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The habitat suitability modelling of dare monkey (*Macaca maura*) in Bantimurung Bulusaraung National Park, South Sulawesi

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Abstract. *Sulawesi Island is the center of the Wallacea area, which has high biodiversity and is inhabited by several endemic plant and animal species, one of which is the dare monkey* (Macaca maura) *which is included in the category of endangered species due to the decline in habitat quality caused by shifting forest functions to other uses, competition feed between animals and rampant poaching due to being an agricultural pest are the reasons for the decline in the dare monkey population. This study aims to analyze habitat suitability and the effect of environmental variables on the habitat of dare monkeys in Bantimurung Bulusaraung National Park. The results of the study are expected to provide an overview of the planning of the Babul National Park area in preparing a priority scale for area management, especially those related to dare monkey conservation. The research was conducted through the development of a species distribution model using Maxent ver 3.4.4. The results show that the AUC value of the model is 0,887 with a standard deviation of ± 0.019 which is a feasible prediction model with a suitable habitat area of 247.34 km^2 (36.5%) and 429.52 km^2 (63.5%). The suitable habitat area is divided into low suitability class 113.13 km^2 (46%), moderate suitability class 81.8 km^2 (33%), and high suitability class 52.41 km^2 (21%). While the environmental variables that most influence the presence of dare monkeys are land cover (36%), distance from the highway (33.3%), distance from rivers (11.5%), and distance from agricultural areas (10.4%).*

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INTRODUCTION

Sulawesi Island is the center of the Wallacea region, which has high biodiversity and is inhabited by several endemic plant and animal species, both flora and fauna. According to Lee et al. (2007), between 25% and 47% of all mammals, birds, amphibians, and reptiles living on the island of Sulawesi are endemic, one of which is the dare monkey (*Macaca maura* HR Schinz 1825). Based on Indonesian government regulations, the dare monkey is one of the protected species based on the Minister of Environment and Forestry Regulation No. P.20 of 2018 Concerning Protected Plant and Animal Species. While according to the IUCN (International Union for Conservation of Nature), in 2020 dare monkeys were categorized into Endangered (EN) species (Riley et al. 2020).

From 1983 to 1994 the estimated population of dare monkeys decreased from 56,000 individuals to under 10,000 (Evans et al. 2001). One of them is caused by forest destruction, which causes this animal to lose its habitat from 23,000 km^2 to 2,800 $km^{2,}$ and the area of conservation area that is still effective for dare monkeys is only about 9.000 ha (Supriatna and Wahyono 2000). In addition, habitat conditions that continue to decline are also caused by several factors, including the shift in the function of forest areas to other uses, competition for feed with different animals and illegal hunting by the community because they are agricultural pests (Labahi 2010).

The size of the area and consideration of the complexity of the problems in the Bantimurung Bulusaraung National Park (Babul National Park), which has an area of 43,750 hectares, requires a thorough study of the function of the area as a habitat for dare monkeys. This study aims to analyze how the habitat suitability and the influence of environmental variables on the dare monkey habitat are carried out through the development of a species distribution approach model with the Maxent ver 3.4.4 application. Maxent can help analyze habitat suitability models on a wide scale by processing data on the presence of species and environmental variables that are thought to affect the presence of these species so that the spatial distribution of species can be mapped (Rahman et al. 2017). The results of the study of habitat suitability models for dare monkeys, area managers can use the results of the analysis as consideration for setting priorities in area management, especially those related to the conservation of dare monkeys (*Macaca maura* HR Schinz 1825).

METHOD

Research Location and Time

The research implementation and data collection related to the suitability of dare monkey habitat lasted for two months, from April to May 2021. The research was carried out in 5 different locations in the Bantimurung Bulusaraung National Park (Babul National Park) area of South Sulawesi Province. Research locations are presented in Figure 1.

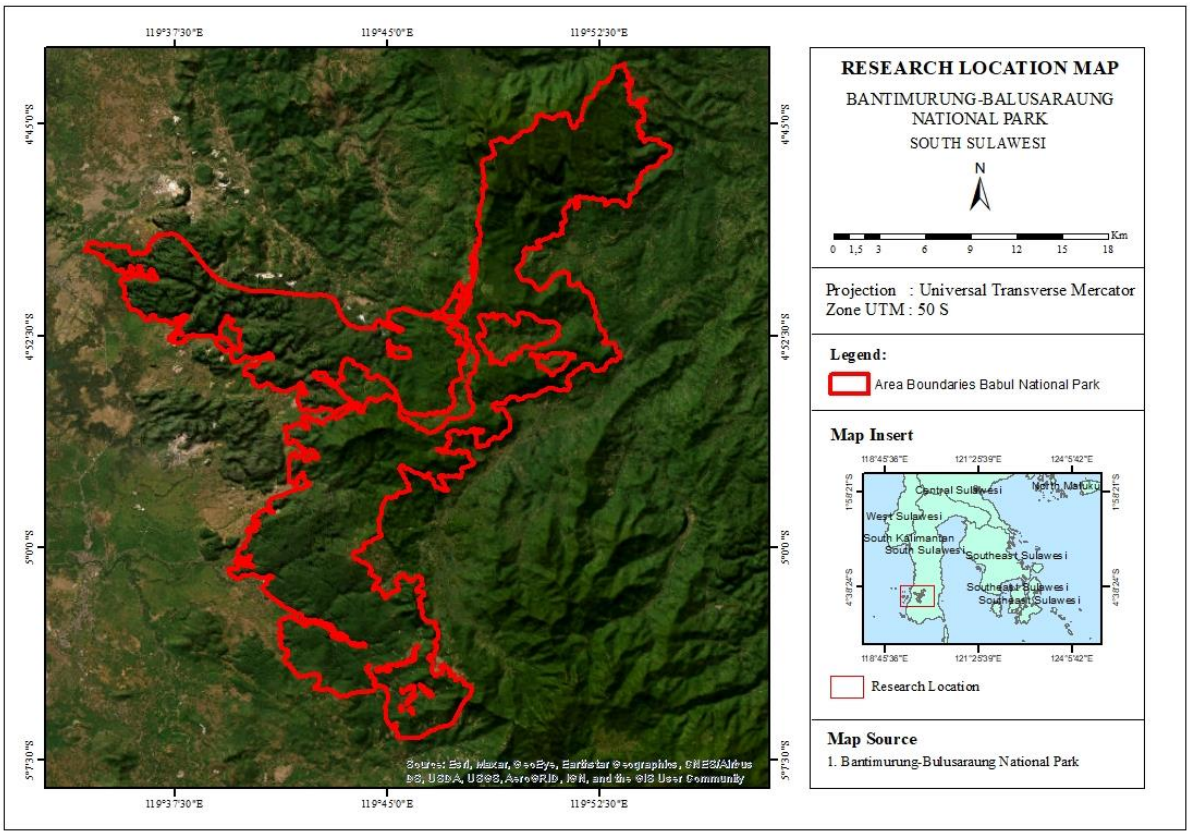

Figure 1 Research site map

Method of Collecting Data

Data processing related to the habitat suitability model for dare monkeys was analyzed from data on encounter points and environmental variables that affect the presence of animals. The results of research and observation obtained data related to the number of meeting points, as many as 191 points, consisting of 139 points obtained from comments on all paths and 52 points obtained from the Babul National Park management. While the environmental variables used are 8 variables in the form of land cover, altitude, slope, temperature, distance from the river, distance from the road, distance from the river, distance from settlements, and distance from agricultural areas.

The distribution of dare monkeys was determined by plotting the data of the identification coordinates of the dare monkeys obtained in the field on the Babul National Park map using ArcMap 10.6 software. The coordinate point data that has been obtained produces a map of the distribution of animals at each research location. Data is converted into Comma Separated Values (CSV) format using Microsoft Excel as input species in maxent.

Processing of habitat suitability data by correcting Landsat 8 OLI satellite image data downloaded at *Earthexplorer.usgs.gov* processing carried out in the form of geometric correction, topographic correction, and identification of land cover using guided classification. The results of the classification are tested for accuracy by looking at the overall accuracy value. Map analysis was carried out on the RBI Map (*Rupa Bumi Indonesia*), which was downloaded at *Tanahair.indonesia.go.id* to get a map of roads, river distribution, settlements, and agricultural areas. The data collected is divided into three districts that are included in the Babul National Park area, namely Maros, Pangkep, and Bone districts. Then calculate the Euclidean distance of roads, rivers, settlements, and agricultural areas as data on the distance to water sources and the distance to human disturbances (roads, settlements, and agricultural areas). DEM data is downloaded from the *portal.opentopography.org* website, which covers the entire Babul National Park area. The next process is geometric correction with datum equations and spatial references; resampling is also carried out to equalize spatial resolution. After this process, DEM data with a resolution of 30 m was obtained for further slope, elevation, and temperature data.

Data processing through the maxent application is carried out by entering the coordinates of the presence of animals in Comma Separated Value (CSV) format and environmental variable data in ascii (asc) format. Further settings are made on the main, *basic*, and *advanced*. Settings in the main menu by changing the *categorical* format on land cover and slope variables as well as *continuous* format on other variables. Then check *auto features*, *create response curves*, *do jackknife* to measure variable importance and output format in *logistic* form.

Settings on the basic menu, all options are checked except *skip if output exists* and *write clamp grid when projecting*. The value on the *random test percentage* is 25%, with the number of *replicates* 15 and the *run type subsample*. The subsample selection aims to divide the existing data into two, namely, training and testing for validation tests. While in the *advanced* menu, the tick on *write output grids is* removed, *maximum iteration* is 5,000.

Data Analysis

The distribution of each primate species in the study area was identified during population observations along the transect with an average length of 1 km. Every encounter with each primate species was recorded using GPS coordinates, to be mapped using ArcGIS software. Based on the mapped coordinates, the distribution of the primate population in the study area is obtained. Furthermore, data analysis was carried out descriptively.

The modeling of the habitat suitability map is carried out through an algorithm-based maxent application that allows calculating the level of habitat preference using data on variables and species presence. Multicollinearity analysis was carried out to avoid correlated variables. The large number of correlated

variables resulted in excess parameters that affected the ability of the application to predict (Morueta-Holme et al. 2010). Multicollinearity analysis was performed using Band Collection Statistics analysis on the spatial analysis tool in ArcMap software.

The habitat suitability model was validated by looking at the AUC (Area Under Curve) value which is the standard method for identifying the prediction accuracy of distribution models (Lobo et al. 2008). The model will be accepted if it has an AUC value exceeding > 0.5, it indicates that the distribution of the species has overlapped with the environmental variables (Fielding and Bell 1997). AUC values that exceed > 0.5 are grouped into three, namely: poor predictions (0.5 - 0.7), reasonable predictions (0.7 - 0.9), and very good predictions (> 0.9) (Peterson et al. 2011). The results obtained through maxent modeling were analyzed by jackniffe analysis, and the percent contribution was then explained descriptively to describe the results obtained. Jackknife analysis can describe the importance and contribution of each environmental variable (Negga 2007).

RESULT AND DISCUSSION

Based on the field survey (ground check) and the population distribution of the dare monkey group using line transect sampling conducted in several areas of Babul National Park in Table 1, there are five paths to observe the distribution of the dare monkeys, namely lanes 1 and 2 in Cenrana, Kab. Maros, Line 3 in Minasatene, Kab. Pangkep and Lines 4 and 5 in Balocci, Kab. Pangkep. In the Babul National Park area, data on the existence of monkey groups have been found with 191 points, including 139 points for the number of observation points and 52 points obtained from the manager of the Babul National Park area. Regarding the general location for observing dare monkeys, an average path length of 1.4 km was obtained with different population distributions per group.

Table 1 Distribution of dare monkeys on the track in Bantimurung Bulusaraung National Park

Track	Number of individuals in group	Track length /Km	Location	The number of points
1	± 40	1.5 km	Cenrana, Maros	33
2	± 38	1.2 km	Cenrana, Maros	36
3	± 34	1.6 km	Minasatene, Pangkep	26
4	± 26	1.3 km	Balocci, Pangkep	17
5	± 37	1.3 km	Balocci, Pangkep	27

Animal Distribution Factors

Physical Factors:

1. **Land cover.** The overlay of the coordinates of the distribution of animals on land cover in the study area shows that the distribution of encounter points with dare monkeys only occupies primary dryland forest (90%) with 172 encounter points and secondary dryland forest (10%) with 19 points.
2. **Distance from the river.** The results of the overlay of the coordinates of the distribution of animals with five distance classes from the river show that the encounter points of dare monkeys are only at three different distance classes, namely 0 - 50 m (45%) with 86 encounter points, 50 - 250 m (53%) with 101 points and 250 - 500 m (2%) with 4 encounter points. The distribution of animal encounter points from the river was primarily found in the 50 - 250 m distance class.
3. **Altitude.** Based on the distribution of animal encounters in the Babul National Park area, it was found that more were found at an altitude class of 300 - 600 meters above sea level. Based on the results of the overlay of the coordinates of the distribution of animals with five altitude classes with an interval of 300 m, it shows that the meeting points of dare monkeys are at four different altitude classes, namely 0 - 300 masl (17%) with 33 encounters, 300 - 600 masl (51%) with 98 points, 600 - 900 masl (18%) with 34 points and 900 -

1.200 masl (14%) with 26 encounter points. Based on the distribution of animal encounters in the Babul National Park area, it was found that most of them were at an altitude class of 300 - 600 meters above sea level.

4. **Slope.** Based on the results of the overlay of the coordinates of the distribution of animals with five slope classes in the Babul National Park area, it shows that the meeting points of dare monkeys are in all slope classes, namely in class 0 - 8% (21%) with 41 encounters, 8 - 15% (25%) with 47 points, 15 - 25% (32%) with 62 points, 25 - 45% (20%) with 38 points and > 45% (2%) with 3 encounter points. Based on the distribution of encounters with animals in the Babul National Park area, most of them are found on the 15 - 25% slope class, which tends to be rather steep.
5. **Temperature.** Based on the results of the overlay of the coordinates of the distributions of animals with five temperature classes with 5 ^{o}C intervals in the Babul National Park, it shows that the dare monkey encounter points are only in three classes, namely 14 - 19 ^{o}C (2%) with 3 encounters, 19 - 24 ^{o}C (53%) with 101 points and 24 - 29 ^{o}C (46%) with 87 encounter points. Based on the distribution of encounters with animals in Babul National Park, most were found in the temperature class between 19 - 24 ^{o}C.

Proxies to anthropogenic Disturbance Factors :

1. **Distance from road.** Based on the results of overlaying the coordinates of animal distribution points with five distance classes from the road in the Babul National Park area, it shows that the dare monkey encounter points are only in four categories, namely < 500 m (2%) with the number of animal encounters as many as 3 points, 500 - 1,000 m (46%) with 88 points, 1,000 - 1,500 m (26%) with 49 points, and 1,500 - 2,000 m (27%) with 51 points. Distribution of encounters with animals is mostly found at distance classes between 500 - 1,000 m.
2. **Distance from settlement.** Based on the results of overlaying the coordinates of the distribution of animals with five distance classes from the settlement, it shows that the meeting points of dare monkeys are in each class, namely < 500 m (1%) with a total of 2 animal encounters, 500 – 1,000 m (28%) with 54 points, 1,000 - 1,500 m (21%) with 41 points, 1,500 - 2,000 m (17%) with 32 points and > 2,000 m (32%) with 62 points. The results of the distribution of animal encounter points in Babul National Park found that many are located at a distance of > 2,000 m.
3. **Distance from agricultural area.** Based on the results of the overlay of the coordinates of the distribution of animals with five distance classes from the agricultural area in the Babul National Park, it shows that the meeting points of the dare monkeys are in each different class, namely < 500 m (29%) with a total of 56 animal encounters, 500 - 1,000 m (15%) with 29 points, 1,000 - 1,500 m (40%) with 77 points, 1,500 - 2,000 m (3%) with 5 points and > 2,000 m (13%) with 24 points. The results of the distribution of animal encounter points in Babul National Park, most of them are at a distance of 1,000 – 1,500 m.

Habitat Suitability Model

Multicollinearity Analysis

The multicollinearity analysis results in Table 2 show that there is a correlation between layers 1 and 3 of 0.84184 and layers 6 and 8 of –0.83793. Processing of environmental variable data in running the habitat suitability model does not use layers 3 and 8, namely the variables of distance from settlements and temperature. The choice of the variable distance from the road is because the road is an environmental variable that is thoroughly spread out and has direct access to the area. Meanwhile, the selection of the altitude variable due to the high and low topography of the region will determine the higher and lower the temperature in the region. So that in processing the habitat suitability model data through the Maxent application, only six variables are used.

Table 2 Multicollinearity analysis results

Layer	1	2	3	4	5	6	7	8
1	1.00000	–0.02556	0.84184	0.45933	0.07323	0.56640	0.17197	–0.56888
2	–0.02556	1.00000	–0.03276	–0.05452	–0.11360	–0.02350	–0.00483	0.08204
3	0.84184	–0.03276	1.00000	0.36470	0.11365	0.42848	0.14711	–0.41910
4	0.45933	–0.05452	0.36470	1.00000	0.20737	0.51700	0.14139	–0.51904
5	0.07323	–0.11360	0.11365	0.20737	1.00000	0.18254	0.13358	–0.31069
6	0.56640	–0.02350	0.42848	0.51700	0.18254	1.00000	0.12979	–0.83793
7	0.17197	–0.00483	0.14711	0.14139	0.13358	0.12979	1.00000	–0.29189
8	–0.56888	0.08204	–0.41910	–0.51904	–0.31069	–0.83793	–0.29189	1.00000

Description: Layer 1= distance from the road; layer 2= distance from river; layer 3= distance from settlement; layer 4= distance from agricultural area; layer 5= land cover; layer 6= elevation; layer 7= slope; layer 8= temperature. (Note: the red color in the table indicates a correlation between variables)

Model Validation

The results of data analysis of animal encounter points with environmental variables in the study area through the Maxent application in Figure 2 show the AUC (Area Under Curve) value on the ROC (receiver operating characteristic) graph for the dare monkey habitat suitability model of 0.887 with a standard deviation of 0.019. Based on the results of model validation shows that the model can be said to be a reasonable prediction with values between 0.7 - 0.9.

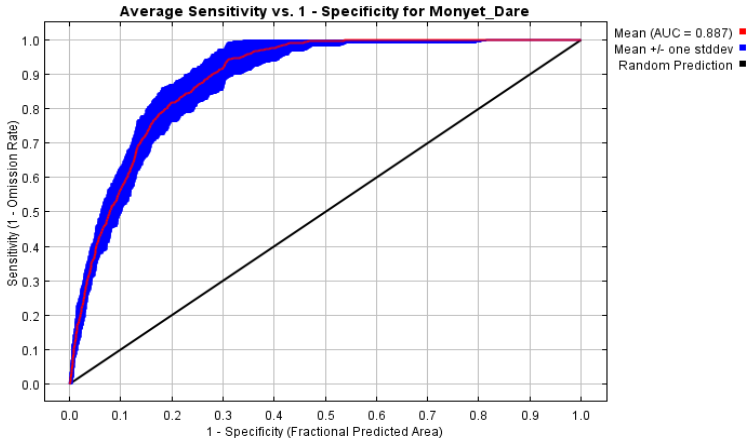

Figure 2 The mean value of AUC (Area Under Curve) in the dare monkey habitat suitability model

Habitat Suitability Model Results

Determination of the habitat suitability model for dare monkeys using the highest and lowest values of the 10th percentile training presence logistic threshold in the MaxentResults.csv file. The lowest value limit used is 0.2813, which is the result of maxent processing. Values less than 0.2813 are classified as areas that are not suitable for dare monkey habitat, and values above 0.2813 are classified as suitable habitats. Furthermore, values greater than the lowest value for habitat suitability limits are divided into 3 classes using the provisions of the equation from Supranto (2000).

The calculation result of suitable habitat area for dare monkeys is 247.34 km^2 (36.5%), while the unsuitable habitat is 429.52 km^2 (63.5%) which can be seen in Figure 3. The suitable habitat area is divided into three categories, namely low, medium, and high class. The habitat area of dare monkeys in Table 3 shows that the low suitability class is 113.13 km^2 (46%) with 21 encounter points, the medium suitability class is 81.8

km^2 (33%) with 55 encounter points, and in the high suitability class, it is 52.41 km^2 (21%) with 115 encounter points.

Table 3 Habitat suitability class of dare monkeys

Suitability Class	Encounter point	Area (km^2)	Percentage (%)
Low	21	113.13	46
Medium	55	81.80	33
High	115	52.41	21
Total	191	138.43	100

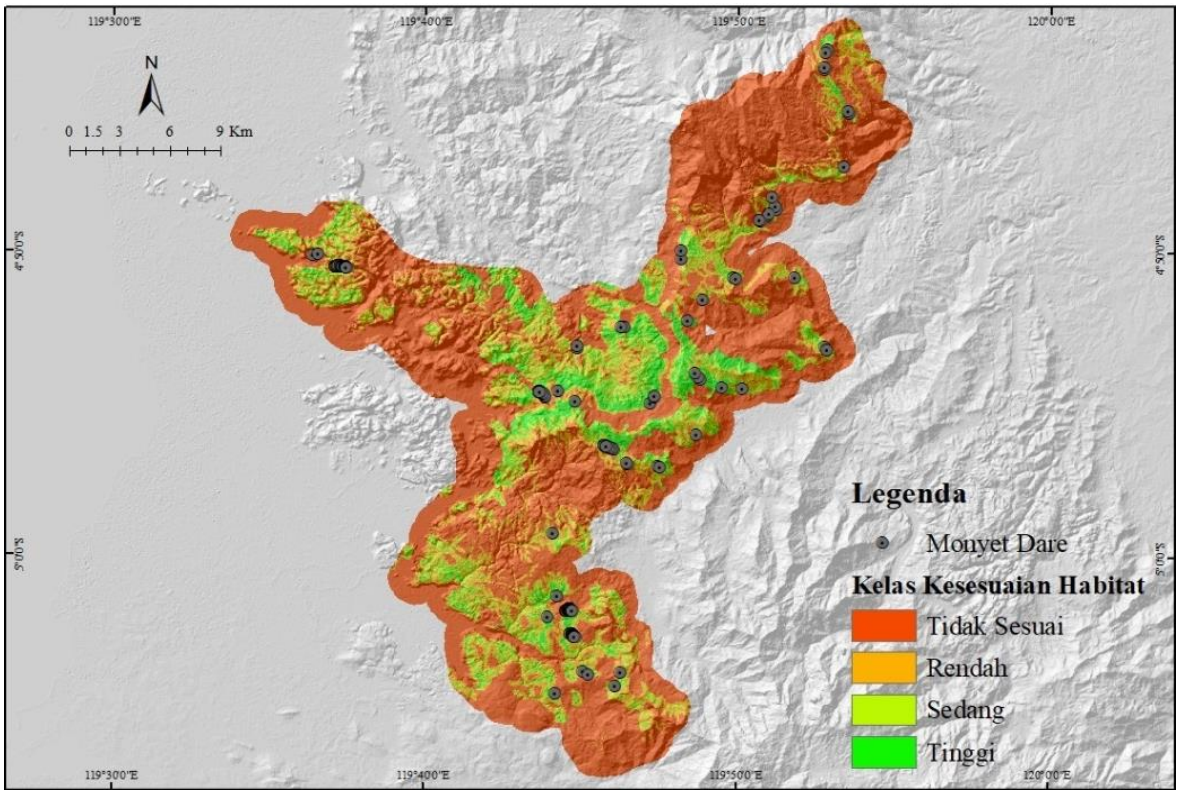

Figure 3 Map of dare monkey distribution in habitat suitability class

Contribution of Environmental Variables

The effect of environmental variables that have the most significant percentage contribution is land cover (36%), distance from roads (33.3%), distance from rivers (11.5%) and distance from agricultural areas (10.4%) which can be seen in Table 4. While the results of the jackknife analysis on the variables that affect the model results also show that the variables that have the highest contribution are the land cover variable (Bio_5) followed by distance from the road (Bio_1), distance from rivers (Bio_2) and distance from agricultural areas (Bio_4).

Table 4 Effect of environmental variables on the habitat suitability of dare monkeys

Environment variables	Contribution percentage	Importance of permutations
Land Cover	36	35.2
Distance from road	33.3	36.5
Distance from river	11.5	13.8
Distance from agricultural area	10.4	8.1
Slope	5.3	2.7
Elevation	3.5	3.6

Environmental Variable Response Curve

The response curve describes the probability of encountering an animal from 0 - 1, a value < 0.5 indicates no encounter with an animal, and > 0.5 suggests an encounter with an animal. The closer to 1, the chance of encountering an animal will be higher (Phillips et al. 2006). The results of the analysis show that land cover has the highest contribution value to the prediction model. The response curve on the land cover shows the presence of animals that can be found only in primary and secondary forests. The response curve of the distance from the road to the encounter of dare monkeys shows a distance curve of 0 and a contribution value of 0.1, the response continues to increase up to a distance of 500 m by 0.6, and the response curve decreases drastically to a distance of 3,000 m and so on. These results indicate an increase in encounters with dare monkeys as they get closer to the road.

The results of the response curve for the distance from the river show that monkeys dare at a distance of 0 by 0.7 and the curve slowly decreases drastically at a distance of 1,000 m by 0.1. The response curve results show that there is an increase in encounters with dare monkeys as they get closer to the river and gradually decrease as they move away from the river. The results of the response curve for the distance from the farm show that monkeys dare at a distance of 0, the contribution value of 0.2 increases at a distance of 100 m by 0.5 and drastically increases slowly starting from a distance of 2,000 m onwards. These results indicate that there is an increase in encounters with dare monkeys the further away from the agricultural area.

Distribution of Animals in Environmental Variables

Physical factor

The relationship between animal distribution and land cover in Babul National Park shows that the presence of dare monkeys is only found in primary and secondary forest cover. According to Francés et al. (2022), primary and secondary forests, namely, forest areas consisting of natural plant species, are forest types suitable for dare monkeys. Suitable habitat for dare monkeys when forest cover > 50% per km^2. This is necessary for finding food and shelter (Fotang et al. 2021). According to Matsumura (1991) dare monkeys consume about 61 species of plants, mainly consisting of species from the Family Moraceae which are found in mixed primary and secondary forests in the karst ecosystem of Babul National Park.

The distribution of dare monkeys related to the distance from the river shows that the animal encounter points are mostly found in the 0 - 50 m and 50 - 250 m classes. On the other hand, the farther away from the river, its presence tends to decrease. According to Astriani et al. (2015) vegetation around water sources is relatively more abundant and fertile compared to locations far from water sources, especially the growth of branches and canopy.

The relationship between the distribution of dare monkeys in the Babul National Park area based on the altitude variable shows that the habitats they inhabit tend to be found at an altitude of 300 - 600 meters above sea level. On the other hand, at an altitude above 600 meters above sea level, the presence of animals tends to decrease. According to Francés et al. (2022) the presence of dare monkeys at the individual and group level is mostly found at altitudes below 1,000 masl (2.08 individuals/km; 0.29 groups/km) compared to altitudes above 1,000 masl (1.05 individuals/km; 0.18 groups/km). The influence of slope on the distribution of dare monkeys in Babul National Park tends to be found in almost all slope classes. However, for the class with very steep slopes, their presence tends to decrease. This is because these animals still carry out many activities above ground (semi-terrestrial).

Proxies to Anthropogenic Disturbance Factors

The results of the analysis of the distribution of dare monkeys on environmental variables found that three variables were examined as disturbance factors, namely distance from the road, distance from settlements, and distance from agriculture. The relationship between the distribution of dare monkeys on the variable distance

from the road has the largest contribution percentage after land cover, which is 33.3%. According to Morrow et al. (2019) the dare monkey group in the Karaenta Forest, Kec. Cenrana, Kab. Maros has a range that covers the north and south side of the road and is often seen crossing the road when traveling through the cruise area. In addition, the dare monkey habitat is generally fragmented into small forest patches, and most of them are in the unprotected forest and overlap with Babul National Park (Supriatna et al. 1992; Sagnoti 2013). Based on the relationship between the distance variable from the road and the presence of dare monkeys, it can be found in a distance class of 500 – 1,000 m (46%) with 88 encounter points.

The distribution relationship of dare monkeys on the distance variable from agriculture has a contribution percentage of 10.4% after the distance variable from the road and tends to be found in the 1,000 – 1,500 m (40%) distance class with 77 encounter points. The magnitude of the effect of the variable on habitat suitability for dare monkeys is due to a large number of agricultural activities outside Babul National Park. According to Supriatna et al. (2020), one of the main activities causing an anthropogenic disturbance outside protected areas in Sulawesi is agriculture.

Dare monkey habitat suitability

Habitat suitability modeling was analyzed spatially using Maximum Entropy (MaxEnt) modeling. In addition, to determine the environmental variables used in the maxent process, a multicollinearity analysis was also carried out to avoid correlated variables. In the results of multicollinearity analysis, the independent variables used are land cover, elevation, slope, distance from the river, temperature, distance from the road, and distance from agricultural areas. The dare monkey habitat suitability model was validated using the AUC (Area Under Curve) test. According to Lobo et al. (2008), the value of the AUC test results on the ROC (receiver operating characteristic) graph is considered a standard method to assess the extent to which the accuracy of the model is said to be more predictive. Based on the results of the validation test, the habitat suitability model for dare monkeys can be said to be a reasonable prediction.

The results of the habitat suitability model for dare monkeys in the Babul National Park area are divided into suitable and inappropriate habitat areas. The area of suitable habitat is 247.34 km^2 which is divided into 3 classes, namely low, medium, and high classes. Most of the dare monkey habitats are incompatible and low suitability areas. Meanwhile, only a small part of the area is a habitat with medium and high suitability classes. The low suitability of the dare monkey habitat in the medium and high classes is also due to the Babul National Park area consisting of a karst ecosystem area which limits the movement of dare monkeys (Albani et al. 2020; Supriatna et al. 2020). Based on the results of modeling the suitability of the dare monkey habitat in Babul National Park, it shows that the low level of suitable habitat compared to unsuitable habitat can illustrate that the threat from the presence of dare monkeys is still relatively high.

The results of modeling the suitability of the dare monkey habitat in Babul National Park show that the low number of suitable habitats compared to unsuitable habitats can illustrate that the threat from the presence of these animals is still relatively high. The magnitude of the threat to the existence of the dare monkey population is not only from the low habitat suitability but a large number of changes in the function of the area to other uses, competition for feed with similar and different animals, and illegal hunting by the community for becoming agricultural pests (Labahi 2010). So it is necessary to make collaborative efforts in conserving animals by the parties, both from the government, area managers, farmers, local residents who live around the area, and people who take advantage of direct access to the Babul National Park area by raising awareness of the importance of coexistence between humans and wildlife. In addition, the large number of areas that are deforested and fragmented into small plots of unprotected forest areas outside the Babul National Park that overlap with the dare monkey range, it is also necessary to make efforts to restore habitat to make the area a protected area. Priority in seeking conservation actions for dare monkeys.

CONCLUSION

The AUC value of the dare monkey habitat suitability model is 0.887 with a standard deviation of ± 0.019, which is a reasonable prediction model with a suitable habitat area of 247.34 km^2 (36.5%), and an unsuitable 429.52 km^2 (63.5%). The suitable habitat area is divided into 3, namely low suitability class 113.13 km^2 (46%), moderate suitability class 81.8 km^2 (33%), and high suitability class 52.41 km^2 (21%). Environmental variables that contribute to and influence the presence of dare monkeys are land cover (36%), distance from the road (33.3%), distance from rivers (11.5%), distance from agricultural areas (10.4%), slope (5.3%), and altitude (3.5%).

The low area of suitable habitat compared to non-suitable habitat, as well as the area that has low suitability compared to medium and high, can illustrate that the threat from the presence of dare monkeys is still relatively high. So it is necessary to make habitat restoration efforts to make the area that becomes a habitat area a priority area in the effort to conserve dare monkeys. In addition, it is necessary to make collaborative efforts in conserving animals by the parties, both from the government, area managers, farmers, local residents who live around the area, as well as people who use direct access to the Babul National Park area by raising awareness about the importance of life. Coexistence between humans and wildlife.

It is necessary to increase the number of observation lines in areas that are habitats for dare monkeys, both outside and inside the overlapping area with Babul National Park. Further analysis is needed regarding more specific variables, namely how the karst ecosystem becomes important in building a model for the suitability of the dare monkey habitat

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