UNESCO Natural World Heritage Sites in Peru:

A Vulnerability Assessment

Introduction

Throughout the world, UNESCO (United Nations Education, Scientific, and Cultural Organization) Natural World Heritage Sites protect areas of extraordinary and unique beauty. Unfortunately, due to increasing human factors, many are greatly at risk. Currently 85 Natural World Heritage sites are listed under significant or critical concern, and in most cases pressures will only continue to rise. While the factors due shift from site to site, many remain constant throughout the globe, such as urbanization, deforestation, extraction, and pollution.

Peru contains two UNESCO Natural and two Mixed World Heritage sites: Huascarán, Manú, and Río Abiseo National Parks, as well as the Historic Sanctuary of Machu Picchu. Machu Picchu is by far the most well-known and frequently visited but was not included in this analysis due to its small geographic area and as its status as significant concern is greatly due to the negative impacts of tourism.

UNESCO sites within Peru have one major item in common: huge levels of endemic species, meaning many species live there and nowhere else. For the most part, this is due to a tropical latitude combining with extremely high Andean elevation gradients, creating landscapes where species that do not exist anywhere else thrive.[1] Additionally, they are under increasing pressure in an area where extraction is a top industry.

Sites[2]

Huascarán National Park is located high within the Cordillera Blanca, the highest tropical mountain range in the world. In addition to a spectacular mountain landscape dotted with glacier lakes, it is habitat for rare species such as the spectacled bear and Andean Condor.

Río Abiseo is located on the slopes of the Andes Mountains, and since 1985, 36 archaeological sites have been discovered, further developing a picture of pre-Inca society in Peru.

Manú is the largest site within Peru, stretching 1.5 million-ha, and protecting vegetation down the slopes of the Andeans into lowland tropical rainforest. The park is a shining example of tropical rainforest, but is greatly threatened by extraction industries from all sides and may exist as one of the most threatened sites in the world.

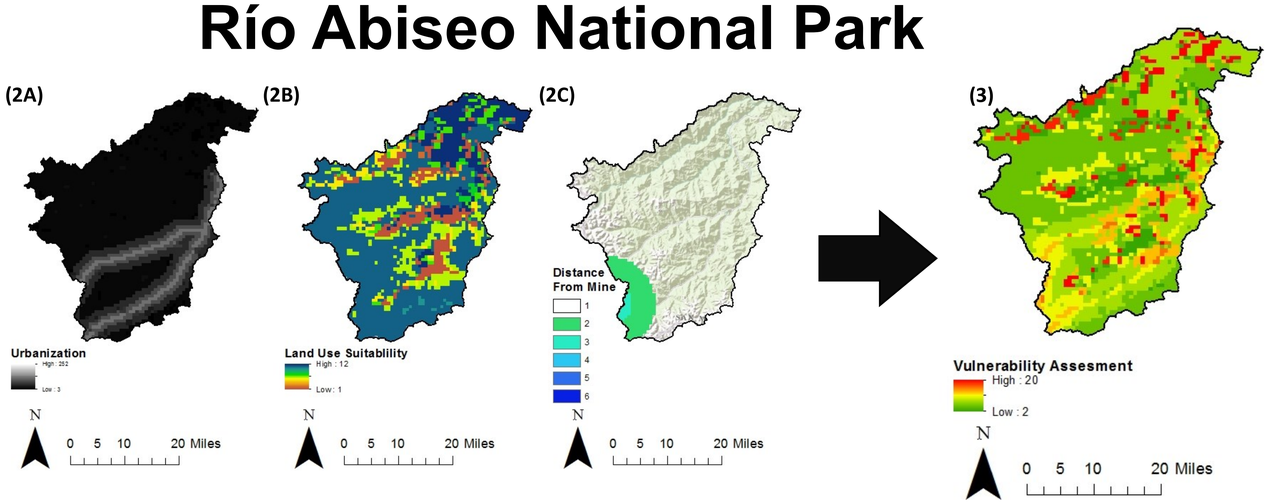
Methodology

To analyze the threats to each of the three sites, concerns of urbanization, land use, and mining were highlighted as areas of highest concern.

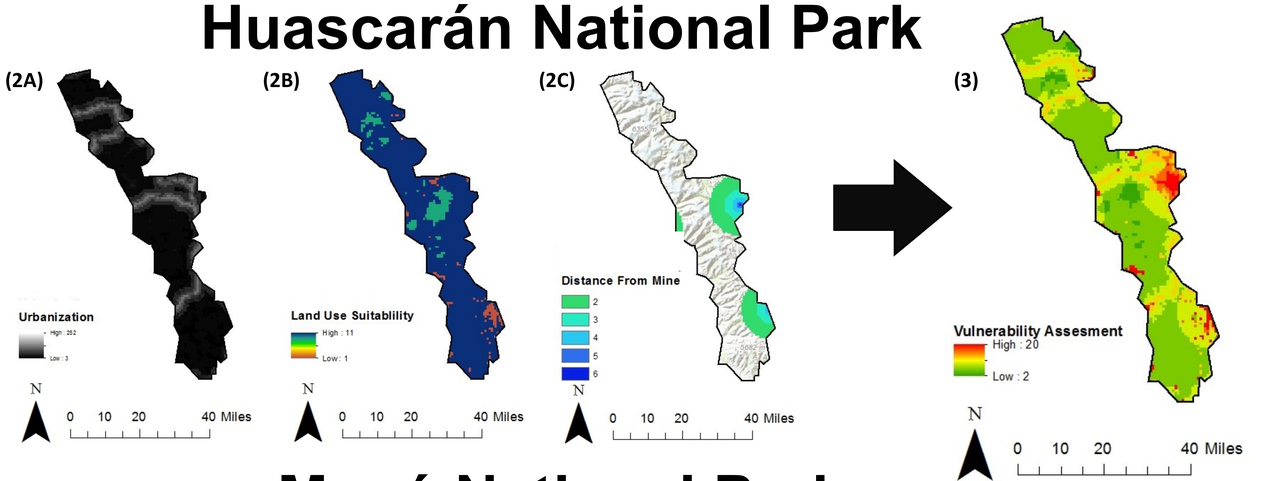
1) Urbanization: I utilized satellite imagery taken at night (known as "night lights and Euclidean distance of locations of major roads throughout Peru to create a proxy for urbanization (Figure 2A).
2) Land Use: I mapped land use focusing on agriculture throughout Peru, and reclassified the data set by its suitability for use within a protected area (Figure 2B).
3) Mining: identified large-scale mining locations throughout Peru, which are indicative areas that could be prone to extraction. Euclidean distance was calculated, and mapped as a raster identifying areas within 15km of a mining site (Figure 2C).
4) Vulnerability Assessment: All three rasters were reclassified, and combined to show Vulnerability Assessment level for each site (Figure 3). Here, high indicates an increased level of threat to the park.

Tufts

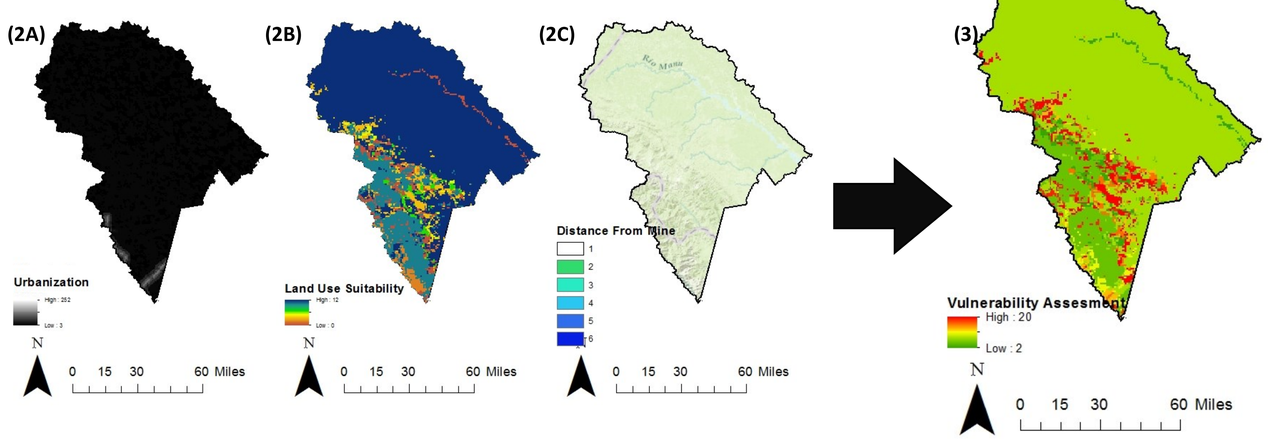
Río Abiseo National Park

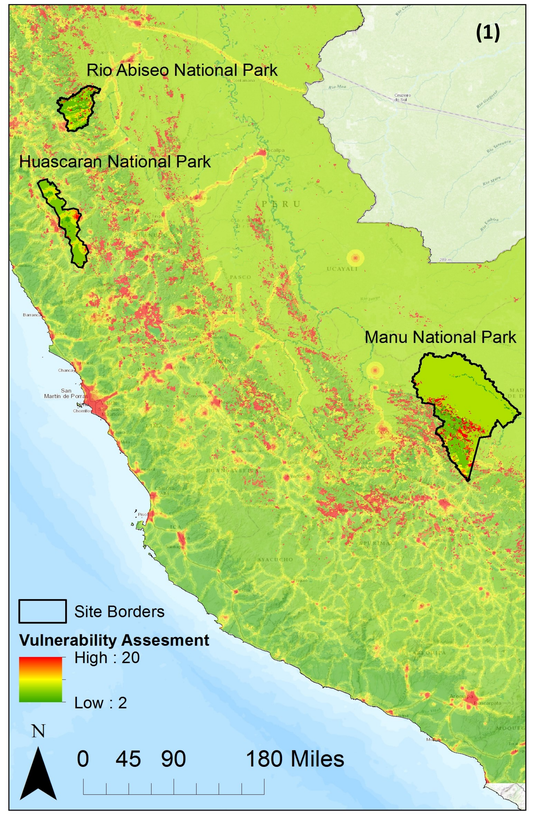


Huascarán National Park



Manú National Park





Discussion

This assessment demonstrates both the high level of threat that exists within each park, but additionally could be used to identify other areas of Peru that could be valuable to conserve for the future. These areas are not alone in containing spectacular landscapes and huge number of endemic species. Additionally, it is important to note that much of the less suitable land use mapped is due to agriculture. Some of the farm land within these areas may be designed in a sustainable way such as mixed in with forested lands, but any encroachment in to protected zones can be a danger for the future.

Limitations and Future Analysis

The major limitation of this assessment is the lack of available and accurate data to describe the true status of mining impacts within Peru. Not only is most available data somewhat out of date, but it neglects small scale, illegal, artisanal gold mining which is responsible for vast amounts of removal. Additionally as the land use data utilized for this analysis is somewhat specific to agriculture, it would be valuable to expand this to contain other land use types. It is clear that this is an area in need of a much more in depth and detailed study to fully encompass the wide range of threats to these irreplaceable locations.

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Projection: WGS_1984_Web_Mercator_Auxiliary_Sphere
Sources: US Geological Survey 2005, NOAA Earth Observation Group 2013, DIVA-GIS, Tufts GIS

1) Van Der Werff, H., & Consiglio, T. (2003). Distribution and conservation significance of endemic species of flowering plants in Peru. *Biodiversity and Conservation*, *13*, 1699–1727.
2)Site details can be explored at WorldHeritageOutlook.org