layer, plants diversity, the presence of predators, human activity, to a height and contour of the mountain each create a slightly different ecological condition. Differences in bird communities that occupy a variety of different types of vegetation can be characterized by the use of characteristic vegetation vertically on each habitat occupied by the bird community (Anderson et al. 1979; Johnsingh and Joshua 1994; Susanto 2016).

### The use of space by a bird

The use of space by birds in the research locations covering all layers of the forest canopy, which is the highest layer, canopy, sub-canopy, shrubs, and forest floor (Figure 4).



**Figure 4.** The use of space in the forest canopy layer of the bird on Mount Waringin and Mount Dewata. A= Emergent & above canopy; B= Canopy; C= Sub-canopy; D= Understory; E= Ground; I= Position the bird occupies the space at the top canopies; II= Position the bird occupies the space at the outer edges of the canopy; III= Position the bird occupies space in the interior of the canopy; IV= Position the bird occupies the space at the bottom of the canopy; V= Position the bird at the position in the main trunk or the ground surface.

Top canopy layer consists of trees emerging, a very limited number, the canopy does not connect with each other tree canopy. The layer is dominated by the use of birds of family Accipitridae and Dicruridae. Accipitridae is a group of birds of prey is large, most of his life was spent at the top of the forest canopy away from other birds. In conducting the migration and activity of flying, the birds are in need of open space. It makes it a small space cannot fly freely, because the birds are not as fast as the little birds. The birds of the families Accipitridae and Dicruridae foraging in an open place by way of ambush prey from a height that can be done by remote viewing very sharp. The use of space in the canopy layer is also carried out by a group of birds Accipitridae as an attempt to avoid predators such as snakes and lizards are eyeing eggs and nest. Bird's predator known for its regeneration is very low at only lay eggs in small amounts in a year. These layers are inhabited by four species of which all peaked at the top of the canopy space. These birds are species that used to hunt above the forest canopy. Plants that make up the lining of which *Symplocos fasciculata* and *Metadina trichotoma*.

Canopy layer is the top layer of forest vegetation in connected with each other. This layer is occupied by birds from family Columbidae, Dicruridae, and Pycnonotidae. Birds of the family group have a moderate size, can fly low over the canopy, and move from one canopy to another canopy, but it is limited in the upper layer only. The canopy has a four position space utilized by birds, namely the position of the space above the canopy, the space on the outer edge of the canopy, the space in the header, and the space under the canopy. Recorded 29 species of birds found in the layer. The position at the top canopies space occupied by three species, the space at the outer edge of the canopy occupied by 13 species, the space inside the canopy occupied by 16 species, and the space under the canopy section is occupied by two species. Plants that many of them make up the canopy layer *Schima wallichii*, *Trema*

*orientalis*, *Macaranga rhizinoides*, and *Altingia excelsa*.

Sub-canopy layer is the layer in the shade canopy on the canopy layer. These layers are occupied arboreal birds flocking birds that come from family Campephagidae, Rhipiduridae, and Zosteropidae. Birds that use a lot of sub-canopy layers is a group of birds able to fly under the shade of the forest canopy, with a very agile movement to move from one tree to another in acting. The birds are often found mixed (flocking) with a group of birds of other species. Groups of various species of birds that move from one tree to another. It is closely linked to the behavior of a typical foraging in groups. Additionally, foraging behavior in groups as part of efforts to prevent themselves from predators (Krebs and Davis 1978). The sub-canopy layer has a four position space is often used by birds (Figure 2), which is the position of the space above the header, the space on the outer edge of the canopy, the space in the header, and the space under the canopy. As many as 30 species of birds found in the layer. The position of the space above the canopy occupied by one species, the space on the outer edge of the canopy occupied by 15 species, the space occupied by the header in 13 species, and the space under the canopy occupied by 13 species.

Canopy layer of strata under the header section is the last layer under the shade of some trees on it; its use is dominated by family Sylviidae and Nectariniidae. These birds are so small and able to move and slipped between the branches of dense vegetation. The birds of the family Sylviidae and Nectariniidae also sometimes found in groups, but the groups of species and the number of individuals that a bit. The Canopy has a 3-position space utilized by birds, namely the position of space in the outer edge of the canopy, the space in the canopy, and the space under the canopy. As many as 25 species of birds found in the canopy layer. The position of the edge of space outside and inside the canopy occupied by each of 14 species, while the area under the canopy occupied by seven species. Plants that many of them make up the canopy layer of *Ficus sinuata*, wild banana (*Musa acuminata*), and dadap (*Erythrina subumbrans*).

Forest floor strata (ground) or layers of shrubs is the bottom layer of all layers of the forest canopy. These layers are dominated their use by birds from family Phasianidae and Turdidae. The birds are a group of birds that cannot fly high and only rely on foot to walk in the move. Birds that live on the forest floor of behavior can be distinguished by species that are able to fly. These layers are inhabited by 11 species of which were placed on the ground level space.

Of all the species of birds are found, there are birds that use lots of canopy layers, including Sweep ninon (*Eumyias indigo*) were found in the four layers of the canopy. Additionally, opior Java (*Lophozosterops javanicus*), Little spiderhunter (*Arachnothera longirostra*), Srigunting hill (*Dicrurus remifer*), Ashy drongo (*Dicrurus leucophaeus*), and Crescent-chested babbler (*Stachyris melanothorax*) were also found in three layers of headers. The birds showed its ability to adapt to the state of the canopy of the different vegetation. This can happen because the source feeds these birds scattered in different canopy layers, such as insects that prey on the move from one layer to

another.

There are eight species of birds that use the three-position space in plants, including regular glasses (*Zosterops palpebrosus*), White-bellied fantail (*Rhipidura euryura*), Rufous-tailed fantail (*Rhipidura phoenicura*), Blue nuthatch (*Sitta azurea*), Mees's white-eye (*Lophozosterops javanicus*), Indigo flycatcher (*Eumyias indigo*), Ashy drongo (*Dicrurus leucocephalus*), and Javan fulvetta (*Alcippe pyrrhoptera*). Species of birds that use spatial positions on many plants, generally has the characteristics of agile birds, small body so fast movements.

Grouping birds in using the forest canopy are not based on speed to fly in space forest, but rather on the foraging patterns of each species in the crowns of trees in the forest. Thiollay (1994) divided the birds in the seven patterns of foraging, namely: (i) a hunter above the header, (ii) the hunter in the header and the outer surface of the tree, (iii) arboreal branches and twigs, (iv) a search of insects on stems, branches and twigs of trees, (v) living on the edge habitat, vegetation and gaps of the new plant, (vi) foraging slightly above the soil surface, and (vii) live in swamps. Foraging pattern of each species of birds can be seen with a breakdown by position of the space on the tree. For example, birds that use more layers of understory layer of small birds which have characteristics as fruit eaters, such family Pycnonotidae and Dicaeidea (Partasasmita et al. 2017)

At each layer of the canopy can be seen widely found various species of birds, this is because in the layer provides a variety of feed resources for a variety of bird species (Oriens 1969), can be fruits, seeds, and insects (Kohn 1972). Moreover, layer of forest canopy provides plenty of space, thus providing a variety of places for the benefit of the activity of birds in accordance with the character of the bird itself. In birds smallish, agile and fast movements more use of space in plants lining the inside, while the bird was bigger and need more space so that it uses a more open space. Thus the division or distribution of birds is closely related to the suitability of space in the canopy layer (Nurwatha 1995; Partasasmita et al. 2010). Each family and species adapt to each layer habitat space for activities, such as for social behavior and foraging.

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