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1 Amazon projects pose risks to 2 Brazil and the World

3
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25 The 29th conference of the parties of the United Nations climate convention
26 (COP 29) began full of promises in Baku, Azerbaijan. These annual meetings attempt to
27 address the unfolding climate crisis, and the talks this year left many crucial issues
28 unresolved. In recent years, a series of climate-fueled disasters and extreme events such
29 as Australian bushfires, drought and fires in the Amazon, floods in southern Brazil,
30 Hurricane Milton in the Gulf of Mexico, and North American and Spanish floods have
31 wreaked havoc across the world. The continued upward trajectory of greenhouse gas
32 (GHG) emissions suggests that the window for limiting warming to 1.5°C above the
33 pre-industrial average may already have closed, given that we have already reached that
34 record temperature in 2024 (Ripple et al. 2024).

35 Unlike major global powers (such as the United States, China and European
36 Union countries), whose main contributors to GHG emissions are the burning of fossil
37 fuels, deforestation is the main source of emissions in developing countries that still
38 have large amounts of tropical forest cover, such as Brazil, Bolivia, Peru, Indonesia and
39 the Democratic Republic of Congo. Tropical forests store about 229 billion tons of
40 carbon in their aboveground live woody vegetation (Baccini et al. 2012), and the
41 conservation of these areas is vital for the mitigation of climate change (Pereira et al.
42 2024). The Amazon, the world's largest rainforest, plays a crucial role in climate
43 stability. The Brazilian portion of the region stores an estimated 59 billion tons of
44 carbon in the vegetation above- and below-ground (Nogueira et al. 2015), while the
45 other countries store roughly 20 billion tons (Fearnside & Silva 2023). Stocks in the soil
46 are even greater, with 93 billion tons just in the top meter in the whole of Amazonia
47 (Quesada et al. 2011). Brazil, which holds over 60% of the Amazon rainforest, has a
48 vital role in containing global warming and could lead the global climate agenda if it
49 complements its current deforestation control measures with reversal of its many
50 policies and plans that imply increased future emissions.

51 Brazil is making efforts to reduce deforestation and implement its National
52 Energy Transition Policy (Governo Brasileiro 2024). The estimated deforestation rate in
53 the Brazilian Amazon for the period from August 2023 to July 2024 was 6288 km²,
54 representing a reduction of 30.6% compared to the previous 12-month period and
55 marking the lowest rate in the last nine years (INPE 2024). However, these data only
56 include clearcutting the forest (i.e., deforestation), and exclude forest degradation
57 caused by selective logging and the very intense fires that occurred during the same
58 period. In addition to the slowdown in loss of Amazon forest, clearing of Cerrado
59 (central Brazilian savanna) also decreased. These positive changes reflect the results
60 command-and-control operations by Brazil's Ministry of Environment and Climate
61 Change. Buoyed by these encouraging results, at COP 29 Brazil presented a revised
62 Nationally Determined Commitment, or NDC, promising to reduce the country's
63 emissions by 59-67% by 2035 relative to the country's emission in 2005 (a year with
64 very high deforestation). While announced as "ambitious," conflicting government
65 actions risk making this goal entirely unattainable (ClimaInfo 2024a). The Brazilian
66 government's current plans contradict the official narrative by supporting three fatal
67 mistakes in the Amazon: 1.) oil extraction at the mouth of the Amazon River (Figure
68 1A); 2.) rebuilding 407 km of the BR-319 (Manaus - Porto Velho) highway (Figure 1B,
69 and C); and 3.) Construction of 933 km of the Ferrogrão Railway (Sinop-Miritituba)
70 (Figure 1D).

71



73

74

75 **Figure 1.** Brazil's hat-trick for Amazon destruction. A) Drillship sent to drill Poço Pitu
 76 Oeste, in Rio Grande do Norte. Oil extraction in the mouth of the Amazon River
 77 contradicts the promise of an energy transition. B-C) Rebuilding 407 km of the BR-319
 78 (Manaus - Porto Velho) highway, which, together with existing and planned roads
 79 connected to it, would expose approximately half of what remains of Brazil's Amazon
 80 rainforest to the entry of deforesters. D) Movement of trucks along BR-163. To build
 81 Ferrogrão, the government wants to increase the width of the BR-163 highway, cutting
 82 down more trees and impacting indigenous lands and conservation units. Photographs:
 83 A) Acervo Foresea, B) Lalo de Almeida/Folhapress, C) P. M. Fearnside, D) Alberto
 84 César Araújo/Amazônia Real.

85

86 **Fossil fuels**

87 Petrobras, Brazil's government oil company, expects to receive a license soon to
 88 drill for oil in the mouth of the Amazon River (Figure 1A). IBAMA (the executive
 89 agency responsible for implementing environmental policy in Brazil) denied Petrobras's
 90 drilling request in May 2023, pointing out a series of adjustments that the company
 91 make to obtain the license. Oil drilling in the mouth of the Amazon River could have
 92 devastating consequences due to the region's status as a socially and environmentally
 93 sensitive area. This activity could impact the Great Amazon Reef System, an ecosystem
 94 that supports corals, sponges, and fish communities, which is highly fragile and poorly
 95 studied, and plays an important role in maintaining the planet's ecological balance
 96 (Rodrigues 2023). Oil extraction could impact Indigenous peoples, quilombolas
 97 (communities of descendants of escaped enslaved Africans), and other traditional
 98 communities in Brazil and the Guianas.

99 Establishing a new oil field in the mouth of the Amazon River, as with other
 100 planned offshore fields along Brazil's coast and in the Amazon forest, implies continued
 101 extraction for decades to come, when the world must halt its use of fossil fuels for
 102 energy. Even the International Energy Agency (IEA), which is usually on the "other
 103 side" of environmental issues, has concluded that no new oil or gas fields should be
 104 initiated anywhere in the world, restricting extraction to already existing fields and
 105 reducing it to zero by 2050 (IEA 2021).

106 It is inconsistent for Brazil, a country that claims to support the goal of limiting
107 global warming to 1.5°C, to aspire to be the last country in the world to cease extracting
108 oil, which is now the government’s plan (ClimaInfo, 2024b). With respect to the
109 proposed drilling in the mouth of the Amazon, President Lula has said that “We will not
110 throw away any opportunity to make this country grow” (Vieceli and Nogueira 2024).
111 Since Brazil will always want to grow, this represents a license to extract oil forever.

112 113 **Highways and railways**

114 The Brazilian Ministry of Transportation wants to rebuild 407 km of the BR-319
115 highway (Manaus-Porto Velho) (Figure 1B and C), BR-319, together with the existing
116 and planned roads connected to it, would expose approximately half of what remains of
117 the Brazilian Amazon rainforest to the entry of deforesters (Fearnside 2022). Once roads
118 are opened providing access to these areas, most of what happens is beyond the
119 government’s, regardless of political discourse on plans for “governance” (Fearnside
120 2024).

121 The Ministry of Transportation also wants to build the 933-km Ferrogrão
122 railway, which would connect the soy-producing region of Sinop, Mato Grosso, to the
123 Port of Miritituba in the state of Pará, paralleling the BR-163 (Santarém-Cuiabá)
124 highway (Killeen 2023) (Figure 1D). The Climate Policy Initiative (CPI) has estimated
125 that the project would cause 2043 km² of deforestation (Araújo et al. 2020). Like BR-
126 319, Ferrogrão has not yet received an installation license and lacks the legally required
127 consultations with impacted Indigenous peoples.

128 Except for the Ministry of Environment and Climate Change, essentially all of
129 the rest of the Brazilian government acts to increase deforestation. The largest area
130 “undesignated” government land is in the area would be opened by the planned roads
131 associated with BR-319, and the National Institute of Colonization and Agrarian
132 Reform (INCRA) intends to legalize land claims in such “undesignated” land (Vilani et
133 al. 2023), a practice that is a major driver of Brazil’s Amazon deforestation (Fearnside
134 2017). President Lula has even said he plans to create a “shelf” of such land for
135 distribution (Machado 2023),

136 Both BR-319 and its planned side roads, such as AM-366, cross one of the best-
137 preserved parts of the Amazon. These projects will be harmful to Indigenous peoples
138 and to biodiversity (Figure 1B, C, and D). They may contribute to the emergence of new
139 pandemics, as the region is one of the largest reservoirs of pathogens in the world
140 (Ferrante 2024). Deforesting the area in question puts important ecosystem services at
141 risk, such as the supply of water vapor to the winds known as “flying rivers” that
142 maintain rainfall in the southern and southeastern regions of the country, including cities
143 such as São Paulo (Zemp et al. 2014; Fearnside 2021), and may also influence the
144 rainfall regime of neighboring countries such as Bolivia, Paraguay and Argentina.

145 While forest near the southern edge of the Amazon is already losing its carbon
146 stock (Gatti et al. 2021), projected climate change threatens much wider areas of forest,
147 including those along BR-319 and the planned side roads that would open the vast
148 forest area west of the highway (Flores et al. 2024). Stress on the forest in this area from
149 drought and heat could cross tipping points beyond which the forest collapses, and this
150 would be greatly aggravated by deforestation, logging, and fire associated with the
151 planned roads.

152 The severe drought in Amazonia caused by the El Niño and the Atlantic dipole
153 phenomena in 2023 and 2024 has been a strong contributor to forest degradation, both
154 by tree mortality from temperature and hydraulic stress and from understory forest fires.
155 Brazil’s announced reduction of deforestation does not include forest degradation,

156 which not only emits when the trees die during fires, but also in the following years as
157 the dead trees decay. Even without the dramatic recent drought, emissions from Amazon
158 forest degradation equal or exceed those from deforestation (Lapola et al. 2023).

159 All of this could lead to GHG emission sufficient to push the global climate past a
160 tipping point (Fearnside and Silva 2023). Loss of Amazon forest would be a critical
161 contribution to a positive feedback loop that could lead to tipping points for other
162 ecosystems, such as coral reefs and permafrost (McKay et al. 2022). Therefore, by
163 indirectly affecting these ecosystems, projects in the Amazon could jeopardize the zero-
164 emission commitments of nations such as Canada, the United States, Russia, European
165 Union countries, and Australia, which will face even greater challenges in containing
166 the destruction of their ecosystems.

167 **Conclusion**

169 This “hat trick” jeopardizes Brazil's environmental efforts and its aspiration to
170 become a global leader in this area. We warn that if this happens, Brazil will fail to meet
171 its emissions reduction targets and could frustrate the net-zero plans of several nations
172 around the world. Opening the heart of the Amazon to land grabbing, deforestation,
173 logging and fire would release carbon stocks that could be critical in pushing global
174 climate past a tipping point. Prolonging fossil fuel extraction does the same,
175 contradicting the promise of an energy transition. Brazil would be one of the biggest
176 victims if global warming escapes control, starting with the loss of the largest and most
177 diverse tropical region in the world and its role in providing ecosystem services vital to
178 people's lives.

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186 **Conflict of interest**

187 The authors declare that they have no competing interests.

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