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Mining undermining Brazil's environment

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LETTERS

Edited by Jennifer Sills

Mining undermining Brazil's environment

ON 5 NOVEMBER 2015, two mining dams jointly owned by Vale and BHP Billiton collapsed in Brazil. The toxic sludge wiped out whole villages, leaving 19 dead and suffocating 600 km of one of Brazil's most valuable rivers (1). One might expect increased scrutiny on the mining sector's social responsibilities after such an event. Instead, Brazilian politicians—many of whom owe their campaign funding to mining companies—have recently pushed forward three pieces of legislation intended to neuter environmental regulations.

The first bill (PL 37/2011) will create the National Mining Agency, giving more autonomy to the sector. In effect, it will allow the mining industry to decide which areas to mine. A complementary piece of legislation (PL 1610/1996) will authorize mining in indigenous lands. There are 4181 official requests from mining companies that are held up by current regulations and awaiting the vote on this bill. If it passes, this will open the possibility for these companies to operate in 177 indigenous territories (2). Indigenous lands cover one-fifth of the Brazilian Amazon and currently represent one of the most effective barriers against deforestation (3). Finally, the constitutional amendment PEC 65/2012 aims to weaken the licensing process of large developments by eliminating the current power that environmental agencies have to suspend a project based on its Environmental Impact Assessment (4, 5). In practice, Environmental Impact Assessments will be reduced to a tick-box requirement for the mining industry.

The biomes most threatened by mining—Amazon, Atlantic Forest, and Cerrado (6)—are also the most valuable in terms of biodiversity and ecosystem services (7). Approval of these three pieces of legislation would signify that Brazil is no longer at the forefront of sustainability and confirm that its politics are vulnerable to development pressures and corporate lobby (6). We agree with Edwards and Laurance (8) that an independent global authority to police large multinational mining companies in developing nations is urgently needed.

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Brazil's Amazon conservation in peril

IN HER NEWS In Depth story "Brazilian crisis threatens science and environment" (27 May, p. 1044), L. Wade explored the consequences of the controversial constitutional amendment that is under consideration in the Brazilian Senate amidst the country's economic and political turmoil. This amendment, known as PEC 65/2012, effectively abolishes Brazil's environmental licensing process (1). Ratification could lead to large-scale, indiscriminate destruction of the Amazon biome.

About 334 dams have been proposed throughout the Amazon basin, and more than half of them are in the Brazilian Amazon (2). In addition, over 1 million square kilometers of the Brazilian Amazon have been registered as under consideration for mining (3). The implementation of many of these proposed projects is hindered by

environmental restrictions: Sixty percent of the Amazonian hydropower potential (4) and 20% of Amazonian areas with registered interest for mining (3) lie inside strictly protected areas and indigenous lands. If ratified, the new amendment will allow developers to ignore environmental restrictions.

Brazil's most recent 10-year energy expansion plan states that 12 megadams must be completed in the Amazon basin by 2024. These dams represent 93% of the country's projected increase in hydropower generation capacity (5). If the amendment is ratified, these future dams—together with associated infrastructure megaprojects such as highways and electricity transmission lines—would be implemented despite insufficient impact assessment. If the associated highway construction also lacks sustainable planning, the dam project could indirectly lead to an indiscriminate expansion of agricultural frontiers and an increase in deforestation rates.

To protect the Amazon ecosystem, we must modernize Amazon energy plans, replace conventional infrastructure with sustainable infrastructure, and integrate planning and management. Recent calls for basin-scale planning before new infrastructure projects (2, 3) are constructed are on the right track. The proposed amendment would derail these plans, putting decades of conservation efforts and the Amazon system itself in jeopardy.

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Proposed changes to regulations would allow mining projects in Brazil's indigenous territories.

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Brazil's Amazonian fish at risk by decree

A MISGUIDED POLICY, based not on science but rather on the need to generate profit, threatens the highly diverse native fish communities in the Amazon River Basin. A controversial law—4330/2016 (1)—signed by the governor of Amazonas State, Brazil, allows the rearing of non-native fish and genetically modified species, as well as the damming of streams for this purpose, even in Areas of Permanent Protection.

In the midst of a Brazilian political crisis (2), the law was sanctioned without consulting the federal government, environmental agencies, or the public. The ratification of the law was not approved by the Ministry of Environment, which opposes it (3). The Amazon Basin hosts the most species-rich fish fauna in the world (4), and this fauna remains uncontaminated by non-native fishes (5). The law is dangerous because one of the main drivers of species introduction in Brazil is the escape of fish from fish farming

facilities (6). Escape of non-native species with high invasive capacity is a serious threat to aquatic biodiversity (7, 8), a threat that can be exacerbated if the escaped fish are genetically modified.

Moreover, aquaculture with non-native species in the Amazon Basin is unnecessary given that native fisheries can be profitable and provide socioeconomic benefits without putting the native fauna at risk. Finally, the new law contradicts current federal laws 5197/67 (9) and 9605/98 (10), which prohibit and criminalize the introduction of species.

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TECHNICAL COMMENT ABSTRACTS

Comment on "Sensitivity of seafloor bathymetry to climate-driven fluctuations in mid-ocean ridge magma supply"

Maya Tolstoy

Olive *et al.* (Reports, 16 October 2015, p. 310) and Goff (Technical Comment, 4 September 2015, p. 1065) raise important concerns with respect to recent findings of Milankovitch cycles in seafloor bathymetry. However, their results inherently support that the Southern East Pacific Rise is the optimum place to look for such signals and, in fact, models match those observations quite closely.

Full text at <http://dx.doi.org/10.1126/science.aaf0625>

Response to Comment on "Sensitivity of seafloor bathymetry to climate-driven fluctuations in mid-ocean ridge magma supply"

J.-A. Olive, M. D. Behn, G. Ito, W. R. Buck, J. Escartín, S. Howell

Tolstoy reports the existence of a characteristic 100,000-year period in the bathymetry of fast-spreading seafloor but does not argue that sea level change is a first-order control on seafloor morphology worldwide. Upon evaluating the overlap between tectonic and Milankovitch periodicities across spreading rates, we reemphasize that fast-spreading ridges are the best potential recorders of a sea level signature in seafloor bathymetry.

Full text at <http://dx.doi.org/10.1126/science.aaf2022>

ERRATA

Erratum for the Report "Genomic correlates of response to CTLA-4 blockade in metastatic melanoma" by E. M. Van Allen *et al.*, *Science* **352, aaf8264 (2016).** Published online 15 April 2016; 10.1126/science.aaf8264

Erratum for the Research Article "Architecture of the type IVa pilus machine" by Y.-W. Chang *et al.*, *Science* **352, aaf7977 (2016).** Published online 8 April 2016; 10.1126/science.aaf7977

Erratum for the Report "MYC regulates the antitumor immune response through CD47 and PD-L1" by S. C. Casey *et al.*, *Science* **352, aaf7984 (2016).** Published online 8 April 2016; 10.1126/science.aaf7984



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Editor's Summary

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