MONTHLY NEWSLETTER
JULY 2020

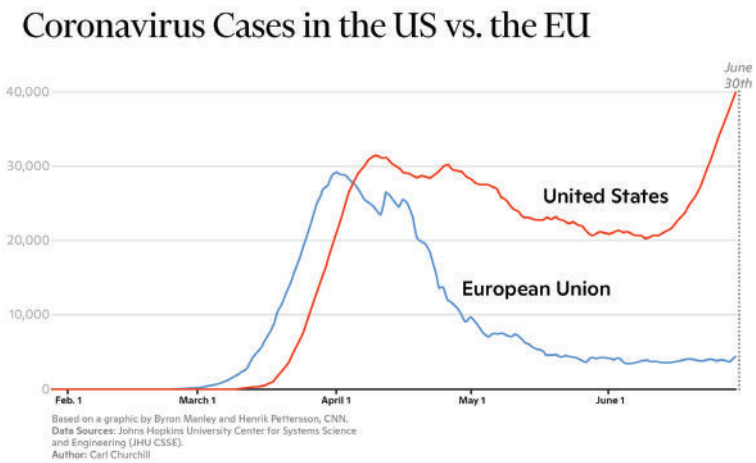
Woods Hole Research Center

Cody O'Loughlin

Reminder: Science works

Dr. Philip Duffy
WHRC President and Executive Director

The ongoing failure of our national response to COVID-19 highlights the challenges we face in managing the more complex and seemingly more distant threat of climate change. As anticipated by epidemiologists, premature and un-coordinated "reopenings" in the US have produced a surge in new coronavirus cases. Daily new case numbers have tripled in the past month, surpassing 60,000 for the first time on July 8. The US leads the world in total cases, with 3.2 million, followed by Brazil with 1.8M. Even though the virus came to Europe first—giving us the chance to learn from their experience—the EU has done a far better job of containing the virus than we have (see figure). We have more than three times as many cumulative cases per million people (9,500) as Canada (2,800), France (2,600), or Germany (2,300)—countries with cultures and systems of law and government which are very similar to ours. Our daily new cases now exceed those in the EU more than ten-fold, even though their population is 35% greater than ours.



These numbers send the clear message that science-based policies work, and that policies which run contrary to science don't. It's clear what needs to be done to contain coronavirus, in part because successful examples elsewhere provide a blueprint. And one would hope that a death rate approaching 1,000 per day would create a sense of urgency and purpose. If we can't execute an informed, coordinated response under these circumstances, it is difficult to imagine that we'll do that in the case of climate change, which is a much more complex challenge and which is widely, if incorrectly, perceived to be a more distant threat.

That perception persists, even though climate change is killing people right now, because harms from climate change are difficult to recognize as such. To a great extent, climate change makes existing problems (like hurricanes and wildfires) worse, rather than creating new ones. This means that individual events like hurricanes and their associated mortality can be attributed to climate change only on a probabilistic basis, and even then, only after a careful study has been done. We can say, for example, that the extreme rainfall in Houston from Hurricane Harvey was made 3.5 times more likely* as a result of climate change. This type of attribution makes causation much less clear, even though the harms are just as real. It makes it easy for folks (well-intentioned and otherwise) not to recognize harms from climate change for what they are.

By contrast, even though COVID testing has been limited in the US, there are nonetheless diagnostic tests which make it relatively straightforward to attribute individual deaths to COVID, and to add up the total burden of mortality.

One reason for our ineffective responses to both COVID and climate change is political polarization. This polarization is needless and also unfounded, because we all face terrible consequences. Both of these hazards, in fact, threaten political stability and social order; history provides ample proof of this. Even so, very few people understand how much is at stake.

SCIENCE WORKS *continued on next page*

WHRC is an independent research organization where scientists study climate change and how to solve it, from the Amazon to the Arctic. Learn more at www.whrc.org.

WHRC is working to change all of this:

Most fundamentally, we're all about "science-based policies," which means nothing more than operating in a paradigm based upon facts as we understand them, and guided by cumulative human understanding and experience, tested against new evidence as that emerges. George Woodwell founded WHRC in 1985 to be a source of science to inform policy, and recent events show that this is needed more, and more urgently, than ever.

To drive home the consequences of climate change we're working with McKinsey & Company to illustrate not only the physical manifestations of climate change (extreme weather, etc.) but also its socioeconomic consequences (like water scarcity and migration). Our partnership with Probable Futures is all about conveying these systemic societal risks to broad and influential audiences. This work is an example of what I see as the most important thing the research community can do: to illustrate what the future world will look like. Only by understanding the full ramifications of climate change can we make informed choices about what kind of future we want to live in.

Our work with the Niskanen Center and with the Faith Science Alliance begins to address political polarization by bridging political divides and broadening support for science-based climate policies. We can disagree about what those policies should be, but we won't get anywhere unless we start from a common, evidence-based understanding of the situation we face. Misguided "reopenings" informed by wishful thinking about coronavirus aren't working out well, and climate-change denial isn't either. That's not going to change.

Finally, let's not get so accustomed to failure that we cease to believe in the possibility of progress. Every crisis presents opportunities, and it is important to use this moment to go beyond damage control and act to make things better: health care delivery and financing, air quality, infrastructure, transportation… not to mention social justice. We should expect no less, and here at WHRC we will continue to work to make this happen.

Thank you, as always, for your interest and support.

* Attributable Human-Induced Changes in the Likelihood and Magnitude of the Observed Extreme Precipitation during Hurricane Harvey. 2017. *Geophysical Research Letters* 44(24).

WHRC, IPAM Amazonia partner on new Amazon deforestation and fire outlook

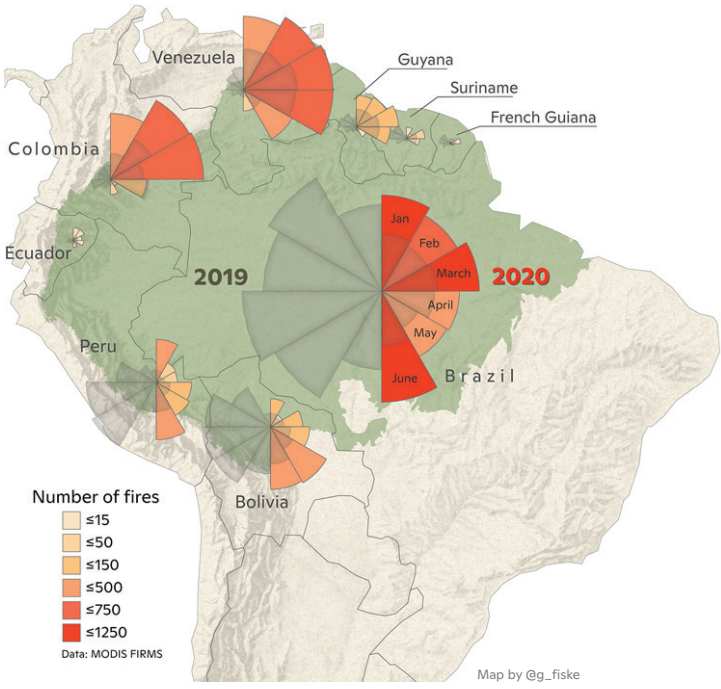
by Miles Grant

Ahead of fires that plague the Amazon in August and September, scientists from Woods Hole Research Center and IPAM Amazônia have issued the first-ever Amazon Deforestation and Fire Outlook. The analysis warns that deforestation in the Brazilian Amazon from January through June rose roughly 20% over the same point last year and is up significantly over the decadal average. Scientists will update the data monthly, with the goal of keeping decision-makers informed about deforestation and fire trends and their climate impacts.

So far in 2020, the Brazilian Amazon has lost more than 3,300 square kilometers (nearly 1,300 square miles) of forest, an area the size of Rhode Island. This year, as in previous years, almost all of the deforestation is taking place on unprotected lands, including private properties and federal lands without a protected status. Protected natural areas and Indigenous territories have seen little deforestation.

"This data points to a second consecutive year of rising deforestation and fires in the Brazilian Amazon, reversing what had been a decade-long trend of relatively low deforestation," said Dr. Michael Coe, WHRC Tropics Program Director. "We can look at this data and see where the deforestation is happening and the majority of it is illegal, people deforesting without permits on their land or stealing land from unprotected areas."

Land clearing typically happens in two waves—first the trees are cut and left to dry, then later they're set on fire to remove the debris. Virtually all fires this year will be human-caused, as naturally-occurring Amazon fires are rare. Burning releases the carbon stored in the wood into the atmosphere. This year's deforestation already has committed at least 115 million metric tons of carbon to eventually entering the atmosphere, equivalent to the annual emissions of 25 million vehicles, or the annual carbon emissions of the entire state of North Carolina.



"Especially with drought numbers looking worse than in recent years, our concern is that fires could escape into neighboring forests, greatly compounding the harm of deforestation. Furthermore, when the Amazon burns it will not only create carbon emissions, but also intense air pollution that will exacerbate the public health crisis at a time when Brazil is seeing some of the worst rates of COVID-19 infection in the world," said Dr. Ane Alencar, IPAM Amazônia Director of Science.

Brazilian President Jair Bolsonaro, facing international pressure to act, announced in early July that he would issue a 120-day moratorium on legal fires. While important, the long-term implications of this act are unclear. It may simply postpone burning until a later date, and it does not address the root problem of deforestation.

Woods Hole Research Center and IPAM Amazônia have developed a framework for stopping Amazon deforestation, engaging key stakeholder groups and addressing both legal and illegal activities.

To support our Amazon research and efforts to raise awareness about the need to stop deforestation, consider a contribution today.

Carbon loss from permafrost thaw may be twice as high as thought

by Miles Grant

Traditional methods of measuring permafrost thaw may be dramatically underestimating vulnerable carbon pools, warns a new study published in the *Journal of Geophysical Research: Biogeosciences* by a team of researchers that included WHRC Arctic Program Director, Dr. Sue Natali. Subsidence, the gradual sinking of terrain caused by the loss of ice and soil mass in thawing permafrost, may result in underestimations of the amount of previously-frozen carbon unlocked from warming permafrost by half.

"These results are a reminder of how much uncertainty there is in our estimates of potential carbon loss from the Arctic and how much more work there is to do," said Dr. Natali.

The study's participants reflect WHRC's deep connections in the Arctic science community. As a postdoctoral researcher in 2008, Dr. Natali helped establish the long-term permafrost warming study that formed the foundation of this research with study co-author Ted Schuur of Northern Arizona University (NAU), who continues to serve as its principal investigator (PI). The experiment warms air, soil, and thaws permafrost using open top greenhouses.

Heidi Rodenhizer, a former student participant in the Polaris Project and now a graduate student working with Schuur at NAU, used the warming experiment to quantify the impact of subsidence on estimates of permafrost thaw. Traditionally, scientists measure ground thaw by putting a metal rod into the ground until it hits solid permafrost, then measuring the depth from the soil surface to frozen ground. However, this method can severely underestimate permafrost thaw when the ground surface has subsided.

Accounting for subsidence, permafrost thawed between 19% (control) and 49% (warming) deeper than previously thought, and the amount of newly thawed carbon within the active layer was estimated to be proportionally greater—37% (control) and 113% (warming). The findings suggest that permafrost is thawing more quickly than some long-term records may indicate, meaning permafrost's contribution to climate change is much larger than thought.

"We knew subsidence brought uncertainty to the soil measurements, but these were shockingly high numbers," said Dr. Natali. "It's another reminder of the urgency of stopping thaw and protecting as much carbon storage as we can. Even if what we know isn't perfect, we have all the evidence we need to act boldly to cut fossil fuel emissions."

NEWS BRIEF | Human activity makes a much greater contribution to year-to-year variations in land-based carbon emissions than previously thought, according to a new study in *Nature Communication*. WHRC senior scientist Dr. Richard Houghton and former WHRC research scientist Alexander Nassikas, now with the Yale Jackson Institute for Global Affairs, were co-authors on the work. This analysis concluded that managed lands contributed 30-45% of interannual variability in the amount of carbon absorbed by terrestrial systems, while natural lands contributed only half of what previous analyses had reported. This research provides new insight into the different factors that affect the absorption or loss of carbon from land, and thus, can help make predictions of future climate change more precise.

McKinsey & Company report outlines carbon neutrality in Poland by 2050

by Anabelle Johnston

Poland can reach economy-wide carbon neutrality by 2050, according to a recent report published by McKinsey & Company with contribution from WHRC scientist Dr. Wayne Walker. The report laid out a plan that would decarbonize the nation across five key sectors: industry, transport, buildings, agriculture, and power. According to the report, shifting away from Poland's historic coal reliance would improve energy independence and contribute to the development of new industries, creating jobs and boosting GDP by 1-2% when complete.

McKinsey's plan would utilize natural carbon sinks to help meet its goal. Dr. Walker collaborated with scientists at The Nature Conservancy to study the carbon sequestration potential of forests in Poland over the next 30 years.

"We combined field and satellite data to calibrate models and generate detailed maps of the amount, distribution, and dynamics of carbon stored in forests," said Dr. Walker. "Additionally, we used these data to estimate the potential for additional carbon storage in places where current stocks in vegetation and soils have been depleted and are below their full potential."

Dr. Walker found that Poland has the potential to increase the amount of carbon stored on land by approximately 2.7 gigatons of CO_2 equivalent, with 0.9 Gt of that in woody biomass and 1.8 gigatons CO_2 equivalent in soils. The report finds that if natural carbon sinks are maximized, they could offset any remaining emissions for the foreseeable future.

The first major McKinsey project to which WHRC contributed was a groundbreaking report released in January of this year which explored some of the socioeconomic consequences of climate change, for example the implications for Florida real estate.

"Once people begin to understand the immediacy and severity of coming societal consequences, I have to think that they will be much more motivated to act to stop climate change," said WHRC President Dr. Phil Duffy. "Also, understanding what's coming allows individual decision makers to take steps to prepare for impacts which we can't avoid."

Already this work has reached the desks of important decision makers. The June report was delivered to the office of Poland's Prime Minister and could be the first step towards a carbon neutral future. WHRC is now involved in a similar effort to produce decarbonization guidance for the entire European Union.

Study: Southern Canadian boreal forest emissions grow as fires worsen

by Miles Grant

Global warming is rapidly increasing the frequency and severity of fires in boreal forests, releasing large amounts of carbon into the atmosphere, including in the productive and managed boreal forests of southern Canada, according to a new study in *Global Change Biology*. WHRC scientists Brendan Rogers and Stefano Potter co-authored the study, which estimates the 2015 fire season in Saskatchewan emitted 36 million metric tons of carbon, or roughly 112 million metric tons of CO_2, equivalent to the annual carbon emissions of the entire state of New Jersey. Together, boreal wildfires and timber harvest are likely transitioning the region from a globally significant carbon sink to a source, driving worsening climate feedback loops.

Boreal forests, which grow in colder regions of the northern hemisphere, have evolved with fire but climate change is driving increases in intensity, extent, and frequency of fires, along with associated deeper burning and higher combustion rates. The southern boreal forests of central Canada already experience relatively high frequencies of fire, as well as more logging. Thus, they can serve as an analogue of future carbon dynamics for more northern forests.

"This is a lens into what the future might look like as our climate warms and northern boreal forests start burning more frequently and more intensely, similar to how southern boreal forests burn now, and as logging continues expanding north into newly-accessible areas," said Dr. Rogers.

To take a closer look at the harms of logging, the study also looked at sites that had been harvested and then burned. It found harvested sites grow more quickly and burn more severely, and therefore emit more carbon. This indicates that different boreal forest land use practices can generate divergent carbon legacy effects. Researchers expect southern boreal forests to continue to lose carbon and become younger overall—a trend that will move north as fossil fuel burning continues to warm our climate and logging operations expand into northern primary forests.

This work was funded by the National Aeronautics and Space Administration (NASA) Arctic Boreal Vulnerability Experiment (ABoVE) and by multiple grants from the Natural Sciences and Engineering Research Council of Canada (NSERC). Support also came from the Netherlands Organization for Scientific Research. Additional resources were provided by NASA High-End Computing Program, and through the NASA Center for Climate Simulation at Goddard Space Flight Center.

WHRC hosts timely discussion of extreme heat and steps towards climate justice

by Anabelle Johnston

With 2020 on track to be one of the hottest years on record, WHRC is connecting the climate dots for the public. On June 24, WHRC hosted *Facing Extreme Heat: Vulnerability and Resistance*, a virtual event featuring Dr. Zach Zobel, WHRC risk scientist, and Eugenia Gibbons, Boston Director of Climate Policy at Health Care Without Harm. Their conversation highlighted the relationship between climate change and increasing occurrence and severity of extreme weather events, socioeconomic disparities in vulnerability, and the compounding dangers of COVID-19.

Over the last half century, the world has seen both higher average temperatures and more record-setting heat extremes. Within the next decade, Dr. Zobel's research shows, regions of the southern United States will experience at least 80 additional dangerous heat index days compared to 1951. In the next 30 years, major cities such as Washington D.C. and New York will experience 3–4 additional weeks of dangerous heat index days, disproportionately impacting vulnerable communities that are currently unequipped to manage these sustained temperatures.

On the global scale, high impact heat waves of 30°C or higher have historically been concentrated in small regions of India and Pakistan. In 40 years, these events will no longer be confined to the Middle East and Southeast Asia.

"We will start to see these [extreme heat waves] in the southwestern part of the United States," said Dr. Zobel. "We will see them in Brazil, in areas such as Shanghai in China, which has very high population density, as well as in other parts of southeast Asia and northern Australia. We will start to see these events pop up all over the world, including in many places that don't have easy access to air conditioning."

Extreme heat has made international news in recent weeks as Verkhoyansk, Russia reportedly reached 38°C (100.4°F) on June 20. If verified, this measurement would be the highest recorded above the Arctic Circle. Sweltering heat swept the United Kingdom and mainland Europe from June 22–26. In the United States, NOAA is warning of higher than average temperatures through September and predicting that 2020 will rank among the four warmest years on record.

This comes as the U.S. is struggling to contain the COVID-19 pandemic. Low-income communities and communities of color in the U.S. face disproportionate risks from both extreme heat and COVID-19, independently. The two are set to collide in potentially deadly ways this summer.

"The COVID-19 pandemic only amplifies and exacerbates the health risks associated with extreme heat," said Eugenia Gibbons. "At a basic level, our response to the pandemic potentially limits our ability to manage comfort and relief from the heat in ways that we would traditionally, and ways that are traditionally beneficial to vulnerable communities, low-income communities, and communities of color—things like cooling centers, public pools, and public splash pads. Because of the pandemic, we have to limit access to and operation of these facilities."

WHRC scientists are also sounding the alarm on how the COVID-19 crisis could amplify the impacts of other summer extreme weather events, hindering disaster response and making it riskier to send victims of hurricanes and wildfires to large shelters.

WHRC Staff Spotlight: Dr. Anna Liljedahl

WHRC Associate Scientist Dr. Anna Liljedahl studies the impact of climate change on the storage and movement of water in the Arctic. She joined WHRC in March, and also holds an Affiliate Professor appointment at the University of Alaska Fairbanks. Anna lives in Homer, Alaska, where she works closely with the community through organizations such as the Alaska Institute for Climate & Energy, Kachemak Bay Conservation Society, and Homer DrawDown.

Why did you pursue a career in science?

I've always enjoyed being out in nature. I spent lots of time in the forest with my Gotlandsruss pony growing up in northern Sweden. I decided to study water because it is the foundation of our world and it makes life on Earth possible. I wanted to learn more about water and even seek new knowledge in cold region landscapes. Snow and ice just had to be involved!

What questions does your research aim to answer?

My funded work so far has aimed to understand what climate warming does to the hydrologic cycle in permafrost and/or glacier affected watersheds, and why. My next chapter, which I started by joining WHRC, will also include how we as a society can adapt to the challenges that come with an altered water cycle, what we can do to not only survive but also thrive and do so with our environment, to grow as a community with the land wherever we may live. I want to work with the people of Kenai Peninsula to explore what we can do together to address hazards such as landslides and tsunamis linked to retreating glaciers and how we can help the salmon survive in the warming streams. Salmon are part of Alaska's soul, as are the glaciers, and both are challenged by a warming climate.

What brought you to WHRC?

WHRC's mission to make science useful to the public and the fact that it involves going beyond doing science for the sake of science appealed to me. I like that I do not have to worry about losing my job if I write or say something about the fossil fuel industry and that it is a 100% research institution. And I love that WHRC allows me to live in beautiful Homer, Alaska!

If you could work on any climate science topic outside your current research area, what would that be?

I've taken the first steps already! I'm reaching out to people I want to work with, if they did not already inspire or invite me to join them. One day, I hope to team up with health experts because I am curious about climate change "trauma", whether it is about losing the salmon in your stream or losing your home to eroding permafrost.

What's your favorite climate-related creative work (book, movie, artwork, etc.)?

The Wave. It's not so much a climate-related movie, but the hazard exists here in Alaska with landslides triggering large tsunamis due to glaciers retreating, leaving unstable ground exposed above deep fjords. Watching that movie the day the *New York Times* article came out about our discovery of the potential Barry Arm landslide made the hazard human to me. It is odd how your science neuron otherwise tends to think about science so objectively.

In the news : highlights

2020 Amazon Deforestation and Fire Outlook
A new report with IPAM Amazônia was issued detailing deforestation, fires and carbon loss from the 2020 fire season and comparing them to recent years. The report will be updated monthly. WHRC issued a joint news release and detailed the findings in last week's Kaneb Webinar Series event, which is available to watch on WHRC's YouTube channel. News overage:

> **Brazil Amazon deforestation up in June, set for worst year in over a decade**. *Reuters*. July 10
>
> The report was discussed on ***CBS This Morning***. July 8
>
> **Intense Arctic Wildfires Set a Pollution Record**. *New York Times*. July 7

It's hot and humid. What happens to people who can't afford air conditioning? *Boston Globe* quotes Zach Zobel in this cover story. July 10

Siberian heat drives Arctic ice extent to record low for early July. *Mongabay* features Sue Natali. July 10

Could Paying Farmers to Store Carbon Help the Climate and Save Farms? *Mother Jones* quotes Jonathan Sanderman. May/June 2020 issue.

Ontario Teachers' lowered portfolio carbon footprint by 15% in 2019: report. *Benefits Canada* mentions our work with Wellington Management and Ontario Teachers' Pension Plan. July 8

The coronavirus pandemic could spell disaster for our rainforests — and the communities that protect them. *The Hill* quotes Marcia Macedo. July 2

A Disastrous Summer in the Arctic. *The New Yorker* quotes Sue Natali. June 27

Murkowski Pushes Improved PWS Warning System. *Cordova Times* (Alaska) mentions scientist sign-on letter that included Anna Liljedahl. June 26

Interfaith Climate Tracker. *National Catholic Reporter* mentions our role organizing the Faith Science Alliance. June 26

Extreme Heat Threatens Elderly, Vulnerable Populations. WCAI interview with Zach Zobel. June 25

The Ticking Time Bomb of Arctic Permafrost. *Eos* (AGU News) quotes Darcy Peter. June 24

Is climate change ramping up the Atlantic hurricane season? *Miami Herald* interview with Jennifer Francis. June 22

Thaw that should chill us. *The Statesman* (India) references WHRC permafrost science. June 20

Research center helps Ontario Teachers develop climate data for investments. *Pensions & Investments* covers our partnership with Wellington Management and Ontario Teachers' Pension Plan. June 18

Oil exploration could leave decades-long scarring in Arctic National Wildlife Refuge, researchers report. *Anchorage Daily News* quotes Anna Liljedahl. June 16

As Amazonian Wildfire Season Approaches, We Must Protect the Vulnerable Forest. *EcoWatch* mentions our carbon data on 2019 fire season. June 15

Ignoring Climate Change Risks Market Chaos. *Barron's* op-ed by Phil Duffy and Theodore Roosevelt V. June 4

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