

Suitability and Vulnerability Spatial Analysis of the Sunda Pangolin Population in Vietnam

Introduction

The pangolin is potentially the world’s most trafficked animal, yet public conservation efforts have yet to address the pangolin’s decline sufficiently (World Wildlife Foundation, 2017). There are multiple species of this unique, armored mammal located on two different continents, but the Sunda pangolin (*Manis javanica*) population in Vietnam is especially vulnerable to poaching (Challender et al., 2014). Southeast Asian pangolin consumers believe that its meat and scales provide different medical benefits, but none of these benefits have been scientifically proven (Challender et al., 2014). Unfortunately, conservation efforts are hindered by the lack of knowledge regarding this critically endangered species; its shy personality and nocturnal habits make the pangolin considerably difficult to research. Additionally, scientists believe that pangolins fare much better in the wild than in captivity, which reduces the opportunities to increase their population numbers (Challender et al., 2014). Therefore, it is important to evaluate the vulnerability of this pangolin species in their natural geographic range by looking at proximity to potential hunters and the presence of other, non-human predators such as tigers and leopards. Most pangolin hunters poach for supplemental income, which implies that the majority are likely to reside in poor parts of the country (Challender et al., 2014). Therefore, areas where potential hunters may live are represented by high poverty regions in Vietnam. It is then also critical to determine which parts of the country are the most suitable for the pangolin to live in, so that the animals can be relocated from high vulnerability regions to these areas if needed. The ultimate goal of this project is to identify the most at-risk populations so that special, protected areas can be established there. Alternatively, the most vulnerable populations could also be relocated into higher suitability regions. The relative importance of this conservation work is amplified due to the ongoing rates of habitat loss and hunting; the pangolins will be forced into extinction before anyone even realizes that they existed.

Methodology

The suitability analysis map was constructed with the consideration of three main factors: land cover, vegetation, and biome. The reclassification of each of these factors was executed based upon the research demonstrating that the pangolin prefers primary or secondary forests with abundant vegetation (Challender et al., 2014). Therefore, under the consideration of the habitat preferences of the pangolin, each factor was assigned a category of either 0, meaning that it was an unsuitable area or 1, meaning that it was a suitable area. A raster calculator was then employed to combine all of these factors and distinguish areas that had various combinations of these factors. Areas that had a 1 in all three categories were deemed the most or “very” suitable while areas that had a 1 in just two of the categories were deemed suitable. Areas that only matched one or zero of the categories were deemed unsuitable.

Reclassification Scheme for the Suitability Analysis Map

Factor	0 = unsuitable	1 = suitable
Land Cover	Urban areas, agricultural areas, and other unsuitable habitats such as wetlands, tundra, and sparsely vegetated areas	Deciduous and Evergreen Forests (both Broadleaf and Needleleaf) and Mixed Forests
Vegetation	Levels of vegetation that fall below 0.7 on the normalized difference vegetation index (NDVI)	Levels of vegetation that exceed 0.7 on the normalized difference vegetation index (NDVI)
Biomes	All other biomes including grasslands, wetlands, tundra, and mangroves	Tropical and Subtropical Moist Broadleaf Forests & Tropical and Subtropical Dry Broadleaf Forests

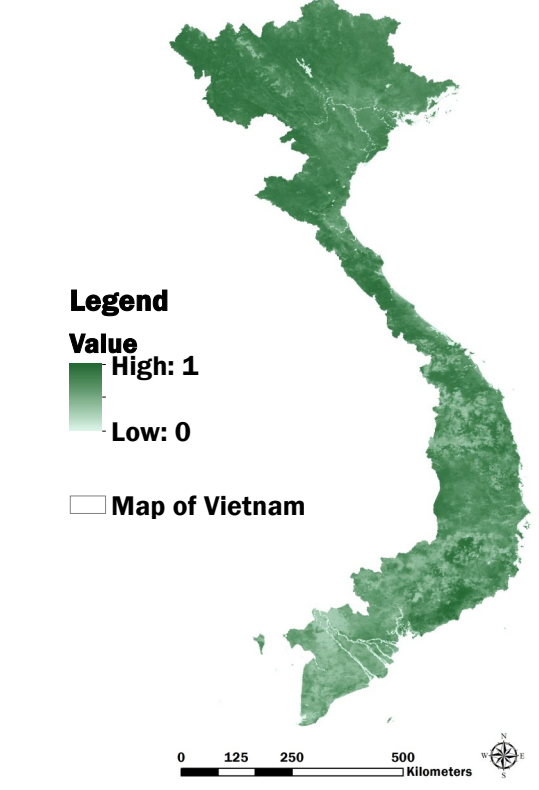
The vulnerability analysis map was constructed with the consideration of two main factors: proximity to high poverty regions and the presence of non-human predators. The high poverty regions were reclassified, so that only areas that demonstrated a poverty rate of greater than 50% were considered threatening. In order to account for the presence of both of the pangolin’s main predators in Vietnam, the geographic population distributions of the Inodchinese Tiger (*Panthera tigris corbetti*) and the Clouded Leopard (*neofelis nebulosa*) were merged. The final map highlights areas in which the pangolins are vulnerable (within a region that is either poverty-stricken or has feline predators), and areas where the pangolins are most vulnerable (within a region that is both poverty-stricken and has feline predators).

Reclassification Scheme for the Vulnerability Analysis Map

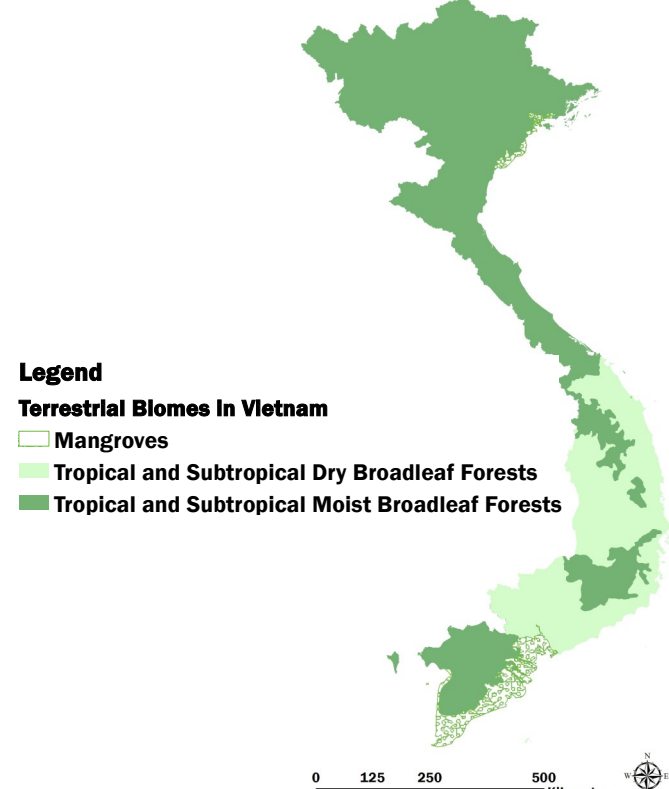
Factor	0 = non-threatening	1 = threatening
High Poverty Regions	Areas that had a poverty rate of under 50%	Areas that had a poverty rate exceeding 50%
Presence of Predators	Absence of tigers and leopards	Presence of tigers and leopards

Suitability Spatial Analysis

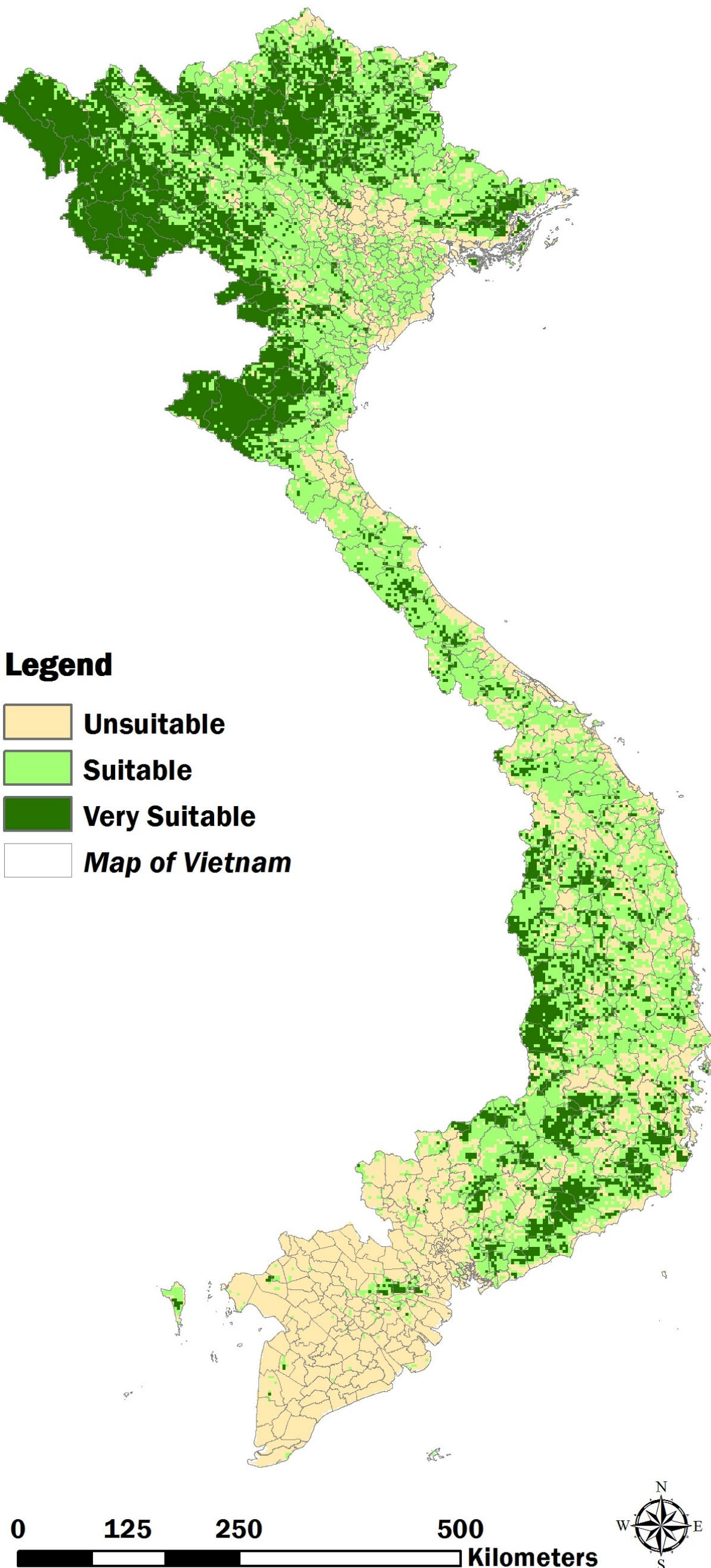
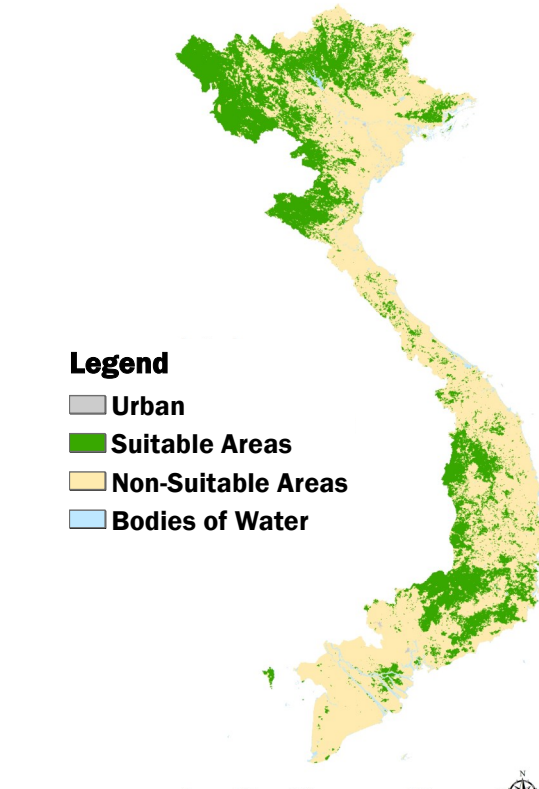
Level of Vegetation (NDVI)



Biomes



Land Cover



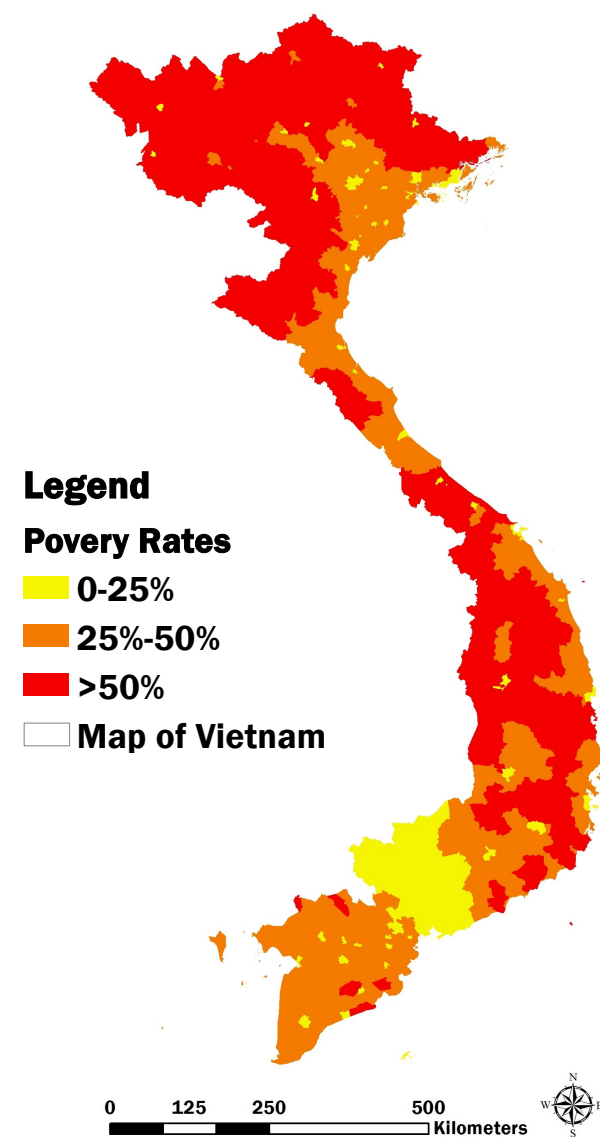
Conclusion

Upon initial evaluation of the vulnerability spatial analysis map, one can observe specific areas in which the Sunda pangolin population in Vietnam are the most threatened by both the presence of local hunters and their main non-human predators, the Indochinese Tiger and Clouded Leopard. The areas in which the pangolins are the most vulnerable are the regions in which conservation efforts should be focused, such as certain regions in southwestern and northwestern Vietnam. Special, protected regions should be established in these places so that hunting can be much more regulated and prevented. Pangolins in these areas should also be tagged, monitored, and looked after. In doing so, pangolins can be tracked using a GPS system. Tracking these pangolins will not only allow scientists to understand more about their behaviors and movement patterns, but can also help pinpoint areas where hunters and poachers are killing these animals as well as where they are trading them. This latter information can be used by law enforcement to locate and punish the poachers and traders appropriately. Some of the most vulnerable pangolins can be removed from their original habitats and relocated to areas distinguished by the suitability map as a darker shade of green. A particular region that would be strongly suggested for conservation would be the northwestern corner of Vietnam, where there are some populations of highly vulnerable pangolins with a considerable amount of suitable area nearby. The proximity to high suitability environments, moreover, facilitates relocation strategies for the highly at-risk populations in the northwest. Areas where pangolins are relocated to should obviously be legally protected as well. Pangolins fill an important ecological role by eating insects such as termites, maintaining balance in the ecosystems they inhabit (Cortlett, 2007). The potential extinction of these animals is not only devastating to the environments that they are present in, however, but it is also extremely unfair. The pangolin is hunted mostly for its scales, which are rumored to provide health benefits. These scales, however, consist primarily of keratin, a protein found in our own hair and fingernails. Therefore, pangolin scales provide no special health benefits. Under this widespread misunderstanding, in 2013, it was conservatively estimated that over 10,000 pangolins were illegally trafficked (Sutter, 2013). If one accounts for the probability that only ten to twenty percent of poaching incidents are actually reported, then the number of pangolins illegally killed and traded increases dramatically (Sutter, 2013). Pangolins should be a major topic of discussion among conservation biologists; their numbers are being drastically reduced due to the enticing profitability of illegal hunt and trade, in addition to feline predation and habitat loss. The conservation of the Sunda Pangolin relies on both the effort of conservation biologists and law enforcement members. With this geographic data, the knowledge and expertise of the conservation biologists can be combined with the efforts of the police so that pangolins can be sufficiently protected and poachers can be found and punished more efficiently.

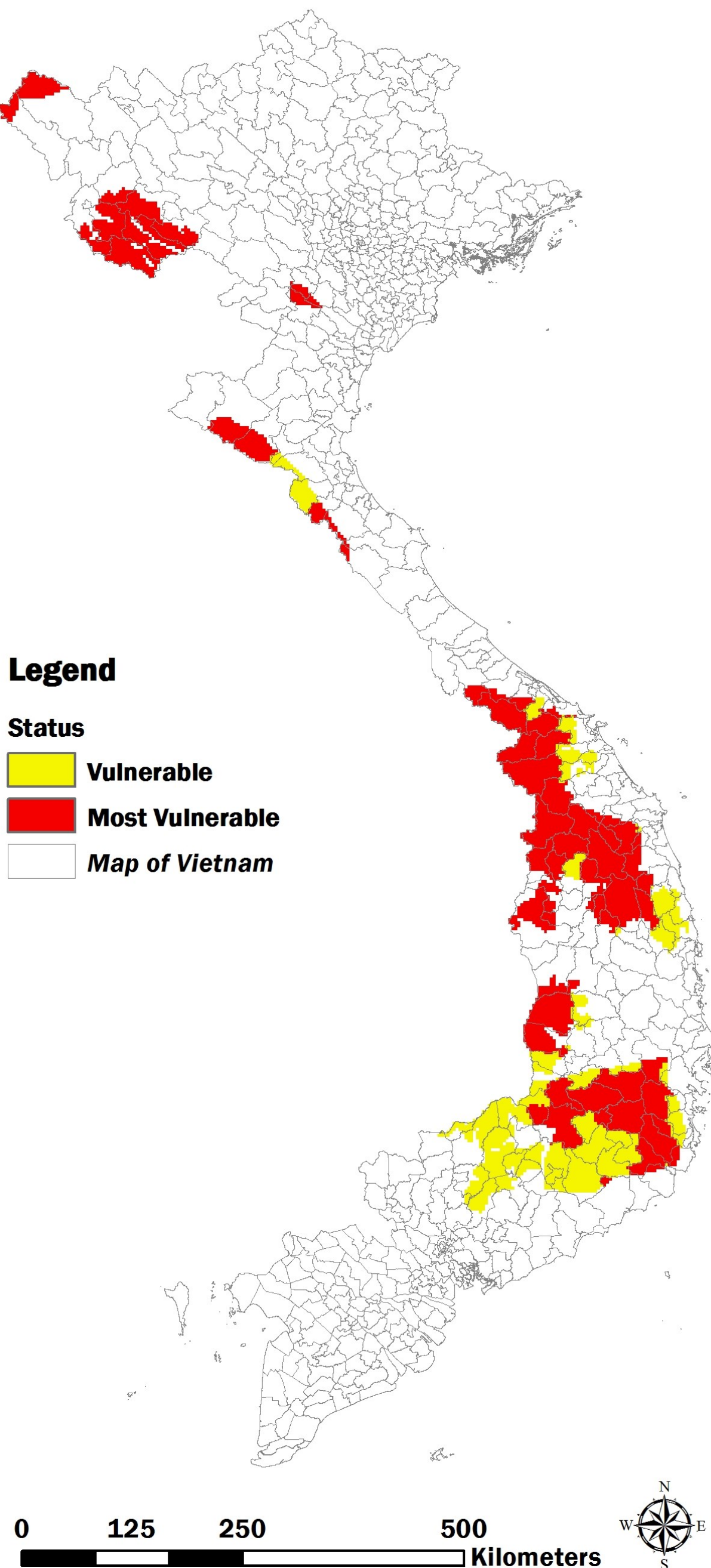
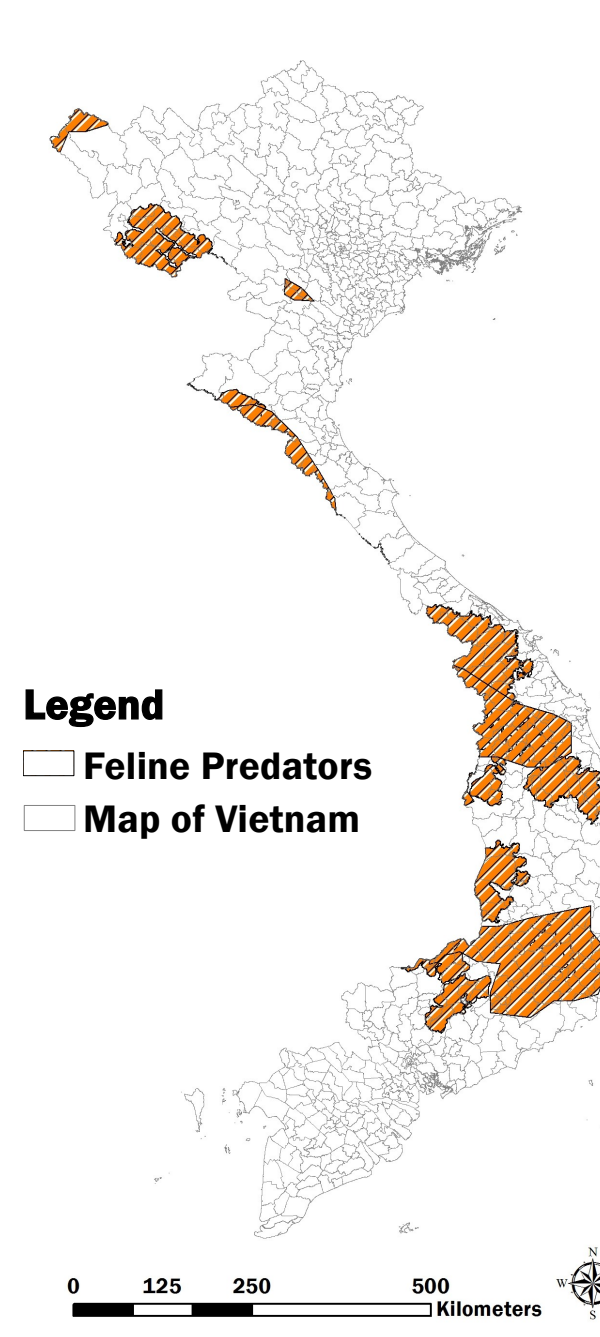


Vulnerability Spatial Analysis

Poverty Rates



Predation



Sources

References:
Chellender, Nguyen Van, Shepherd, and Krishnasamy. "Manis javanica ." *Manis javanica (Malayan Pangolin, Sunda Pangolin)*. N.p., 2014. Web. 08 May 2017. <<http://www.iucnredlist.org/details/12763/0>>.
Corlett, Richard T. "The Impact of Hunting on the Mammalian Fauna of Tropical Asian Forests." *Biotropica* 39.3 (2007): 292-303. Web.
Sutter, John D. "About This Story." *CNN*. Cable News Network, 2013. Web. 08 May 2017.

Data:
Biomes: *The Nature Conservancy*
Sunda Pangolin Population: *IUCN Red List*
Indochinese Tiger & Clouded Leopard Population: *IUCN Red List*
Land Cover: *U.S. Geological Survey*
Poverty Rates in Vietnam: *Poverty Mapping (Case Studies)*
Map of Vietnam: *Tufts M: Drive*

Images:
Pangolin: <http://www.animalplanet.com/wild-animals/endangered-species/pangolin/>



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Introduction to GIS
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