

ANALYSIS OF THE EDGE EFFECT ON BIRD AND PRIMATE DISTRIBUTION IN THE ECOLOGICAL CORRIDOR HABITAT OF MOUNT HALIMUN SALAK NATIONAL PARK (TNGHS)

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ABSTRACT

This study aims to analyze the threat of edge effects on endemic animal populations due to the presence of causeways in the TNGHS corridor habitat. Indicators of the occurrence of edge effects are characterized by the further distance of wildlife populations from sources of disturbance such as noise, light, and frequency of human activity mechanisms. Belt transect research method for population study and distribution of Javan Gibbon and Surili. Intensive Point Account (IPA) to measure the diversity index of bird species and Javan eagles. Encounter Rate is used for animal distribution studies. Results On the observation transect made along 3 km, the population density of Javan Gibbons was obtained 0.114 ind/ha, Surili 0.024 indv/ha, and Monkey 0.028 indv/ha. Bird species diversity index in 3 habitat patches each Purasari $H' = 2.78$ with 38 species; Garehong with 27 species, and Corridor $H' = 3,087$ with 27 species. The similarity of species is that there are only 7 species of birds found in the 3 habitats of the patch. As a result of primate population density and burnng species similarity, it can be concluded that the cross-corridor access road area has experienced an edge effect and tends to be a bottle-neck area for the distribution of animals, especially primates.

KEYWORDS Edge Effect, Endemic Wildlife, Ecological corridor.



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INTRODUCTION

In conservation management, it is known as the edge effect, one of which affects the distribution of animal populations in the area. The existence of causeways that divide the habitat can cause motor vehicle noise, street lighting, and the frequency of human activities is increasing (Tripathy et al., 2021).

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Indicators of the occurrence of edge effects are characterized by the further distance of wildlife populations from sources of disturbance such as noise, light, and frequency of human activity mechanisms. The types of wildlife that are classified as affected are birds and mammals with a certain level of sensitivity to the sources of the disturbance (Menchana, A., at al., p. 65).

The form of countermeasures against the impacts of the edge effect is to create a pattern of limiting activities in the corridor area both artificially, naturally, and ecological and biological approaches, especially in the conservation of animals that are categorized as endemic, rare, and threatened (Hilty et al., 2019).

TNGHS is the largest remaining natural rainforest in West Java. This mountain forest feature has a high wealth of biological species, including rare, endemic, and endangered species, including endemic bird species Javan Eagle (*Nissaetus bartelsi*), Golden Hornbill or Golden Julang (*Aceros undulatus*). Endemic primates Javan Gibbon (*Hylobates moloch*), Surili (*Presbytis comata*), rare large mammals Leopard (*Panthera pardus*), mouse deer (*Tragulus javanica*). In addition, the existence of increasingly rare amphibian species Red Toad (*Leptophryne cruentata*) (Sahab et al., 2015).

The presence of edge effects can exert different influences on bird species depending on guild and habitat preference (Graviola et al., 2022). Moreno R, Guerrero-Jimenez CJ (2019) adds that the presence of edge effects can initiate a series of random effects throughout the ecosystem structure through species interactions. Populations of separate species as well as entire communities can change from interior habitats to ecotone habitats due to changes in habitat structure, such as climate variables or surrounding ecosystems (Handel, 2012).

Fragmentation results in a decrease in forest area, an increase in the number of patches, an increase in isolation, and an edge effect (Aristizabal et al., 2019). Edge is the boundary between two different types of ecosystems; Forest edge is the boundary between forested and non-forested ecosystems or between two forests that have different compositions or structures; and the edge effect is the effect of processes on the edge that cause differences in structure, composition, and function near the edge compared to the ecosystem next door (Garrah et al., 2015). Understanding the ecology of fringing habitats is critical in decision-making for population conservation (As' ary et al., 2023).

The tendency of edge effects can be seen on the status of wildlife species and populations. Birds are wildlife that can live in almost all habitat types, have high mobility and adaptability to a wide variety of habitat types (Gregory et al., 2021). In primate populations, the influence of forest edges has also been widely studied. However, the study places more emphasis on the influence of forest edges on population density (Kheng et al., 2018).

The threat of a conservation corridor area other than habitat fragmentation is the existence of open road access that passes through conservation habitat. The existing road access in the TNGHS corridor is a causeway between Bogor and Sukabumi districts and is an alternative road that is quite crowded with the frequency of getting in and out of motorized vehicles (Istiadi et al., 2024). Furthermore, it was explained that the road has a length of about 1 kilometer with a road width of 5 meters with smooth road conditions paved on the contour of the road that is uphill

in length and down in length. The frequency of vehicles recorded as many as 700 to 1200 vehicles every day passing on this corridor road access (Istiadi, Y and Priatna, D., 2023, p. 9).

Based on the above, the research will analyze the tendency of edge effects on road access within the TNGHS corridor, there are: 1) Are there a hierarchical cluster of bird species diversity in several habitat patch areas in the ecological corridor of Mount Halimun Salak National Park? 2) Are there any influence of the frequency edge effect across corridor access on primate distribution on the ecology of the Mount Halimun Salak National Park corridor?

RESEARCH METHOD

The type of research used includes descriptive survey types through quantitative techniques to test the comparison of bird species diversity in 3 habitat patch areas, each corridor patch, Garehong patch, Purasari patch. primate population studies; Javan Gibbon, Surili, and Long-tailed Monkey. The belt transect method is used to collect data on bird and primate species and populations. Belt transect is made along 3 km along the access road corridor, Intensive Point account (IPA), and Encounter Rate.

The research location is in the area of conservation area connection between Mount Halimun and Mount Salak. This area has a length of 9.8 km as a forest area that contacts the Mount Halimun and Mount Salak areas. Administratively, the research area includes Cianjen District, Bogor Regency, and is directly adjacent to Kabandungan District, Sukabumi Regency (Fig. 1). The study was conducted from October – December 2023, consisting of simultaneous collection of primate and bird population data in the first week of each month.

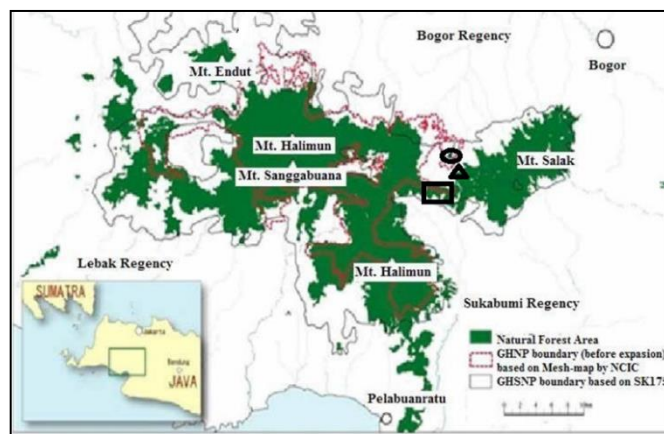


Figure 1. Research location and Gunung Halimun National Park, West Java

RESULT AND DISCUSSION

From the results of data collection, 78 birds species have been identified in patch areas and formed clusters of bird species distribution patterns that are relevant to the risks of disturbance in each region, the Patch Areas are distinguished by the

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Purasari cluster, Garehong cluster, and Coridor cluster. The dominating species in the corridor area are eagle species, especially the Javan eagle as a characteristic of carnivorous birds with extensive roaming in ecotone areas and primary forest areas. Other types of eagles are the Snake Eagle and the Black Eagle. Insectivorous species are also in open forest areas and borders on the entire patch area. While seed-eating birds, insects, caterpillars dominate the closed forest area in mainland Coridor.

The bird diversity index in the corridor area is a high diversity index of $H' = 3.087$ ($1.5 < H' < 3.5$) with 26 bird species. In the Garehong patch area, the bird diversity index is a high diversity index of $H' = 3.19$ ($1.5 < H' < 3.5$) with 53 species, namely that the presence of species is strongly influenced by natural habitats. Compared to the patch area in the corridor access road, the diversity of bird species is higher in the Purasari patch area which is further away from the corridor road access, the bird diversity index in the Purasari area is a high diversity index of $H' = 2.78$ ($1.5 < H' < 3.5$) with 42 species, namely that the existence of species is strongly influenced by natural habitats.

The similarity between these 3 patch regions shows that there are only 7 species found in the 3 patches. Between Garehong and Corridor 2 species, Purasari with corridor 1 species, and Purasari with Garehong 27 species. This shows that the Purasari and Garehong patch areas have higher similarity, and the corridor patch has constraints in the distribution of bird species and populations (Figure 2).

The process of type differences between patch regions is determined by several things, namely the relative effect of time, the degree of diversification, and ecological limitations (Machac, 2020). Threatened birds are migratory birds, and their distribution on seasonal differences is strong. High overlap with land use differences, the distribution range of bird species will shrink. This supports the hypothesis that homogeneous environments have the opposite effect on the distribution of birds that are widespread and narrow and ultimately increase the similarity of birds across regions (Sun et al., 2022). For this reason, it is necessary to understand the factors that affect bird species diversity, on sensitive ecosystems, and the level of importance for detecting and monitoring habitat changes. (Süel et al., 2021).

An endemic bird species, the Javan Eagle (*Nissaetus bartelsi*) is often found in corridor patches with ecotone habitat characteristics. Other types of eagles as well as the Black Eagle (*Ichnateus malayanus*) and the Snake Eagle (*Spilornis cheela*) are also quite often found in the same habitat characteristics.

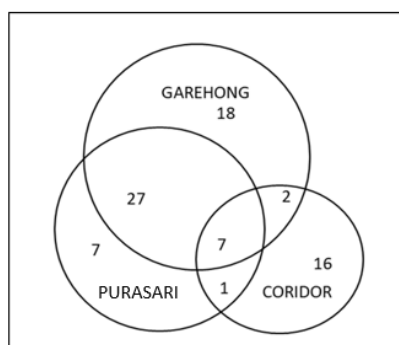


Figure 2. Slices of species similarity bird species between patch regions

In the status of primate species and populations, Javan Gibbon endemic species (*Hylobates moloch*) found 1 group as permanent residents, consisting of 1 adult male, 1 adult female with babies, and 2 young individuals. The existence of this population can be seen in the movement across the road through the canopy of trees that are still connected, and are only found in one particular location.

Table 1. Data collection of primate population in koridor of TNGHS

No.	Nama Lokal	Species	Jumlah pengamatan						JML
			1	2	3	4	5	6	
1	Owa Jawa	<i>Hylobates moloch</i>	6	4	2	4		3	19
2	Surili	<i>Presbytis comata</i>	3				1		4
3	Monyet Ekor panjang	<i>Macaca fascicularis</i>					3		3

From the data collection, the population density of Javan Gibbons is 0.114 indv/ha, Surili is 0.024 indv/ha, and Long-Tailed Monkeys are 0.018 indv/ha. This population density is much lower than the primate population density for all habitats in TNGHS. Nurvianto S, Adrianti DT, Hamdan F, Triyanto J, Darmanto A (2022) identified that the southern gibbon was only found in East Bravo Rangda Block and Tanjung Biru Block with a population density of 0,34 individual/km² respectively. Martiyani, T. R. Et al (2022) showed that the population density of javan gibbon in Cikaniki is 26,67 ind/km², Citalahab is 16,67 ind/km², and Star Energy is 8,33 ind/km².

While the other species, Surili (*Presbytis comata*) is only found 1 group in the patch area far from cross-road access. So does the Long-tailed Monkey (*Macaca fascicularis*). This is because the population cannot cross the road terrestrial due to the frequency of vehicles, while access to trees and habitat does not support the profit of crossing the road.

Javan Surili (*Presbtis comata*) is one of the endemic species in West Java, Indonesia. This species also internationally listed as an endangered species by IUCN red list and listed as one of the protected primates in Indonesia. Table above showed that Surili founded 2 times with group 1 – 3 individual. Santosa, Yanto. Rahmawati, Catur., and Yudea, C (2020) reported that in the Mount Halimun National Park with the condition of undisturbed forest areas found that there are 2-8 individuals in a group, and disturbed forest areas of 2-6 individuals. Furthermore, according to reference in the Situ Patenggang Nature Reserve area, he found that the size of Javan surili groups in the area was 3-8 individuals per group.

Based on the above findings, it can be said that the existence of road access that divides the corridor habitat has shifted the direction of bird population mobilization to the north, namely the Garehong patch and Puraseda patch areas. While in the primate population almost putur is said to have occurred bottle neck on the causeway access. Primate populations of both Javan Gibbons and Surili, or Monkeys are isolated in each Halimun block and Salak block.

Comparison with the results of previous studies, revealed that edge effects can vary on the type of edge habitat space adequacy by primate populations. Such ecological change capacity could be particularly relevant for reducing species responses to habitat loss and anthropogenic disturbance (Andriatsitohaina et al., 2020). In Javan Gibbon populations there tends to be an edge effect because the

habitat has been fragmented and the edge effect has increased. That fragmentation occurs in areas cut off by roads (Widyastuti et al., 2023).

CONCLUSION

There are a distribution cluster of bird species diversity between patch areas, the corridor area has a smaller number of species compared to the Garehong and Purasari fragmentation areas. This shows that edge effects have occurred in the corridor area due to disruption of cross-road access. There are an influence of edge effect of corridor road access on Javan Gibbon Primate (*Hylobates moloch*) and Surili (*Presbytis comata*) populations with low density compared to other habitat areas in TBGHS, Javan Gibbon population has one cross-road mitigation path, while Surili is not detected crossing corridor roads.

Scientifically, the theory of Island Geography regarding metapopulations in patch habitats can be conserved by managing corridors as distribution canals and migration of endemic animals. One of the conservation mitigations is through limiting motorized vehicles crossing the corridor road and making access to animal crossing paths permanently.

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