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Spatial Analysis for Habitat Estimation of the Sumatran Chestnut-necklaced Partridge *Tropicoperdix charltonii atjenensis* (Galliformes: Phasianidae) in Aceh, Sumatra, Indonesia

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Abstract
The Sumatran Chestnut-necklaced Partridge *Tropicoperdix charltonii atjenensis* is a subspecies endemic to the lowland forests of Aceh and Lampung, Sumatra. This study used the Analytical Hierarchy Process (AHP) to identify suitable habitats for this subspecies, considering environmental variables such as elevation, tree cover, slope, distance to water sources, and anthropogenic factors. Data collection and spatial analysis were conducted from July 22 to August 23, 2023. The AHP analysis revealed that *T. c. atjenensis* is typically found in lowland habitats with specific characteristics: average elevation of 130 meters, proximity to water sources, and very dense forest cover (93%). Additionally, suitable habitats tend to be far from road access (average distance of 1.7 km) and residential settlements (average distance of 5.3 km). The resulting distribution map highlights the importance of well-preserved, forested areas as primary habitats for this subspecies.

Keywords: Analytical Hierarchy Process (AHP), habitat suitability, lowland forests, Chestnut-necklaced Partridge, *Tropicoperdix charltonii*.

Introduction

The Chestnut-necklaced Partridge *Tropicoperdix charltonii* is a terrestrial bird in the Phasianidae family, inhabiting lowland tropical rainforests in the Indonesia and Thai-Malay Peninsula (Birdlife International 2001; Taufiqurrahman *et al.* 2022). Characterized by its distinctive chestnut-colored breast feathers and dark neck collar this species has undergone taxonomic revisions (Eaton *et al.* 2016). Recent studies have recognized certain regional populations as distinct species, such as the Sabah Partridge *Tropicoperdix graydoni* found in Sabah, Malaysia (BirdLife International 2021). Consequently, T. *charltonii* is now divided into two subspecies: *T. c. charltonii*, occurring in southern Thailand and Peninsular Malaysia, and Sumatran Chestnut-necklaced Partridge *T. c. atjenensis*, endemic to the lowland forests of Aceh and Lampung in Sumatra (del Hoyo et al. 2020; Avibase 2025).

The *T. c. atjenensis* is a Sumatran subspecies with a limited geographic distribution, first described nearly a century ago (Boakes *et al*. 2018). Despite its rediscovery in 2023 in a fragmented forest area in North Aceh, information on its population and habitat remains scarce (Wahyudi *et al.* 2023). Aceh's extensive lowland forests are crucial habitats for many endemic and rare species, but human-induced pressures are intensifying due to increasing demands for land use (Nuribadah 2022). This poses significant conservation challenges for *T. c. atjenensis*, as its habitat is highly vulnerable

to forest fragmentation and degradation (Richter 2024).

Studying *T. c. atjenensis* is crucial for both scientific understanding and conservation, particularly in the face of climate change and habitat degradation (Medrano-Vizcaino *et al.* 2023). This research enhances our knowledge of the species' ecology, behavior, and habitat preferences, informing conservation management priorities and identifying key areas for protection in Aceh. By elucidating its distribution patterns and habitat requirements, this study bridges knowledge gaps and supports science-based conservation efforts, ultimately contributing to the long-term survival of *T. c. atjenensis* in a rapidly changing environment.

Methods

The study was conducted in the Cot Girek Wildlife Corridor from 22 July to 23 August 2023, spanning 3,400 hectares of primary forest, secondary forest, and fragmented zones (coordinates: 4°57'2.19"N, 97°8'40.95"E to 4°50'38.34"N, 97°27'58.32"E) (Fig. 1). We used the Visual Encounter Survey (VES) method to detect *T. c. atjenensis* in its habitat (Crump & Scott 1994; Graeter *et al.* 2013; Boynton *et al.* 2021). Each observation was recorded with GPS coordinates using a Garmin GPSMAP 66st device, and the data were analyzed to determine the species' distribution patterns and habitat characteristics. This analysis was then expanded to a broader spatial scale, covering North Aceh, East Aceh, and Aceh Tamiang.

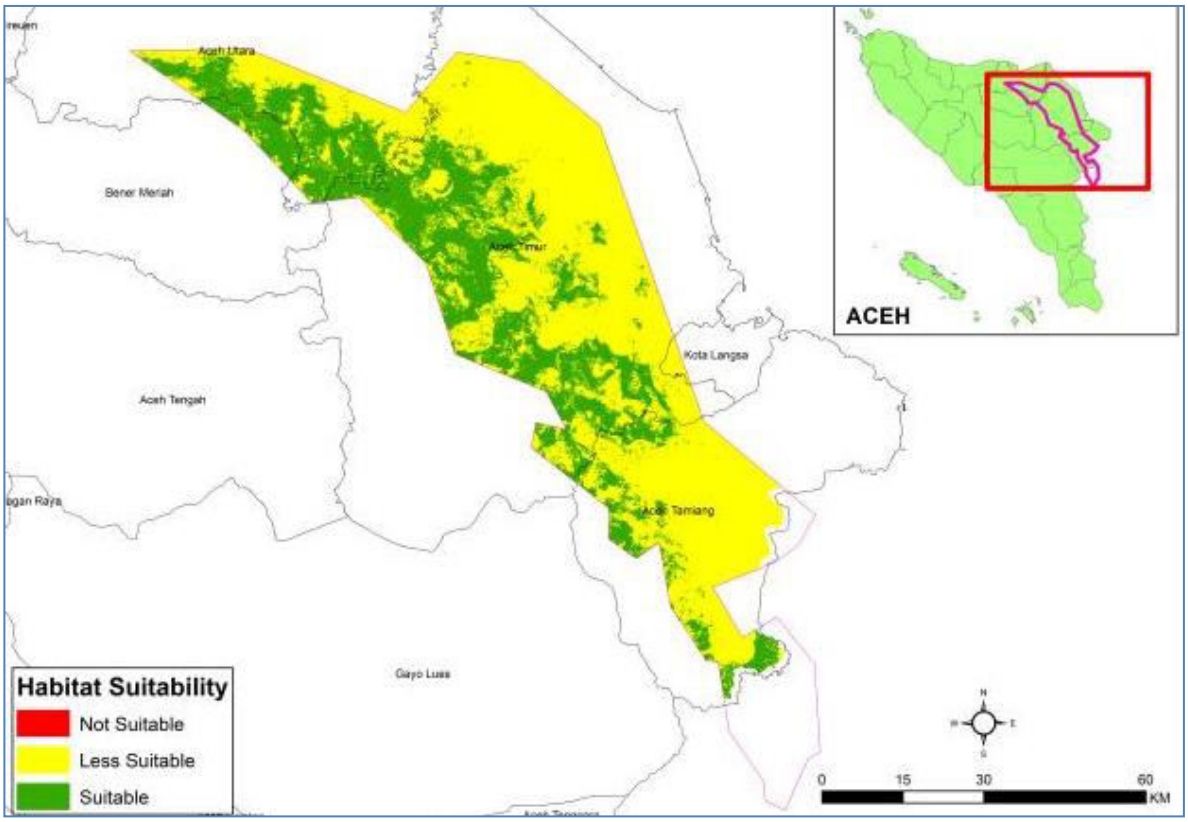


Figure 1. The ma of Cot Girek Wildlife Corridor and habitat suitability maps of The Sumatran Chestnut-necklaced Partridge *Tropicoperdix charltonii atjenensis* in Aceh Province (Yellow is not potential and green is potential).

This study considered two groups of environmental variables: habitat variables (elevation, distance from rivers, tree cover, and slope) and anthropogenic variables (distance from roads, settlements, and forest edges). These variables were chosen for their relevance to the habitat characteristics and anthropogenic pressures influencing *T. c. atjenensis* presence. According to Meinshausen (2008), the selection of these variables enabled a systematic approach to addressing the research problem, facilitating comparisons between structural components and identifying correlations among attributes.

All data on the presence of *T.c.atjenensis* will be analyzed using Geographic Information System (GIS) software to generate habitat suitability maps. To assess the habitat suitability for this species, the AHP method will be used. This is a multi-criteria decision-making approach based on expert judgment that allows for the evaluation and ranking of various environmental and anthropogenic variables (Imam. & Tesfamichael 2013). This method helps assess habitat suitability by assigning weights to each variable based on its importance in supporting the species' ecological preferences (Kumar *et al*. 2023). Given the limited references on *T. c. atjenensis*, each variable is assigned an equal weight in the analysis process.

Results and Discussion

During field surveys in the Cot Girek Wildlife Corridor, *T. c. atjenensis* was recorded at three locations, providing insights into its habitat preferences and ecological behavior (Table 1). The observations were made at: Alue Campli (N 4°54'22", E 97°16'12"), where individuals were seen foraging along a riverbank in a secondary forest at 151 meters elevation; Geulumpang (N 4°55'23", E 97°13'14"), where the species was detected through its distinctive calls at 125 meters elevation; and Alue Blang (N 4°54'50", E 97°12'13"), where calls were heard from a secondary forest near a river at 37 meters elevation.

Table 1. Records of *T. c. atjenensis* from 22 July to 23 August 2023 in the Cot Girek Wildlife Corridor, Aceh Province, Sumatra.

Location	Coordinate	Individual	Habitat	Note
Alue Campli	N 4°54’22’, E 97°16’12	1	Secondary forest and close to the river	Recorded foraging along the riverbank.
Geulumpang	N 04^{0}55’23, E 97^{0}13’14	1	Secondary forest	Hear the sound
Alue Blang	N 04^{0}54’50, E 97^{0}12’13	1	Secondary forest and close to the river	Hear the sound

GIS analysis of field data identified key environmental variables influencing *T. c. atjenensis* habitat suitability. Based on the three recorded locations, the following habitat suitability criteria were established (Table 2):

- Elevation: areas below 300 meters are highly suitable, while those above 1,000 meters are less suitable.
- Distance from rivers: areas within 100 meters are highly suitable, while those beyond 500 meters are less suitable.
- Tree cover: areas with over 70% cover provide better habitat support, while those with less than 70% are less suitable.
- Slope inclination: slopes below 15% are more favorable, while those above 25% are less suitable.

Habitat Suitability Analysis

The analysis using the AHP method indicates that the average habitat of *T. c. atjenensis* is at an altitude of 130 meters, and distance 406 meters from the nearest river (Table 3). Additionally, it has a tree cover of 93% and a slope of 60°. From an anthropogenic perspective, the species’ habitat is, on average, 1.7 km from the nearest road, 5.3 km from human settlements, and 271 meters from the forest edge.

Table 2. Habitat suitability and variable weighting for Analytical Hierarchy Process (AHP) analysis.

Variabel	Not Suitable 1	Less Suitable 2	Suitable 3	Weight
a. Environmant Variable				
Elevation	<1000	300-1000	0-300	14,29
River Distance	<500	100-500	0-100	14,29
Tree Cover	0-70	70-90	90-100	14,29
Slope	>25	15-25	0-15	14,29
b. Anthropogenic Variable				
Road Distance	0-100	100-500	>500	14,29
Settlement Distance	0-2500	>4700	2500-4700	14,29
forest edges Distance	>2500		0-2500	14,29

The potential habitat distribution map (Fig. 1) shows that *T. c. atjenensis* tends to inhabit areas with well-preserved forest cover (green areas), while regions with high accessibility and human disturbance (yellow areas) are less suitable. Research findings indicate that *T. c. atjenensis* prefers lowland habitats below 300 meters, characterized by relatively flat terrain and proximity to riverine areas with dense tree cover (BirdLife International 2021; Madge & McGowan 2002; del Hoyo *et al.* 2020). This preference likely stems from the availability of food resources, such as seeds and insects, and protection from predators (Sekercioglu 2006). Dense forest cover also provides a stable environment with optimal temperature and humidity, crucial for tropical forest birds (Powell *et al.* 2020).

Table 3. Habitat suitability and variable weighting for Analytical Hierarchy Process (AHP) analysis.

Variabel	Min	Max	Mean
a. Environmental Variable			
Elevastion (m)	8,73	790	130
River Distance(m)	0,00	5.763	406
Tree cover (%)	0,00	100	93
Slope (◦)	0,01	29	6
b. Anthropogenic Variable			
Road Distance (m)	0,00	9.819	1.754
Settlement Distance (m)	0,00	15.127	5.338
Forest edgesdistance (m)	0,00	13.390	271

Anthropogenic factors significantly influence habitat suitability for certain birds (Iqbal *et al.* 2020; Shi *et al.* 2024), and it is presumed for *T. c. atjenensis.* Our study shows that the species tends to inhabit areas with minimal human disturbance, avoiding highly accessible regions like roads. However, it may tolerate moderate human disturbance, such as areas near settlements that border forests with intact vegetation and minimal land-use changes. The findings emphasize the importance of preserving lowland forests and areas adjacent to water sources for *T. c. atjenensis* conservation. Effective conservation efforts should prioritize limiting land clearing and infrastructure development that increases human accessibility and habitat degradation.



Figure 2. The Sumatran Chestnut-necklaced Partridge *Tropicoperdix charltonii atjenensis* in Cot Girek Wildlife Corridor, Aceh, Sumatra, Indonesia.



Figure 3. Another Sumatran Chestnut-necklaced Partridge *Tropicoperdix charltonii atjenensis* in Cot Girek Wildlife Corridor, Aceh, Sumatra, Indonesia.

This study has limitations in understanding *T. c. atjenensis* responses to extreme environmental changes, such as habitat conversion to palm oil plantations and increased forest fragmentation. Future research should investigate the species' adaptability to changes in habitat structure, resource availability, and ecological pressures. Verification of analysis results is also necessary to ensure accurate habitat distribution predictions. By addressing these knowledge gaps, future studies can enhance our understanding of *T. c. atjenensis* ecology and inform more effective conservation strategies.

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References

Avibase. 2025. *Chestnut Necklaced Partridge* (*Tropicoperdix charltonii*). Available from: https://avibase.bsc-eoc.org/species.jsp?avibaseid=E9C99FD74D7C713B. Accessed on 3 May 2025.

BirdLife International. 2021. Species factsheet: Chestnut-necklaced Partridge *Tropicoperdix charltonii.* Available from: https://datazone.birdlife.org/species/factsheet/chestnut-necklaced-partridge-tropicoperdix-charltonii. Accessed on 9 May 2025.

Boakes, E.H., Fuller, R.A. & McGowan, P.J.K. 2018. The extirpation of species outside protected areas. *Conservation Letters*: e12608. DOI: https://doi.org/10.1111/conl.12608

Boynton, M.K., Toenies, M., Cornelius, N. & Rich, L.N. 2021. Comparing camera traps and visual encounter surveys for monitoring small animals. *California Fish and Wildlife* 107(2): 99-117. DOI: https://doi.org/10.51492/cfwj.107.9

Cochard, R. 2017. Scaling the Costs of Natural Ecosystem Degradation and Biodiversity Losses in Aceh Province, Sumatra. *In*: Shivakoti, G.P., Pradhan, U. & Helmi. (Eds). *Redefining Diversity & Dynamics of Natural Resources Management in Asia, Volume 1. Sustainable Natural Resources Management in Dynamic Asia.* Elsevier, Amsterdam, pp 231-271. DOI: https://doi.org/10.1016/B978-0-12-805454-3.00013-X

Crump, M. L. & Scott, N.J. 1994. Visual encounter survey. *In*: Heyer, W.R., Donnelly, M.A., McDiarmid, R.W., Lee-Ann C., Hayek, L.C. & Foster, M.S. (Eds). *Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians.* Smithsonian Institution Press, Washington, D.C., pp 84-91.

del Hoyo, J., McGowan, P.J.K. Collar, N., Boesman, P.F.D., Christie, D.A. & Kirwan, G.M. 2020. Chestnut-necklaced Partridge (*Arborophila charltonii*), version 1.0. *In*: del Hoyo, J., Elliott, A., Sargatal, J., Christie, D.A. & E. de Juana, E. (Eds). *Birds of the World.* Cornell Lab of Ornithology, Ithaca.

Eaton, J.A., van Balen, B., Brickle, N.W. & Rheindt, F.E. 2021. *Birds of the Indonesian Archipelago: Greater Sundas and Wallacea.* Lynx Edicions, Barcelona, 496 pp.

Graeter, G. J., K. A. Buhlmann, K.A., Wilkinson, L.R. & J. Gibbons, W. 2013. *Inventory and monitoring: recommended techniques for reptiles and amphibians.* Partners in Amphibian and Reptile Conservation Technical Publication IM-1, Birmingham, 321 pp.

Imam, E. & Tesfamichael, G.Y. 2013. Use of remote sensing, GIS and analytical hierarchy process (AHP) in wildlife habitat suitability analysis. *Journal of Materials and Environmental Sciences* 4(3): 460-467.

Iqbal, M.., Purwoko, A., Hanafiah, Z., Setiawan, A., Yustian, I. & Zulkifli, H. 2020. Is the Covid-19 pandemic boosting the hunting of phasianidae in Western Indonesia ?. *BirdingAsia* 33(1): 25-26.

Kumar, V., Raghevendra, S., Devagiri, G. M., Rani, V. 2023. Assessing Asian Elephant habitat preferences in the Central Western Ghats using GIS, Remote Sensing, and Analytical Hierarchy Process (AHP). *International Journal of Environment and Climate Change* 13(10): 3355-3365. DOI: https://doi.org/10.9734/ijecc/2023/v13i103004

Medrano-Vizcaino, P., Grilo, C. & Gonzalez-Suarez, M. 2023. Research and conservation priorities to protect wildlife from collisions with vehicles. *Biological Conservation* 280: 109952. DOI: https://doi.org/10.1016/j.biocon.2023.109952

Meinshausen, N. 2008. Hierarchical testing of variable importance. *Biometrika* 95(2): 265–278. DOI: https://doi.org/10.1093/biomet/asn007

Nuribadah, N. 2022. The existence of the government of Aceh in reducing forest destruction. *Asia-Pacific Journal of Public Policy* 8(1): 25-35.

Powell, L.L., Cordeiro, N.J. & Stratford, J.A. 2020. Ecology and conservation of avian insectivores of the rainforest understory: A review. *Biological Conservation* 188: 1-10. DOI: https://doi.org/10.1016/j.biocon.2015.03.025

Richter, J., Goldman, E., Harris, N., Gibbs, D., Rose, M., Peyer, S., Richardson, S. & Velappan, H.J. 2024. Spatial Database of Planted Trees (SDPT Version 2.0). Technical Note. World Resources Institute, USA, 80 pp. DOI: https://doi.org/10.46830/writn.23.00073

Sekercioglu, C.H. 2006. Increasing awareness of avian ecological function. *Trends in Ecology & Evolution* 21(8): 464-471. DOI: https://doi.org/10.1016/j.tree.2006.05.007

Shi, J., Meng, L., Xia, S., Liu, S. & Zhou, L. 2024. Habitat Suitability and Determinants for Anatidae in Multi-Watershed Composite Wetlands in Anhui, China. *Animals* 14(7): 1010. DOI: https://doi.org/10.3390/ani14071010

Taufiqurrahman, I., Akbar, P.G., Purwanto, A.A., Untung, M., Assiddiqi, Z., Wibowo, W.K., Iqbal,M., Tirtaningtyas, F.N & Triana, D.A. 2022. *Panduan Lapangan Burung-burung di Indonesia Seri 1: Sunda Besar.* Birdpacker Indonesia-Interlude, Batu., 398 pp [in Indonesian]

Wahyudi, T., Rachmi. & Ardhina, M. 2023. The first Sumatran records of Chestnut-necklaced Partridge (*Tropicoperdix charltonii atjenensis*) since 1939. *BirdingAsia* 40: 16-17.