



MONTHLY NEWSLETTER
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WOODS HOLE RESEARCH CENTER



Rising from the ashes of the Amazon, a path forward for Brazil's development and the world's climate

Dr. Michael Coe
Tropics Program Director

An alarming rise in human caused fires in Brazil captured the world's attention in the middle of 2019. Using up-to-the-minute satellite data, our team at IPAM-Amazônia and WHRC quickly determined that the fires were almost exclusively associated with illegal deforestation. In other words, people felt confident in 2019 that they could illegally deforest private and public lands and burn the trees, without fear of being prosecuted.

Now it is early 2020 and the deforestation and fire season is rapidly approaching. People generally start cutting trees in April and the fires start 2 or so months later after the felled trees have dried out. As scientists who've dedicated our careers to Amazon conservation, we know that it is time to have serious conversations about how to stop fires and protect our global climate, but also how to fix a broken model of economic development that encourages short-sighted deforestation.

We've already lost over 750,000km² of the Amazon—nearly 20%—in the last four decades. We really can't afford to lose more. In addition to harboring immense biodiversity, this forest is a very important part of the global climate. It stores as much carbon as 10 years of human-caused emissions and is the source of much of the rainfall locally and thousands of miles away. That, in turn, supports agriculture, urban water supplies, and a large fraction of Brazil's economy. Thus, continued deforestation doesn't just destroy a magnificent forest, it will likely lead to catastrophic climate change, more frequent crop failures in Brazil, and even greater economic uncertainty globally.

Rather than conserving tropical forests, current political and economic forces are accelerating us towards an irreversible tipping point. Climate change is already beginning to degrade remaining forests. Indigenous people and forest communities,

responsible for protecting almost half of the Amazon, are losing their land rights and protections. Roads, railroads, and dams are being proposed and constructed to unsustainably exploit pristine forests.

Yet the science is clear: Additional deforestation would materially *decrease* the productivity of existing Brazilian farmland, accelerating global warming while reducing food security. This is frequently misunderstood, but our data is unequivocal.



A sustainable path forward begins with the recognition that the current development model, which assumes that nature stands in the way of development, is wrong. We must shift to a model which recognizes that forest conservation and development can go hand in hand. This was already achieved in the mid-2000s when Brazil reduced its deforestation rates by about 80% while increasing its soybean and beef production.

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Study: Indigenous territories protect Amazon carbon, but aren't immune to degradation

A new study suggests that Amazon Indigenous territories and protected natural areas are emitting formerly undetected amounts of carbon, yet their net emissions remain low, allowing them to outperform other land categories across the nine-nation region. The study, published in the *Proceedings of the National Academy of Sciences*, was produced by scientists, policy experts, and indigenous leaders from Woods Hole Research Center, IPAM Amazônia, Coordinadora de las Organizaciones Indígenas de la Cuenca Amazónica (COICA), Rede Amazônica de Informação Socioambiental (RAISG), and Environmental Defense Fund (EDF).

Researchers used innovative techniques to measure carbon emissions caused by forest degradation and disturbance, rather than deforestation alone, finding that forest growth helped indigenous territories show the lowest net loss of carbon, with 90% of net emissions coming from outside protected lands. Combined,

Amazon indigenous lands and protected natural areas cover 52% of the Amazon and store 58% of its aboveground carbon.

The study suggests protected lands are increasingly at risk from illegal activities and growing threats to the rule of law, endangering their role in maintaining vulnerable landscapes intact. Their findings led the authors to call for strengthening the rights of indigenous peoples.

“The role that indigenous peoples and local communities have played in maintaining Amazon forests intact is indisputable, yet our study shows that their territories are not immune to forest loss from degradation and disturbance. That includes climate change, logging, mining, road-building, and other forms of development that act to diminish forest integrity,” said WHRC scientist Dr. Wayne Walker, the study’s lead author.

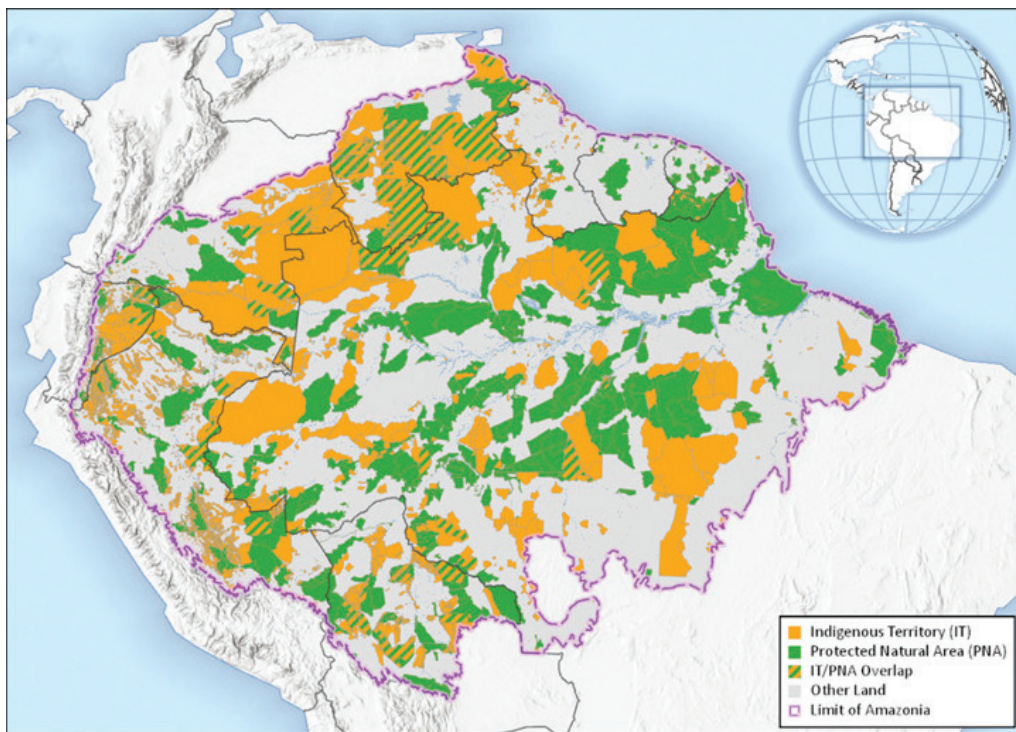
The authors looked at losses and gains in carbon over the period 2003-2016, using an update to data originally published by a team that included WHRC scientists Drs. Alessandro Baccini, Richard Houghton and Walker. Additionally, they disaggregated losses into those attributable to forest conversion (e.g., deforestation) and those due to anthropogenic degradation and natural disturbance.

Lands outside Indigenous territories and protected natural areas accounted for about 70% of total carbon losses and nearly 90% of the net change—on less than half the total land area. In contrast, Indigenous territories and protected natural areas comprise more than half the land area and contributed just 10 percent of the net change, with 86% of losses on those lands offset by gains through forest growth. Thus, there was a nine-fold difference in net carbon loss outside Indigenous territories and protected natural areas (–1,160 metric tons of carbon) compared with inside (–130 MtC).

Almost 90% of Amazon indigenous territories have some form of legal recognition, but the authors of the study note that government concessions for mining and petroleum extraction overlap nearly one-quarter of all recognized territorial lands, substantially increasing their vulnerability to adverse impacts.

“Our research reveals what indigenous peoples across the Amazon are reporting to their leaders,” said Tuntiak Katan, an author and vice-coordinator of COICA. “Governments are weakening environmental protections, violating existing indigenous land rights, and encouraging impunity in the rule of law. The situation is putting at risk the existence of our peoples and our territories, which contain the world’s most carbon-dense forests.”

Wayne S. Walker et al. PNAS 2020; 117:6:3015-3025



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There are a number of proven ways that this can be achieved again in Brazil. They include: eliminating land grabbing and land speculation through federal designation of public forests; reducing legal deforestation on private property through payments for ecosystem services; incentivizing production increases on existing lands through targeted investments; fostering economic, environmental, and social improvements through assistance to smallholder farmers; and creating the

civil infrastructure to both reduce reliance on fires as part of the clearing process, and to put out fires once they start. These are all areas where WHRC and our partner IPAM are actively working.

Yes, these all cost money—but they also will yield economic, social, and environmental gains for Brazil and the world, and will help reduce global climate change.

You can support this work with a contribution to the WHRC/IPAM Amazon Fund.

Scientists seek stronger understanding of Arctic's role in extreme winter weather

When it comes to understanding the relationship between global warming and severe winter weather, what should we trust—our eyes or computer models? That's the subject of a new review article in *Nature Climate Change* co-authored by WHRC scientist Dr. Jennifer Francis.

The controversy centers on the influence of the rapidly warming Arctic and precipitously shrinking sea ice. The Arctic has lost half of its sea-ice coverage and three-quarters of sea-ice volume in just the last four decades. The change has occurred so quickly that only a short period of real-world data exist for analysis. Most projections by models indicate that sea ice loss would not cause more disruptions of the stratospheric polar vortex, which are often associated with severe winter weather. Instead, models predict, winters in the United States should become milder.

But Dr. Francis has been a leader among scientists whose work suggests the increased frequency of severe winter weather may, in fact, be directly linked to Arctic climate change. Specifically, conditions favorable for disrupting the polar vortex may be fueling severe winter weather in the United States, Europe, and Asia.

"Studies of the real world generally agree with each other that disproportionate Arctic warming is disrupting the jet stream in ways that cause more extreme weather events, while research based on simulations by computer models struggles to capture these relationships. Our study points to shortcomings in model formulations, the use of inappropriate metrics, and large random atmospheric fluctuations as the most likely culprits fueling this controversy," said Dr. Francis.

What might resolve the divergence? One possibility is to devise a set of model experiments in which the exact same starting conditions are used in a variety of different models. For example, the simulations should begin with the same sea-ice coverage, ocean temperature patterns, and atmospheric conditions. In addition, measurements used to assess the response of weather patterns should not average over large regions and time periods as is usually done, but instead



target changes in jet-stream waviness, location, and strength, all of which may differ over a winter and across a region. The jet stream creates and controls our weather, so anything that affects it will also affect our weather.

"This work is all about gaining a better understanding of how climate change will affect extreme weather events, which are already costing many lives and billions of dollars every year," said Dr. Francis.

In other news, Dr. Francis was recently elected to serve a 3-year term as a Council Delegate to the American Association for the Advancement of Science (AAAS) Atmospheric and Hydrospheric Sciences section.

Journal's "Focus on Changing Fire Regimes" features WHRC editor, research

WHRC scientist Dr. Brendan Rogers recently served as guest editor for a special issue of the journal *Environmental Research Letters*. *Focus on Changing Fire Regimes: Interactions with Climate, Ecosystems, and Humans* showcases 27 studies, several co-authored by WHRC researchers, on how fires are changing in

a warming world and what that means for ecosystems and human societies.

The studies look at a wide range of fire-related topics, from how plants and fire evolved together, helping regulate atmospheric oxygen, to how prescribed wildland fires may harm local public health. A paper co-authored by WHRC scientists Dr. Paulo Brando, Dr. Michael Coe, and Dr. Marcia Macedo looks at how Amazon droughts worsened by climate change are increasing forest flammability by reducing understory humidity and fuel moisture. Droughts also increase forest flammability indirectly by decreasing soil moisture, triggering leaf shedding, branch loss, and tree mortality—all of which add fuel to fires.

The issue is the result of countless hours of work by Dr. Rogers and his fellow guest editors, coordinating submissions and

writing a synthesis article that sums up the work.

"It has never been more important to understand these dynamics as fire regimes are changing, and in many instances intensifying, due to climate change, land use, and other global change drivers," Dr. Rogers and his fellow guest editors conclude. "We recommend an increased emphasis on understanding these interactions, including the ways in which humans influence fire regimes, the full economic costs of wildfires, and an increased emphasis on attribution, especially for large and damaging wildfire seasons."

The study also endorses strategy that's a key tenet of WHRC's work—bringing scientists together with policymakers to make sure fire management is informed by the best available science.



Helping Armenia rebuild forests, cut emissions

As Armenia works to reverse historic deforestation, WHRC science is playing a role in developing best practices to help the nation meet its Paris Agreement emissions reduction goals. Armenia recently invited some of the world's top scientists, forestry professionals, and political leaders to a three-day Forest Summit, with WHRC scientist Dr. Glenn Bush a featured speaker.

Armenia is a former Soviet republic in the semi-arid mountainous Caucasus region between Asia and Europe. War with neighboring Azerbaijan led to an energy crisis in the early 1990s, forcing Armenians to cut down trees for domestic firewood, deforesting huge areas of the country. Illegal commercial logging that sprung up during the energy crisis has persisted, with local activists now saying illegal activities are a bigger threat to Armenian forests than subsistence

harvesting. Without swift action on reforestation, they warn desertification is a possibility.

Armenian Prime Minister Nikol Pashinyan opened the Forest Summit pledging to double his nation's forest cover by 2050 and to start by engaging citizens in a massive planting effort this year. Reforestation is also a safety issue, as barren mountain sides have led to worsened floods. The Armenia Tree Project, based in Massachusetts and an effort by the Armenian Assembly of America, has helped plant 6 million trees since the 1990s.

"Armenia is facing critical climate and environmental management problems creating immediate challenges for national economic development. I was impressed by the national government's progressive ideas on prioritizing forest landscape restoration as a key opportunity

to resolve immediate concerns over economic growth and stability, but also as a strategically important issue for longer term climate adaptation," said Dr. Bush. "Taking part in the summit was a great opportunity to share experiences from WHRC's work in the DRC on institutional and organizational issues in mobilizing climate finance for landscape forest conservation and management."

WHRC is exploring opportunities to partner with the Armenia Tree Project to further provide analysis and technical assistance to support the development and implementation of Armenia's rapidly developing forest and climate change policy. WHRC's expertise in landscape planning, forest and soil carbon monitoring and management, as well as economic and social analysis, will help in the design and prioritization of policy and management actions.



photo: Armenia Tree Project

WHRC briefing presidential campaigns on climate risks and tipping points

As the 2020 presidential race moves forward, WHRC has been providing climate change briefings to campaign officials to help shape messaging and issue platforms.

The briefings have been offered to every presidential campaign, and so far meetings have taken place with policy experts for Sen. Amy Klobuchar (D-Minnesota), former Massachusetts Governor Deval Patrick, and billionaire Tom Steyer.

“The staff on these campaigns are aware of big picture climate change issues,

so we have been providing more detail on aspects that we think are critically important,” said WHRC Chief of External Affairs Dave McGlinchey. “We’ve been focusing on biophysical thresholds, like emissions from permafrost regions. We have also been discussing our climate risk work, and how that can be used to inform policy-making and adaptation.”

The permafrost discussions have been centered on recent research about winter emissions, led by WHRC scientists Dr. Sue

Natali and Dr. Jennifer Watts. That research was published in *Nature Climate Change*, and showed that permafrost is emitting significant amounts of greenhouse gases during winter months—tipping the region into a source of emissions.

“Permafrost emissions need to be a part of the policy conversation,” McGlinchey said.

WHRC is currently making arrangements to provide a briefing for the staff of Republican candidate Bill Weld, also a former governor of Massachusetts.

In the news : highlights

Jetstream gives New York-London flight a record breaking boost. *Boston Globe* quotes Jennifer Francis on global warming's influence. February 11

Want a green Valentine's Day gift? Don't buy chocolate. Or roses. *Washington Post* cites WHRC's statistic that deforestation accounts for 10% of annual carbon dioxide emissions. February 11

Trump and GOP push to help plant 1 trillion trees won't be easy. *Washington Examiner* quotes Wayne Walker. February 7

In hottest decade on record, climate change appears nowhere in State of the Union address. *USA Today* quotes Phil Duffy. February 5

The Arctic-Midlatitude Climate Dialogue Gets a Tropical Twist. *Weather Underground* quotes Jennifer Francis. February 5

Trump nods to GOP shift on warming without saying 'climate'. *E&E News* quotes Phil Duffy. February 5

Will Big Business Finally Reckon with the Climate Crisis? *The New Yorker* runs a profile of Spencer Glendon and our McKinsey partnership. February 4.

The Rich Ignore Climate Change. Spencer Glendon Wants to Scare Them Into Action. *Vice* profiles Spencer Glendon. February 4

Success of Microsoft's 'moonshot' climate pledge hinges on forest conservation. *Mongabay* quotes Bill Moomaw. February 3

Planting 1 trillion trees might not actually be a good idea. *The Verge* quotes Wayne Walker. January 31

Scientists support indigenous land rights. *The Ecologist* quotes Wayne Walker. January 30

Trust our expertise or face catastrophe, Amazon peoples warn on environment. *The Guardian* (UK) quotes Wayne Walker. January 28

Indigenous, protected lands in Amazon emit far less carbon than areas outside. *Mongabay* quotes Wayne Walker. January 28

60 Minutes reruns **Pleistocene Park** featuring Max Holmes. January 26

Dwindling Arctic Sea Ice May Affect Tropical Weather Patterns. *InsideClimateNews* features Jennifer Francis. January 27

Melting Arctic sea ice may be altering winds, weather at equator: study. *Mongabay* quotes Jennifer Francis. January 27

Impending Amazon tipping point puts biome and world at risk, scientists warn. *Mongabay* details recent Paulo Brando study. January 27

Dozens Of Countries Could Reverse Carbon Emissions Just By Caring For Nature. *Forbes* mentions WHRC's involvement in the study. January 26

Cape seen as protected from weakening of Clean Water Act. *Cape Cod Times* quotes Chris Neill. January 25

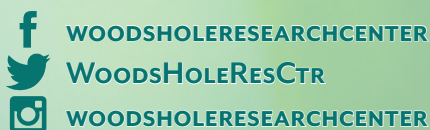
Hard-To-Budge Birds Raise Bacteria Levels In Falmouth's Green Pond. *Falmouth Enterprise* quotes Chris Neill. January 24

Welp, Scientists Found 28 New Virus Groups in a Melting Glacier. *Popular Mechanics* links to a previous Sue Natali quote on the carbon content of thawing permafrost. January 23

Australia wildfires unleash millions of tons of carbon dioxide. *NBCNews.com* quotes Richard Houghton. January 22

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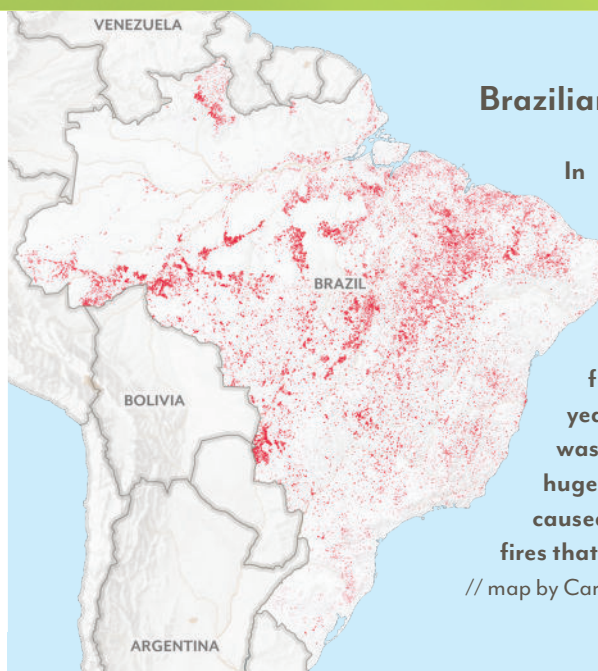
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Brazilian Wildfires 2019

In mid-2019 fires were threatening large portions of the Amazon. Our science showed that: 2019 had the greatest levels of deforestation in 10 years; there were more than 110,000 fires—85% more than the previous year; it wasn't a drought year—2019 was wetter than previous years. This huge jump in devastating fires was caused by illegal deforestation and the fires that accompany it.

// map by Carl Churchill



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