



LETTERS

Edited by Jennifer Sills

Venezuela's harmful mining activities grow

In 2016, Venezuela's government designated 112,000 km² of tropical rainforest and Indigenous land as the Orinoco Mining Arc (OMA), a special economic zone for mining (1). This controversial decision, which aimed to tighten government oversight over mineral mining and trading in the region, resulted instead in promoting a complex network of intertwined legal and illegal mining activities throughout the country (2). To protect Venezuela's people, culture, biodiversity, and environment, the country must curtail mineral extraction.

Since the OMA was established, there has been over 60,000 ha of mining activity in the southern Orinoco region (3). In the Guiana Shield, one of the most biodiverse regions in the world, mining is responsible for more than 90% of total deforestation (4). The mines are subject to no environmental or sociocultural impact assessments (3). Moreover, designating the land for mining in the OMA violates the national sovereignty and natural and cultural heritage of 14 Indigenous Nations (5) as well as the rights of Venezuelan citizens to prior consultation.

The OMA's lack of oversight has allowed mining to proliferate in protected areas (6). Mining has led to the destruction of ecosystems in the Canaima and Caura National Parks, which overlap with the OMA. Yapacana National Park, which is located outside the OMA's borders, has been harmed indirectly (7). Mining activities are also taking place atop sacred tepuis (8), table-top mountains considered houses of gods by Indigenous peoples.

Mining in the OMA has also exacerbated violence and public health challenges. Military and armed syndicates

have been fighting for control of various mining operations, further blurring the lines between legal and illegal activities (9). The mining workforce in the OMA includes child labor and modern slavery. Violence and crimes against women are commonplace (2). More than 80% of malaria cases in regions bordering the Brazilian Amazon originate in Venezuela in areas with high mining activity and increasing deforestation (10).

The negative impacts of mining on society and international security are overlooked in most long-term socioeconomic planning contexts, in part because of critical data gaps. In Venezuela, official data on mining extraction are lacking (6), and misleading global statistics hinder control measures and investigative processes.

To mitigate the social and ecological damage caused by mining in Venezuela, the international community should monitor Venezuela's mining activities (11) and, in the case of illegal activities, penalize those involved. The Venezuelan government should work with neighboring countries to eliminate the illicit market and require international organizations to reduce the purchase of illegally extracted gold. The government should also consult with civil society, especially Indigenous (12) and scientific communities, to assess the risks of mining activities and devise and enact mitigation and environmental restoration plans.

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REFERENCES AND NOTES

1. "Decreto N° 2.248, mediante el cual se crea la Zona de Desarrollo Estratégico Nacional 'Arco Minero del Orinoco'" (2016); <https://www.notilogia.com/2016/02/gaceta-oficial-n-40-855-creacion-del-arco-minero-del-orinoco.html> [in Spanish].
2. B. Ebus, "Digging into the Mining Arc." *Info Amazonia and Correo del Caroni* (2018); <https://arcominero.infoamazonia.org/story>.
3. "Amazonía bajo Presión 2020" (Red Amazónica de Información Socioambiental Georreferenciada, 2020); <https://www.raisg.org/es/publicacion/amazonia-bajo-presion-2020/>.
4. M. Kalamandeen *et al.*, *J. Appl. Ecol.* **57**, 1730 (2020).
5. V. Morón-Zambrano, E. Isasi-Catalá, F. Cavada-Blanco, E. Agudo-Adriani, A. Blanco-Davila, Eds., *Una Mirada al Soberbio Sur del Orinoco: entendiendo las implicaciones del Arco Minero: Edición Especial de Explora* (Sociedad Venezolana de Ecología y Provita, 2018) [in Spanish].
6. "Gold flows from Venezuela: Supporting due diligence on the production and trade of gold" (OECD, 2021); <https://mneguidelines.oecd.org/gold-flows-from-venezuela-supporting-due-diligence.htm>.
7. M. R. Cabello, "Gold mining devastation beneath the eyes of Roraima Tepuy," *Correo del Caroni* (2020).
8. S. Schmidt, A. V. Herrero, J. K. Chen, "The gold-mining city that is destroying a sacred Venezuelan mountain," *The Washington Post* (2022).
9. UN Office of the High Commissioner for Human Rights, "Venezuela: UN releases report on criminal control of mining area and wider justice issues" (2020); <https://www.ohchr.org/en/press-releases/2020/07/venezuela-un-releases-report-criminal-control-mining-area-and-wider-justice?LangID=E&NewsID=26096>.
10. M. E. Grillet *et al.*, *Science* **359**, 528 (2018).
11. C. V. Burrelli, "Venezuela's ecocide needs international attention" (Center for Strategic and International Studies, 2020).
12. Convention on Biological Diversity, "Kunming-Montreal Global Biodiversity Framework: 2030 targets" (2022); <https://www.cbd.int/gbf/targets/>.

10.1126/science.adh4314

Renewable energy in China's abandoned mines

Maximizing the development of renewable energy such as wind and solar power is an effective way to achieve carbon neutrality (1). China has promised to triple its wind and solar capacity to more than 1.2 GW by 2030 (2), but the photovoltaic and fan equipment needed to meet this goal will require substantial land resources (3). Although the country is building massive wind and solar power bases in the western Gobi Desert, the desert region is far from areas of high power demand (4). China needs to find more land for renewable energy systems in the eastern part of the country (5). Repurposing abandoned mine lands could be the solution (6).

Scientific and governmental interest in land-constrained energy production is growing (7). Chevron Questa has built photovoltaic projects in an open-pit mine in New Mexico (7). Photovoltaic projects have also been initiated in the abandoned mines in Meuro and Schipkau, Germany (8).



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Science, **380** (6646), .

DOI: 10.1126/science.adh4314

View the article online

<https://www.science.org/doi/10.1126/science.adh4314>

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