Rapid Change and Development in Tropical Ecosystems due to Alluvial Gold Mining: A Multi-Sensor Fusion Approach to Quantify Impacts

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Peru’s Operation Mercury successfully stifled mining in its targeted areas, but activity shifted northwards

We examined 9 mining areas (Left, top) using both Sentinel-1 and Sentinel-2 to estimate change in mining pond extent and ‘yellowness’ before and after Operation Mercury (Left, bottom). Overall, pond extent changed from increasing by 33-90% per year before the intervention, to decreasing 4-5% per year afterwards (center). Between 70-90% of all ponds were abandoned in the targeted mining zones (right). However, we found that mining activity in nearby areas north of the intervention zone increased, with pond area increasing by 42-83% and deforestation totaling 3-5 km² per year.

Deep Learning allows for the identification and tracking of individual mining ponds and activity

We developed E-ReCNN, which combines convolutional and recurrent neural networks into a singular network. This is a supervised deep learning approach that identifies features (ponds) and keeps track of each pond’s status (actively mined, inactive, or in a state of transition between active and inactive).

Alluvial Gold Mining is an unrecognized major threat to tropical rivers across the planet

Using data from the Landsat 5 and 7 ETM+ records, we assessed the impact of alluvial gold mining across the planet. We identified 381 mining areas across 49 countries (Top Left), affecting 173 rivers, with mining beginning after 2006 in 45% of all sites (Bottom Left). We estimate over 35,000 river km in which SSC has been altered by mining, with over 21,000 km having SSC more than double their pre-mining average (Above Left). Across all continents, SSCs increase by several SDs relative to pre-mining levels following mining offset (Above Right). Our results provide a timeline for river impacts at a country-wide resolution (Right).