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Threats of Brazil's new oil-drilling frontier

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Standfirst: Oil drilling has been proposed at the mouth of the Amazon River in one of the most protected states in the Brazilian Amazon, Amapá. If the pending project is approved,

drilling is likely to go forward in 19 other oil blocks in this region, where biodiversity and socio-economic wellbeing of local populations could be at risk.

Despite Brazil being a powerhouse in efforts to protect it's highly biodiverse lands and improve sustainability outcomes in recent decades, Brazil's majority state-owned energy company Petrobrás, has sought to expand it's oil drilling activities to increase the country's oil production and tax revenues[1]. The Brazilian government's widely contested justification for this is that oil extraction will provide funds to finance the transition to renewable energy sources. The current focus for expanding oil extraction in Brazil is the northernmost part of the "Equatorial Margin" on the coast of Amapá, in block FZA-M-59 (Fig. 1), with a proposal to open 19 new oil fields in this area by 2028[1]. This environmentally sensitive zone includes Brazil's largest areas of mangroves, Ramsar sites and reef systems. Currently, Brazil's government oil company (Petrobrás) is in a dispute with the Brazilian Institute for Environment and Natural Resources (IBAMA) over compliance with licensing conditions, especially those concerned with actions to minimize the environmental impact of an oil spill should one occur[2,3].

Currently (July 2025), Petrobrás' conceptual fauna rescue plan has been approved by IBAMA (https://agencia.petrobras.com.br/w/ibama-aprova-plano-da-petrobras-e-autoriza-realizacao-de-simulado-em-aguas-profundas-do-amapa). However, inspections and simulations are now required for its full approval. It is a legal requirement that the rescue plan meets the minimum requirements described in the Good Practices Manual - Management of fauna affected by oil[2]. These minimum requirements include moving effected animals to the mainland in less than 24 hours or stabilizing animals in less than 6 hours in an appropriate boat, and Petrobrás' rescue program has yet to show that it can comply with these in the case of Block FZA-M-59[2]. The authorization of prospecting in this single block (block FZA-M-59) is expected to lead to a cascade of authorizations for the 19 drilling blocks where drilling rights have recently been sold at auction in other parts of the Amazon River estuary (Fig. 1).

Socio-environmental context

The entry of the Amazon River into the Atlantic Ocean is marked by the interaction of mega tides with the enormous flow of the river, which shapes most of the coast into vast intertidal mudflats and flooded grasslands, in addition to mangroves. These conditions make the Amapá coast abundant in wildlife and fishing resources and make the area critical for

climate regulation and maintaining the genetic diversity of animal and plant populations[5]. However, while ~70% of the state's area is currently in protected areas, coastal, savanna and marine ecosystems, including the reef systems, are both less studied and less protected, and are particularly vulnerable to the impacts of oil extraction[4,6].

The abundant biodiversity helps support Amapá's population of more than 700,000. While 79% of the population is concentrated in the state's estuarine or oceanic coastal cities (Macapá, Santana and Oiapoque), the state is home to five indigenous groups, as well as other traditional peoples, including more than 40 *Quilombola* communities (descendants of Africans who escaped slavery) and numerous traditional riverside dwellers (*ribeirinhos*), who maintain traditional activities including artisanal fishing, family farming and the harvesting of non-timber forest products (NTFPs). In terms of both volume of production and market share, the most important NTFPs in Amapá are açaí (*Euterpe oleracea*), Brazil nuts (*Bertholletia excelsa*) and cacao (*Theobroma cacao*)[7]. Artisanal fishing of coastal and inland waters is a cultural activity and source of income and food for traditional populations. Fishing is the main primary economic activity in the state, with key centers at the mouth of the Oiapoque River in the north of the state and the mouth of the Amazon River in the south, although much of this activity is carried out by factory fishing vessels from other states[7].

Likely impacts of oil extraction off the coast of Amapá

Oil spills off the coast of Amapá are a major fear associated with the mouth-of-the-Amazon project[8]. Oil spill simulations using calibrated hydrodynamic models and specialized tools that predict environmental impacts and guide contingency planning, have been conducted along the Amazon River waterway particularly in the coastal-estuarine zone (not in the deeper water zone in ocean)[9]. The calibrated models have shown that plumes from oil spills tend to remain close to the coast and extend up to 132 km within 72 hours, with potentially catastrophic impacts on biodiversity, protected areas, artisanal fisheries, and water supply to urban areas[9]. To the best of our knowledge, no study has considered the potential increase in traffic of large vessels, including those that will transport crude oil, which could lead to increased marine wildlife disturbance through their physical presence and noise.

Most fundamental are the impediments to plugging an oil leak should one occur. While the North Brazil Current at the surface flows to the north, another current beginning at a depth of 201 m flows to the south[2]. Among the consequences of the strong and complex currents in the area is the difficulty this poses in controlling potential spills. The water depth also impedes halting a leak: the 2.88 km depth at the site is essentially double the 1.5 km

depth at the site of the 2010 Deepwater Horizon oil spill in the Gulf of Mexico that took many attempts over a five-month period to contain. While immense gaps exist in understanding of how oil spills in the equatorial margin would impact aquatic ecosystems, reefs and coastal zone, it is likely that large populations of birds and mammals would be impacted, including iconic species such as scarlet ibises (*Eudocimus ruber*) and jaguars (*Panthera onca*). The Maraca-Jipioca islands are home to one of the densest populations of jaguars and are considered to be a regional nursery for this apex predator[10].

Oil spills could threaten the food security and sovereignty of local communities and indigenous and traditional peoples, who rightly complain that they have not been fully consulted regarding licensing of oil exploration in the region[3]. For example, açaí has been a staple food around the Amazon River estuary since pre-Columbian times and has been shown to play a key role in food security[11]. However, it is likely to be impacted by a potential oil spill as it is a floodplain palm. Açaí is also economically important, and it is estimated that its production chain in the Amazon River estuary alone generated more than R$6 billion (~US$ 1 billion) in 2023[12]. A potential oil spill could also seriously impact artisanal fishers in Amapá. For example, a major spill in 2019 on the northeast coast of Brazil affected thousands of kilometres of coastline and hundreds of thousands of artisanal fishers[13].

Even without spills occurring, in countries where strong institutions, transparency, and well-designed fiscal policies are lacking, oil and gas extraction, like other types of mining, can lead to plummeting social indicators and other measures of well-being. For example, in southeastrern Brazil, rather than the expected social development, from exploitation of the pre-salt offshore oilfields inequality and other social problems have increased in the coastal communities that receive royalties[14]. One of the biggest problems is the lack of monitoring of money from royalties or the investment of these in social or sovereign funds, thus preventing a more equitable distribution of the costs and benefits of the mineral exploitation[14].

Alternative pathways to development

If Brazil moves forward with oil extraction in the mouth of the Amazon River, it will risk potentially huge negative impacts on the biodiversity and traditional peoples. The expansion of soybean and corn cultivation, and the opening of new mines in recent years in Amapá, does not favor the local population or environmental preservation[6]. The use of oil as fuel will have to end soon due to the need to prevent global warming from escaping from human control, and oil is therefore unlikely to guarantee long-term employment and income

for the local population[14]. We emphasise the need for better pathways to development for Amapá.

Instead of investing in oil extraction, Amapá could be a key place to promote a rapid energy transition given that, if used for solar energy, just 1% of the state's area could produce 50 times more energy than is consumed by its population[15]. This energy surplus could be used to produce synthetic fuels, which are likely to be an important component of a clean global energy matrix, especially to decarbonize the transport sector. Beyond this, the public and private sectors in Amapá should support the local bioeconomy with a focus on local products, such as the "black gold of the Amazon" (açaí), one of the leading products exported by Amapá, and should also involve investment in implementation of industries for processing açaí and other local products such as cassava (*Manihot esculenta*), pineapple (*Ananas comosus*), pracaxi (*Pentaclethra macroloba*), and andiroba (*Carapa guianensis*), adding value, and increasing producers' income. Finally, Amapá has a huge potential for community-based tourism that could offer an important contribution to the local economy with strengthening of local leadership and associations, participatory mapping of areas with tourism potential, and selective investments in infrastructure and tourism.

The Brazilian government must understand that development at any cost does not benefit local populations. Furthermore, the country cannot rely on single development solutions, which rarely provide opportunities for the bulk of the population. Rather than oil, adopting an array of inclusive sustainable-development measures is the path to bringing long-term welfare to the people of Amapá.

Figure legend

Fig. 1 – (a) Northern coast of the Brazilian Amazon, highlighting the equatorial margin and the state of Amapá, Ramsar Sites, blocks planned for oil exploitation and Amazon reefs. (b) Individual jaguar walking through the wetlands of the Maracá-Jipióca Ecological Station (photo taken by camera trap), a Ramsar Site. (c) Floodplain forest area of the Pedreira River next to the Quilombo Carmo do Maruanum. (d) Açaí palm in a floodplain forest area near Macapá, capital of the state of Amapá. (e) Wetland landscape that is influenced by the Amazon River's tide, Quilombo do Matapi. Ramsar sites: https://rsis.ramsar.org/. The databases for planned oil blocks and equatorial margin: https://www.gov.br/anp/pt-br/assuntos/exploracao-e-producao-de-oleo-e-gas/dados-tecnicos/acervo-de-dados. The area of Amazonian reefs was extracted from ref. 4. The border of the countries was extracted from https://metadados.snirh.gov.br/geonetwork/srv/api/records/7cfd53c4-b4e1-4aba-a79b-

857a19649df6. Photo (b) by Herbert O. B. Duarte. Photos (c) and (e) by William D. Carvalho. Photo (d) by Helenilza Cunha.

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Authors contributions

HOBD, KM, PMF, ACC and WDC conceived the research. HOBD, KM, RRH, PMF and WDC wrote the main manuscript text. All authors reviewed the manuscript.

Competing interests

The authors declare no competing interests.

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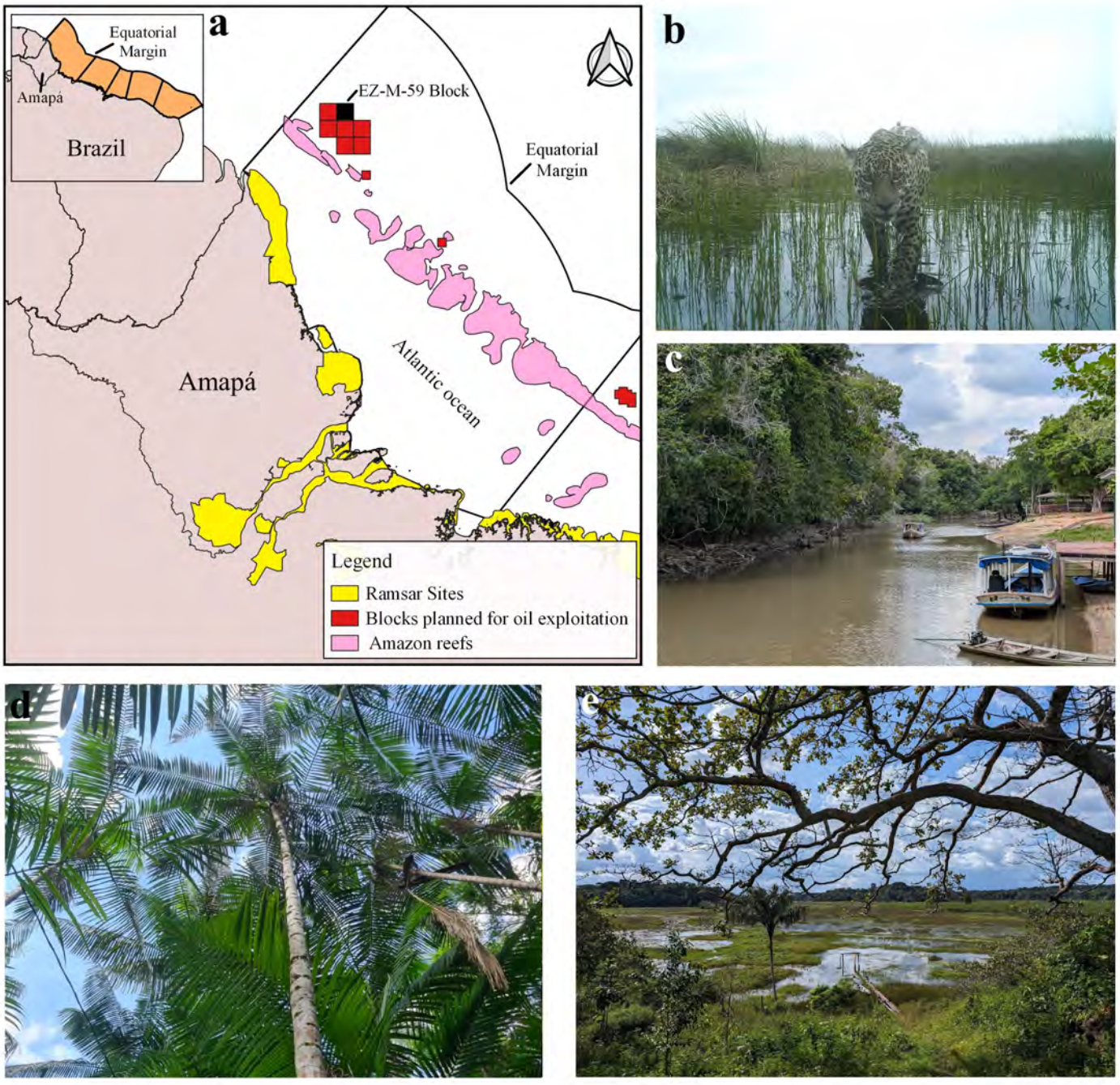
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