Take The Leopard Home

A Suitability and Connectivity Analysis of North Chinese Leopards

Take me home ......

North Chinese Leopards...

... (*Panthera pardus japonensis*) used to be distributed across northern and eastern China. Because of human disturbances, habitat loss, and reduced prey abundance, the number of the species has drastically declined, and the remaining populations are usually present in small, isolated areas.

Taihang Mountains are ...

... a mountain range extends along the northeast to the southwest, stretching along provinces Henan, Shanxi, and Hebei. Although leopards are generalists adaptable to multiple habitat types, the current leopard populations are only found in the forests in the Taihang Mountains, to avoid human activities.

Chinese Felid Conservation Alliance...

... launched an initiative in summer 2017 to reintroduce North-Chinese leopards to more areas in the Taihang Mountains and connect the isolated habitats. This project will assess the potential habitats and corridors for the leopards, and the results will be presented to CFCA as a reference to their field research area selection.

Methods

Suitability Analysis: Factors critical to leopard habitat suitability are identified from peer-reviewed literature. Spatial analyst tools were used to perform a weighted suitability analysis. Weight and reclassification criteria are listed in the reclassification table below.

Connectivity Analysis: Least-cost tool was used to identify corridors between habitats.

Lingqiuqingtun 灵丘青屯 Nature Reserve

Lingqiuqingtun is a national nature reserve in Shanxi, China since 1993. Its area is 10 km², small for leopards but can sustain the prey populations and provides a stop connecting the two distant habitats.

Project Proposed Region | Weighted Suitability — High / Low
Corridor
Leopard Extant habitat | Protected Areas Suitability — More / Less

0 50 100 200 km

HenanLuanchuan 河南栾川

Luanchuan is a county in Henan Province that is highly suitable for the leopards with a few adjacent protected areas. Reintroduction in the mountains should be considered.

Conclusions

Leopard habitats and corridors are restrained to the west of the Taihang Mountains. Although there are protected areas located around the extant leopard habitats, they are too small and scattered, and only Lingqiuqingtun Nature Reserve is suitable for connecting the habitats.

Leopards can potentially be reintroduced into protected areas of southern Henan, but must pass a low suitable area, and natural dispersal may not be feasible. If leopards are reintroduced to Luanchuan, Henan, however, viability of population is high due to many protected areas in a highly suitable region. Reintroduction to the eastern Henan and Hebei is unlikely due to urbanization.

Factors	Nightime Lights (Scaled NPP-VIIRS)	Land Cover	Distance to Rivers	Kernel Density of Highways (per km²)	Population Density (per km²)	Distance to Highway	Distance to High speed Railway	Canopy Cover (%)	Prey Species Availability	Elevation (m)	Slope (% Rise per Meter)
Weight	15%	15%	10%	10%	10%	10%	10%	10%	5%	2.5%	2.5%
Extremely Low Suitability (Suitability Score 1)	>200 (brightest)	Water; Urban and built-up; Snow and ice	>10km	0.2~0.25	>100	≤2.5km	≤2.5km	0~15	Only has wild boar or muntjak	<250	0~7
Low Suitability (Suitability Score 2)	100~200	Barren or Sparsely vegetated; Croplands; savannas	7.5-10km	0.15~0.2	25-100	2.5~5km	2.5~5km	15~30	Only has wild boar and muntjak	250~900	7~20
Average Suitability (Suitability Score 3)	50~100	Cropland/Natural vegetation mosaic; woody savannas; Permanent wetlands	5-7.5km	0.1~0.15	15-25	5~10km	5~10km	30~45	Only has Siberian Roe Deer	900~1200	20~35
High Suitability (Suitability Score 4)	25~50	Open shrublands; Closed shrublands; grasslands	2.5-5km	0.05~0.1	7-15	10~15km	10~15km	45~60	Has Siberian Roe Deer and wild boar or muntjak	1200~1500	35~50
Extremely High Suitability (Suitability Score 5)	3~25 (darkest)	Mixed, Deciduous Broadleaf, Deciduous Neddieleaf, Evergreen Broadleaf, and Evergreen Needleleaf forests	≤2.5km	0~0.05	0-7	>15km	>15km	>60	Has Siberian Roe Deer, wild boar and muntjak	>1500	>50

Table 1. Reclassification table of critical factors
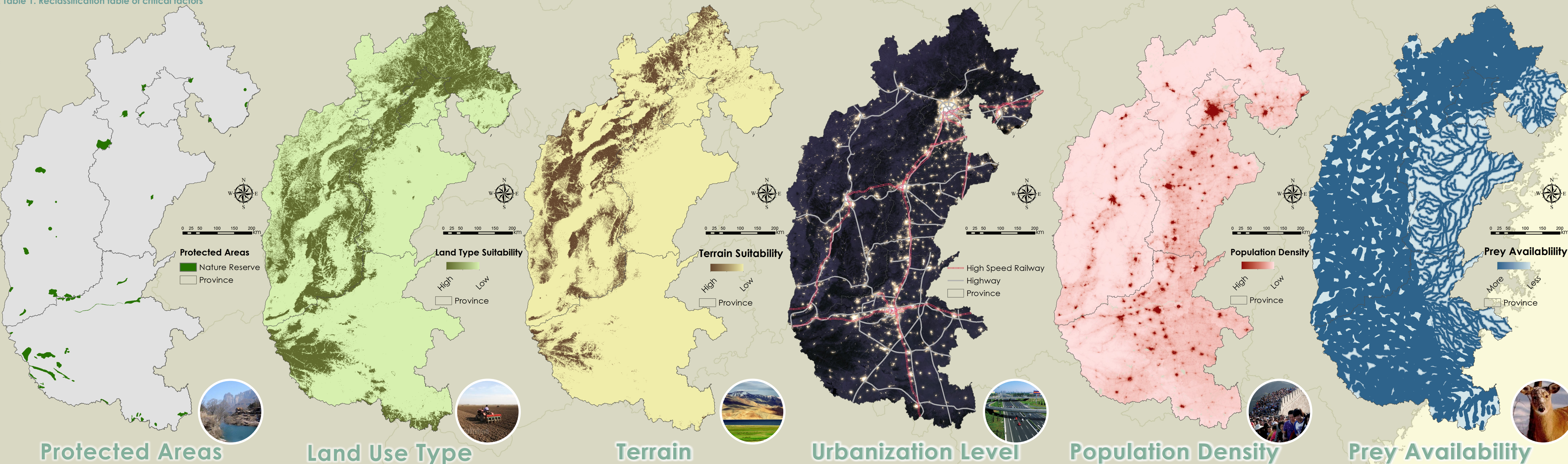
Protected Areas

Protected areas ensure leopards survival by protecting them and their preys from poaching, and are considered important in leopard conservation. Protected area data from Protected Planet, IUCN was processed by intersecting with prime leopard habitats.

Land Use Type

Map with reclassified suitability based on land use (2/3 weight) & canopy cover (1/3 weight). Camera-trap data of leopards show that leopards prefer forest and dry habitats, and avoid man-made landscapes. Land use data from MODIS and Canopy cover data from Global Forest Watch were classified into 1 (low) -5 (high) suitability scores (see Table 1 for details).

Terrain

Elevation and slope do not directly impact leopard survival, but plain and low elevation are often settled by humans, which leopards avoid. Leopards are good climbers and are not limited by high elevation or steep slope. Elevation data from CGIAR-CSI are processed using the slope tool, and slope and elevation were classified into 1 (low) -5 (high) suitability scores and added (see Table 1 for details).

Urbanization Level

Noises from highways and railroads disturb leopard activities and create fragmentations of the habitat. Highway and high speed railways data from Harvard Chinamap were processed using Euclidean distance. Highway data was also processed using kernel density. All layers and nighttime lights data was classified into 1 (low) -5 (high) suitability scores (see Table 1 for details).

Population Density

Large population density increases human-leopard conflicts both directly and indirectly, for example, leopards attack cattle. Leopards also tend to avoid densely populated area when possible. Population density data from Worldpop was classified into 1 (low) -5 (high) suitability scores and added (see Table 1 for details).

Prey Availability

Weighted map based on distance to water (2/3) and prey species presence (1/3). Although leopards prefer dry areas, their preys stay close to water. River data from DCW was processed using Euclidean distance, and prey species distribution from IUCN was added with more weight on the Siberian roe deer. Both layers were classified into 1 (low) -5 (high) suitability scores and added (see Table 1 for details).

Ying (Katherine) Zhou

MCM Candidate 18', Tufts Cummings School of Veterinary Medicine
MCM 591 GIS for Conservation Medicine
Presented on December 15, 2017

Projection: Asia Lambert Conformal Conic

Data Sources: Global Administrative Area (GADM), International Union for Conservation of Nature (IUCN), WorldPop, Global Forest Watch, Protected Planet, Moderate Resolution Imaging Spectroradiometer (MODIS), Digital Chart of the World (DCW), Harvard Chinamap, Consortium for Spatial Information (CGIAR-CSI), NASA, ESRI Datamaps 10

Photo Sources: Chinese Felid Conservation Alliance (CFCA)

Special thanks to: Carolyn Talmadge, for her technical and mental support throughout this project and the whole semester; Jing Zhang, for generously offering her couch for me to crash on in the days I spent in the data lab, so that I can avoid the three hours on the train late at night.

Tufts UNIVERSITY

Cummings School of Veterinary Medicine