Mapping Overlap Between Extractive Industries, Agriculture, and Indigenous Communities: A Case Study of the San Andrés Mine in Copán, Honduras

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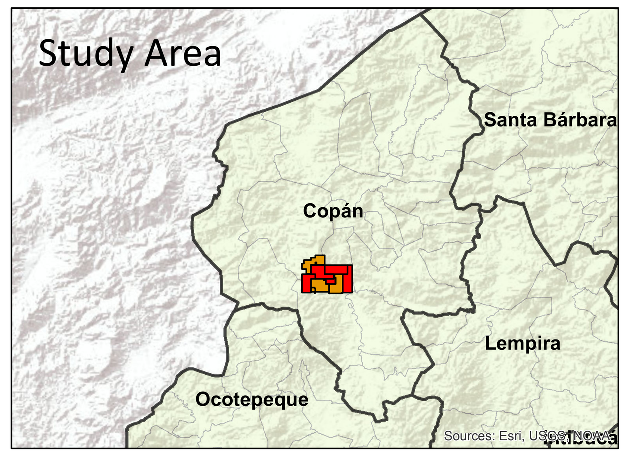
Extractive Industries in Honduras

Ever since the arrival of the Spanish in the 16th century, extractive industries have played a pivotal role in shaping Honduran political and economic history. The presence of large-scale metal exploration and exploitation have challenged the social and environmental fabrics of the Honduran communities in which extractive industries operate (Oxfam, 2016). In the last two decades, local communities, grassroots organizations, universities, and international NGOs have challenged the Honduran government and transnational mining companies about harmful mining practices, while investigating the social and environmental implications of metal mining in Honduras.

In spite of increased interest in researching the social and environmental implications of metal mining in Honduras, more work needs to be done to understand the historic expansion and development of mining to understand the effects of mining on people and land-cover change. By investigating the spatial extent of the San Andres mine between 1991 and 2016, this study aims to contribute to a growing body of literature regarding the intersection of conflict and extractive industries in Honduras and will specifically focus on the San Andrés mine because it is a frequently contested mine in the last two decades.



The San Andrés mine is a controversial open-pit mine situated in western Honduras in La Unión, in the department of Copán. The historic expansion of the San Andrés mine has led to the destruction of property, forceful displacement of communities, water contamination, air pollution, and the destruction of land cover (ICEFI, 2014; Oxfam, 2016). The social and environmental consequences linked to the presence of the San Andrés mine have raised questions regarding the livelihoods of the local communities.

Study Objectives

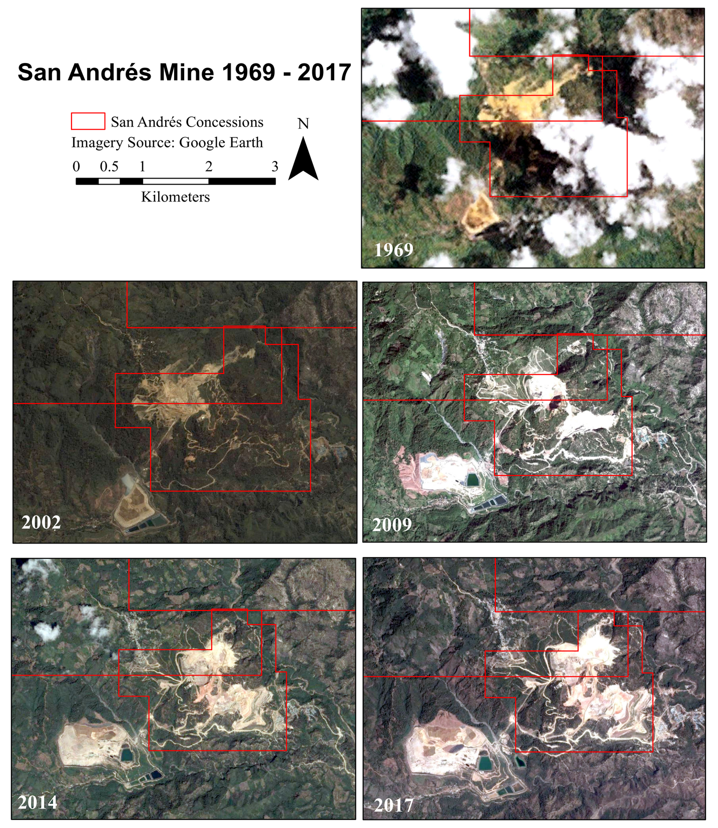
The objective of this research is threefold:

- ❖Use Landsat imagery to map and analyze the spatial extent of the San Andrés mine between 1991 to 2016
- ❖Characterize the spatial overlap between the San Andrés mining concessions and critical landscape units including agriculture and local settlements in 2016
- ❖Characterize the populations and settlements at future risk of displacement

Methodology

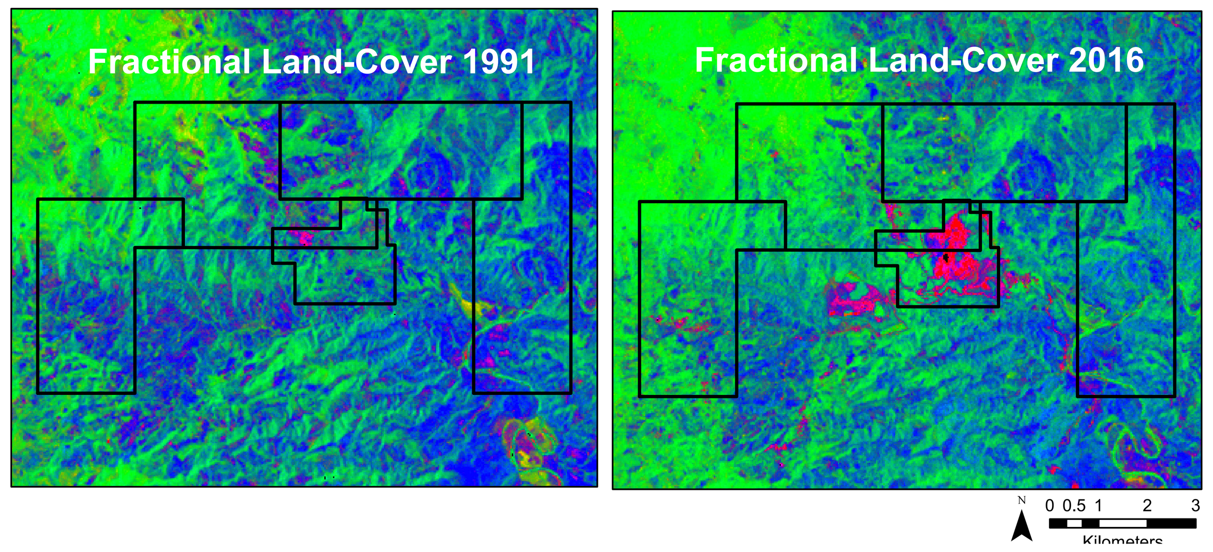
Data Description

Two 30-m Landsat images were taken into consideration for this research. The two satellite images were captured on March 20, 1991 and April 9, 2016 and were obtained from the Landsat-5 and Landsat-8 OLI, respectively. The Landsat images were used in combination with the San Andrés mining concession polygons, a categorical 2014 land cover image, settlement point data, and Google earth imagery (see right).



CLASlite

This study primarily uses the Carnegie Landsat Analysis System - Lite (CLASlite) program to characterize land-cover change in the San Andrés mining concessions between 1991 and 2016. CLASlite is a free remote sensing software developed by the Carnegie Institute for Science at Stanford University, which uses an automated identification system to monitor forest cover, deforestation, and forest disturbance (Asner et al, 2009).



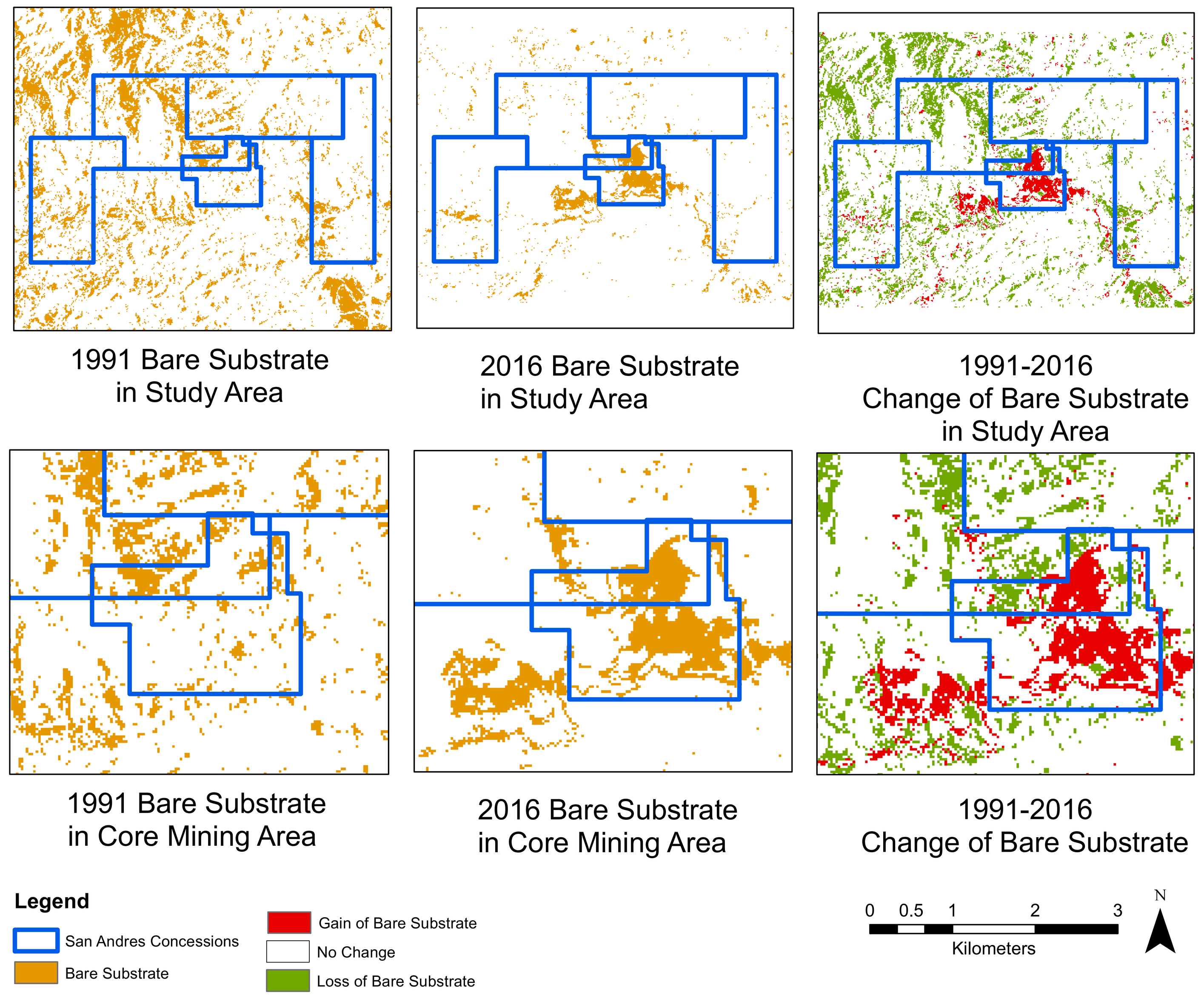
CLASlite can identify changes in forest cover in increments of 1% of a Landsat pixel, which is more fine-scale compared to other land cover change analysis approaches (Asner et al., 2013). Through the application of image calibration and an Automated Monte Carlo Unmixing technique, CLASlite produces fractional forest cover images including a Photosynthetic Vegetation (PV), Non-Photosynthetic Vegetation (NPV), or Bare Substrate (S) based on the values classified in an existing spectral library (Carnegie Institute for Science, 2014).

ArcGIS

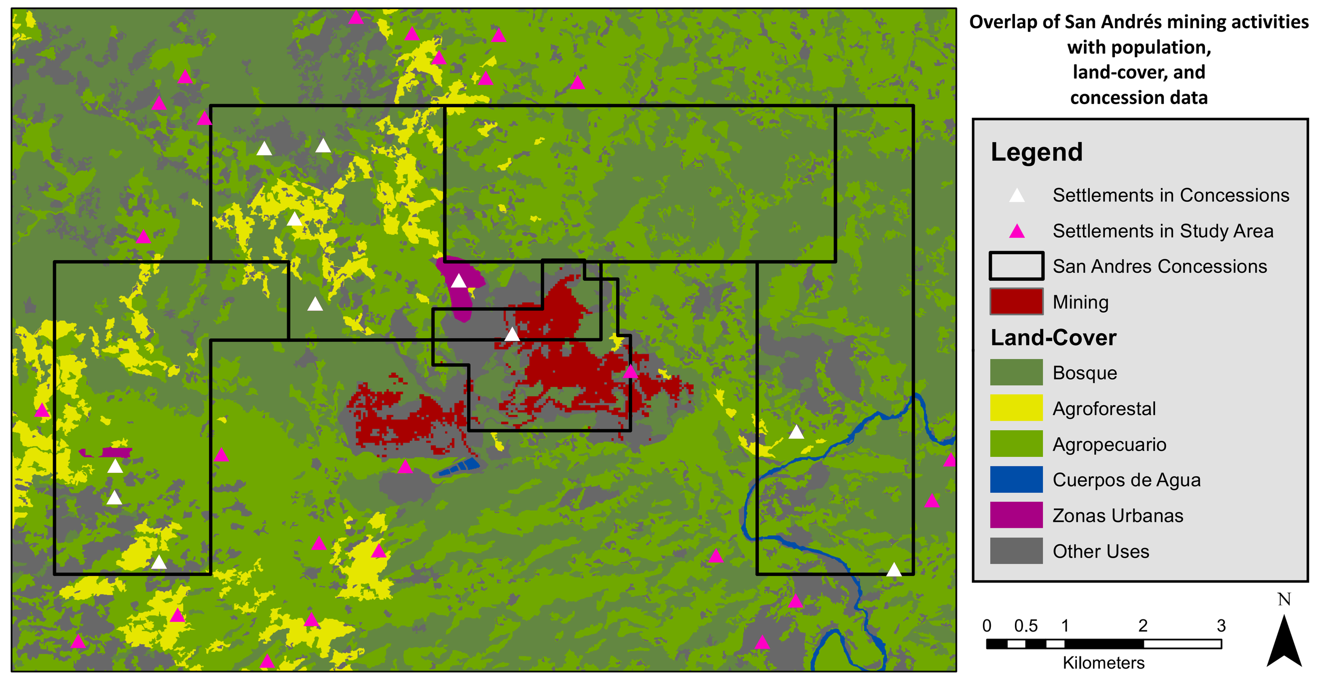
For the purposes of this study, only the Bare Substrate (S) fractal image was taken into consideration. The pixels that contained 20%+ S in the 1991 and 2016 images were classified as Bare Substrate in new binary images. The newly classified 1991 and 2016 images were overlaid with Google Earth imagery to verify the overlap of substrate and mining activities and were then quantified to determine the expansion of the mining operations over 25 years. Additionally, the pixels were overlaid with the mining polygons, settlement point data, and the land-cover imagery for further interpretation.

Results

From 1991 to 2016 there was a 99.94% loss of bare substrate in the study area. However, not all of these pixels are associated with open-pit mining. For example, many of the 1991 bare substrate pixels are concentrated in the upper left quadrants where there was no metal mining. To quantify the bare substrate pixels associated with mining in 1991 and 2016 the core mining areas were identified and delineated using Google Earth Imagery. It is important to note that the San Andrés mine has existed for several decades and the earliest imagery from Google Earth is on in 1969, which shows the size of the core mining area is similar to the mine in 1991. Using this approach there was a 247.75% increase in bare substrate in the core mining area between 1991 and 2016. Visual interpretation of Google Earth imagery between 1991 and 2016 suggests most of the land converted to bare substrate was forest.



The potential future expansion of the San Andrés mine also has serious implications for different land-cover classes and the populations residing within the mining concessions. As of 2010, an estimated 2,574 people live within the concessions boundaries in 2010 while an additional 1,944 people live in close proximity to the concessions boundaries. These communities are at risk of displacement if Aura Minerals, the current owner of the San Andrés mine operations, choses to expand.



Conclusion

Spatial analysis of the San Andrés mine between 1991 and 2016 shows that bare substrate in the core mining area increased by 247.75%. The analysis also provides insight on land-cover change over a 25-year span within and in close proximity to the San Andrés concessions. For example, the imagery shows how the core mining areas shift across the landscape, leading to population displacement and permanent land-cover changes. As the core mining pits have shifted across space and time, there is more destruction of native habitat, primarily forests, while old mining pits are reclaimed with mono-cropped pine trees. The loss of forest has implications for the livelihoods of the communities living in close proximity to the mine: less potential for agroforestry, loss of grazing space for farm animals, and limited availability of biofuels and medicinal plants (ICEFI, 2014). Furthermore, the reclamation of the mining pits does not restore the landscape to its original state and no longer has the same purpose: mono-cropped pine forests do not support the same subsistence practices the local communities used prior to the land modification.

The San Andrés mine is a focal point of mining in Honduras. The geographical expansion, mining practices, and the conflicts associated with the mine are closely monitored by local communities, the Honduran government, international NGOs, and transnational mining companies. The future direction of the San Andrés mine influences the future of mining and mining practices in Honduras. Since the San Andrés mine is so influential to mining practices and legislations in Honduras, it is important to characterize and understand the historical expansion of the mine (Ben Fash, Personal conversation, March 28 2017).

This research contributes to a growing body of literature about extractive industries in Honduras, which already discusses some of the specific political, economic, social, and environmental implications of metallic mining in Honduras.

References

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