Abstract
Previous studies have quantified the extension of gold mining activities (Swenson et al., 2011; Elmes et al., 2014) and associated it with forest loss (Asner et al., 2013; Asner et al., 2017) in the Madre de Dios region of Peru. This study uses Spectral Mixture Analysis (SMA) in a cloud-computing platform to map forest loss within and outside key land tenure areas in this region. Landsat 7 Enhanced Thematic Mapper plus (ETM+) and Landsat 8 Operational Land Imager (OLI) Surface Reflectance data were utilized spanning 2013 and 2017 and spectral unmixing was performed to identify patterns of forest loss for each year. Planet Scope and RapidEye imagery were used to conduct an accuracy assessment and to identify potential drivers.

Objectives
- Quantify rates of forest loss within protected areas and indigenous communities
- Analyze how forest loss relates to other land tenures such as mining permits and reforestation concessions
- Identify main drivers of forest loss and explain how they relate with land use dynamics

Methodology
- Spectral Mixture Analysis: We defined forest, bare soil, water and shadow as endmembers and applied the spectral unmixing algorithm embedded in Google Earth Engine
- Change Detection: Forest loss is indicated by a decrease in 50% of the forest fraction between a post composite and a pre composite
- Validation and Accuracy Assessment: For 2013, 20 scenes with 5-m resolution from RapidEye-1, RapidEye-2, RapidEye-3, and RapidEye-5 were utilized, and for 2017, 41 scenes with 3-m resolution from PlanetScope were utilized. A stratified sampling design with 1008 randomly generated points and proportional allocation was used according to Olofsson et al. (2014) guidelines

Results & Discussion
Temporally and extensive forest loss progression can be observed, with concentrations revealed along the Malinowski River, within the Kotsimba community, on the northern border of the Tambopata National Reserve, and within the buffer zone of the protected areas. Many possible small-scale mining sites are located alongside the Inambat river.

Extent and Rates (ha)

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The average rate of forest loss in the study area between 2013 and 2017 is 3210 ha/yr. Our results also suggest that approximately 52% of the forest loss lies outside the mining permits’ locations.

Potential Drivers
- Gold mining
- Agriculture/Settlement
- Alluvium
- Misclassification

Accuracy Assessment
- Overall Accuracy: 95%
- Producer’s Accuracy:
  - Forest Loss: 78%
  - No Forest Loss: 97%
- User’s Accuracy:
  - Forest Loss: 74%
  - No Forest Loss: 98%

Conclusions
- Forest loss expansion continues to prevail in this region, threatening protected areas like the Tambopata National Reserve and the Indigenous Community of Kotsimba
- The maps created with the use of Landsat data provide information for subsequent assessments on land cover planning and monitoring
- The use of the spectral mixture algorithm as a change detection technique provides accurate results