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# 1 Amazon projects pose risks to 2 Brazil and the World

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25 The 29<sup>th</sup> 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 km<sup>2</sup>,  
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 km<sup>2</sup> 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

## 168 **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.

179

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186

## 187 **Conflict of interest**

188 The authors declare that they have no competing interests.

189

## 190 **References cited**

191 Araújo R, Assunção J, Bragança A. 2020. The Environmental Impacts of the Ferrogrão  
192 Railroad: An Ex-Ante Evaluation of Deforestation Risks. Policy Brief, Climate  
193 Policy Initiative, Rio de Janeiro, RJ, Brazil. 8 pp.  
194 [https://www.climatepolicyinitiative.org/publication/the-environmental-impacts-](https://www.climatepolicyinitiative.org/publication/the-environmental-impacts-of-the-ferrograo-railroad/)  
195 [of-the-ferrograo-railroad/](https://www.climatepolicyinitiative.org/publication/the-environmental-impacts-of-the-ferrograo-railroad/)

196 Baccini A, Goetz SJ, Walker WS, Laporte NT, Sun M, Sulla-Menashe D, Hackler J,  
197 Beck PSA, Dubayah R, Friedl MA, Samanta S, Houghton RA. 2012. Estimated  
198 carbon dioxide emissions from tropical deforestation improved by carbon-  
199 density maps. *Nature Climate Change* 2: 182–185.

200 ClimaInfo. 2024a. Que NDC é essa? Nova meta climática do Brasil decepciona.  
201 ClimaInfo, 11 November 2024. [https://climainfo.org.br/2024/11/10/que-ndc-](https://climainfo.org.br/2024/11/10/que-ndc-essa-nova-meta-climatica-do-brasil-decepciona)  
202 [essa-nova-meta-climatica-do-brasil-decepciona](https://climainfo.org.br/2024/11/10/que-ndc-essa-nova-meta-climatica-do-brasil-decepciona)).

203 ClimaInfo. 2024b. Petrobras quer estar entre as produtoras de petróleo em 2050, diz  
204 Tolmasquim. ClimaInfo, 2 December 2024.

205 [https://climainfo.org.br/2024/12/01/petrobras-quer-estar-entre-as-produtoras-de-](https://climainfo.org.br/2024/12/01/petrobras-quer-estar-entre-as-produtoras-de-petroleo-em-2050-diz-tolmasquim/)  
206 [petroleo-em-2050-diz-tolmasquim/](https://climainfo.org.br/2024/12/01/petrobras-quer-estar-entre-as-produtoras-de-petroleo-em-2050-diz-tolmasquim/)

207 Fearnside PM. 2017. Deforestation of the Brazilian Amazon. In: H. Shugart (ed.)  
208 Oxford Research Encyclopedia of Environmental Science. Oxford University  
209 Press, New York, USA.  
210 <https://doi.org/10.1093/acrefore/9780199389414.013.102>

211 Fearnside PM. 2021. Lessons from Brazil's São Paulo droughts (commentary).  
212 Mongabay, 30 July 2021. [https://news.mongabay.com/2021/07/lessons-from-](https://news.mongabay.com/2021/07/lessons-from-brazils-sao-paulo-droughts-commentary/)  
213 [brazils-sao-paulo-droughts-commentary/](https://news.mongabay.com/2021/07/lessons-from-brazils-sao-paulo-droughts-commentary/)

214 Fearnside PM. 2022. Amazon environmental services: Why Brazil's Highway BR-319  
215 is so damaging. *Ambio* 51: 1367–1370.

216 Fearnside PM. 2024. Impactos da rodovia BR-319 – 9: O discurso de governança.  
217 Amazônia Real, 26 June 2024. [https://amazoniareal.com.br/impactos-da-](https://amazoniareal.com.br/impactos-da-rodovia-br-319-9-o-discurso-de-governanca/)  
218 [rodovia-br-319-9-o-discurso-de-governanca/](https://amazoniareal.com.br/impactos-da-rodovia-br-319-9-o-discurso-de-governanca/)

219 Fearnside PM, Silva RA. 2023. Amazon region hit by trio of droughts in grim snapshot  
220 of the century to come. *The Conversation*, 22 November 2023.  
221 [https://theconversation.com/amazon-region-hit-by-trio-of-droughts-in-grim-](https://theconversation.com/amazon-region-hit-by-trio-of-droughts-in-grim-snapshot-of-the-century-to-come-217652)  
222 [snapshot-of-the-century-to-come-217652](https://theconversation.com/amazon-region-hit-by-trio-of-droughts-in-grim-snapshot-of-the-century-to-come-217652)

223 Ferrante L. 2024. A road to the next pandemic: the consequences of Amazon highway  
224 BR-319 for planetary health. *The Lancet Planetary Health* 8: e524–e525.

225 Flores BM, Montoya E, Sakschewski B, Nascimento N, Staal A, Betts RA, Levis C,  
226 Lapola DM, Esquivel-Muelbert A, Jakovac C, Nobre CA, Oliveira RS, Borma  
227 LS, Nian D, Boers N, Hecht SB, ter Steege H, Arieira J, Lucas IL, Berenguer E,  
228 Marengo JA, Gatti LV, Mattos CRC, Hirota M. 2024. Critical transitions in the  
229 Amazon forest system. *Nature* 626: 555–564.

230 Gatti LV, Basso LS, Miller JB, Gloor M, Gatti Domingues L, Cassol HLG, Tejada G,  
231 Aragão LEOC, Nobre C, Peters W, Marani L, Arai E, Sanches AH, Corrêa SM,  
232 Anderson L, Von Randow C, Correia CSC, Crispim SP, Neves RAL. 2021.  
233 Amazonia as a carbon source linked to deforestation and climate change. *Nature*  
234 595: 388–393.

235 Governo Brasileiro. President Lula launches National Energy Transition Policy,  
236 expected to bring BRL 2 trillion in investment. Planalto. (22 November 2024;  
237 [https://www.gov.br/planalto/en/latest-news/2024/08/president-launches-national-](https://www.gov.br/planalto/en/latest-news/2024/08/president-launches-national-energy-transition-policy-expected-to-bring-brl-2-trillion-in-investment)  
238 [energy-transition-policy-expected-to-bring-brl-2-trillion-in-investment](https://www.gov.br/planalto/en/latest-news/2024/08/president-launches-national-energy-transition-policy-expected-to-bring-brl-2-trillion-in-investment)).

239 IEA (International Energy Agency). 2021. Net Zero by 2050: A Roadmap for the Global  
240 Energy Sector. IEA, Paris, France. 222 pp.  
241 [https://iea.blob.core.windows.net/assets/ad0d4830-bd7e-47b6-838c-](https://iea.blob.core.windows.net/assets/ad0d4830-bd7e-47b6-838c-40d115733c13/NetZeroBy2050-ARoadmapfortheGlobalEnergySector.pdf)  
242 [40d115733c13/NetZeroBy2050-ARoadmapfortheGlobalEnergySector.pdf](https://iea.blob.core.windows.net/assets/ad0d4830-bd7e-47b6-838c-40d115733c13/NetZeroBy2050-ARoadmapfortheGlobalEnergySector.pdf)

243 INPE. Estimativa de desmatamento na Amazônia Legal para 2024 é de 6.288 km<sup>2</sup>. (13  
244 November 2024. [https://data.inpe.br/big/web/wp-](https://data.inpe.br/big/web/wp-content/uploads/2024/11/NT_Amz_tx_Prodes2024_T.pdf)  
245 [content/uploads/2024/11/NT\\_Amz\\_tx\\_Prodes2024\\_T.pdf](https://data.inpe.br/big/web/wp-content/uploads/2024/11/NT_Amz_tx_Prodes2024_T.pdf)).

- 246 Killeen TJ. 2023. Infrastructure in the Pan Amazon: Railroad development. *Mongabay*,  
 247 21 September 2023. [https://news.mongabay.com/2023/09/infrastructure-in-the-](https://news.mongabay.com/2023/09/infrastructure-in-the-pan-amazon-railroad-development/)  
 248 [pan-amazon-railroad-development/](https://news.mongabay.com/2023/09/infrastructure-in-the-pan-amazon-railroad-development/)
- 249 Lapola DM, Pinho P, Barlow J, Aragão LEOC, Berenguer E, Carmenta R, Liddy HM,  
 250 Seixas H, Silva CVJ, Silva-Junior CHL, Alencar AAC, Anderson LO,  
 251 Armenteras D, Brovkin V, Calders K, Chambers J, Chini L, Costa MH, Faria  
 252 BL, Fearnside PM, Ferreira J, Gatti L, Gutierrez-Velez VH, Han Z, Hibbard K,  
 253 Koven C, Lawrence P, Pongratz J, Portela BTT, Rounsevell M, Ruane AC,  
 254 Schaldach R, Da Silva SS, Von Randow C, Walker WS. 2023. The drivers and  
 255 impacts of Amazon forest degradation. *Science* 379: eabp8622.
- 256 Machado R. 2023. Lula fala em criar 'prateleira' de terras improdutivas para evitar  
 257 invasões. Folha de São Paulo, 27 June 2023.  
 258 [https://www1.folha.uol.com.br/poder/2023/06/lula-fala-em-criar-prateleira-de-](https://www1.folha.uol.com.br/poder/2023/06/lula-fala-em-criar-prateleira-de-terras-improdutivas-para-evitar-invasoes-de-terra.shtml)  
 259 [terras-improdutivas-para-evitar-invasoes-de-terra.shtml](https://www1.folha.uol.com.br/poder/2023/06/lula-fala-em-criar-prateleira-de-terras-improdutivas-para-evitar-invasoes-de-terra.shtml)
- 260 McKay ADI, Staal A, Abrams JF, Winkelmann R, Sakschewski B, Loriani S, Fetzer I,  
 261 Cornell SE, Rockström J, Lenton TM. 2022. Exceeding 1.5°C global warming  
 262 could trigger multiple climate tipping points. *Science* 377: eabn7950.
- 263 Nogueira EM, Yanai AM, Fonseca FO, Fearnside PM. 2015. Carbon stock loss from  
 264 deforestation through 2013 in Brazilian Amazonia. *Global Change Biology* 21:  
 265 1271–1292. <https://doi.org/10.1111/gcb.12798>
- 266 Pereira CC, Kenedy-Siqueira W, Negreiros D, Fernandes S, Barbosa M, Goulart FF,  
 267 Athayde S, Wolf C, Harrison IJ, Betts MG, Powers JS, Dirzo R, Ripple WJ,  
 268 Fearnside PM, Fernandes GW. 2024. Scientists’ warning: six key points where  
 269 biodiversity can improve climate change mitigation. *BioScience* 74: 315–318.
- 270 Quesada CA, Lloyd J, Anderson LO, Fyllas NM, Schwarz M, Czimczik CI. 2011. Soils  
 271 of Amazonia with particular reference to the RAINFOR sites, *Biogeosciences* 8:  
 272 1415–1440.
- 273 Ripple WJ, Wolf C, Gregg JW, Rockström J, Mann ME, Oreskes N, Lenton TM,  
 274 Rahmstorf S, Newsome TM, Xu C, Svenning J-C, Pereira CC, Law BE,  
 275 Crowther TW. 2024. The 2024 state of the climate report: Perilous times on  
 276 planet Earth. *BioScience* biae087.
- 277 Rodrigues M. 2023. Oil from the Amazon? Proposal to drill at river’s mouth worries  
 278 researchers. *Nature* 619: 680–681.
- 279 Vilani MR, Ferrante L, Fearnside PM. 2023. The first acts of Brazil’s new president:  
 280 Lula’s new Amazon institutionality. *Environmental Conservation* 50: 148–151.
- 281 Vieceli L, Nogueira I. 2024. Lula volta a defender exploração de petróleo na margem  
 282 equatorial. Folha de São Paulo, 12 June 2024.  
 283 [https://www1.folha.uol.com.br/ambiente/2024/06/lula-volta-a-defender-](https://www1.folha.uol.com.br/ambiente/2024/06/lula-volta-a-defender-exploracao-de-petroleo-na-margem-equatorial.shtml)  
 284 [exploracao-de-petroleo-na-margem-equatorial.shtml](https://www1.folha.uol.com.br/ambiente/2024/06/lula-volta-a-defender-exploracao-de-petroleo-na-margem-equatorial.shtml)
- 285 Zemp DC, Schleussner C-F, Barbosa HMJ, Van Der Ent RJ, Donges JF, Heinke J,  
 286 Sampaio G, Rammig A. 2014. On the importance of cascading moisture  
 287 recycling in South America. *Atmospheric Chemistry and Physics* 14: 13337–  
 288 13359.