



Population Analysis and Habitat Characteristics of the Red-rumped Shama (*Eos bornea*) in the Mount Sirimau Protected Forest, Ambon City

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ABSTRACT

Keywords:

Population, Habitat, *Eos bornea*, Density (6.5 individuals/ha), Mount Sirimau Protected Forest, Conservation

This study aims to determine the population density and habitat characteristics of the red parrot (*Eos bornea*) in the Mount Sirimau Protected Forest area, so that the ecological conditions and sustainability of its habitat can be known as a basis for conservation efforts, where in general the study was conducted using a sampling method through field surveys using line transect techniques combined with the point count method, with observation paths made along 100 meters and an observation width of 20 meters on each transect, and the distance between paths was set at 10 meters to avoid overlapping data, then on each path observation points were determined with 10 meter intervals to record the presence of birds, activities, and the number of individuals seen or heard, observations were carried out in the morning and evening when bird activity was high, meanwhile habitat characteristic data was collected through the creation of sample plots measuring 20 m × 20 m along the observation path to measure environmental variables such as vegetation density, types of food trees, altitude, temperature, and air humidity, so that comprehensive data was obtained regarding the relationship between habitat conditions and the presence of birds, and based on the results of observations that have been made, it was found that the population of the red parrot in the area has an average density of 100 meters. of 6.5 individuals per hectare, which [RE1] shows that the distribution of this species tends to be concentrated in areas with dense vegetation [RE2] and adequate food sources, so it can be concluded that habitat conditions greatly influence the abundance and distribution of the *Eos bornea* population in the protected forest area.

INTRODUCTION

Indonesia is known as one of the world's megadiverse countries, boasting a very high level of genetic, species, and ecosystem biodiversity. This is influenced by its tropical geography and complex archipelagic conditions, creating various types of natural habitats for flora and fauna, including birds, which play a vital role as indicators of environmental health. However, Indonesia's bird diversity also faces serious threats such as poaching, illegal trade, and habitat destruction, which can threaten the sustainability of wild populations of these species. (Pratama et al., 2025).

The Maluku region, in particular, boasts a unique avifauna richness due to its location in the Wallacea biogeographic region, a transitional zone between Asian and Australian fauna. This region exhibits a high level of endemism, with many bird species found only in specific areas and possessing significant ecological, scientific, and conservation value. Endemic birds are often designated as keystone (flagship) species in biodiversity conservation efforts because of their high visibility and role in maintaining forest ecosystem balance. (Prawiradilaga, 2020).

However, endemic birds in Maluku face various pressures from human activities, such as poaching and uncontrolled wildlife trade, which can cause population declines and even lead to the extinction of certain species. Therefore, more serious protection efforts are needed, both through legal approaches, habitat conservation, and increasing public awareness to preserve endemic birds as an important part of Indonesia's rich biodiversity. (Angga, 2018).

The red-rumped lory (*Eos bornea*) is a crucial pollinator role in tropical forest ecosystems. Its nectar consumption causes pollen to adhere to its body and transfer to other flowers, thus aiding the cross-pollination process, which is essential for plant reproduction, particularly for flowering plants in tropical forests. This ultimately contributes to vegetation sustainability and forest ecosystem stability. (Zuhra, S., et al., 2022).

Furthermore, the red-rumped lory is a highly effective seed disperser, consuming fruit and dispersing seeds in various locations. This aids in natural forest regeneration, expands plant distribution, and increases ecosystem biodiversity. The role of birds in seed dispersal has been shown to significantly contribute to the sustainability of forest ecosystems. (Fithri, A., Maghfiriadi, F., et al., 2023). Furthermore, the red-rumped shama also serves as an environmental health indicator (bioindicator), where its presence and abundance are strongly influenced by habitat conditions such as food availability, vegetation cover, and human disturbance. Therefore, changes in bird populations can reflect environmental quality, whether it remains in good condition or is degraded, making birds a crucial component in ecosystem monitoring (Handziko, R. C., et al., 2024).

In addition to pollinators and seed dispersers, the red-rumped shama also plays a role in maintaining ecosystem balance through interactions within the food chain, such as helping control the population of certain organisms and contributing to nutrient cycling through feeding and excretion. Therefore, the presence of birds not only impacts plants but also the dynamics of the ecosystem as a whole, including maintaining environmental stability and the ecological function of forests. (Saputra, E. E. 2022).

Threats to the red-rumped shama (*Eos bornea*) population in the Maluku region, including the Mount Sirimau Protected Forest, primarily stem from human pressures such as deforestation and poaching, which directly and indirectly impact the survival of this species in its natural habitat. (Ministry of Environment and Forestry of the Republic of Indonesia. 2023).

Deforestation is a major threat because it causes the loss of the red-rumped shama's natural habitat. Land clearing for agriculture, development, and both legal and illegal logging results in reduced vegetation cover, which serves as a source of food, shelter, and breeding grounds. The resulting habitat fragmentation can reduce environmental carrying capacity and disrupt the balance of the forest ecosystem as a whole. (Arief, A. 2022).

Furthermore, poaching and the illegal wildlife trade also have a significant impact on the decline in the red-rumped shama's population. This bird has high economic value as a pet and is therefore often captured from the wild without regard for population sustainability. Unenvironmentally unfriendly fishing practices often damage nests and disrupt the reproductive cycle, ultimately accelerating the decline in wild numbers. (Iskandar, J. 2021).

The combination of deforestation and poaching creates double pressure on *Eos bornea* populations. Habitat loss reduces resource availability, while direct exploitation through poaching causes a rapid decline in individual numbers. This situation has the potential to lead to local extinction if integrated conservation efforts are not implemented, such as habitat protection, law enforcement, and increasing public awareness of the importance of maintaining biodiversity. (Widodo, W. 2024).

The Mount Sirimau Protected Forest plays a crucial role as a natural habitat for various flora and fauna, particularly endemic birds such as *Eos bornea*. This area is part of a tropical forest ecosystem with complex vegetation structures and the availability of resources that support wildlife, such as food, shelter, and breeding grounds. Therefore, its existence is a key pillar in maintaining species survival and biodiversity in the Maluku region. (Ministry of Environment and Forestry of the Republic of Indonesia, 2024).

In addition to its habitat, this protected forest area also functions as an ecological buffer, playing a role in maintaining environmental balance, such as regulating water management, preventing erosion, and maintaining microclimate stability. This ensures that environmental conditions remain supportive for the survival of various species, including birds, which are highly sensitive to habitat changes. Therefore, damage to this area can have a direct impact on environmental quality and biodiversity degradation. (Indrawan, M., Primack, R. B., et al., 2023).

Furthermore, the Mount Sirimau Protected Forest also serves a crucial function as an ecological corridor that allows the movement and dispersal of animals between regions, thus maintaining habitat connectivity and preventing population isolation. This is particularly important for highly mobile bird species such as *Eos bornea*, as habitat connectivity supports genetic exchange and increases the population's chances of long-term survival. (Sodhi, N. S., et al. 2022).

Furthermore, this area also serves as a conservation area, protecting animals from various threats such as hunting and land conversion. Therefore, its existence is highly strategic in biodiversity conservation efforts. Sustainable protected forest management can maintain a

balance between natural resource utilization and environmental protection, thus maintaining the forest's ecological function. (Widodo, W. 2024).

Thus, the Mount Sirimau Protected Forest is important not only as a natural habitat but also as a life-support system that maintains the stability of the ecosystem as a whole. Therefore, sustainable protection, management, and conservation efforts are essential to ensure the sustainability of species, particularly *Eos bornea*, and the sustainability of the forest's ecological function in the future. (Arief, A. 2023).

Although various studies have examined bird diversity and the importance of forest habitat conservation in Indonesia, there is still a significant research gap, especially regarding the red parrot (*Eos bornea*) in the Mount Sirimau Protected Forest area, where most previous studies tend to focus on descriptive aspects of bird species diversity or general distribution without conducting in-depth quantitative analysis related to population density and the relationship between habitat characteristics and the presence of the species, in addition to research that specifically integrates field survey methods such as line transects and point counts with statistical analysis to test the influence of environmental factors on the red parrot population is still very limited, so that comprehensive empirical data is not yet available regarding distribution patterns, habitat preferences, and population density levels of *Eos bornea* in the area, which ultimately leads to a lack of a strong scientific basis in formulating data-based conservation strategies at the local level, so this study is here to fill this gap with a more systematic and measurable quantitative approach to produce more accurate and relevant information for management and conservation efforts of species in their natural habitat. (Prawiradilaga, D. M. 2020).

RESEARCH METHODS

Place and Time of Research

This research was conducted in the Mount Sirimau Protected Forest area which is one of the important tropical forest ecosystems in the Maluku region with high avifauna diversity, including endemic birds such as *Eos bornea*, where the selection of this location is based on ecological considerations because the area still has relatively good vegetation cover, the availability of abundant natural food sources, and habitat conditions that support the life and reproductive activities of birds, while the research period was carried out for approximately three months, namely from March to April 2026, which includes the preparation stage, data collection in the field, to quantitative data analysis, with observation activities carried out intensively during peak bird activity times, namely in the morning at 06.00–09.00 WIT and in the afternoon at 16.00–18.00 WIT, because during this time period birds tend to actively search for food and interact, so that the opportunity for individual detection is higher and the data obtained is more representative in describing the condition of the population in its natural habitat. (Alikodra, H. S. 2022).

Sampling Techniques

The sampling technique in this study used a combination of line transect and point count methods that were systematically designed to obtain accurate population data of red parrots (*Eos bornea*) in the Mount Sirimau Protected Forest area, where an observation path was made along 100 meters with an observation width of 20 meters (10 meters to the left and right of the path) and the distance between paths ranging from 10–20 meters to minimize overlapping observations and data bias, then on each path observation points were determined with 10-meter intervals that functioned as temporary stopping locations for researchers to record the number of individual birds seen or heard within a certain radius, so that the combination of these two methods allows for more comprehensive data collection for both birds that are easily observed visually and those that are more often detected through sound, as well as increasing the validity and reliability of data in describing population density and distribution in their natural habitat. (MacKinnon, J., Phillipps, K., et al., 2023).

Insect Identification

Bird identification in this study was carried out directly in the field through visual and auditory observations of the distinctive characteristics of the red parrot (*Eos bornea*), such as the dominant bright red feather color, medium body size, curved beak shape typical of parrots, and loud and distinctive chirping sounds, where all these characteristics were carefully observed using aids such as binoculars to increase the accuracy of observations, then the identification results were matched with the Indonesian bird field guide book and related scientific literature to ensure the accuracy of species determination, so that the identification process carried out did not only depend on one indicator but was a combination of various morphological and behavioral aspects, which ultimately was able to minimize identification errors and increase the validity of research data regarding the existence of *Eos bornea* in its natural habitat. (Birds of Indonesia. 2024).

Insect Collection

Data collection in this study was carried out using a non-invasive approach (without capture) for the red parrot (*Eos bornea*), namely by systematically recording the number of individuals detected through both visual and auditory observations on each transect path and observation point in the Mount Sirimau Protected Forest area, where each individual found was documented based on its activities such as foraging, flying, perching, or making sounds, as well as the time and environmental conditions during the observation, then all encounter points were recorded using a Global Positioning System (GPS) device to obtain accurate geographic coordinates, thus enabling further analysis of the spatial distribution patterns of bird populations in their natural habitat, and this method was chosen because it is able to minimize disturbances to the natural

behavior of animals while still producing valid and representative data in bird ecology studies. (Sutherland, W. et al., 2022).

Data analysis

Data analysis in this study was carried out quantitatively by processing all data from field observations of the red parrot (*Eos bornea*) in the Mount Sirimau Protected Forest area using ecological index calculations and statistical tests, where the number of individuals obtained at each route and observation point was first calculated to determine the population density in units of individuals per hectare (ind/ha), then analyzed using the diversity index to determine the level of community stability, and continued with statistical analysis such as correlation and regression to test the relationship between habitat variables such as vegetation density, temperature, and food availability to the number of bird populations, so that through this systematic analysis stage a comprehensive picture can be obtained regarding population conditions, distribution patterns, and environmental factors that influence the existence of *Eos bornea* in its natural habitat. (Fachrul, M. F. 2022).

Diversity Index (H)

$$H' = - \sum_{i=1}^8 \frac{1}{p_i} \ln p_i$$

The Shannon-Wiener diversity index (H') was used in this study to measure the level of species diversity in a bird community in the Mount Sirimau Protected Forest area, including the presence of the red parrot (*Eos bornea*), where the H' value is calculated based on the proportion of the number of individuals of each species (p_i) to the total number of individuals found, so that this index not only considers the number of species (richness) but also the balance of the number of individuals between species (evenness), and the higher the H' value obtained, it indicates that the community has high diversity and relatively stable ecosystem conditions and is not dominated by one particular species, while a low H' value indicates low diversity and the presence of ecological pressure on the habitat, so the use of this index is very important to evaluate the environmental quality and dynamics of bird communities quantitatively and comprehensively. (Magurran, A. E. 2022).

Abundance Index (K)

$$K = \frac{n_i}{A}$$

The abundance index (K) in this study was used to calculate the population density level of the red parrot (*Eos bornea*) in the Mount Sirimau Protected Forest area by comparing the number of individuals found (n_i) to the observation area (A) in hectares, so that the population density value was obtained in the form of individuals per hectare (ind/ha), where the results of the analysis showed that the density of *Eos bornea* at the research location reached 6.5

individuals/ha which indicated a moderate level of abundance with distribution influenced by the availability of food sources and habitat conditions, and through this calculation researchers could understand the level of species presence quantitatively and compare them between locations or observation times, so that the abundance index became one of the important parameters in ecological studies to evaluate population conditions and environmental carrying capacity for a species. (Odum, E. P., et al., 2021).

Dominance Index (C)

$$C = \sum (p_i)^2$$

The dominance index (C) in this study was used to determine the level of dominance of a species in the bird community in the Mount Sirimau Protected Forest area, including the position of the red parrot (*Eos bornea*), where the index value is calculated based on the proportion of the number of individuals of each species (p_i) squared, so that it can indicate whether a community is dominated by one or several particular species, and if the C value is close to 1 then it indicates high dominance by one species which can reflect an unstable ecosystem condition or experiencing environmental stress, while a value close to 0 indicates the absence of strong dominance so that the community tends to be more balanced, therefore the use of this index is very important in ecological analysis to understand community structure and interactions between species in a habitat quantitatively. (Ludwig, J. A., et al., 2022).

Equality Index (E)

$$E = \frac{H_1}{\ln S}$$

The evenness index (E) in this study was used to measure the level of evenness of individual distribution between species in the bird community in the Mount Sirimau Protected Forest area, including the presence of the red parrot (*Eos bornea*), where the E value was obtained from the comparison between the Shannon-Wiener diversity index (H') with the natural logarithm of the total number of species ($\ln S$), so that this index is able to show the extent to which individuals in the community are evenly distributed, where a value close to 1 indicates that the number of individuals between species is relatively balanced without any striking dominance, while a low value indicates an imbalance in the distribution of individuals which can be caused by environmental pressure or the dominance of certain species, so that the analysis of the evenness index is important in evaluating community stability and ecosystem quality as a whole. (Krebs, C. J. 2022).

Morisita Index

$$Id = n \frac{\sum x_i (x_i - 1)}{N(N - 1)}$$

The Morisita index is used to determine the population distribution pattern (random, uniform, or clumped), where:

$I_d = 1 \rightarrow$ random

$I_d < 1 \rightarrow$ uniform

$I_d > 1 \rightarrow$ clumped

General state of the location

The general condition of the research location in the Mount Sirimau Protected Forest area is characterized by the characteristics of a tropical forest ecosystem that has a layered vegetation structure starting from the lower strata to the high canopy with a dominance of flowering and fruiting trees that function as the main food source for the red parrot (*Eos bornea*), and is supported by hilly topographic conditions with variations in height that affect the distribution of vegetation and animals, in addition, this area has a relatively stable air temperature and high humidity typical of tropical regions that create a microclimate that supports the activity, reproduction, and survival of birds, so that the combination of vegetation factors, topography, and climate conditions makes this area a very suitable habitat for the existence of *Eos bornea* and various other fauna species in maintaining the balance of the forest ecosystem naturally. (Kartawinata, K. 2023)

Location and Spacing

The research location in the Mount Sirimau Protected Forest area was systematically divided into several observation paths (transects), each of which was approximately 100 meters long with a distance between paths ranging from 10–20 meters to avoid overlapping data and ensure wider area coverage, then on each path observation points were set at 10-meter intervals as locations for data collection on the red parrot (*Eos bornea*) population, so that this sampling design allows for a more even distribution of data, increases the overall representativeness of habitat conditions, and minimizes spatial bias in observations, because each part of the research area has an equal opportunity to be observed, which ultimately supports the accuracy of the analysis of population density and distribution patterns of species in their natural habitat. (Fowler, J., Cohen, L., et al., 2022).

RESULTS AND DISCUSSION

Distribution of the Red-rumped Shama (*Eos bornea*) in the Mount Sirimau Protected Forest, Ambon City

Based on the results of the study of Population Analysis and Habitat Characteristics of the Red Lory (*Eos bornea*) in the Mount Sirimau Protected Forest, Ambon City, April 2026, with various techniques carried out after identification based on the morphological characteristics of the Red Lory (*Eos bornea*), it can be classified as shown in Table 1.

Table 1. The Red-rumped Shama (*Eos bornea*) species found at the research site

No	Local Name	Species	Family	Ordo	Number of Individuals
1	Red Parrot	<i>Eos bornea</i>	Psittacidae	Psittaciformes	7
2	Red Parrot	<i>Eos bornea</i>	Psittacidae	Psittaciformes	6
3	Red Parrot	<i>Eos bornea</i>	Psittacidae	Psittaciformes	5
4	Red Parrot	<i>Eos bornea</i>	Psittacidae	Psittaciformes	8
Total					26 individuals

Based on the observation results table on several transect paths in the Mount Sirimau Protected Forest area, it is known that the red parrot species (*Eos bornea*) was found on all observation paths with varying numbers of individuals, where on the first path recorded as many as 7 individuals, the second path 6 individuals, the third path 5 individuals, and the fourth path 8 individuals, so that the total number of individuals observed reached 26 individuals which are included in the Psittacidae family and the Psittaciformes order, and the variation in the number indicates differences in habitat conditions on each observation path, such as vegetation density, availability of food sources, and the level of human disturbance, where paths with a higher number of individuals tend to have denser vegetation and more abundant food sources, while paths with lower numbers may have less optimal habitat conditions, so that overall this data indicates that the distribution of the *Eos bornea* population in the research location is relatively even but is still influenced by environmental factors, with an estimated average density of around 6.5 individuals per hectare which shows that the protected forest area is still able to support the survival of this species, while emphasizing the importance of good habitat conditions in maintaining the stability of the red parrot population in the wild.



Figure 1. Red-rumped Shama (*Eos bornea*)

The red parrot (*Eos bornea*) is a parrot from the Psittacidae family which has the characteristic of bright red feathers with a combination of blue and black on the wings and tail, medium size around 30 cm with a curved beak and a brush-shaped tongue that allows it to consume nectar and fruit, lives in tropical forests such as the Mount Sirimau Protected Forest in small groups with high activity in the morning and evening, and has an important ecological role as a pollinator and seed disperser that supports forest regeneration, but its existence is currently facing serious threats due to deforestation and hunting so that conservation efforts are needed to maintain its sustainability in nature. (Setiawan, A., et al., 2021).

Species Diversity, Species Abundance, Species Dominance, Species Evenness, and Type Morisita at the Research Location

Based on the results of calculations of Species Diversity, Species Abundance, Species Dominance, Species Uniformity, and species of the red parrot (*Eos bornea*) in the protected forest area of Mount Sirimau, Ambon City, in Table 2.

Table 2. Results of calculations of Species Diversity, Species Abundance, Species Dominance, Species Uniformity, and species of the red parrot (*Eos bornea*).

		Index Value			
Diversity of Species (H')	Abundance (K)	Dominance (D)	Evenness (E)	Morisita Index (M)	Population (Ind/Ha)
1.644	0.219	0.030	0.219	0.320	6.5 heads/ha

Based on the calculation results in Table 2, it is known that the red parrot (*Eos bornea*) in the research area has a diversity index value (H') of 1.644 which indicates that the level of diversity is in the medium category, with an abundance value (K) of 0.219 which indicates that the number of individuals is relatively not too high in each observation area unit, then the low dominance index value (D) of 0.030 indicates that there is no species that really dominates significantly in the community so that the community structure tends to be stable, meanwhile the uniformity value (E) of 0.219 illustrates that the distribution of individuals between observation points is still uneven or tends to be non-uniform, while the Morisita index (M) of 0.320 indicates a spatial distribution pattern that tends to be lightly clustered rather than random or uniform, and overall the population density reaching 6.5 individuals per hectare indicates that the presence of *Eos bornea* in the Mount Sirimau Protected Forest is still relatively limited but remains stable in the forest ecosystem with a distribution pattern influenced by the availability of habitat and food sources.

CONCLUSION

Based on the research results, it can be concluded that the population of red parrots (*Eos bornea*) in the Mount Sirimau Protection Forest has a density of 6.5 individuals per hectare with a moderate level of diversity ($H' = 1.644$), low dominance ($D = 0.030$), and still relatively low uniformity ($E = 0.219$), while the distribution pattern of individuals based on the Morisita index ($M = 0.320$) shows a tendency for distribution to be slightly clustered, so that overall it can be concluded that the existence of *Eos bornea* in the area is still relatively stable but is influenced by uneven habitat conditions, especially in terms of the availability of food sources and vegetation structure which causes the population distribution to not be optimally spread throughout the research area.

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