

# More than half of all tropical deforestation directly attributable to industrial mining takes place in Indonesia

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New research published in *PNAS* today showed that, out of 26 countries, Indonesia accounted for 58.2% of the tropical deforestation directly

caused by industrial mining activities. Brazil, Ghana and Suriname also stood out in the study, which underscored the need for stronger measures to protect tropical forests from destructive economic activities like mining.

The researchers overlapped the geographic coordinates of industrial mines in operation from 2000–2019 with forest loss data from the Global Forest Change dataset for the same period. The data covered 26 countries representing 76.7% of the total tropical [deforestation](#) observed from 2000–2019. Coal extraction in the Indonesian province of East Kalimantan drove the [mining](#)-related deforestation in the country. The deforestation from [iron ore](#) and [gold mining](#) in the Brazilian state of Minas Gerais was clearly visible in the satellite data, while bauxite and gold mining were predominant in Ghana and Suriname.

Industrial mining also had widespread indirect impacts on deforestation. More than two-thirds of the countries studied had, within 50 kilometers of the areas designated for mines, higher rates of deforestation that were not connected to other factors.

"Against the rapidly growing demands for minerals, in particular for metals for [renewable energy](#) and e-mobility technologies, government and industry policies must take into account both the direct and indirect impacts of extraction," said Anthony Bebbington, Ph.D., Higgins Professor of Environment and Society at Clark University's Graduate School of Geography and corresponding author for the study.

"Addressing these impacts is an important tool for conserving [tropical forests](#) and protecting the livelihoods of communities who live in these forests."

For Indonesia, Brazil and Ghana, [tropical deforestation](#) from industrial mining peaked from 2010–2014 but continues today. Coal mining in Indonesia in particular doubled in this time period as output grew to

match increased demand from China and India. The scope of forest destruction in the country stood out in the study, especially in East Kalimantan which lost 19% of its tree cover in the past two decades. The province, the center of [coal mining](#) for the country, hosts the construction site of the future national capital Nusantara, a city being built where a timber plantation once stood—and a tropical [forest](#) before that.

The study points to the need for Environmental Impact Statements and other permitting requirements for industrial mining to include a broader geographic scope that includes more territory outside of the project concession area. Applications for new mining projects should also not be examined in isolation; the cumulative impacts of other projects, such as agricultural developments, need to be considered.

"There is a broad range of environmental damage caused by mining operations on top of deforestation, including destruction of ecosystems, loss of biodiversity, disruption of water sources, the production of hazardous waste and pollution," said Stefan Giljum, lead author of the study and associate professor at the Institute for Ecological Economics, Vienna University of Economics and Business. "Government permitting should take all of this into account; an industrial mine can easily disrupt both landscapes and ecosystems. Industrial mining remains a hidden weakness in their strategies to minimize environmental impacts."

"Although Indonesia's total deforestation has declined annually since 2015, these findings emphasize the continued need for strong land use planning to ensure mining does not destroy forests or violate community rights," said Hariadi Kartodihardjo, Ph.D., Professor of Forest Policy at Bogor Agricultural University.

Previous research in the Brazilian Amazon has shown that acknowledging and enforcing the collective property rights of

Indigenous Peoples and local communities is one of the most effective ways to [prevent deforestation](#), as deforestation in their territories is significantly lower than in places managed by other government or private entities.

The most recent [United Nations climate report](#) concurred, stating, "Supporting Indigenous self-determination, recognizing Indigenous Peoples' rights and supporting Indigenous knowledge-based adaptation are critical to reducing climate change risks and effective adaptation."

The study did not include direct deforestation from artisanal and small-scale mining, as standardized global databases with geographic coordinates for such operations do not yet exist in forms that are amenable to statistical analysis. But the authors recognize that artisanal and small-scale mining, as well as illicit mining, generate significant environmental damage that demands scrutiny, response and remediation.

**More information:** A pantropical assessment of deforestation caused by industrial mining, *Proceedings of the National Academy of Sciences* (2022). [DOI: 10.1073/pnas.2118273119](https://doi.org/10.1073/pnas.2118273119).

Provided by Clark University

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