

A Preliminary Habitat Suitability Analysis for the Restoration of South China Tigers in Hupingshan Reserve, China

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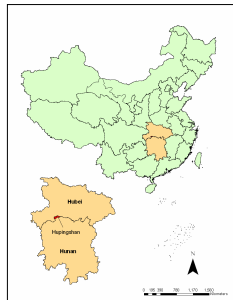


Figure 1. Map of the study area. Hupingshan is located on the border of Hunan and Hubei provinces.

Abstract:

The South China tiger, *Panthera tigris amoyensis*, once roamed the greater part of southern China. However, expanding human populations and other anthropogenic effects have resulted in the extinction of the wild population. The Chinese government has expressed interest in a reintroduction program for this species of tigers. Recent studies suggest that the Hupingshan preserve is potentially a good candidate for a tiger reintroduction program. Hupingshan is located on the border of the Hunan and Hubei provinces in Southern China. This study was a preliminary habitat suitability analysis, for the restoration of South China tigers in the Hupingshan reserve, China. ArcGIS 9.0 was used to develop a model that combined roads, railroads, slope, land cover, park classification, and population density. The tiger habitat suitability analysis was performed by weighting and combining the various layers. Preliminary results suggest that the Hupingshan reserve is suitable habitat for the reintroduction of South China tigers.

Introduction:

The South China tiger, *Panthera tigris amoyensis*, once roamed in abundance through the southern lowland forested provinces of China. Deforestation, urban sprawl, and uncontrolled hunting have caused the rapid decline in this majestic cat. In the 1950s there may have been as many as 4,000 South China tigers in the wild (Tilson, et al. 2004). Current estimates indicate that this tiger subspecies is in severe danger of becoming extinct, if it is not already, in the wild. Field surveys have yielded poor results in searching for these tigers; however, reports from villagers indicate the possible presence of a few tigers in the Hupingshan reserve, located on the border of the Hunan and Hubei provinces (Figure 1). The Chinese government has expressed an interest in reintroducing the South China tiger in certain nature reserves. This study is a preliminary habitat suitability analysis for the South China tiger. The goal of the study was to ask the question whether the Hupingshan reserve is suitable habitat for the South China tiger. The study also looked at the two provinces surrounding the reserve for suitable tiger habitat.

Methods:

ArcGIS 9.0, a Geographic Information System (GIS), was used for this analysis. Data were downloaded from the USGS, the Global Land Cover Facility, the Socioeconomic Data Center, and China in Time and Space. Six data layers were used for the analysis: land cover, population density, slope, park classification, roads, and rail roads. Each data layer was reclassified with values that indicated the suitability of that data for tigers (best (10), worst (0)). All data were projected into the Asia Lambert Conformal Conic projection.

The original land cover file was initially reclassified to combine all the forest, woodland, and shrubland categories into respective categories in an effort to simplify the data (Figure 2). The data were again reclassified to assign values to the various classifications: forest (10), woodland (8), shrubland (6), grassland (5), cropland (2), bareground (1), urban areas (0), and water (0).

Population density was classified into seven categories and reclassified into values (in parentheses): 25-30 (8), 30-50 (7), 50-100 (6), 100-200 (3), 200-500 (2), 500-1,000 (1), and >1,000 (0) (Figure 3).

Slope was classified into 10 categories (Figure 4). The lowest slope was reclassified with a value of 10 and each successive increment in slope decreased by 1 unit of value.

The area within the park was valued at 10 units and areas outside the park were valued at 5 units.

Roads and Railroads received identical treatment. A 4 km buffer was produced on both the rail roads and roads (2km on each side). Roads and rail roads (with buffer) were valued at 1 unit and areas outside of the road and rail road area were valued at 10 units (Figure 5).

After all the layers were reclassified with values an equation was produced to calculate suitable habitat for the tigers. The following formula was used: (land cover)*.5 + (slope)*.1 + (population density)*.1 + (park classification)*.2 + (rail road)*.05 + (road)*.05. A preliminary map displaying suitable habitat was then produced.

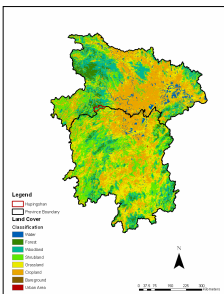


Figure 2. Land cover map of the study area. Land cover was reclassified for final analysis.

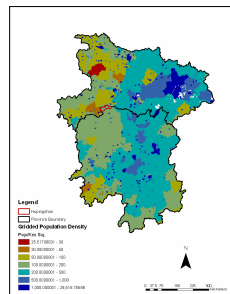


Figure 3. Population density map for study area, derived from the Gridded World Population (CIESEN).

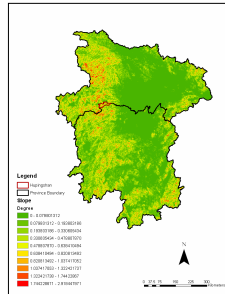


Figure 4. Slope derived from a GTOPO30 DEM for the study area. Slopes were reclassified for final analysis.

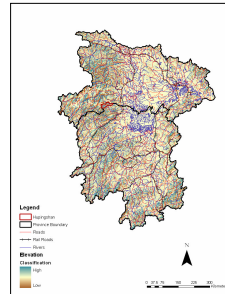


Figure 5. Map depicting roads, rail roads, and rivers of the study area placed over a hillshade at 20% transparency.

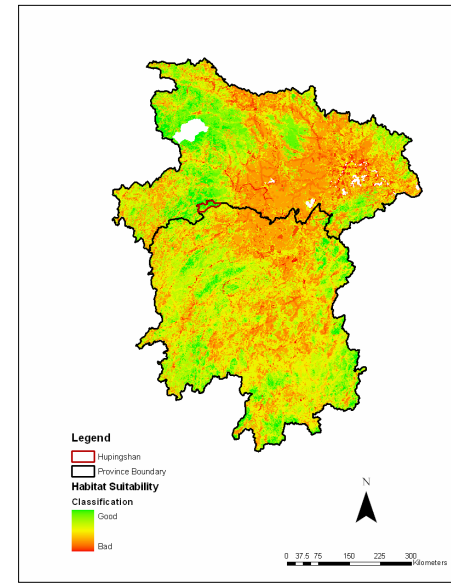


Figure 6. Preliminary suitability analysis for the study area. Red and orange are poor habitats for tiger and green is suitable area.

Results:

The areas of low suitability (red/orange) were mostly located in lowland areas where there was high human population density and land use was mostly cropland (Figure 6). High suitability was located in mountainous regions, with low population density and heavy forest cover (Green). A suitable habitat was considered any value above 8. An area calculation of areas above 8 units of value, indicated that 8,982,570 km² (2.3% of total area) was suitable habitat for the South China tiger.

Discussion:

The suitability analysis indicates that there is not much suitable habitat for the South China tiger. Although there is very little suitable habitat, the area within and around the Hupingshan reserve has a significant amount of suitable habitat. It is important to note that this project is preliminary analysis. The data used was at a very large scale, all data was classified in 1 km² cells. The large scale yields generalized results. These generalized results, however, are very promising. The future of these tigers looks bleak; hopefully, this study will lend insight into a possible habitat restoration and reintroduction for the South China tigers.

Acknowledgements:

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Literature Cited:

Tilson, R., Defu, H., Muntfering, J., and Nyhus, P.J. 2004. Dramatic decline of wild South China tigers *Panthera tigris amoyensis*: field survey of priority tiger reserves. *Oryx* 38(1): 40-47.

Data Sources:

Center for International Earth Science Information Network (CIESIN), Columbia University; International Food Policy Research Institute (IFPRI); and World Resources Institute (WRI). 2000. Gridded Population of the World (GPW), Version 3. Palisades, NY: CIESIN, Columbia University. <http://sedac.ciesin.columbia.edu/gpw/>

Hansen, M., DeFries, R., Townshend, J. R. G. and Sohlberg, R., 1998. 1 Km Land Cover Classification Derived from AVHRR. College Park, Maryland: The Global Land Cover Facility <http://glcf.umiacs.umd.edu/data/landcover/index.shtml>

Qin Tang, William Lavelly and Liu Chuang: Fundamental GIS: Digital Chart of China, 1:1M, Version 1 Published and Disseminated by CIESIN at URL: <ftp://ftpserver.ciesin.org/pub/data/China>

USGS. Eros Data Center. 1996. GTOPO30. <http://edc.usgs.gov/products/elevation/gtopo30.html#description>