

Science for Environment Policy

High gold prices drive expansion of mining activity in the Amazon forest of Peru

Gold mining areas in the Peruvian Amazon rainforest expanded from under 10 000 hectares in 1999 to over 50 000 hectares by 2012, and now destroys more forest than agriculture and logging combined, new research has shown. Using high-resolution satellite imaging, researchers estimated gold mining areas to be twice as large as estimated by previous studies, which did not include the combined effects of thousands of small, mainly illicit, mining operations.

The Amazon rainforest of the Madre de Dios region in south-eastern Peru is one of the most [biodiverse](#) areas in the world and is also a major store of carbon. However, gold is found in the region and the expansion of gold mining activities, largely driven by rising international gold prices, is destroying parts of the rainforest and polluting the environment.

Apart from the three large commercial gold mines in the area, most of the thousands of mining operations are small-scale and unregulated. Illegal mining in dense tropical [forest](#) is hard to detect by traditional satellite imaging because the operations move frequently and are small-scale. In contrast to traditional satellite mapping, this study used high-resolution satellite imaging to map both large and small-scale gold mining activity in the region between 1999 and 2012.

With a resolution of 10 m², the technique provides a high level of detail that can reveal very small-scale changes in forest cover. The accuracy of the satellite mapping technique was confirmed with surveys on the ground and measurements from aircraft fitted with radar and optical sensors.

The imaging, which covered approximately 2.6 million hectares, revealed that gold mining areas expanded from under 10 000 hectares in 1999 to over 50 000 hectares by 2012. This is approximately double other estimates which were based on the three large mines and did not include the combined effect of thousands of small, mainly illicit, mining operations.

Proliferation of gold mining activity was particularly noticeable from 2008 to 2012, as the international price of gold dramatically increased after the global financial crisis in 2008. On average, 6 145 hectares of forest were lost each year in this period, compared with 2 166 hectares per year before 2008.

Also during this period, the area covered by small mining operations increased by 600%, so that by 2012, these unregulated mines accounted for over 50% of mining activity. Gold mining now destroys more forest in this region than the combined effects of ranching, agriculture and logging.

In addition to the loss of the forest and associated biodiversity, [soil](#) erosion increases sediment levels in rivers, harming aquatic ecosystems. Mercury, which is used to extract the gold from the soil and gravel, was identified as a major problem, because it pollutes air and water and can enter the food chain. Other environmental damage is caused by miners hunting for game in the forest.

This high-resolution technique has presented a clearer picture of the scale of mining activity in the region. The information can be used by authorities and conservation bodies to address the problem of forest degradation caused by gold mining.



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DOI:10.1073/pnas.1318271110. This study is free to view at:

www.pnas.org/content/early/2013/10/23/1318271110.full.pdf+html

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