



Brazil is using the disruption of Russian fertilizer imports to justify allowing mining in Indigenous lands.

Edited by Jennifer Sills

War serves as excuse for Amazon destruction

The Russian invasion of Ukraine is providing a new excuse for Amazon destruction. On 2 March (7 days after the invasion began), Brazilian President Jair Bolsonaro called on the National Congress to give urgency to approving bill PL 191/2020 to supply Brazil's agribusiness with the fertilizers the country normally imports from Russia (1). On 9 March, Bolsonaro's supporters in Congress passed a motion granting "urgent" status to the bill, allowing it to bypass the normal committee process. The motion was approved but has not been finalized out of fear of international boycotts of Brazilian minerals.

PL 191/2020 would open Indigenous lands to mining, hydroelectric dams, and logging, cattle ranching, and industrial agriculture by non-Indigenous entrepreneurs and companies (2). It was submitted to the National Congress in February 2020 by President Bolsonaro and gained priority in February 2021 when both houses of Congress were captured by the coalition of parties that supports Bolsonaro's anti-environmental agenda (3). However, it stalled until the invasion of Ukraine.

Indigenous lands are essential to maintaining the environmental services

of Brazil's Amazon rainforest, given that these lands protect more forest than do federal "conservation units" (4). The supposed justification for approving the bill is the alleged need to extract potassium, a key component of fertilizers, from the Autazes mine in Brazil's state of Amazonas. However, Autazes is not located on officially recognized Indigenous land, making the passage of the bill irrelevant to this goal (5). Furthermore, Russia is not the world's only source of potassium: Other countries, led by Canada, are major international suppliers (6). Even within Brazil, mining Amazonia is not required to obtain potassium. The largest potassium deposits are in the state of Minas Gerais, and Brazil's deposits outside of Amazonia could supply the country with potassium until at least 2100 (7).

Passing PL 191/2020 would not achieve the goals articulated by its supporters. Even if it affected the status of the planned mine in Autazes, the project would not be functional in time to solve Brazil's predicted fertilizer shortage for the coming year. Imports will have to supplement the supply. Major mining companies in Brazil are now opposing PL191/2020 (8). International actors, including the Canadian companies invested in Autazes (9), should not agree to initiate this project given the false pretenses under which the bill is being advanced. Moreover, if the bill goes into effect without changes, mineral importers

should follow through with potential boycotts to show that the irresponsible actions by Brazil have consequences.

Paulo Arthur A. Trindade^{1,2*}, Juliana S. Araújo^{2,3}, Valter M. Azevedo-Santos^{1,2,4}, Friedrich W. Keppeler^{1,2,5}, Tommaso Giarrizzo^{1,2,6}, Philip M. Fearnside⁷

¹Federal University of Pará, Belém, PA, Brazil.

²Aquatic Ecology Group, Belém, PA, Brazil.

³Paulista State University, Sorocaba, SP, Brazil.

⁴Federal University of Tocantins, Porto Nacional, TO, Brazil.

⁵Center for Limnology, University of Wisconsin—Madison, Madison, WI 53706, USA.

⁶Marine Sciences Laboratory, Federal University of Ceará, Fortaleza, CE, Brazil.

⁷National Institute for Research in the Amazon, Manaus, AM, Brazil.

*Corresponding author.

Email: pauloaatrindade@gmail.com

REFERENCES AND NOTES

- R. D. Coletta, "Bolsonaro usa possível falta de fertilizantes da Rússia para defender mineração em terras indígenas," *Folha de São Paulo* (2022); <https://www1.folha.uol.com.br/mercado/2022/03/bolsonaro-usa-possivel-falta-de-fertilizantes-para-defender-mineracao-em-terras-indigenas.shtml?origin=folha> [in Portuguese].
- Câmara dos Deputados, 2020 PL191/2020 (2020); www.camara.leg.br/proposicoesWeb/fichadetramitacao?idPrOposicao=2236765 [in Portuguese].
- L. Ferrante, P. M. Fearnside, *Science* **371**, 898 (2021).
- E. M. Nogueira, A. M. Yanai, S. S. Vasconcelos, P. M. L. A. Graça, P. M. Fearnside, *Reg. Environ. Change* **18**, 573 (2018).
- M. Santilli, "Bolsonaro mente sobre potássio em terras indígenas," Instituto Socioambiental (2022); <https://neomundo.org.br/2022/03/09/bolsonaro-mente-sobre-potassio-em-terras-indigenas/> [in Portuguese].
- Government of Canada, "Potash facts" (2022); www.nrcan.gc.ca/our-natural-resources/minerals-mining/minerals-metals-facts/potash-facts/20521.

- T. Pimentel, "Estudo da UFMG contradiz Bolsonaro sobre exploração de potássio em terras indígenas para fertilizantes," *g1 Minas* (2022); <https://g1.globo.com/mg/minas-gerais/noticia/2022/03/07/estudo-da-ufmg-contradiz-bolsonaro-sobre-exploracao-de-potassio-em-terras-indigenas-para-fertilizantes.ghtml> [in Portuguese].
- M. Pajolla, "Após repercussão negativa, mineradoras abandonam defesa de PL que atinge terras indígenas," *Brasil de Fato* (2022); www.brasildefato.com.br/2022/03/15/apos-repercussao-negativa-mineradoras-abandonam-defesa-de-pl-que-atinge-terras-indigenas [in Portuguese].
- A. Boadle, "Bolsonaro pushes for mining on Brazil's indigenous lands, citing fertilizer pinch," *NASDAQ* (2022); www.nasdaq.com/articles/bolsonaro-pushes-for-mining-on-brazils-indigenous-lands-citing-fertilizer-pinch.

10.1126/science.abq3611

Drug building blocks and libraries at risk in Ukraine

Ukrainian chemical vendors such as Life Chemicals, Otava, and Enamine supply more than 50% of the 400,000 chemical building blocks used by scientists internationally to synthesize new drugs (1). These building blocks also serve as the substrates for libraries of more than 40 billion readily accessible or "tangible" molecules, which can be constructed by stitching the building blocks into larger molecules and are synthesized as needed. Drawing from these molecules has revealed novel leads for multiple drug targets (2–6). More than 90% of this tangible chemical space also comes from Ukraine. The Russian invasion of Ukraine endangers both the unique building block library and the 40 billion–molecule tangible library that derives from it.

Ordinarily, more than 2000 new building blocks are synthesized per month by Enamine alone (7)—the collection is the fruit of decades of synthesis by thousands of chemists. For the first month of the war, production stopped entirely. Work has tentatively restarted, but the reprieve is fragile.

These building blocks and tangible libraries have been constructed over the past 30 years, as has the expertise to assemble them into the kaleidoscope of compounds that, until 24 February, were openly available to the world's drug hunters and chemical biologists. International aid should include protection for Ukrainian scientists, their families, and their labs and reagents. Improved safety for supply lines into and out of Ukraine will preserve access to and the integrity of the building-block and tangible chemical libraries. Once the war has ended, it will be vital to help the Ukrainian scientific community rebuild, allowing them to continue their work to the benefit of all.

Ivan S. Kondratov^{1,2}, Yuri S. Moroz^{3,4}, John J. Irwin⁵, Brian K. Shoichet^{5*}

¹Enamine Ltd., Kyiv 02094, Ukraine. ²V.P. Kukhar

Institute of Bioorganic Chemistry & Petrochemistry, National Academy of Sciences of Ukraine, Kyiv 02660, Ukraine. ³Chemspace, Kyiv 02094, Ukraine. ⁴Taras Shevchenko National University of Kyiv, Kyiv 01601, Ukraine. ⁵Department of Pharmaceutical Chemistry and Quantitative Biology Institute, University of California San Francisco, San Francisco, CA 94143, USA. *Corresponding author. Email: shoichet@cgl.ucsf.edu

REFERENCES AND NOTES

- Y. Zabolotna *et al.*, *J. Chem. Inf. Model* **62**, 2171 (2021).
- J. Lyu *et al.*, *Nature* **566**, 224 (2019).
- R. M. Stein *et al.*, *eLife* **9**, e53779 (2020).
- C. Gorgulla *et al.*, *Nature* **580**, 663 (2020).
- A. A. Sadybekov *et al.*, *Nature* **601**, 452 (2022).
- A. Alon *et al.*, *Nature* **600**, 759 (2021).
- Enamine, Building Blocks Catalog; <https://enamine.net/building-blocks/building-blocks-catalog>.

COMPETING INTERESTS

B.K.S. cofounded Epiodyne; Deep Apple Therapeutics, Inc., a drug discovery company; and BlueDolphin, LLC, a molecular docking contract research organization. J.J.I. cofounded Deep Apple Therapeutics, Inc., and BlueDolphin, LLC.

10.1126/science.abq7841

Protecting global marine animal forests

Despite years of awareness raised through international initiatives such as the UN Climate Change Conference in Glasgow (COP26) (1), the Decade of Ocean Science for Sustainable Development (2021–2030) (2), and the Ecosystem Restoration decade (3), human activities continue to deeply transform marine ecosystems (4). Sustainable Development Goal 14—Life Below Water—is the least-funded and most-underrepresented objective in the European Union (2), with decades of budget allocation delay for ocean research and conservation. Benthic ecosystems suffer from the effects of bottom trawling, urban and agricultural pollution, bioinvasions, climate change, and other anthropogenic pressures (5). Among these ecosystems, marine animal forests, which are dominated by benthic suspension feeders such as sponges, hard corals, and gorgonians, form three-dimensional habitats (6) that are particularly vulnerable to disturbances (7).

Marine animal forests include habitats ranging from coastal to deep sea, representing one of the largest biomes on Earth (8). The forests are ecologically relevant as biodiversity hotspots and nursery grounds, and evidence suggests that they have the potential to provide ecosystem services (9), especially by ameliorating the effects of climate change by immobilizing carbon (10). However, information on distribution, population dynamics, connectivity, and ecosystem functioning of key

marine animal forest species is still lacking. Although technology is available to gather the needed data (11), these targets are not currently a political priority.

Anthropogenic disturbances, past and present (12), jeopardize the ecological processes of marine animal forests and threaten the services they provide to human societies worldwide. These communities urgently need conservation, monitoring, and restoration far beyond the efforts made up to now. Protecting marine animal forests requires scientific, social, and political investment in increasing our knowledge. With a more extensive understanding, we will be able to properly manage these threatened habitats. Given that their eradication will have substantial negative consequences for the maintenance of planetary health, marine animal forests should be prioritized in conservation plans.

Sergio Rossi*, Lorenzo Bramanti, Paulo Horta, Louise Allcock, Marina Carreiro-Silva, Martina Coppari, Vianney Denis, Louis Hadjioannou, Enrique Isla, Carlos Jimenez, Mark Johnson, Christian Mohn, Covadonga Orejas, Andreja Ramšak, James Reimer, Baruch Rinkevich, Lucia Rizzo, Maria Salomidi, Toufiek Samaai, Nadine Schubert, Marcelo Soares, Ruth H. Thurstan, Paolo Vassallo, Patrizia Ziveri, Juanita Zorrilla-Pujana

*Corresponding author.

Email: sergio.rossi@unisalento.it

For full author affiliations, go to www.science.org/doi/10.1126/science.abq7583.

REFERENCES AND NOTES

- UN Climate Change Conference UK 2021 (2021); <https://ukcop26.org/>.
- Decade of Ocean Science for Sustainable Development (2021–2030); www.oceandecade.org.
- UN Decade on Ecosystem Restoration 2021–2030; www.decadeonrestoration.org.
- N. L. Bindoff *et al.*, in *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*, H.-O. Pörtner *et al.*, Eds. (Cambridge University Press, 2019), pp. 447–587.
- C. M. Duarte *et al.*, *Nature* **580**, 39 (2020).
- S. Rossi *et al.*, in *Marine Animal Forests: The Ecology of Benthic Biodiversity Hotspots*, S. Rossi *et al.*, Eds. (Springer, 2017), pp. 1–28.
- M. R. Clark *et al.*, *Front. Mar. Sci.* **10**, 3389/fmars.2019.00063 (2019).
- J. S. Stark *et al.*, in *The IUCN Global Ecosystem Typology 2.0: Descriptive Profiles for Biomes and Ecosystem Functional Groups*, D. A. Keith *et al.*, Eds. (IUCN, Gland, Switzerland, 2020).
- C. Paoli *et al.*, in *Marine Animal Forests: The Ecology of Benthic Biodiversity Hotspots*, S. Rossi *et al.*, Eds. (Springer, 2017), pp. 1271–1312.
- S. Rossi, L. Rizzo, in *Perspectives on the Marine Animal Forests of the World*, S. Rossi, L. Bramanti, Eds. (Springer-Nature, 2020), pp. 333–400.
- P. Rossi *et al.*, *Front. Mar. Sci.* **10**, 3389/fmars.2021.591292 (2021).
- R. H. Thurstan, J. M. Pandolfi, P. S. Zu Ermgassen, in *Marine Animal Forests: The Ecology of Benthic Biodiversity Hotspots*, S. Rossi *et al.*, Eds. (Springer, 2017), pp. 947–964.

COMPETING INTERESTS

The authors represent the Marine Animal Forest of the World COST Action initiated by the European Cooperation in Science and Technology (<https://maf-world.eu/>).

10.1126/science.abq7583

War serves as excuse for Amazon destruction

Paulo Arthur A. TrindadeJuliana S. AraújoValter M. Azevedo-SantosFriedrich W. KeppelerTommaso GiarrizzoPhilip M. Fearnside

Science, 376 (6596),

View the article online

<https://www.science.org/doi/10.1126/science.abq3611>

Permissions

<https://www.science.org/help/reprints-and-permissions>

Use of this article is subject to the [Terms of service](#)