Wildfires in old-growth Amazon forest areas rose 152% in 2023, study shows

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Forest fires raged in Boca do Acre in 2023. Credit: Débora Dutra/CEMADEN

Although the rate of deforestation in the Brazilian Amazon fell in 2023, the region is faced with another challenge in the shape of fire affecting the native vegetation that has so far been spared destruction. An article published in the journal *Global Change Biology* warns that wildfires in old-growth forests rose 152% last year compared with 2022, despite a drop of 16% in the total number of fires throughout the Amazon and a 22% drop in deforestation.

In an analysis of satellite images, the authors detected a rise in forest wildfires from 13,477 in 2022 to 34,012 in 2023. The main cause was drought. The region has been experiencing longer and more frequent dry periods. There were prolonged droughts in 2010 and 2015-16, which left the forest more prone to fire and led to fragmentation of the plant cover. Another severe drought began last year and is still in progress, making the situation still worse.

According to surveys by the National Space Research Institute (INPE), the number of fires throughout the Amazon in the first three months of 2023 was 7,861, more than in any of the previous eight years and more than half the Brazilian total (followed by the Cerrado, with 25%). Until then, the highest first-quarter number recorded had been 8,240 (in 2016).

"It's important to understand the geographic pattern of these fires. Each of the areas concerned requires a different response. Our analysis pointed to more fires in old-growth forest areas than in previous years, which is alarming not just because of the loss of vegetation, which is invariably followed by deforestation, but also because the carbon stored by the forest becomes carbon emissions when it burns," said Guilherme Augusto Verola Mataveli, corresponding author of the article and a remote sensing specialist with INPE's Earth Observation and

Geoinformatics Division.

Last year, some members of the research group published another article showing that wildfires increased along an emerging deforestation frontier in the area of Boca do Acre in the southwest of Amazonas state, North Brazil, between 2003 and 2019.

"Old-growth forest stores larger amounts of carbon, which becomes greenhouse gas emissions when it burns, contributing to climate change. Another negative effect relates to public health problems. In October 2023, Manaus [the capital of Amazonas state] had the worst air quality of any city in the world bar one," Mataveli said.

Burnings also increased in other states, including Pará, where the number of old-growth forest fires reached 13,804 in 2023, up from 4,217 in 2022.

The situation in Roraima is one of the worst in the region: Over half the fires detected in the Amazon in 2024 have occurred in this state, which has the fifth-largest Indigenous population in Brazil (97,320) and saw 14 of its 15 municipalities declare a state of emergency in March because of fire. Schools were closed because of the smoke, and severe drought left Indigenous communities without access to food and exposed to respiratory disorders, among other problems.

In response to Agência FAPESP, the National Center for Forest Fire Fighting and Prevention (PREVFOGO), an arm of IBAMA, the main federal environmental agency, said it has been working with other institutions since November 2023 to combat and prevent forest fires in Roraima. More than 300 firefighters and four aircraft have been involved in this campaign since January.

"Climate change is a key driver of the increase in forest fires, and El

Niño has also added risk owing to its links with the prolonged drought in the region. We stress the importance of the firefighting efforts of state and municipal environmental authorities in collaboration with federal agencies. This partnership is fundamental to assure strategic and effective prevention of [forest fires](#)," the IBAMA/PREVFOGO statement said.

The Ministry of Environment and Climate Change (MMA) responded to a request for a statement by reinforcing the above points.

Forest resilience

Tree mortality due to fire in primary forest areas often exceeds 50% of the above-ground biomass, so wildfires can greatly reduce the volume of carbon stored in the Amazon in the long term.

In February, carbon emissions due to fire in Brazil were the highest for 20 years, reaching 4.1 megatons, with Roraima in the lead, according to the Copernicus Atmospheric Monitoring Service. Copernicus is the Earth observation component of the European Union's space program.

Forest resilience is also weakened by wildfires, affecting the forest's capacity to create a humid microclimate below the canopy that contains and recycles moisture within the ecosystem.

Another point made by the researchers in the article is that the increase in invasive wildfires due to heightened forest flammability poses a significant challenge to traditional subsistence farmers who normally use controlled fire as a land management strategy.

According to Luiz Aragão, leader of the research group and last author of the article, "The Amazon is becoming more vulnerable environmentally, socially and economically as time passes without

effective solutions to the fire problem." Although deforestation rates have fallen lately, the area affected continues to expand.

"We predicted this in an article by our group published in 2010 in the journal *Science*," Aragão said. "Both deforested areas and areas where the forest is now being destroyed are active sources of fire ignition by humans. Deforestation fragments the landscape, creating more boundaries between forest areas and open areas and making old-growth forest areas more permeable to fire."

"The aggregate impact of extreme droughts like the current one, alongside landscape fragmentation, continuous use of fire, more areas of fire-degraded forest, illegal logging and edge effects will make the forest increasingly flammable. Urgent measures are needed to mitigate fires and maintain the Amazon as Brazil's greatest asset to achieve sustainable national development."

The article also advocates more command-and-control operations, more numerous and better-equipped fire brigades, and constant improvement of monitoring systems.

"With the use of artificial intelligence, we can try to develop systems that not only show where fires are occurring but also predict where they're most likely to break out in future so that we can focus preventive action on specific areas," Mataveli added.