Land Cover Change Surrounding the Interoceanic Highway in Tambopata, Peru

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Abstract

The Interoceanic Highway stretches from the Pacific Ocean to the Atlantic, increasing accessibility to many areas of the Amazon. While it offers opportunities for economic growth and wellbeing, the highway has also prompted concerns about deforestation since its completion in 2010. Madre de Dios, in southeastern Peru, is considered a biodiversity hotspot and is facing issues related to intensifying agriculture and illegal gold mining. This project utilized Landsat 5 ETM, Landsat 8 OLI/TIRS, and Aqua and Terra MODIS data to analyze changes in land cover occurring surrounding the Interoceanic Highway in Tambopata, a province within Madre de Dios. To assess these changes, we analyzed the Normalized Difference Vegetation Index (NDVI) between 2001 and 2018, and conducted supervised classifications of the study area. The project found that forest cover in the region overall has decreased from 92.9% in 2001 to 85.0% in 2018, with larger changes occurring closer to the highway. In a buffer zone extending 250m from the highway, forest cover decreased from 65.4% in 2001 to 32.5% in 2018. Land cover change analyses demonstrated that most forest loss occurred through the conversion of forest to grassland.

Study Area

Fig. 1 Map of the study area and Interoceanic Highway in Tambopata, Peru.

Methodology

Processing
- Landsat 5 / Landsat 8 Surface Reflectance and MODIS Land Cover in Google Earth Engine
- Cloud mask, seasonal (June-August) medians

Analysis
- NDVI timeseries by season and buffer zone
  - *NDVI = (NIR – Red) / (NIR+Red)*
- Yearly supervised classifications (2001-2018) using MODIS as training data
- Land cover timeseries by buffer zone

Validation
- Comparison with Hansen Forest Cover dataset
- Ground truth validation in the field

Results

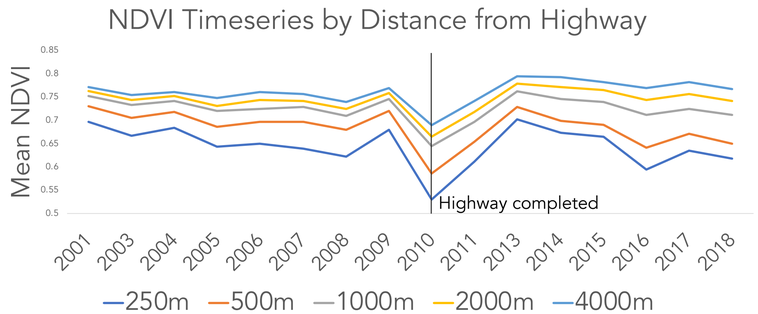

Fig. 2 NDVI timeseries by buffer zones from highway. Buffer zones farther from the highway tend to have higher mean NDVI values than zones closer to the highway.

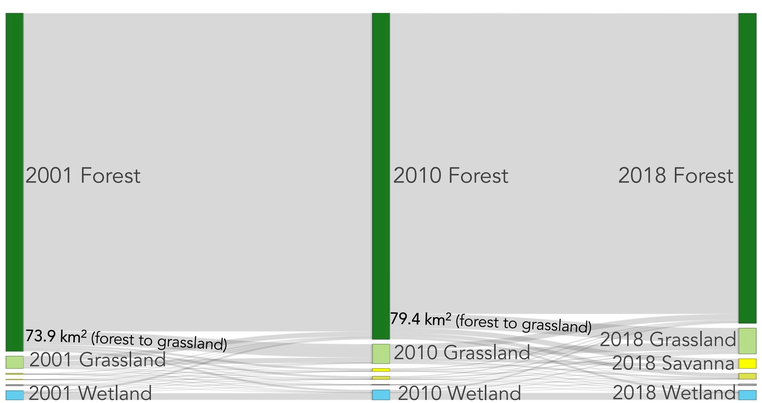

Fig. 3 Sankey diagram representing land cover change between 2001, 2010 and 2018. The most prominent transition between the years was forest to grassland conversion.

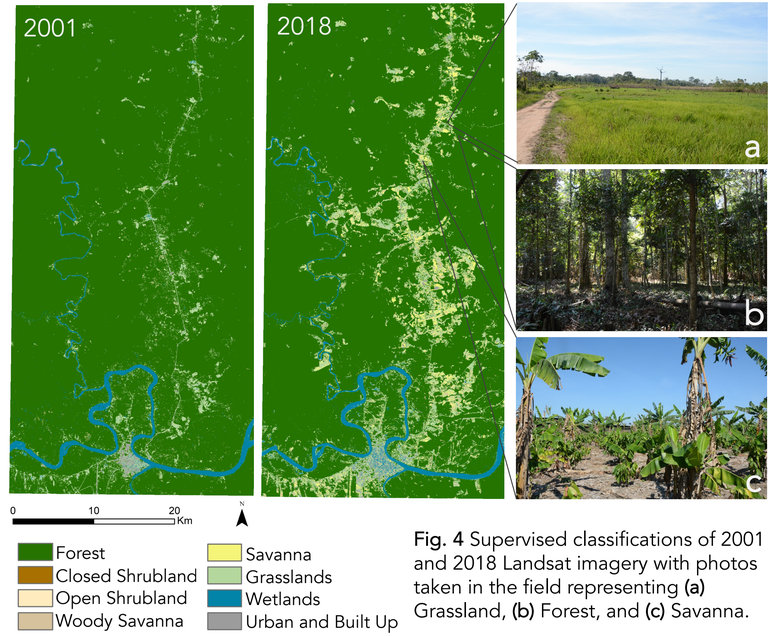

Fig. 4 Supervised classifications of 2001 and 2018 Landsat imagery with photos taken in the field representing **(a)** Grassland, **(b)** Forest, and **(c)** Savanna.

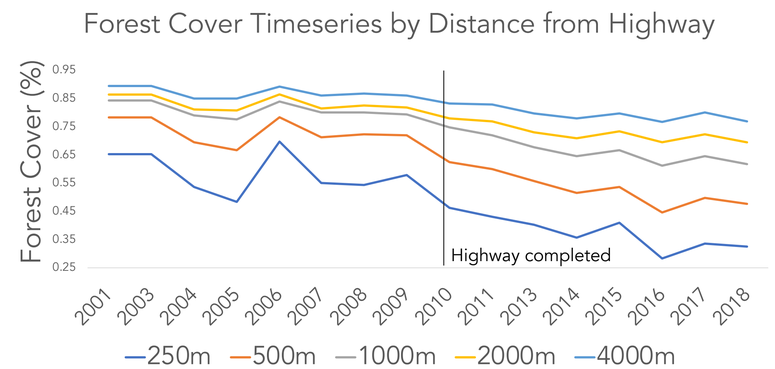

Fig. 5 Forest cover timeseries by buffer zones from highway. Areas closer to the highway saw earlier and more substantial forest loss than farther areas.

Conclusions

- NDVI is lowest and forest loss is most substantial closer to the highway
- No detectable increase in rates of deforestation after the completion of the highway in 2010
- Supervised classifications with MODIS training data achieved acceptable accuracy (76% overall based on ground validation), but land cover classes could be redefined to better suit the region

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