

Spreading the Sunshine:

A Suitability and Connectivity Analysis of Sun Bears in Peninsular Malaysia

What are sun bears?

Sun bears (*Helarctos malayanus*) are the smallest and least studied of the eight bear species. Little is know about these bears, including their distributions and population densities, due to their remote habitat and shy nature. Sun bears live in lowland tropical rain-forests in Southeast Asia. They can be identified by the distinctive yellow patch on their chest, which legend says represents the rising sun.



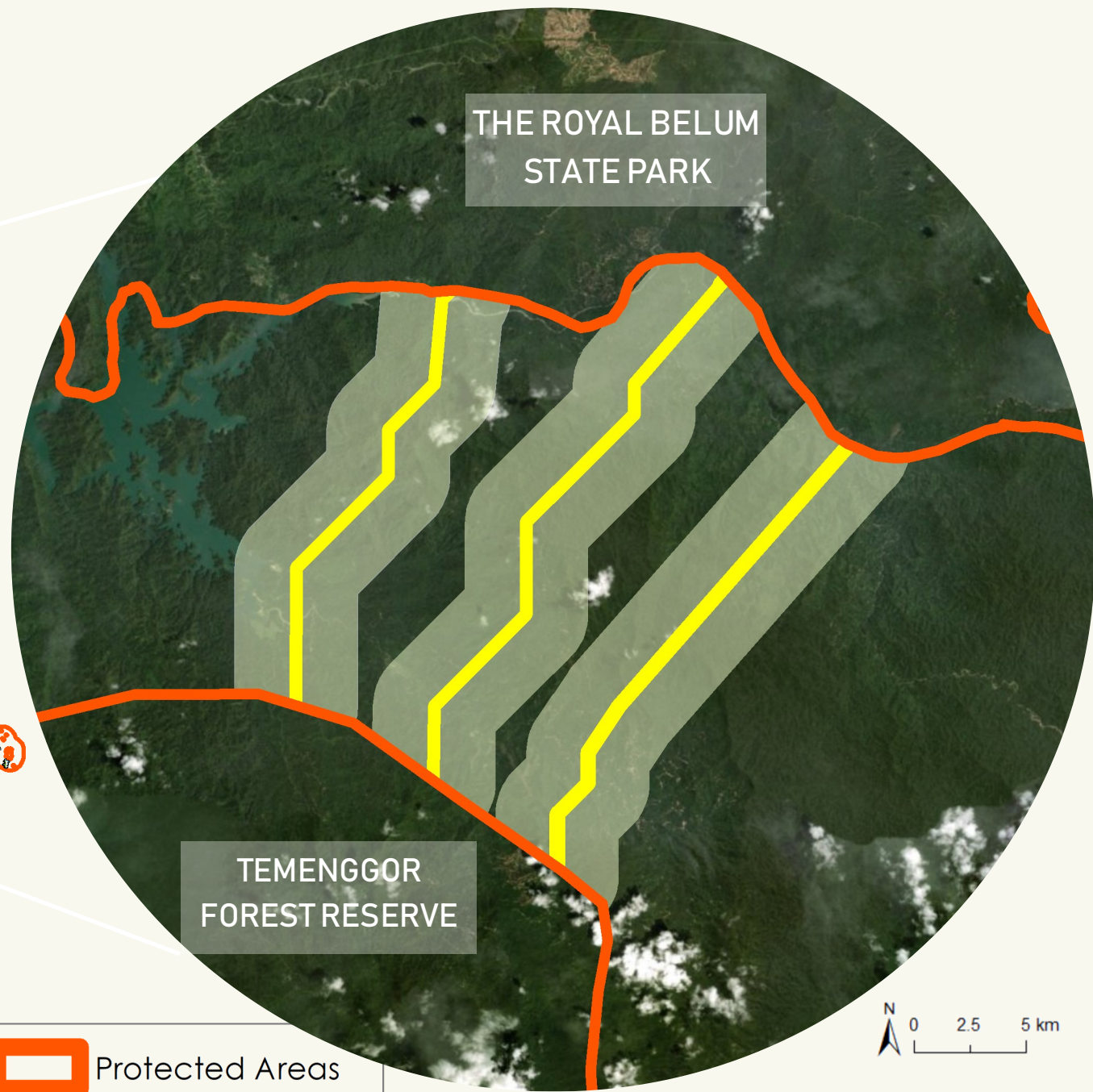
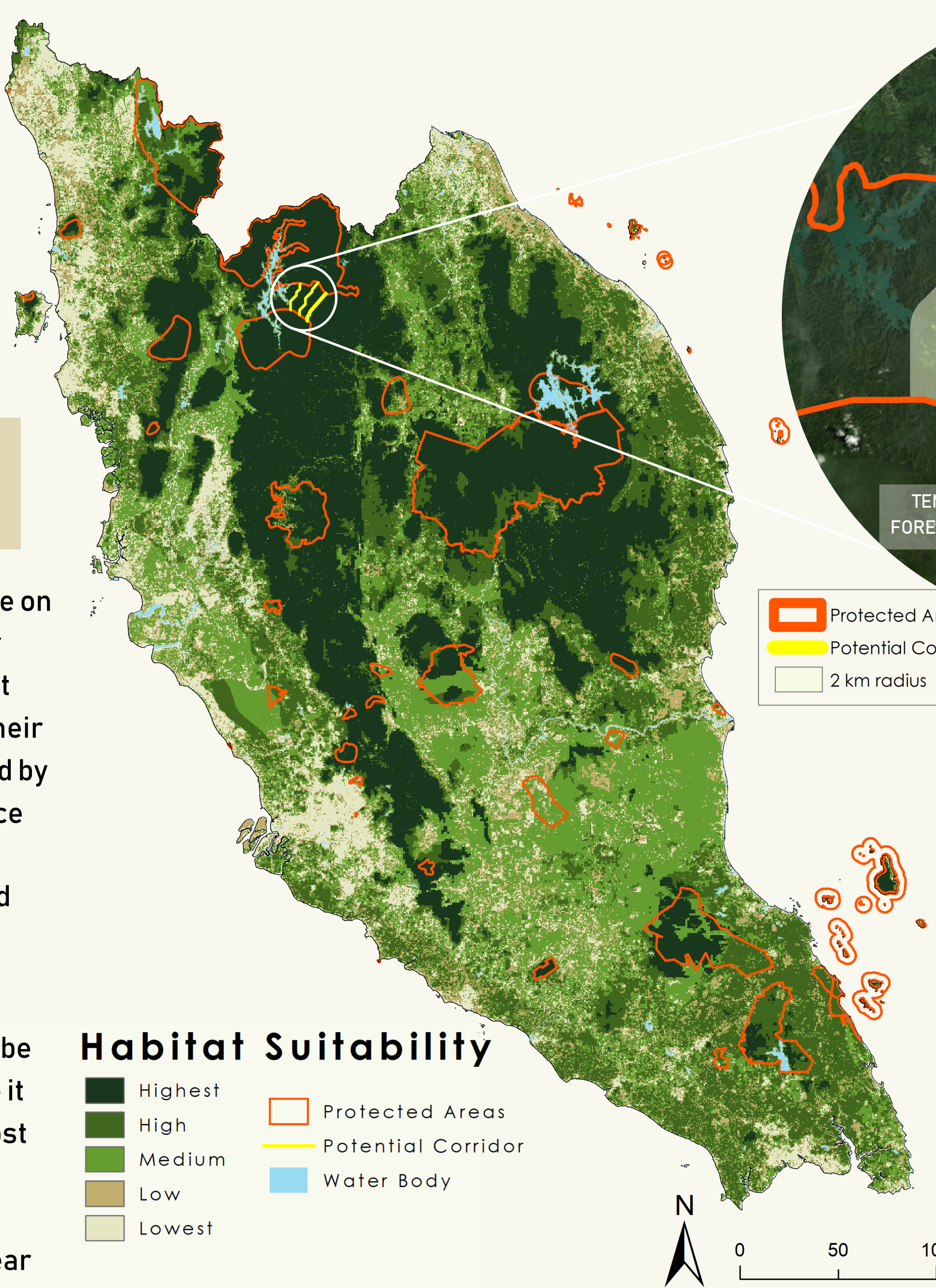
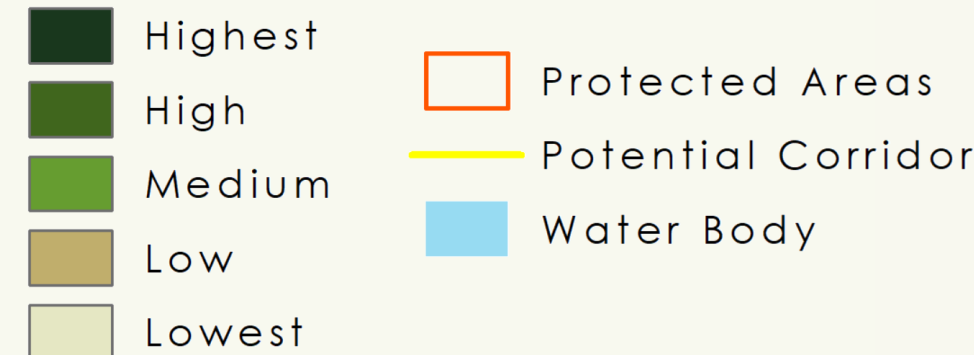
Why do they need protection?

Sun bears are categorized as vulnerable on the IUCN Red List. Historically, sun bear habitat encompassed most of Southeast Asia but is now severely fragmented. Their population is estimated to have declined by at least 30% in the last 30 years. They face threats from deforestation due to the

increase in plantations and illegal logging, as well as poaching.

Sun bear habitat needs to be further protected because it has been reported that most of the current protected areas do not cover the majority of suitable sun bear habitats, which puts those areas at risk for destruction. Adding protection for potential passageways between national parks ensures that the already fragmented habitat does not further degrade.

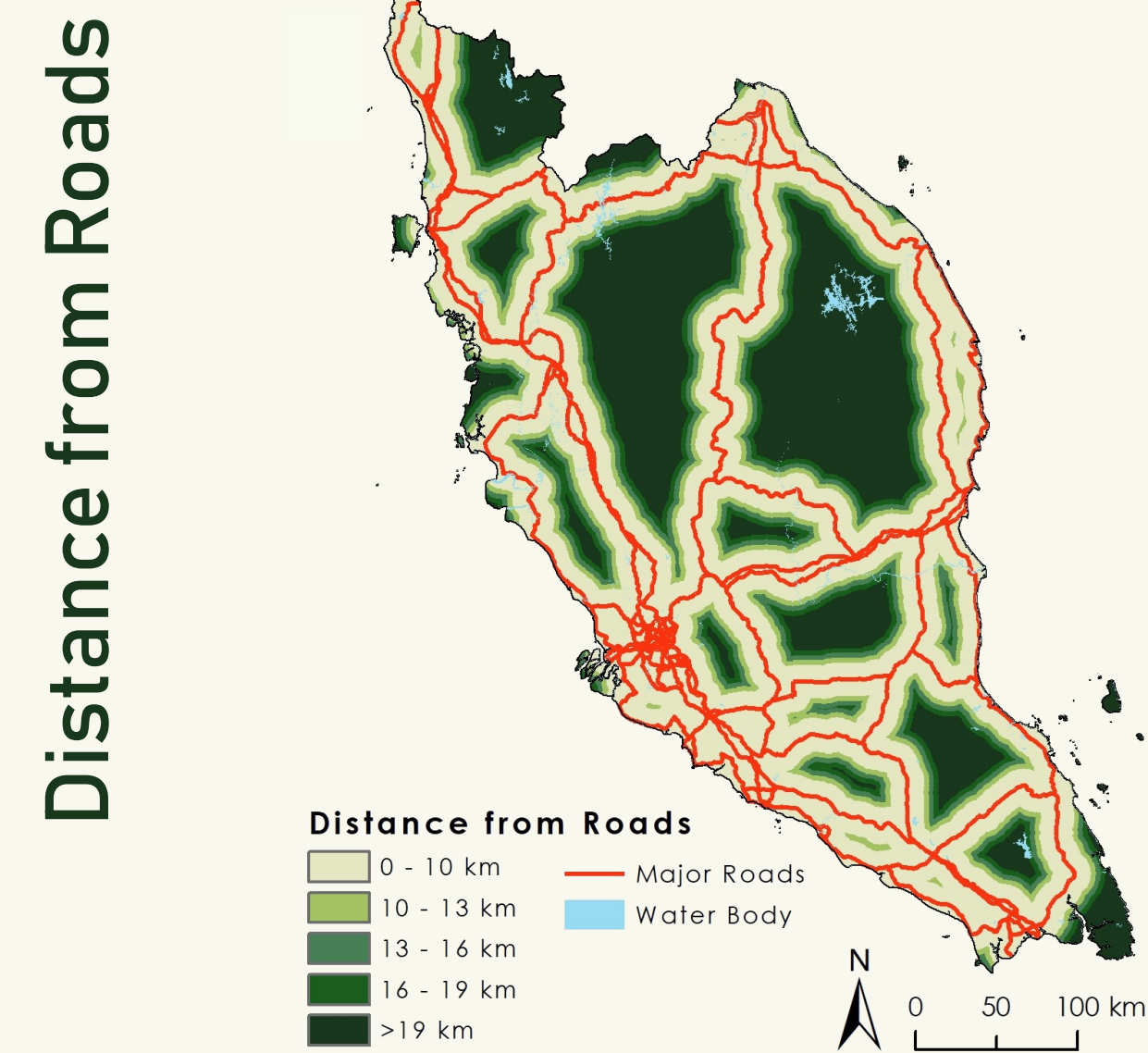
Habitat Suitability



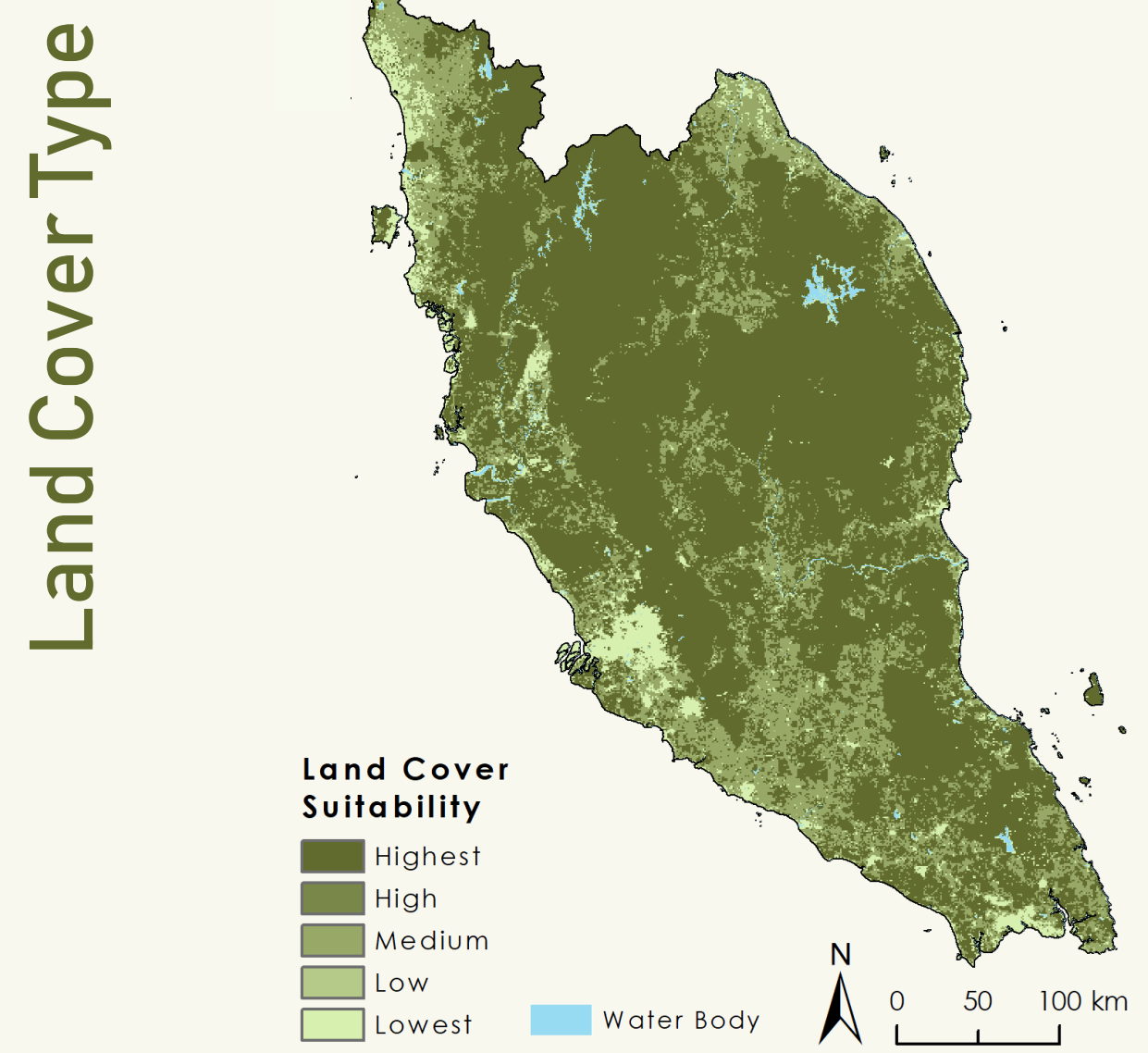
Potential Paths

3 potential corridors were identified between The Royal Belum State Park and Temenggor Forest Reserve ranging between 15.4 km and 20.3 km. These represent the actual paths that would be most suitable for a protected corridor area for sun bear travel between the parks. There is a 2 km buffer on each potential pathway to give the bears enough space to safely travel. 16 km², or 4 x 4 km area is the average size of a male sun bear range. With the 4 km span around the path, bears could safely travel over a number of days.

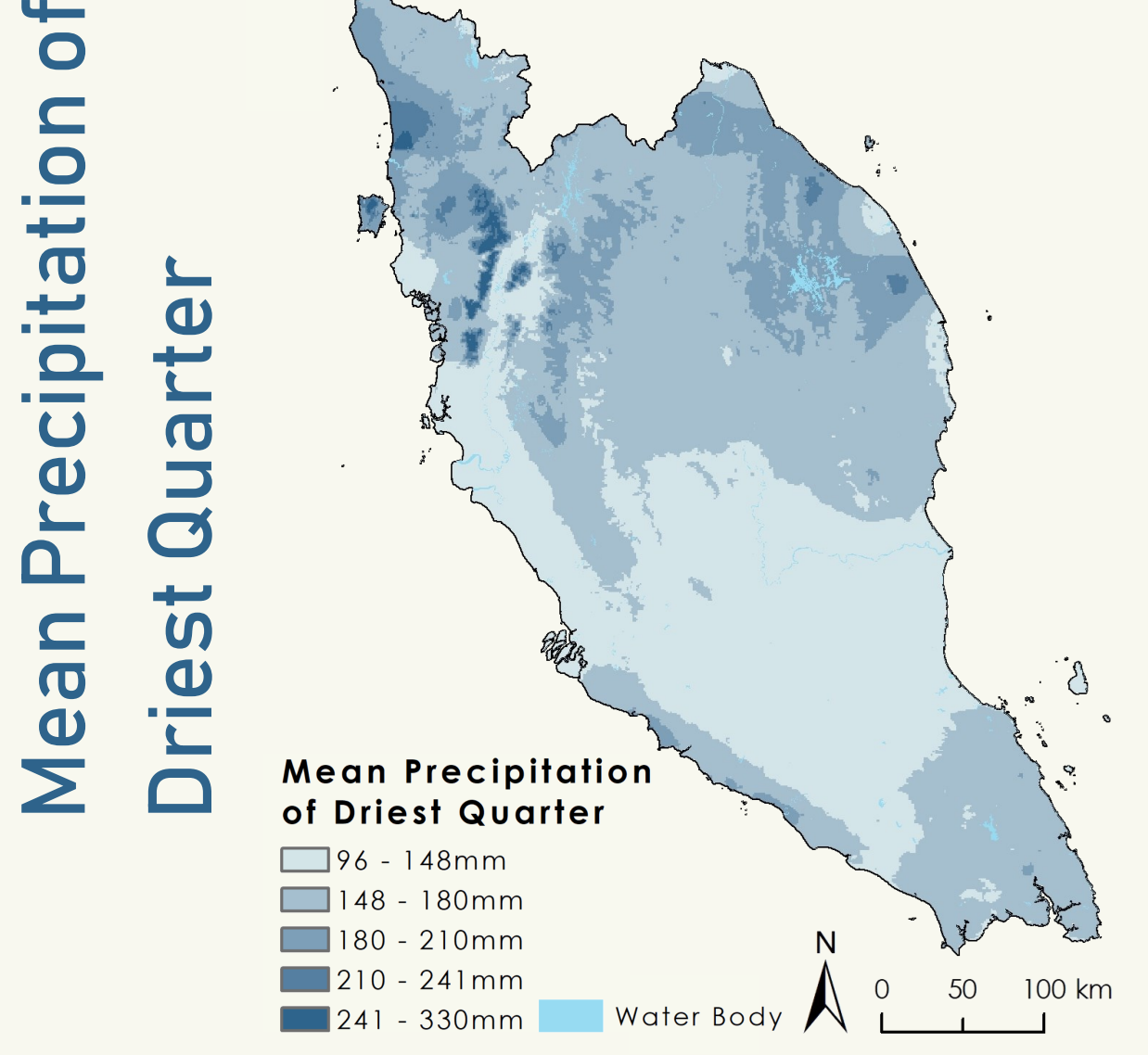
Factors	1 Extremely High Suitability	2 High Suitability	3 Average Suitability	4 Low Suitability	5 Extremely Low Suitability
Distance to Roads	>19 km	16km-19km	13km-16km	10km-13km	0-10 km
Seasonality	10°C-11.85°C	9°C-10°C	8°C-9°C	7°C-8°C	5.6°C-7°C
Mean Annual Temperature	19°C - 26°C	14°C - 19°C	10°C - 14°C	4°C - 10°C	>26°C
Mean Precipitation of Driest Quarter	260-330 mm	210-260 mm	150-210 mm	120-150 mm	96-120 mm
Land Cover	Evergreen Needleleaf Forest Evergreen Broadleaf Forest	Deciduous Needleleaf Forest Deciduous Broadleaf Forest Mixed Forest	Closed Shrublands Open Shrublands Cropland/Natural Vegetation Mosaic	Woody Savannas Savannas	Water Grasslands Permanent Wetlands Croplands Urban & Built-Up Snow & Ice Sparsely Vegetated
Tree Cover	80-100%	60-80%	40-60%	20-40%	0-20%



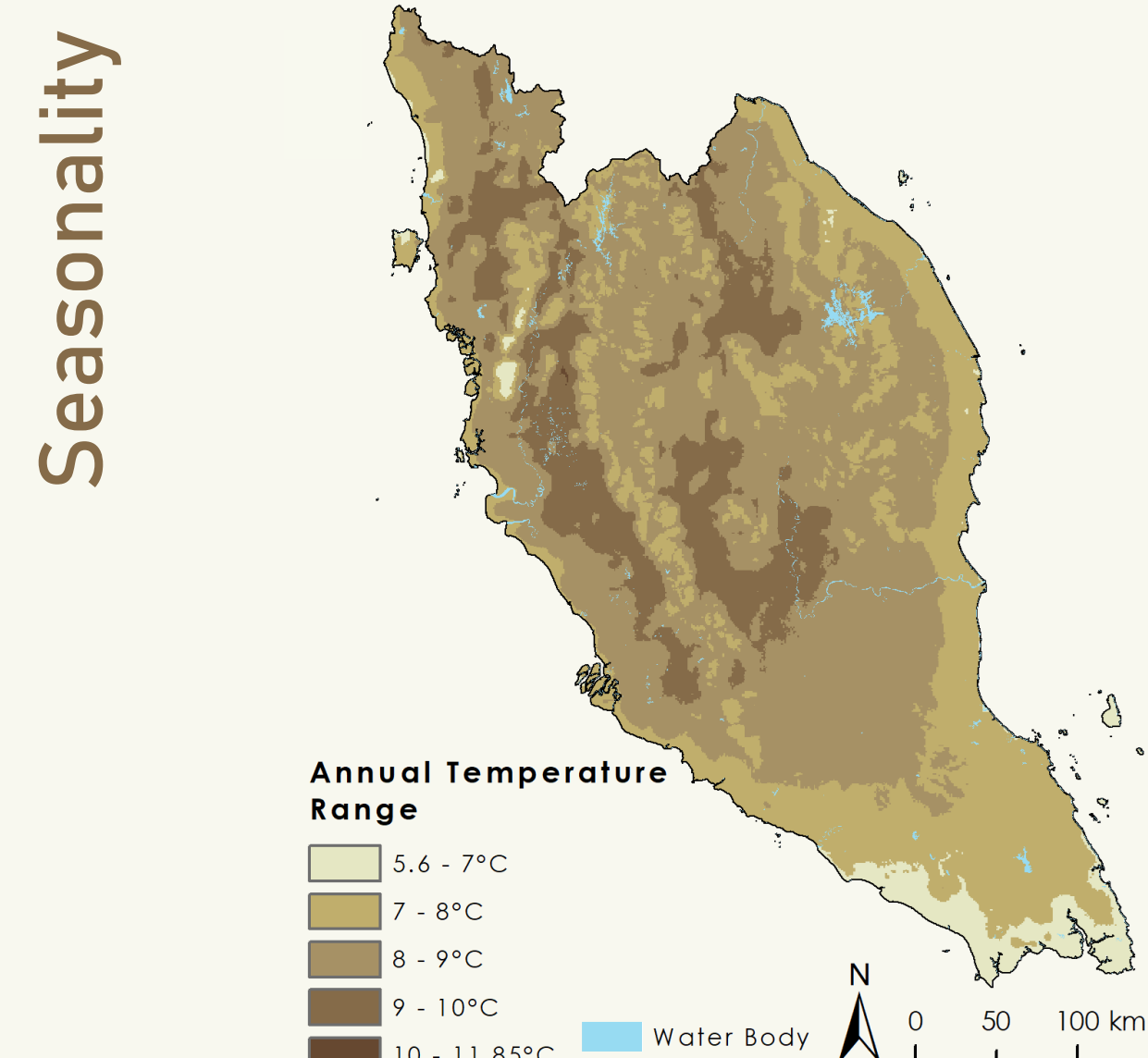
Sun bears have been found to choose habitats preferentially with increasing distance from roads. Euclidean distance was run on major roads dataset. Low suitability was reclassified as <10 km from roads while high suitability was reclassified as >19 km from roads.



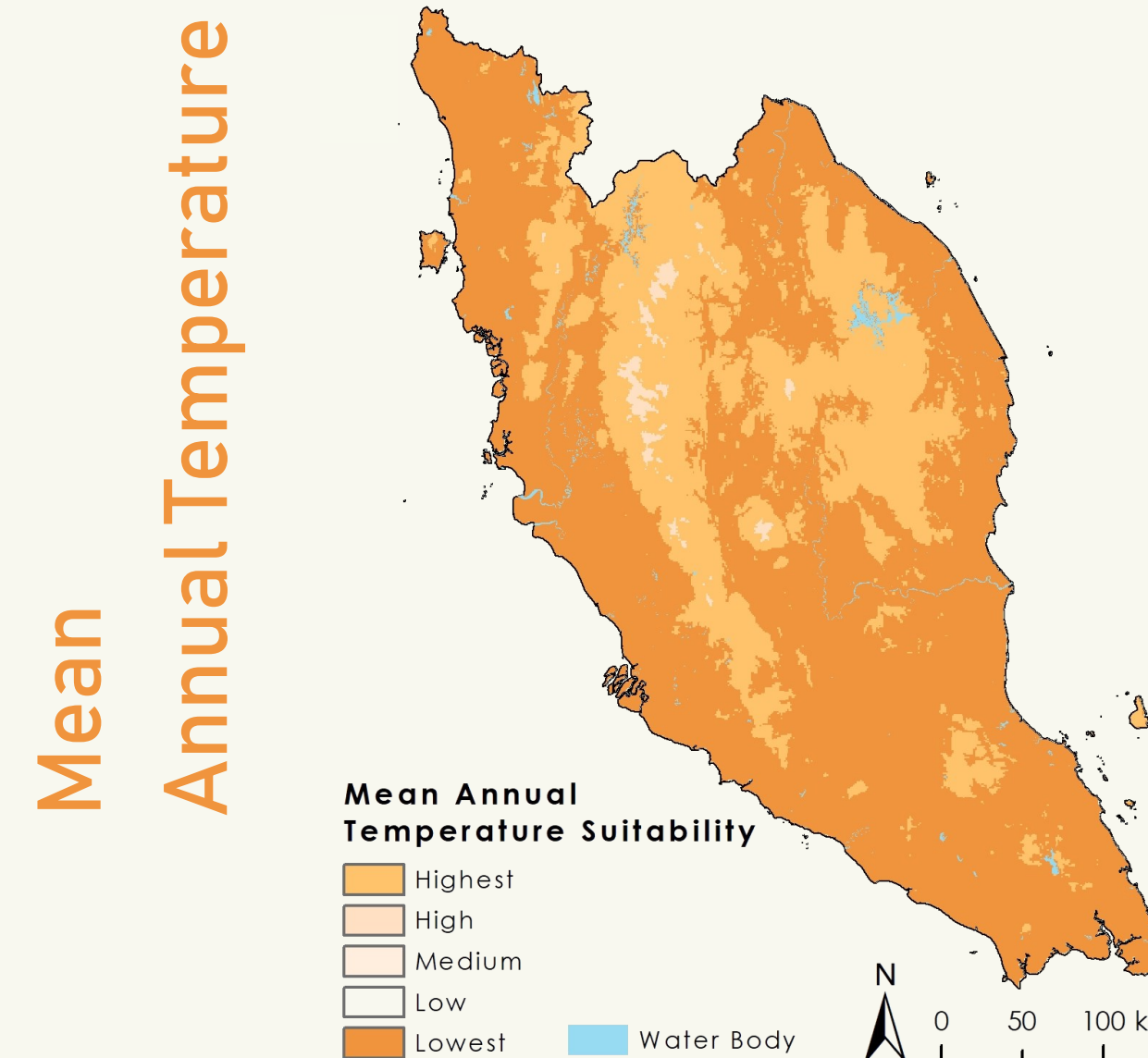
Land cover data was reclassified with the most suitable habitats being evergreen needleleaf and broadleaf forests. The least suitable land types were those with little tree cover such as grasslands, croplands, urban areas, and sparsely vegetated areas.



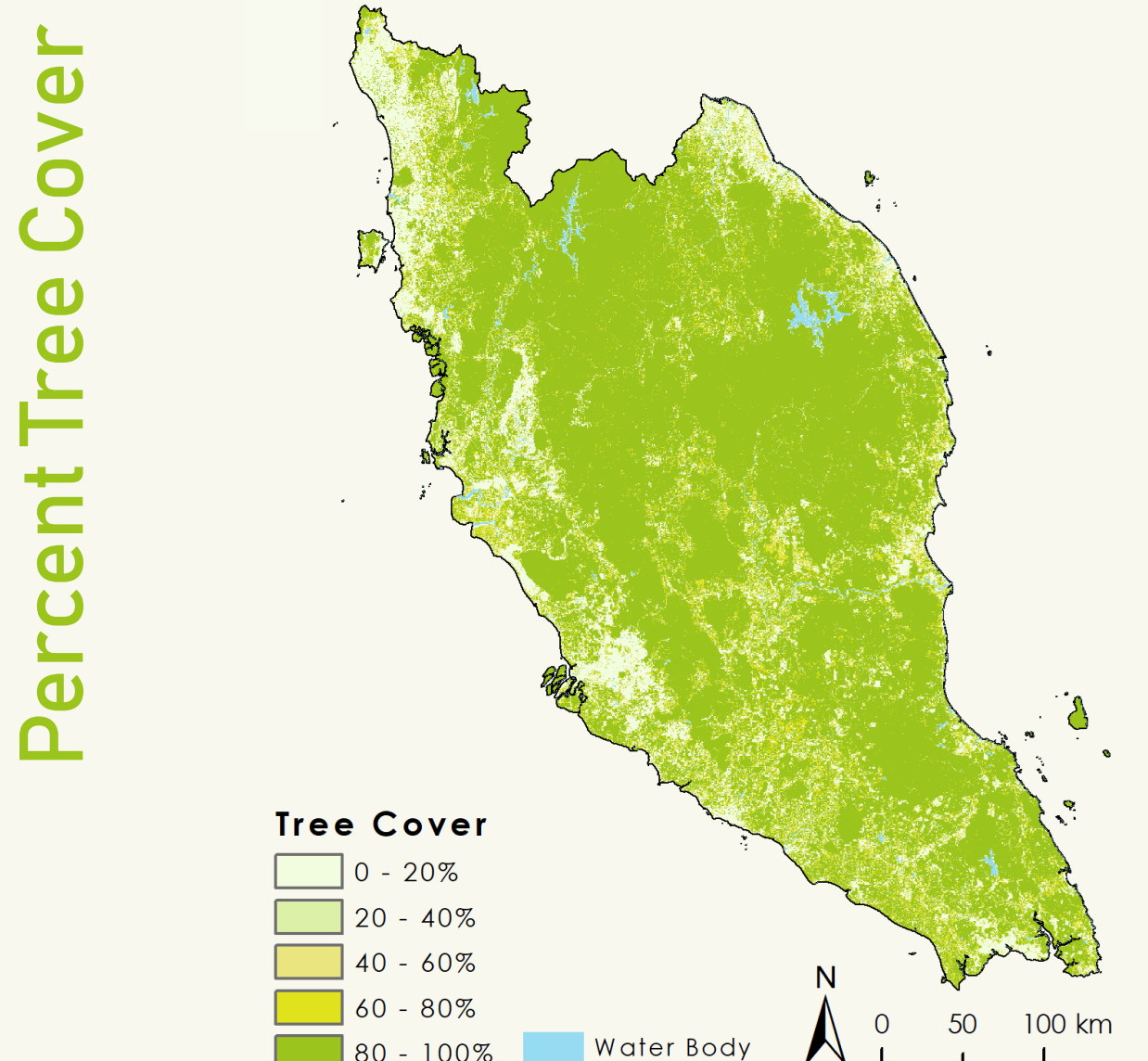
Areas became more suitable for sun bear habitat with increasing precipitation of the driest quarter of the year, or the months of June, July, and August. Mean driest quarter precipitation was reclassified with 96-148 mm being the least suitable and 241-330 mm being the most suitable.



Sun bears prefer areas in Malaysia where it is more seasonal, with temperature fluctuations around 10-12°C throughout the year. Annual temperature range data was reclassified with a 5.6-7°C range being the least suitable and a 10-11.85°C range being the most suitable.



The temperature in Malaysia is hot and humid, averaging around 27°C. Sun bears prefer warmer temperatures until it becomes too hot, around 26°C. Mean annual temperature data was reclassified with 19-26°C being the most suitable and >26°C being the least suitable.



Sun bears prefer to live in areas with dense tree cover and have not been sighted in any areas with less than 20% canopy cover. Tree cover data was reclassified with <20% being the least suitable and >80% being the most suitable.

Methods

1. Suitability Analysis

Calculated by first determining the most important factors for sun bear habitats. All variables were reclassified into 5 categories with 1 being the most suitable and 5 being the least suitable. Variables were weighed by importance for habitat selection using raster calculator (Tree cover-30%, Mean annual temp- 20%, Mean precipitation of driest quarter- 20%, Land cover- 15%, Seasonality- 10%, Distance to roads- 5%). Factors, reclassifications, and weights determined by Nazeri et al. (2012).

2. Least Cost Path Analysis

Used final suitability map to determine most practical area for corridor. Determined by identifying the protected areas closest together connected by highly suitable habitat. Three starting and ending points were then chosen. Cost distance and cost path tools used to calculate paths that travel through areas most suitable according to criteria. Raster then converted to polyline.

Conclusions

The suitability analysis shows that there is a lot of suitable habitat in Malaysia for sun bears so the goal now is preventing its decline. The true distribution of these bears is not well known so a suitability analysis is an informed way to predict actual spread. The corridor analysis aimed to identify the most suitable areas to protect that would connect known protected areas in peninsular Malaysia. Connecting these areas would help preserve declining sun bear populations. Identifying these areas could also help inform wildlife managers of the most beneficial areas to protect.

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Talia Greenblatt
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