International Journal Of Health, Engineering And Technology (IJHET) *E-ISSN 2829 - 8683*
Volume 5, Number 2, July 2026, *Page. 2509 - 2518*
Email : editorijhess@gmail.com

Spatial Modeling Of Proboscis Monkey (Nasalis larvatus) Habitat Suitability Using Maximum Entropy In Tabunganen District

Dita Mahalleni[1)], Selamat Riadi[2)], Arif Rahman Nugroho[3)] , Wisnu Putra Danarto[4)]
[1,2,3,4)] Faculty of Social and Political Sciences, Lambung Mangkurat University, Banjarmasin, Indonesia

*Corresponding Author
E-mail: 2110416320017@mhs.ulm.ac.id

Abstract

The proboscis monkey (Nasalis larvatus) is a primate endemic to Borneo Island that faces threats due to habitat degradation and fragmentation. This study aims to analyze environmental factors influencing the presence of proboscis monkeys and model their habitat suitability in Tabunganen District, Barito Kuala Regency. The study used 18 proboscis monkey presence points monitored by the South Kalimantan Natural Resources Conservation Agency in 2025 and seven environmental variables analyzed using the Maximum Entropy method. The model produced an Area Under Curve value of 0.936, indicating excellent predictive ability. Distance from rice fields contributed the largest contribution (64.7%), followed by distance from gardens (14.2%) and distance from rivers (9.3%). The modeling results indicate that most areas fall into the low suitability class, while habitats with moderate to high suitability are concentrated in mangrove areas, riparian vegetation, and areas adjacent to rivers. These findings can be used as a basis for habitat management and determining proboscis monkey conservation priorities in Tabunganen District.

Keywords: Proboscis Monkey, Habitat Suitability, Maximum Entropy, Spatial Modeling, Conservation

INTRODUCTION

The proboscis monkey (Nasalis larvatus) is a primate endemic to the island of Borneo, found only in Indonesia, Malaysia, and Brunei. This species is protected in Indonesia and is categorized as Endangered by the International Union for Conservation of Nature (IUCN) due to habitat loss, area fragmentation, and human activity pressures. Proboscis monkeys generally inhabit mangrove forests, swamp forests, and riparian areas adjacent to rivers. In addition to their role as seed dispersers, the presence of proboscis monkeys is also an important indicator of the health of wetland ecosystems, making the preservation of their habitat crucial (SSU Atmoko et al., 2017; Suwarto et al., 2016).

Tabunganen District in Barito Kuala Regency is one of the coastal areas in South Kalimantan that remains a natural habitat for the proboscis monkey. This area is dominated by mangrove ecosystems, tidal swamps, and river networks that provide food sources, shelter, and breeding grounds for the proboscis monkeys. Furthermore, Tabunganen District also encompasses important conservation areas, namely the Kuala Lupak Wildlife Sanctuary and the Pulau Kaget Wildlife Sanctuary (Barkati, 2024; Noor et al., 2023).

Monitoring results from the South Kalimantan Natural Resources Conservation Agency (BKSDA) show that the proboscis monkey population in the Pulau Kaget Wildlife Sanctuary (SM) and the Kuala Lupak Wildlife Sanctuary (SM) experienced fluctuating dynamics during the 2016–2024 period. The population in the Pulau Kaget Wildlife Sanctuary tended to be in the range of 73–124 individuals, with the highest increase occurring in 2021 before declining again in the following years. Meanwhile, the population in the Kuala Lupak Wildlife Sanctuary showed a significant increasing trend from 158 individuals in 2016 to 548 individuals in 2021, then decreased in 2022–2024 although it remained at a relatively higher number compared to the beginning of the observation period. This fluctuation pattern indicates that the dynamics of the proboscis monkey population are influenced by changes in habitat conditions and environmental pressures that occur temporally. This condition indicates that the sustainability of the proboscis monkey population is highly dependent on the availability of suitable habitat, maintained ecosystem quality, and low anthropogenic pressures such as land conversion and habitat fragmentation (Zainuddin, 2016). The development of the

proboscis monkey population in Pulau Kaget Wildlife Sanctuary and Kuala Lupak Wildlife Sanctuary during the period 2016–2024 is presented in Figure 1.

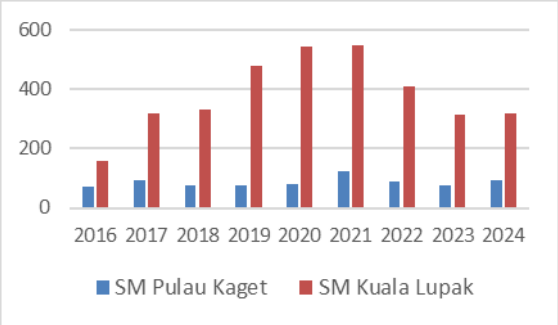

Figure 1. Development of Proboscis Monkey Population in Pulau Kaget Wildlife Reserve and Kuala Lupak Wildlife Reserve 2016 – 2024

Source: Modified by author 2026

Identifying suitable habitat is a crucial step in supporting proboscis monkey conservation efforts. Information on habitat characteristics provides insight into environmental factors influencing species presence, which can be used as a basis for conservation area management, habitat restoration, and the determination of priority protection areas. Therefore, an approach capable of analyzing the relationship between species presence data and environmental conditions spatially is needed to produce more objective and comprehensive information.(Lee et al., 2019; Mayasari et al., 2021).

One approach widely used in species distribution analysis is Species Distribution Modeling (SDM). This approach links species presence data with environmental variables to predict a species' potential distribution in a region. Various methods have been developed within SDM, but Maximum Entropy (MaxEnt) is one of the most widely used because it can produce accurate predictions using presence-only data, even under relatively limited data conditions. Furthermore, MaxEnt can integrate various environmental variables, such as topography, vegetation, and land use, making it suitable for application in wildlife conservation research.(Elith et al., 2010; Elith & Leathwick, 2009; Lamsal et al., 2022).

Several previous studies have utilized the MaxEnt method to model wildlife habitats, including proboscis monkeys.Suwarto et al., (2016)shows that the suitability of proboscis monkey habitat in Kutai National Park is influenced by water sources, food availability, disturbance, and gregarious nature.Nuryani et al., (2024)also reported that mangrove forests, distance from rivers, distance from the coastline, and the Leaf Area Index (LAI) were the main variables determining the suitability of proboscis monkey habitat in the Teluk Adang Nature Reserve. The study's results indicate that proboscis monkey habitat characteristics can vary from region to region, necessitating an analysis that takes local environmental conditions into account.

Research on the spatial distribution of proboscis monkey habitat in Tabunganen District using the Maximum Entropy approach is still relatively limited, even though this area has coastal landscape characteristics that differ from other conservation areas in Kalimantan. This study used seven environmental variables, namely the Normalized Difference Vegetation Index (NDVI), elevation, slope gradient, distance from rivers, distance from settlements, distance from rice fields, and distance from plantations to analyze factors that influence the presence of proboscis monkeys. The results are expected to be able to identify the most influential environmental variables and produce a habitat suitability map that can be used as a basis for decision-making in habitat management and proboscis monkey conservation in Tabunganen District.

Literature Review

A habitat is an area that provides various life necessities for a species, including food sources, shelter, and breeding grounds, as well as environmental conditions that support its survival. Habitat characteristics are influenced by various environmental factors, such as vegetation conditions,

topography, hydrology, and land use. Changes in habitat characteristics due to anthropogenic activities, such as land conversion, residential development, and agricultural expansion, can degrade habitat quality and affect wildlife distribution patterns. Therefore, identifying habitat characteristics is an important aspect in supporting biodiversity conservation and management efforts.(Davis et al., 2017).

The proboscis monkey (Nasalis larvatus) is a primate endemic to the island of Borneo, belonging to the Cercopithecidae family and the Colobinae subfamily. This species prefers mangrove forests, swamp forests, riparian forests, and coastal areas adjacent to water bodies. Proboscis monkeys utilize vegetation as a food source, resting place, and protection from predators, making the presence of good vegetation a crucial factor in maintaining their population. Furthermore, proximity to rivers is a common habitat characteristic, as rivers serve as movement routes, water sources, and predator avoidance mechanisms. These conditions lead to changes in land cover and habitat fragmentation, which can impact the presence and distribution of proboscis monkeys in the wild.(T. Atmoko et al., 2021; Suwarto et al., 2016).

Advances in remote sensing technology and Geographic Information Systems (GIS) have enabled spatial analysis of species distribution through the Species Distribution Modeling (SDM) approach. This approach links species presence data with environmental variables to predict habitat suitability in an area. The modeling results not only depict potential habitat locations for a species but also identify the environmental factors most influential on its existence. This information is crucial for supporting the development of conservation strategies, habitat change evaluation, and sustainable area management planning.(Elith & Leathwick, 2009; Zurell et al., 2020).

One of the most widely used methods in Species Distribution Modeling is Maximum Entropy (MaxEnt). This method works based on the principle of maximum probability (maximum entropy) by utilizing presence-only data and environmental variables to predict the potential distribution of a species. MaxEnt has the ability to produce models with a high level of accuracy even though the amount of presence data is relatively limited and is able to accommodate complex relationships between environmental variables. Model performance evaluation is carried out using the Receiver Operating Characteristic (ROC) curve and the Area Under Curve (AUC) value, where an AUC value closer to 1 indicates a better model's predictive ability.(Elith et al., 2010).

Various studies have shown that the characteristics of wildlife habitats are influenced by a combination of several environmental variables.Suwarto et al., (2016)Research shows that habitat disturbance, vegetation availability, and proximity to water sources are important factors influencing the distribution of proboscis monkeys in Kutai National Park.MUBARAQ, (2023)also showed that land cover type, altitude, slope gradient, distance to the river, and NDVI values were variables that influenced the habitat preferences of the white-fronted langur with an AUC value of 0.859, indicating the model had good predictive ability. Meanwhile, Ardiani et al. (2023) explained that the use of MaxEnt was able to produce endemic wildlife habitat modeling with a high level of accuracy and identify dominant environmental variables that influence species distribution. The results of this study indicate that spatial modeling using MaxEnt can be an effective approach in supporting wildlife conservation by identifying potential habitats and the environmental factors that influence them.

This study applies the Maximum Entropy method to model the habitat suitability of proboscis monkeys (Nasalis larvatus) in Tabunganen District, Barito Kuala Regency. The modeling was conducted using seven environmental variables: the Normalized Difference Vegetation Index (NDVI), elevation, slope, distance from rivers, distance from settlements, distance from rice fields, and distance from gardens. This analysis is expected to identify the environmental factors that most influence the existence of proboscis monkeys and produce a habitat suitability map that can be used as a basis for managing conservation areas and policy-making in proboscis monkey conservation efforts in South Kalimantan.

RESEARCH METHODS

This research was conducted in Tabunganen District, Barito Kuala Regency, South Kalimantan Province. The research area was chosen because it remains the natural habitat of the proboscis monkey (Nasalis larvatus), which is spread across mangroves, tidal swamps, and riverbanks, but is experiencing pressure due to changes in land use. The research location is geographically at coordinates 114°30'00"–114°40'00" East and 3°10'00"–3°20'00" South. The research location is presented in Figure 2.

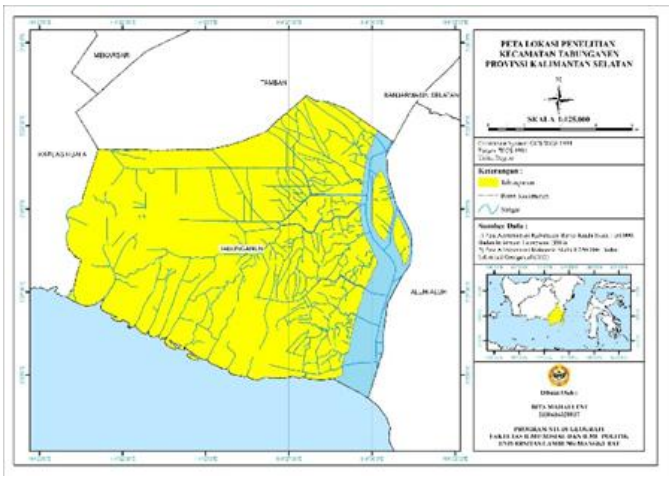

Figure 2. Research Location Map
Source: Modified by author 2026

This study uses primary and secondary data. Primary data consists of 18 presence-only points of proboscis monkeys obtained from monitoring by the South Kalimantan Natural Resources Conservation Agency (BKSDA) during 2025. Secondary data includes Sentinel-2 imagery to obtain Normalized Difference Vegetation Index (NDVI) values, National Digital Elevation Model (DEMNAS) data to generate elevation and slope information, and river network, land use, and administrative boundary data obtained from relevant agencies. All spatial data were processed using ArcGIS 10.8 software, while habitat suitability modeling was performed using Maximum Entropy (MaxEnt) version 3.4.4.

The environmental variables used in the modeling consist of seven variables, namely NDVI, elevation, slope, distance from rivers, distance from settlements, distance from rice fields, and distance from gardens. NDVI values are calculated using Sentinel-2 imagery to describe the level of vegetation density. Elevation and slope variables are obtained from DEMNAS data, while distance variables from rivers, settlements, rice fields, and gardens are calculated using Euclidean Distance analysis in ArcGIS. All variables are converted to ASCII raster format with a uniform coordinate system, pixel size, and resolution so that they can be used as input data in MaxEnt modeling.

Habitat suitability modeling was conducted using the Maximum Entropy (MaxEnt) method, which utilizes species presence data (presence-only) and environmental variables to predict the level of proboscis monkey habitat suitability. Each environmental variable and proboscis monkey presence point were entered into the MaxEnt software, resulting in a habitat suitability probability map with values between 0 and 1. In addition to producing a habitat suitability map, the MaxEnt software also generates contribution values for each environmental variable (percent contribution), a response curve, and a Jackknife test used to identify the variables most influential on proboscis monkey presence. This method was chosen because it is capable of producing species distribution predictions with a high degree of accuracy even though it only uses species presence data.(Phillips et al., 2006).

Prior to modeling, all environmental variables were tested using multicollinearity analysis to identify relationships between variables to minimize model bias. Next, model performance was evaluated using the Receiver Operating Characteristic (ROC) curve and the Area Under Curve (AUC) value. AUC values range from 0 to 1, with values closer to 1 indicating a better model's ability to predict habitat suitability. Interpretation of the research results was based on the AUC value, the contribution of environmental variables, the response curve, the Jackknife, and the habitat suitability map generated by the MaxEnt model.(Phillips et al., 2004).

RESULTS AND DISCUSSION

This study used 18 presence-only locations of proboscis monkeys (Nasalis larvatus) obtained from monitoring by the South Kalimantan Natural Resources Conservation Agency (BKSDA) in 2025 as input data for Maximum Entropy (MaxEnt) modeling. These locations were spread across several locations in Tabunganen District, dominated by mangroves, riparian vegetation, tidal swamps, and coastal areas. The distribution of these locations indicated that most locations were located near river networks and areas still covered by natural vegetation. This indicates that the proboscis monkeys are still closely linked to their natural habitat, which provides food sources, shelter, and movement corridors. Details of the proboscis monkey presence locations used in this study are presented in Table 1.

Table 1.Proboscis Monkey Presence Point Table

No	Species	X	Y	Location
1	Proboscis Monkey	209189,2332	9615820,345	Kuala Lupak Middle School
2	Proboscis Monkey	223165,8112	9621007,047	SM Pulau Kaget
3	Proboscis Monkey	222149,5412	9621790,094	SM Pulau Kaget
4	Proboscis Monkey	223080,5359	9623139,706	SM Pulau Kaget
5	Proboscis Monkey	222297,1802	9623412,336	SM Pulau Kaget
6	Proboscis Monkey	214861,526	9617766,276	(Outside Area)
7	Proboscis Monkey	214342.9606	9613358,068	SM Pulau Kaget
8	Proboscis Monkey	223014,1336	9621161.23	SM Pulau Kaget
9	Proboscis Monkey	218520,015	9612849,157	Kuala Lupak Middle School
10	Proboscis Monkey	217763,1912	9613044.06	Kuala Lupak Middle School
11	Proboscis Monkey	218401,144	9613241,052	Kuala Lupak Middle School
12	Proboscis Monkey	223468.9711	9620110,263	Kuala Lupak Middle School
13	Proboscis Monkey	218490.7995	9613512,166	Kuala Lupak Middle School
14	Proboscis Monkey	222209,1054	9622661,022	SM Pulau Kaget
15	Proboscis Monkey	222269,3713	9619691,739	(Outside Area)
16	Proboscis Monkey	222325,2757	9622799,451	SM Pulau Kaget
17	Proboscis Monkey	223234,3382	9621465,469	SM Pulau Kaget
18	Proboscis Monkey	222311,7312	9622021,433	SM Pulau Kaget

Source: South Kalimantan BKSDA, 2025

The clustered distribution of presence points in certain areas indicates that proboscis monkey habitat in Tabunganen District is not evenly distributed. This pattern indicates that proboscis monkey presence is influenced by different environmental characteristics at each location. Therefore, an analysis of the relationship between presence points and environmental variables is necessary to predict the level of habitat suitability. This presence data is then used as input in modeling using the Maximum Entropy (MaxEnt) method to identify environmental factors that influence proboscis monkey habitat distribution.

A multicollinearity test was conducted on all environmental variables to determine the level of interrelationship between them before the modeling process. The test results showed that all variables had correlation values below the threshold for multicollinearity, thus all variables were deemed suitable for use in the modeling. This condition indicates that each variable provides different information in explaining the characteristics of the proboscis monkey habitat and does not cause significant bias in the modeling results. The results of the multicollinearity test are presented in Table 2.

Table 2. Multicollinearity Test Results

Layer	1	2	3	4	5	6	7
1	1,00000	0.05494	0.29355	0.05602	0.02930	-0.05352	0.00442
2	0.05494	1,00000	0.08586	0.35389	0.18756	-0.00962	0.09951
3	0.29355	0.08586	1,00000	-0.00680	0.16673	-0.03671	0.16211
4	0.05602	0.35389	-0.00680	1,00000	0.13540	0.10208	-0.16382
5	0.02930	0.18756	0.16673	0.13540	1,00000	0.30688	0.14800
6	-0.05352	-0.00962	-0.03671	0.10208	0.30688	1,00000	0.13001
7	0.00442	0.09951	0.16211	-0.16382	0.14800	0.13001	1,00000

Source: Modified By Author 2026

Habitat suitability modeling used the Maximum Entropy (MaxEnt) method utilizing 18 presence-only proboscis monkey points and seven environmental variables. The model evaluation results produced an Area Under Curve (AUC) value of 0.936 with a standard deviation of 0.027. This value indicates that the model has excellent predictive ability in distinguishing suitable and unsuitable habitats for proboscis monkeys. Phillips et al. (2006) stated that models with AUC values above 0.90 are included in the excellent model category, so the prediction results have a high level of confidence. The Receiver Operating Characteristic (ROC) curve is shown in Figure 3.

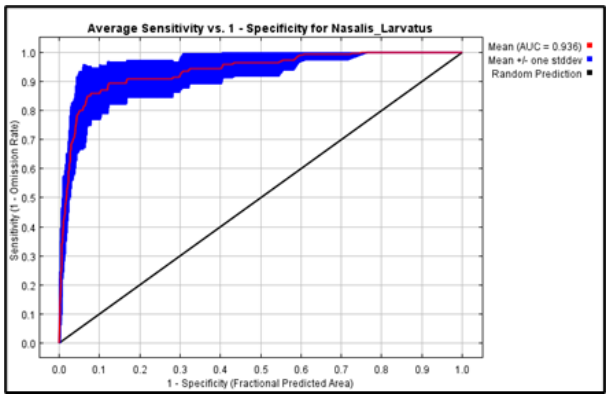

Figure 3.MaxEnt Model ROC (Receiver Operating Characteristic) Curve

Source: Modified by author 2026

The contribution of each environmental variable to the model was calculated using MaxEnt output in the form of a percentage contribution. The analysis results showed that the variable distance from rice fields contributed the largest, namely 64.7%, followed by distance from gardens (14.2%), distance from rivers (9.3%), slope (4.0%), distance from settlements (3.5%), elevation (2.9%), and NDVI (2.5%). These contribution values indicate that land use characteristics have a greater influence than topography or vegetation factors in shaping the proboscis monkey habitat distribution model. The results of the variable contribution analysis can be seen in Table 3.

Table 3.Variable Contribution Analysis Table

No	Variables	Percentage Contribution
1	Ricefield	64.7
2	Garden	14.2
3	River	9.3
4	Slope	4
5	Perkim	3.5
6	Elevation	2.9
7	Ndvi	2.5

Source: Modified by author 2026

The distance from rice fields variable provided the highest contribution to the model, but this does not indicate that proboscis monkeys use rice fields as their primary habitat. The high contribution value better reflects the landscape characteristics of Tabunganen District, which is dominated by a mosaic of riparian vegetation, mangroves, and agricultural land. Proboscis monkeys' natural habitat is still often found in areas directly adjacent to rice fields, making this variable an important indicator in habitat distribution modeling.

The Jackknife test showed that the distance from rice fields variable produced the highest training gain when used alone and produced the largest decrease in gain when removed from the model. This condition indicates that this variable provides the most information in explaining the distribution of proboscis monkey habitat. The response curve also shows that the probability of proboscis monkey presence increases in locations close to rivers, with medium to tall vegetation, and in lowlands with relatively gentle slopes. The results of the Jackknife test are shown in Figure 4 and the response curve is presented in Figure 5.

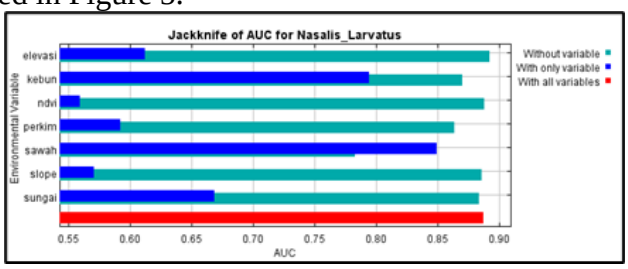

Figure 4. Jackknife test results on environmental variables

Source: Modified by author 2026

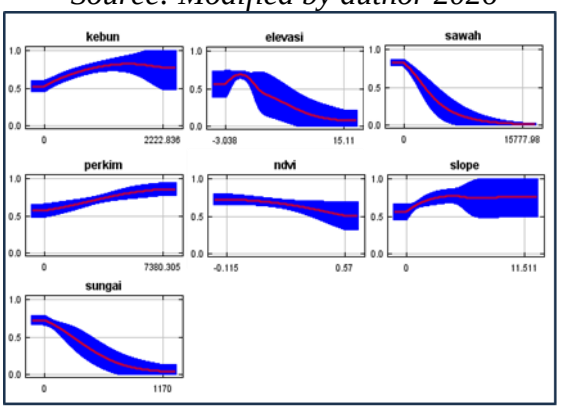

Figure 5.Jackknife Test Results on Environmental Variables

Source: Modified by author 2026

The habitat suitability map generated through Maximum Entropy (MaxEnt) modeling has a probability value between 0–1 which is then classified into three classes: low, medium, and high suitability. The low suitability class dominates most of the study area, while the medium suitability class is spread across areas that still have natural vegetation cover and are located around river

networks. Habitat with a high level of suitability is only found in certain locations, generally in mangrove areas, riparian vegetation, and coastal areas that still have relatively good habitat quality. The distribution of habitat with a high level of suitability does not form a large area, but tends to be scattered in the form of habitat patches separated by cultivated land and settlements. This condition indicates that the proboscis monkey habitat in Tabunganen District has experienced fragmentation so that connectivity between habitats has become increasingly limited. The Habitat Suitability Map of Proboscis Monkey (Nasalis Larvatus) in Tabunganen District resulting from Maximum Entropy modeling is presented in Figure 6.

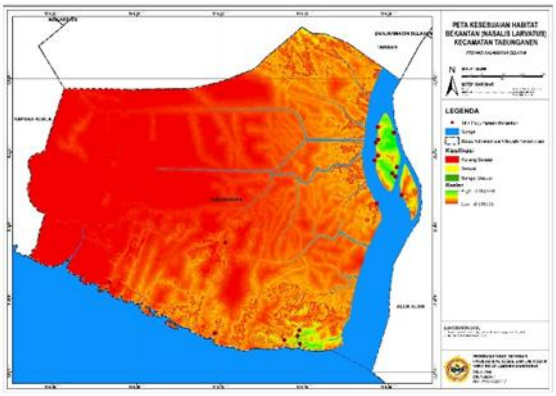

Figure 6. Habitat Suitability Map for Proboscis Monkeys (Nasalis Larvatus) in Tabunganen District

Source: Modified by author 2026

CONCLUSION

This study shows that the Maximum Entropy (MaxEnt) method is able to model the suitability of proboscis monkey (Nasalis larvatus) habitat in Tabunganen District with a very good level of accuracy, indicated by the Area Under Curve (AUC) value of 0.936. The modeling results identified that distance from rice fields was the environmental variable that provided the largest contribution to model formation, followed by distance from gardens and distance from rivers, while the NDVI, elevation, slope, and distance from settlements variables provided relatively smaller contributions. These conditions indicate that the characteristics of the landscape in Tabunganen District, especially the interaction between cultivated areas and natural vegetation, influence the distribution pattern of proboscis monkey habitat.

The habitat suitability map shows that most areas in Tabunganen District are classified as low suitability, while habitats with moderate to high suitability are concentrated in areas that still have natural vegetation cover, especially mangrove ecosystems, riparian vegetation, and areas adjacent to river networks. The distribution of habitats with high suitability tends to be fragmented, indicating that proboscis monkey habitat is still under pressure due to changes in land use. The results of this study can be used as a basis for determining conservation area priorities, habitat management, and developing proboscis monkey conservation strategies in Tabunganen District to maintain population sustainability and habitat connectivity.

REFERENCES

Atmoko, SSU, Saputra, F., Suwarso, S., Husein, HZ, Triandika, K., & Fahrizal, D. (2017). Biodiversity of the Sembakung Block, Nunukan Regency, North Kalimantan Province.

Atmoko, T., Mardiastuti, A., Bismark, M., Prasetyo, LB, & Iskandar, E. (2021). Population and distribution of proboscis monkeys (Nasalis larvatus) in the Berau Delta. Wallacea Forestry Research Journal, 10(1), 11. https://doi.org/10.18330/jwallacea.2021.vol10iss1pp11-23

Barkati, A. (2024, July). REPORT ON THE IMPLEMENTATION OF ACTIVITIES, MONITORING THE PROSPECTUS MONKEY POPULATION IN THE KUALA LUPAK WILDLIFE SANCTUARY IN 2024.

Davis, S.W., Stanley, Matthew L., Moscovitch, Morris, & and Cabeza, R. (2017). Resting-state networks do not determine cognitive function networks: A commentary on Campbell and Schacter (2016). Language, Cognition and Neuroscience, 32(6), 669–673. https://doi.org/10.1080/23273798.2016.1252847

Elith, J., Kearney, M., & Phillips, S. (2010). The art of modeling range-shifting species: The art of modeling range-shifting species. Methods in Ecology and Evolution, 1(4), 330–342. https://doi.org/10.1111/j.2041-210X.2010.00036.x

Elith, J., & Leathwick, J. R. (2009). Species Distribution Models: Ecological Explanation and Prediction Across Space and Time. Annual Review of Ecology, Evolution, and Systematics, 40(1), 677–697. https://doi.org/10.1146/annurev.ecolsys.110308.120159

Lamsal, K., Malenovský, Z., Woodgate, W., Waterman, M., Brodribb, T. J., & Aryal, J. (2022). Spectral Retrieval of Eucalypt Leaf Biochemical Traits by Inversion of the Fluspect-Cx Model. Remote Sensing, 14(3), 567. https://doi.org/10.3390/rs14030567

Lee, ATK, Carr, JA, Ahmad, B., Ferisa, A., Handoko, Y., Harsono, R., Graham, L., Kabangnga, L., Kurniawan, NP, Keßler, PJA, Kuncoro, P., Prayunita, D., Priadjati, A., Purwanto, E., Russon, A., Sheil, D., Sylva, N., Wahyudi, A., & Foden, W. (2019). Reforestation efforts for tomorrow's climate.

Mayasari, R., Amlarrasit, A., Sitorus, H., & Santoso, S. (2021). DISTRIBUTION AND HABITAT CHARACTERISTICS OF Anopheles spp. IN KEMELAK BINDUNG LANGIT VILLAGE, OGAN KOMERING ULU REGENCY IN 2018. SPIRAKEL, 12(2), 69–78. https://doi.org/10.22435/spirakel.v12i2.3168

MUBARAQ, H. (2023). SPATIAL MODELING OF WHITE-FORGED LUNANG (Presbytis frontata) HABITAT PREFERENCES AROUND THE COAL MINING AREA OF PT. ARUTMIN SITE SENAKIN.

Noor, Y., Gunawan, CI, Santosa, DTB, & Arvianti, DEY (2023). SWAMP LAND AND COMMUNITY SOCIO-ECONOMIC EMPOWERMENT.

Nuryani, A., Suhardiman, A., Boer, C., Suba, RB, Sulistioadi, YB, & Rayadin, Y. (2024). Study of the Use of Maximum Entropy for Modeling Habitat Suitability of Proboscis Monkeys (Naslais larvatus wurmb, 1787) in the Teluk Adang Nature Reserve Area. Journal of Environmental Science, 22(5), 1174–1183. https://doi.org/10.14710/jil.22.5.1174-1183

Phillips, S. J., Anderson, R. P., & Schapire, R. E. (2006). Maximum entropy modeling of species geographic distributions. Ecological Modelling, 190(3), 231–259. https://doi.org/10.1016/j.ecolmodel.2005.03.026

Phillips, S. J., Dudík, M., & Schapire, R. E. (2004). A maximum entropy approach to species distribution modeling. Twenty-First International Conference on Machine Learning - ICML '04, 83. https://doi.org/10.1145/1015330.1015412

Suwarto, S., Prasetyo, L. B., & Kartono, A. P. (2016). Habitat suitability for Proboscis Monkey (Nasalis larvatus Wurmb, 1781) in the mangrove forest of Kutai National Park, East Kalimantan. International Journal of Bonorowo Wetlands, 6(1), 12–25. https://doi.org/10.13057/bonorowo/w060102

Zainuddin, H. (2016). BKSDA Akui Populasi Bekantan Turun Drastis. ANTARA News Kalimantan Selatan. https://kalsel.antaranews.com/berita/38688/bksda-akui-populasi-bekantan-turun-drastis

Zurell, D., Franklin, J., König, C., Bouchet, P. J., Dormann, C. F., Elith, J., Fandos, G., Feng, X., Guillera-Arroita, G., Guisan, A., Lahoz-Monfort, J. J., Leitão, P. J., Park, D. S., Peterson, A. T., Rapacciuolo, G., Schmatz, D. R., Schröder, B., Serra-Diaz, J. M., Thuiller, W., … Merow, C. (2020). A standard protocol for reporting species distribution models. Ecography, 43(9), 1261–1277. https://doi.org/10.1111/ecog.04960