Woodwell Climate Research Center

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Newsletter • August 2020
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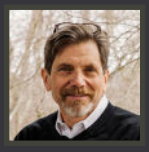
No regrets



Dr. Philip Duffy
President & Executive Director

Epidemiological studies estimate that between 70 and 99% of the victims of COVID-19 in the United States would be alive today if we had followed science-based policies right from the start of the pandemic. This may sound implausible, but other countries with similar cultures, systems of governance, and demographics, and with access to the same information we had, have been much more successful in controlling the virus. There can be no question that we've lost many, many people who didn't need or deserve to die of COVID-19.

The same is true of climate change. The World Health Organization estimates that climate change kills 150,000 people a year, mainly through extreme weather events, increases in water-related and vector-borne disease. Much or most of this mortality would not be happening if policymakers had heeded decades of warnings by scientists, including many associated with this institution.

As with COVID, we're still not doing nearly enough to control climate change. The simple fact that carbon dioxide continues to accumulate in the atmosphere tells us that we need to do more.

At stake are not only millions of lives, but the very livability of parts of our planet. If that sounds like hyperbole, consider that recent studies have documented "wet-bulb temperatures" exceeding 35°C* — a level of heat and humidity which is fatal to otherwise healthy humans, even sitting in the shade with a breeze. Our work shows that this unprecedented level of deadly heat and humidity will become more frequent and widespread in coming decades, along with other impacts that are already dismally familiar: turbocharged wildfires and hurricanes, more frequent floods, increased water scarcity, and more.

Terrible though those things are, what truly alarms me is the possibility that these threats could become amplified by runaway "biotic feedbacks." As the planet warms, nature itself starts to release greenhouse gases, adding to those emitted by humans. Thawing Arctic permafrost may be the greatest risk, as it holds twice as much carbon as is now in the atmosphere.

But forests, soils, even the ocean, are all likely to absorb less carbon or even begin to emit it as they warm. These "natural" emissions will drive more warming, leading to more emissions and yet more warming. As our founder, George Woodwell, says, "the warming feeds the warming."

George warned about this possibility in testimony to the US Senate in 1986. At that time, biotic feedbacks to climate change were just an idea. Now they are happening. How large they will become is among the most important questions facing humanity and is a major focus of our work here at the Woodwell Climate Research Center. But we can't wait for scientific certainty before acting—the risks are too great. Unlike human emissions from fossil fuel burning and deforestation, which theoretically at least we control, strong biotic emissions of greenhouse gases would be impossible to stop. If we let these emissions become too great, we might lose the ability to determine our planetary destiny.

The pressing need to understand that science — and to see that it is acted on—is a great example of why George Woodwell founded WHRC in 1985, and why our mission is more important and more urgent than ever. I am proud to lead an organization which has had outsized real-world impact throughout its history. Disproportionate impact is a key element of our ambition and vision. We don't want to be the biggest climate change organization, just the best. Our new name is a key step towards making that possible. In order to have the visibility and impact this crisis demands, we need a name which is unique and which clearly conveys what we do. We need to reach a lot more people, and our new name will help us to do that.

Ignoring science on COVID hasn't worked well, and it won't work well on climate change, either. Today's health and economic crisis is an opportunity to accelerate the necessary transition to a low-carbon economy. The world will be different after COVID; let's work together to make it better. Thanks, as always, for your interest and support.

* Raymond et al., Sci. Adv. 2020; 6 : 1838 8 May 2020

New name, renewed commitment

After 35 years as Woods Hole Research Center, we have become the Woodwell Climate Research Center. This shift honors our visionary founder and provides a clear sense of the Center's continuing mission to advance climate research that drives real-world change. Along with the new name, Woodwell Climate is unveiling a new logo mark and launching a new web platform.

"I could not be more proud of the work we've done and the impacts that we've had as Woods Hole Research Center," said President and Executive Director Dr. Philip Duffy. "But the simple fact that carbon dioxide continues to accumulate in the atmosphere means we need to do more. To do that, we need a name which is unique and which conveys that we work on the most important challenge facing humanity."The new identity comes as the result of a deliberate, data-driven process that started nearly two years ago. A team of Woodwell Climate staff and board members, working with Moth Design and 43,000 Feet, and in constant consultation with the full staff and board, conducted a thorough discovery process and recommended the name Woodwell Climate Research Center to more clearly communicate our focus on climate change, and to honor our founder, Dr. George Woodwell.

"What we do now and in the next several years will determine our collective fate. We believe that this moment calls for an intentional re-commitment to the values and mission at our Center's core," said Joseph J. Mueller, Board Chair of Woodwell Climate Research Center. "We are thrilled to announce that we will now be known as the Woodwell Climate Research Center, to honor Dr. George Woodwell's long-standing vision for the Center, and to signify a promise and a call to action for that ethos to guide our work as we rise to meet the unprecedented challenges facing us at this critical period in our history."

"The greatest threat in the world—the issue of environment, politics, and economics—is now the crushing issue of climatic disruption on a global scale," Dr. Woodwell said. "The work we do here works its way into economic systems, and determines the effectiveness and the utility of political action."

Dr. Woodwell founded the Center in 1985, envisioning an organization where top researchers would work to address the most important questions in environmental science, develop evidence-based solutions, and engage decision-makers across sectors of society. He has pioneered multiple areas of ecological research, and was one of the first to raise the alarm about climate change. His 1986 testimony before Congress outlined many impacts of climate change that were then hypothetical, but which have become realities. That testimony, and Dr. Woodwell's career of connecting science and society, has inspired many of Woodwell Climate's staff.

"Lives and welfare and aspirations, wealth, poverty, and the future are all tied together in aspects of the research we do."

– Dr. George Woodwell

Above: Founder Dr. George Woodwell preparing to cut the ribbon for the launch of Woodwell Climate Research Center, flanked by Board Chair Joe Mueller (left) and President Dr. Philip Duffy (right).

New reports continue McKinsey, Woodwell Climate scientific partnership

by Miles Grant
Director of Publications & Media Relations

The partnership between McKinsey & Company and Woodwell Climate Research Center has delivered a series of groundbreaking reports in 2020, the latest focusing on climate risk in Asia, and how climate change may harm global infrastructure. Woodwell Climate scientists produced analyses of physical climate hazards for the reports.

Many governments in Asia are well positioned to address climate challenges and capture the opportunities that come from managing climate risk effectively, according to *Climate risk and response in Asia*, a preview of an upcoming report from the McKinsey Global Institute. Infrastructure and urban areas are still being built out in many parts of Asia. This gives the region a unique chance to avoid past mistakes and ensure ongoing development is both more resilient and better able to withstand heightened climate risk. Like all parts of the world, Asia must reduce emissions to avoid pending consequences of dangerous levels of climate warming.

The second McKinsey Global Institute report, *Risk, resilience, and rebalancing in global value chains*, is an infrastructure-focused case study expanded from January's broader report. It warns climate change could increasingly disrupt critical systems, increase operating costs, exacerbate the infrastructure funding gap, and create substantial spillover effects on societies and economies. Failing to account for climate change in the design, construction, and maintenance of infrastructure assets will cost owners and operators and leave communities vulnerable. But the report also says investments in adaptation can reduce costs from climate-related damage and avoid knock-on effects.

"The partnership between McKinsey and Woodwell Climate is, at its heart, about raising awareness of climate risk when it comes to the choices we make as individuals, businesses, and communities. Decisions from where to site a production facility, to rating the creditworthiness of a municipality, to buying a family home – all of these are enhanced through knowledge of present and future climate risk exposure," said Dr. Christopher Schwalm, Woodwell Climate's Risk Program Director. "Across a broad range of climate perils, from hurricanes to wildfires, the sooner we incorporate climate risk into how we do business, how we make policy, and how we plan for the future, the better off we will be."

In June, McKinsey & Company released a report concluding that Poland can reach economy-wide carbon neutrality by 2050, and providing a roadmap for doing so. The report included research by Woodwell Climate scientist Dr. Wayne Walker on the substantial role Poland's forests could play in capturing carbon emissions

McKinsey is now working on similar decarbonization guidance for the entire European Union, and Woodwell Climate scientists are contributing to the land use portion of the research.

"Our work with McKinsey is tightly focused on providing actionable information," said Dave McGlinchey, chief of external affairs for Woodwell Climate. "By combining our world-class science with McKinsey's extensive, global network, we're reaching the people who have the power to enact large-scale change. This kind of impact is critical for taking on climate change."

North American forest carbon absorption hurt by warming, study finds

by Miles Grant
Director of Publications & Media Relations

Northern Hemisphere forests have been soaking up more carbon dioxide during growing seasons over the last 60 years, according to a new study that included Woodwell Climate Research Center scientist Dr. Brendan Rogers, but it concludes that the effect is not uniform, with most of the greening and increased photosynthesis happening in Eurasia. Meanwhile, researchers warn that warming is increasing stress on the high-latitude forests of Alaska and Canada.

Vegetation of the Northern Hemisphere removes CO_2 from the atmosphere in its productive growing phase, then returns CO_2 to the air when it dies and decomposes. This seasonal cycle creates a ripple in the atmosphere's CO_2 concentration. Measurements of CO_2 at Utqiagvik, Alaska (formerly Barrow) date back to 1960, showing a 30-50% increase in the seasonal amplitude of CO_2 fluctuations, a phenomenon known as "the hyperventilating biosphere." While previous research has described these changes and debated whether increased photosynthesis in the summer versus increased decomposition, or CO_2 emissions, in the winter were the main drivers, regional contributions from the two polar continents had been largely overlooked.

"There's been a simple narrative that warmer temperatures and CO_2 fertilization has been universally fueling plant photosynthesis across the high

Above: Dr. Brendan Rogers examines a fire-damaged forest.

latitudes," said Dr. Rogers. "While that's true on the whole, we found starkly divergent responses across regions."

The new analysis suggests that Siberia has seen a stronger greening trend, which has strengthened its summer carbon sink and amplified the difference between winter and summer. In contrast, the North American Arctic-boreal zone is showing much more browning as a result of worsening fires, pests, and droughts.

Those continental contrasts are backed up by observations made in the field and through remote sensing, providing independent evidence for differing ecological responses and carbon dynamics to global change drivers. It's unclear exactly why Siberia is doing better in a warming world than North America, but it may benefit from having a different mix of tree species, continuous permafrost that holds up the water table during droughts, or weather teleconnections that buffer the worst dry periods.

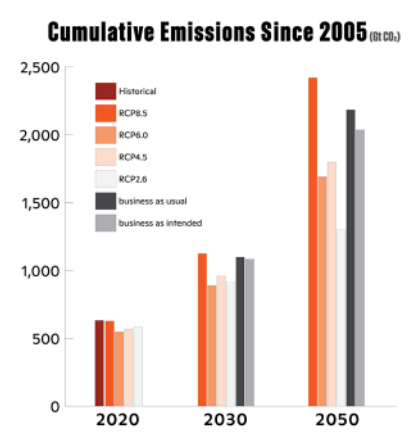
Data used in the study extended through 2017. Heat waves and rampant wildfires across Siberia, such as we've seen the past two summers, counteract its carbon sink strength and could make the region look more like its North American counterpart—which would be bad news for climate change.

The study was led by researchers at the University of Michigan and utilized NOAA observational data. It was supported by funding from the NASA Arctic-Boreal Vulnerability Experiment (ABoVE) and Carbon Cycle Science programs

"Worst case" CO_2 emissions scenario is best match for assessing climate risk, impact by 2050

by Miles Grant
Director of Publications & Media Relations

The RCP 8.5 CO_2 emissions pathway, long considered a "worst case scenario" by the international science community, is the most appropriate for conducting assessments of climate change impacts by 2050, according to a new article published in the Proceedings of the National Academy of Sciences. The work was authored by Woodwell Climate Research Center Risk Program Director Dr. Christopher Schwalm, Dr. Spencer Glendon, a Senior Fellow at Woodwell Climate and founder of Probable Futures, and by Woodwell Climate's President Dr. Philip Duffy. The paper argues that the scenario, long dismissed as alarmist or misleading, is actually the closest approximation of both historical emissions and anticipated outcomes of current global climate policies, tracking within 1% of actual emissions.



Schwalm, C.R., S. Glendon, and P.Duffy. 2020. PNAS

"Not only are the emissions consistent with RCP 8.5 in close agreement with historical total cumulative CO_2 emissions (within 1%), but RCP8.5 is also the best match out to mid-century under current and stated policies with still highly plausible levels of CO_2 emissions in 2100," the authors write.

They go on to say that "not using RCP8.5 to describe the previous 15 years assumes a level of mitigation that did not occur, thereby skewing subsequent assessments by lessening the severity of warming and associated physical climate risk."

Four scenarios known as Representative Concentration Pathways (RCPs) were developed in 2005 for the most recent Intergovernmental Panel on Climate Change Assessment Report (AR5). The RCP scenarios are used in global climate models, and include historical greenhouse gas emissions until 2005, and projected emissions subsequently. RCP 8.5 assumes the greatest fossil fuel use, and a resulting additional 8.5 watts per square meter of radiative forcing by 2100.

The commentary also emphasizes that, while there are signs of progress on bending the global emissions curve and that our emissions picture may change significantly by 2100, focusing on the unknowable, distant future may distort the current debate on these issues.

"For purposes of informing societal decisions, shorter time horizons are highly relevant, and it is important to have scenarios which are useful on those horizons. Looking at mid-century and sooner, RCP8.5 is clearly the most useful choice," they write.

The article also notes that the utility of RCP 8.5 would not be significantly impacted by the COVID-19 pandemic, as maintaining pandemic restrictions through the end of 2020 would likely result in less than a 1 percent reduction in total cumulative CO_2 emissions since 2005. This is true across all RCPs and observations.

"Given the agreement of 2005-2020 historical and RCP8.5 total CO_2 emissions and the congruence between current policies and RCP8.5 emission levels to mid-century, RCP8.5 has continued utility, both as an instrument to explore mean outcomes as well as risk," they concluded. "Indeed, if RCP8.5 did not exist, we'd have to create it."

Despite COVID-19 limitations, scientists advance research

by Anabelle Johnston
Communications Intern

Woodwell Climate Research Center adapted fieldwork plans for summer 2020 to ensure the safety of scientists and members of local communities. Travel has been restricted and lab use has been limited, but work continues. In the past few months, Woodwell Climate researchers have developed creative ways to advance their science under unprecedented conditions.

"The biggest direct impact on my work has been from the lab shutdown," said Dr. Jon Sanderman. "We made do, with research assistant Gabe Duran continuing to process soil samples from home."

The Falmouth campus has partially reopened following guidelines from the state of Massachusetts, says COVID Safety Director Lindsay Scott. The building is capped at half-capacity and common areas have been closed. Essential staff may enter after completing a virtual training conducted by Scott, who handles the campus scheduling.

Scientists that choose to conduct fieldwork in some capacity also must send their protocols to Scott for approval prior to stepping out into the field. While fieldwork can often be conducted in a socially-distant manner, tasks such as equipment hand-off must be reevaluated with pandemic guidelines in mind.

In late August, Dr. Marcia Macedo and Kathleen Savage plan to travel to Howland Forest in Maine to measure greenhouse gas fluxes from vegetation. Both scientists will be taking extra precautions to ensure the research meets safety standards, traveling separately and sampling six feet apart.

Macedo, Savage, and Paul Lefebvre have already gotten a taste of socially distant fieldwork. They recently took to local wetlands on Cape Cod to test floating flux chambers that enable researchers to measure the exchange of carbon dioxide between air and water. The team originally planned to deploy these in the Congo and Brazil. After making necessary adjustments to the equipment, Savage instead has mailed materials to collaborators in the Democratic Republic of the Congo along with instructional videos for deployment and sampling. This work is supported by the Fund for Climate Solutions.

Fieldwork conducted by the Arctic team has been placed on hold to prevent the spread of disease to remote communities in Alaska and Canada. However, Woodwell Climate scientists have found other ways to conduct research and lend climate expertise. For example, Woodwell Climate revamped this year's Polaris Project to be primarily online, while offering this year's students a chance to make the trip to Alaska in 2021.

Analysis of high resolution imagery in the Arctic has led to discoveries with impacts far beyond summer 2020. For example, Dr. Anna Liljedahl's use of satellite remote sensing has identified a melting glacier in Alaska's Barry Arm that raises the risk of a tsunami-generating landslide. While remote sensing and computer modeling have always been widely used by Woodwell Climate researchers, they have become even more prevalent.

"My pre-COVID plans had me in the Yukon-Kuskokwim delta in Alaska for much of this summer, where I'd intended to work with a small team collecting data about the impacts of permafrost thaw and wildfire on carbon cycling," said Dr. Rachael Treharne. "Now, I'm taking a completely different approach to some similar questions, using a mathematical model to estimate how carbon released from fire and permafrost across the Arctic could impact our ability to meet the Paris Agreement temperature targets. It's been quite a learning curve but also a really refreshing opportunity to learn some completely new skills that I'll be able to build into my research in the future."

Woodwell Climate scientists have also been using this time to plan for safer and better fieldwork practices in the long term. Dr. Melissa Ward and Dr. Liljedahl will be leading a working group to establish a robust set of guidelines for Arctic fieldwork protocols going forward.

Staff profile: Lindsay Scott

by Anabelle Johnston
Communications Intern

Lindsay Scott is Woodwell Climate Research Center's lab manager and a research assistant studying river systems and promoting science outreach. She is a member of the Woods Hole Diversity Advisory Committee and Woodwell Climate's Diversity, Inclusion Retention and Equity committee, working to identify and dissolve barriers to entry into the scientific community. Lindsay recently took on the role of COVID Safety Director, developing Woodwell Climate's return to work policy, training staff in proper safety procedures, and ensuring the center is up-to-date on the latest case-loads and changing guidance in relation to the new virus.

Why did you pursue a career in science?

I think it is a combination of having a science teacher as a parent (my dad), realizing I could combine my interest in the environment with my interest in scientific inquiry, and having a really

Above Left: Research Assistant Gabe Duran in his home laboratory, Above Right: Lab Manager and Research Assistant Lindsay Scott in the Woodwell lab.

supportive mentoring environment throughout undergrad. I had work study money that allowed me to intern in different lab spaces while I was in school and with that I met people and learned about research opportunities available to me.

What questions does your research aim to answer?

I work on river systems with Dr. Max Holmes. Our projects aim to measure and show how climate change is affecting river systems globally and in our metaphorical backyard here on Cape Cod.

What's your biggest challenge or obstacle?

Restarting the lab after the COVID shutdown/pause and then keeping it running with few staff on hand is a challenge because many of our instruments don't do well when they're idle for any period of time. Instruments that measure aqueous samples are finicky and need constant care to work properly in the best of times. We've also run into compounding issues - for example, I got one instrument running, then, with data from that instrument, I realized our pure water system wasn't functioning correctly.

Even though it can be frustrating at times, I do enjoy problem solving, getting to the bottom of an issue, diagnosing the problem correctly, and fixing it.

What brought you to Woodwell Climate?

I worked at Marine Biological Laboratory (MBL) for a while, so was in the community. When my former boss (Chris Neill) moved up the road, I joined him as a Research Assistant.

What makes Woodwell Climate special in the scientific community?

For a small institution, we consistently punch above our weight with the work we do and are involved with. For example, our efforts to expand remote sensing are outstanding.

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

In this moment in time, the first thing that comes to mind is the #ShowYourStripes project. The images show a lot of information in a simple way.

In the news: highlights

Forest Contribution to Seasonal Carbon Flux Depends on Location, Study Says. *The Science Times* quotes Brendan Rogers, August 18

Death Valley's brutal 130 degrees may be record if verified. *Associated Press* quotes Jennifer Francis, August 18

California's Heat Wave Just Set a Global Temperature Record. *Bloomberg* quotes Jennifer Francis, August 18

Beyond location — how climate change could redefine real estate. *TodayOnline* (Singapore) op-ed by Spencer Glendon, August 13

Drought Conditions Elevated to 'Significant' Across Cape and Islands. WCAI quotes Zach Zobel, August 12

COVERAGE OF THE RCP 8.5 REPORT

This worst-case climate scenario might be the most realistic. *Popular Science*, August 7

There Are Still Real Fights Over Climate Change, Just Not the Ones You Think. *Bloomberg*, August 4

'If RCP8.5 Did Not Exist, We'd Have to Create It' for Climate Change by 2050. *Newsweek*, August 3

The Worst-Case Scenario for Global Warming Tracks Closely With Actual Emissions. *Inside Climate News*, August 3

Worst case emissions scenario is the most realistic. Earth.com, August 3

NOAA updates hurricane season forecast, predicting up to 25 named storms, highest number ever. *Palm Beach Post* quotes Jennifer Francis, August 6

Long-time Contrarian Michael Shellenberger Is a Republican Star Witness in Climate Hearings. *DeSmogBlog* quotes Jennifer Francis, August 6

Shellenberger's Optimistic, Viral Take on Climate Future Challenged by Scientists He Cites. Snopes.com quotes Jennifer Francis, August 4

'Biggest Little Farm' director on farming with nature, not against it. *Mashable* profiles Jonathan Sanderman's work with the director. July 30

Climate Change Is Happening - How Will It Affect Your Fly Fishing? *Flylords* interview with Max Holmes, July 30

Alaska Enveloped in Siberia Wildfire Smoke as Heatwave Causes Irreversible Damage to Permafrost *Newsweek* quotes Sue Natali. July 30

ATP and AUA Acopian Center for the Environment Provide Blueprint for Armenia's Reforestation Efforts. Armenian Weekly mentions Glenn Bush, July 27

cover: Alaska landscape photo from Dr. Brendan Rogers while conducting field work in 2012.

Donations play an important role in securing the future of Woodwell Climate Research Center's work—and help safeguard the health of our planet for generations to come.

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