Strong early returns in partnerships to quantify climate risks

Dr. Philip B. Duffy
President & Executive Director

One of my hopes and goals, when WHRC began working with the investment industry, was that making investors more aware of physical climate risk (i.e. business risks from extreme weather, etc.) would increase awareness of this important risk category in the broader corporate world.

An important step in that direction took place this month with the release by Wellington Management and the California Public Employees Retirement System (CalPERS) of guidelines for corporate disclosure of physical climate risk. These guidelines, a direct result of WHRC’s work with Wellington and CalPERS, encourage companies to assess and disclose their physical climate risk—as distinct from risks associated with possible climate policies such as carbon taxes. Physical climate risks include, for example, risks to company-owned infrastructure from storms or flooding, risks to supply chains from various forms of extreme weather, and risks associated with customer migration or loss of prosperity, which may be climate-related.

We believe that when corporations start to look at their exposures to physical climate risk, they will be impressed with the scope and scale of near term risks. This has been the case with Wellington and CalPERS themselves, and it has been interesting and rewarding to see the personal journeys of individuals we’ve worked with as they gain more appreciation of the risks posed by climate change.

As more corporations understand their physical risks from climate change, this will send the message that climate change is a threat to the corporate bottom line. This is absolutely critical in mobilizing the private sector to address climate change, because it makes doing that an act of self-interest rather than a corporate social responsibility. To state it plainly, understanding the near term risks means that even those interested only in profit will be

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Scientists push back on spike in Amazon deforestation

by Miles Grant

Human-caused fires in Brazil captured the world’s attention this summer, shining a renewed spotlight on the need to conserve the Amazon rainforest. With partners at IPAM Amazônia, WHRC scientists pushed for action on deforestation.

Brazilian President Jair Bolsonaro took office last year promising to limit indigenous rights and expand industry in the Amazon. In April, his administration announced authorities would no longer burn equipment used in illegal mining and logging operations to stop it from being used elsewhere. Those policies contributed to a doubling of deforestation under Bolsonaro, with a corresponding surge in forest fires set to clear downed trees.

This year’s Brazilian Amazon fires have produced between 104 and 141 million metric tons of carbon dioxide (CO$_2$), according to an analysis by scientists at WHRC and IPAM Amazônia. That’s equivalent to annual tailpipe carbon pollution from 22.6 to 30.6 million cars, or the annual CO$_2$ emissions from the entire state of North Carolina. This summer, WHRC experts have been featured in nearly 200 news stories about the Amazon fires, reaching an estimated audience of 656 million, according to Meltwater media monitoring. WHRC Adjunct Scientist Dr. Paulo Brando also testified before Brazil’s National Congress.

The international outcry has sparked boycotts of Brazilian leather by companies like Timberland, H&M, and The North Face, and imperiled a trade deal with Europe. In September, Bolsonaro launched a costly effort to reverse the failure to prevent the fires in the first place, sending 800 soldiers and agents to the Amazon to put out fires, look for illegal activity, and resume burning illegal equipment.

WHRC will continue working to protect tropical forests in the Amazon and around the world, including at the upcoming COP 25 climate talks in Santiago, Chile.
Good morning everyone. First I’d like to thank you for this opportunity to speak a bit about the research done by our group. There are over twenty years of research, and I’d like to underscore the fact that these research projects were published in principal journals around the world.

The principal point I’d like to make here today is that the cumulative deforestation of the Amazon region over the past twenty or thirty years is already sufficiently extensive to influence the climate of the region. In other words, there are 760,000 square kilometers of deforested land - more than 7,000,000 football fields—twice the size of the state of Goiás plus 100,000 hectares—and this deforestation has already altered the climate of the southeast region of Amazonia. There has been an increase of 3 weeks in the length of the dry season. This increase is frightening. This means a shortening of the rainy season; those who plant crops know the problem of having a shorter window for planting. And this deforestation [climate change] occurs because, when you knock down an Amazonian tree, you lose the capacity of this system to take water that is in the soil and pump it into the atmosphere.

In our research we have encountered tree roots that reach depths of 10, 15, even 20 meters. And this is why we have trees in the Amazon that can pump into the atmosphere somewhere between 300 and 500 liters of water per day. I’ll repeat - one large tree in the Amazon, 300 to 500 liters of water per day. Imagine the 500 to 600 trees that live in a hectare of forest. And for this reason, when we reduce the capacity of this system to pump water into the atmosphere, we have an increase in the surface air temperature. In other words, we already have an increase in the length of the dry season, together with an increase in temperature.

This brings me to my second point. Because of this increase—because of this change in climate—we have more flammable forests in the Amazon. The healthy, undegraded forests of the Amazon rarely catch fire. But as we deforest, we have forest edges that are much more vulnerable to forest fires, not clearing burns associated with deforestation but fires in standing, living forest. And we have an increase in this over time. When we have a drought we have those catastrophic fires that we have already seen. Between the years 2000 and 2010, 85,000 square kilometers of forest burned. 85,000 square kilometers of living forest burned between 2000 and 2010! It’s a huge number. These forests are not resistant to fire, because their bark is very thin, so the environmental disaster is very big when you have these forest fires happening. A key thing we are seeing is that without a drought, forests rarely burn. So when we look at 2019, we see that the fires of 2019 have a special characteristic that we can compare with the fires of other years. In spite of the increase in forest flammability that we’ve seen over time, we haven’t had that many forest fires this year. What we have had is an increase in deforestation, and an increase in number of fires set to burn forests that were already cut down. And if we had had a drought in 2019, we would have a catastrophic situation. Catastrophic. So since we have had an increase in forest flammability, we would have to reduce the sources of ignition—in this case, it’s the matches used to set burns to clear cut forests. But instead we have increased this condition.

So in the coming years, what do we have to do to reduce the chance of forests catching fire? We need to reduce deforestation, because it reduces the sources of ignition—those matches that light fires to burn [already] cut forests. We reduce deforestation, we stabilize the local and regional climate. It becomes more difficult to burn, even more with the global changes. Reducing deforestation, we reduce the quantity of forest edges vulnerable to fire—those more degraded forests. Besides everything else this will help agriculture, as I’m sure many of our other invited guests today will talk about.

Thank you very much.

PARTNERSHIPS continued from front

motivated to address climate change. I am proud of the role that WHRC is playing in making this happen.

There’s more to come in WHRC’s work with the private sector. Later this year, another corporate partner will release a flagship report on the business and broader societal ramifications of climate change. This report will make the case very forcefully that climate change is a threat to human prosperity. Nearly all of the science upon which this is based was done here at WHRC, and I am proud of the effort and talent our people put into making this happen.

These corporate relationships are new for WHRC, and I believe are an important pathway to impact. This is especially needed in an era when our federal government is doing everything it can to make climate change worse. Even so, I am excited about the potential from working with the private sector—including their ability to influence federal policy. Thanks as always for your interest and support.
Worsening wildfires threaten “legacy carbon” storage in boreal forests
by Miles Grant

Climate change is altering the cycle of fire in boreal forests, releasing “legacy carbon” that had previously been safely locked away for hundreds to thousands of years, according to a new study published in Nature by a team of researchers that included WHRC Assistant Scientist Brendan Rogers. Boreal forests that have acted as carbon sinks for millennia are now becoming sources of atmospheric carbon.

The research team included collaborators from Northern Arizona University, the Government of the Northwest Territories (NWT), four Canadian universities, and University of Alaska, Fairbanks. They studied the aftermath of the NWT's catastrophic 2014 fire season. That year, 385 fires burned roughly 3 million hectares of forest in the territory, an area larger than Massachusetts and Rhode Island.

Scientists used radiocar bon (14C) dating to look at the age of remaining and burned soil within fires from the catastrophic fire season in 2014. They found that legacy carbon, or carbon that had survived past fire cycles, remained protected from combustion in older stands where the historical fire return interval persisted. But in stands younger than 60 years old, legacy carbon burned.

“We found more frequent and intense fires are exposing legacy carbon and burning it. This is consistent with other signs of an intensifying wildfire regime fueled by human-induced climate change,” Rogers said. “We are seeing an increasing number of young forest stands burn across the boreal biome. This means that more and more legacy carbon is being emitted to the atmosphere, signaling a change in long-term carbon dynamics. These forests have acted as a carbon sink of global importance for millennia, which may be coming to an end.”

In nearly half (45%) of the young stands the researchers sampled, legacy carbon burned. And while the amount of legacy carbon didn’t alter total carbon emitted from these fires, the pattern the researchers identified has global implications for future climate scenarios. “The frequency of boreal forest fires is projected to increase even more with expected climate warming and drying, and as a result total burned area is expected to increase 130-350% by mid-century,” the authors write, expanding the proportion of young forests vulnerable to burning and loss of legacy carbon.

“In a sense, what we’re talking about here is the difference between spending down your checking account, and spending down your retirement account. While young carbon can replenish on a human time scale, legacy carbon takes generations to build, and we need to keep as much of it safely locked away as possible. It adds even more urgency to our need to cut carbon pollution and deforestation to limit the climate debt we’re passing along to future generations,” said Rogers.

The study was supported by the NASA Arctic Boreal Vulnerability Experiment (ABoVE), as well as a National Science Foundation (NSF) Division of Environmental Biology (DEB) Rapid grant. Additional funding was provided by Natural Sciences and Engineering Research Council (NSERC) Discovery Grants, the Northwest Territories Cumulative Impacts Monitoring Program, and Polar Knowledge Canada’s Northern Science Training Program. Logistical support was provided by the Government of the Northwest Territories – Wilfrid Laurier University Partnership Agreement.

Study highlights need for better understanding of climate impact on “blue carbon”
by Miles Grant

Coastal wetlands and marshes are critical biodiversity hotspots, protect communities from storms and act as important carbon sinks, but a new study by a team including WHRC’s Dr. Jonathan Sanderman warns we don’t know enough about how our rapidly changing climate and coastal development are disrupting them. The study was published in the September issue of Nature Geoscience.

Warming water, rising seas, runoff pollution, and landscape development are impacting microbial community makeup and function, pore water chemistry and vegetation dynamics. Taken together, these changes can have major but uncertain impacts on the global reservoir of so-called “blue carbon”—the carbon captured and stored by the world’s ocean and coastal ecosystems.

Excess nutrient runoff, known as eutrophication, has been a focus of The TIDE Project, a study conducted by WHRC and partners in the Plum Island Estuary of the Great Marsh north of Boston. The research has found loading coastal marshes with nitrogen does a surprisingly large amount of damage, changing vegetative growth patterns and accelerating organic matter decomposition. The result is that marshes struggle to keep up with sea level rise and are more vulnerable to edge collapse.

“Will salt marshes and mangroves keep up with sea level rise and keep accumulating organic matter, or will degradation alter the cycle? Blue carbon is incredibly important in our understanding of the global carbon cycle, but most of our existing models oversimplify the mechanisms that affect it. This study is a step toward improving predictions of soil organic carbon stores and incorporating of coastal vegetated ecosystems into global carbon budgets and management tools,” said Dr. Sanderman, an associate scientist at WHRC.

While this study lays out some of the questions, more studies and more dedicated funding will be key to getting answers and supporting more effective ecosystem management. Identifying high-value blue-carbon ecosystems and take measures to increase their sustainability will also communities protect infrastructure and plan for our changing climate.
“Science on the Fly” engaging anglers to expand water sampling
by Miles Grant

The Woods Hole Research Center recently launched “Science on the Fly,” an global project that unites anglers and scientists to investigate rivers in key regions of the world. This initiative will dramatically expand scientific monitoring of river systems by engaging the fly fishing community including anglers, fly shops, outfitters, and professional guides. The resulting data will allow the WHRC team to understand how the rivers and watersheds are changing, and to communicate this information to key constituencies and decision makers, according to WHRC Deputy Director Dr. Max Holmes, a lifelong fly fisherman.

“The chemistry of a river tells a story, but that story is only ever known if the samples are collected that allow the story to be heard. There are no data in a lot of these places. They’re rapidly changing and no one’s looking. We need to study rivers and watersheds over a large area and integrate that knowledge into our broader understanding of climate change,” Holmes said.

Science on the Fly is initially focusing on two critical regions, the Rocky Mountains and western Alaska, each of which is being dramatically impacted by climate change. For the research in the Rocky Mountains, Science on the Fly is beginning by partnering with Telluride Angler, whose fishing guides and their clients began collecting water samples in summer 2019. The goal is to expand the research in the Rocky Mountains through partnerships with additional fly shops in 2020.

Science on the Fly’s work in western Alaska began this summer with a trip to the Kwethluk River in the Yukon Delta National Wildlife Refuge. Experts from a range of backgrounds and disciplines traveled to the remote Alaskan wilderness for the expedition, including WHRC Senior Adviser to the President Dr. John Holdren, Research Assistant Anya Suslova, WHRC Board Member and Fishpond Founder and CEO Johnny Le Coq, and documentary director and producer Stash Wislocki. The team collected water samples along 100 miles of the river and placed sensors that record river temperature and depth every hour, as well as sensors that measure the temperature of permafrost alongside the river on the remote and largely undisturbed Kwethluk. After a full week of floating on the river sampling water, fly-fishing for salmon and trout, and spotting half a dozen grizzly bears, the team still hadn’t seen so much as a single sign of another human being.

“It was an eye-opening experience to be with such a diverse group coming at the trip from such different perspectives,” said Suslova. “We drilled into the permafrost for a temperature measurement and it’s always memorable to be around people holding permafrost core for the first time. Imagine sitting on a soft carpet of tundra and holding in your hands the thawing history of Earth and this place from thousands of years ago. That’s pretty amazing.”

Science on the Fly will expand to several different rivers in western Alaska next year by partnering with Papa Bear Adventures, an outfitter that transports and equips anglers for multiday float trips down several rivers at the southern extent of Arctic permafrost, including the Kwethluk. Papa Bear’s clients, mainly fly fishers, will be offered the opportunity to participate in Science on the Fly’s research by collecting water samples and related data as they float down the rivers. Science on the Fly will also organize additional expeditions similar to the 2019 expedition.

“The Rocky Mountains and Alaska were obvious places to start Science on the Fly because they are already being dramatically impacted by climate change,” Holmes said. “But to maximize our scientific and societal impact, the vision for Science on the Fly is global. I’ve been spending a lot of time staring at my globe, thinking about where in the world engaging fly fishers as citizen scientists can have the greatest impact.”

To learn more about Science on the Fly, or to help the team realize its vision, please contact Max Holmes at rmholmes@whrc.org or 508-444-1548.

Photos by John Land LeCoq
Fund for Climate Solutions awards new round of climate research projects

WHRC’s Fund for Climate Solutions has announced support for a new round of innovative climate science initiatives. The Fund advances climate solutions by extending or augmenting crucial research efforts, seeding new projects that offer breakthrough policy or scientific impact, and allowing startup projects to get off the ground to show proof of concept.

The new projects being supported by the Fund:

Integrating state-of-the-art science with indigenous knowledge to support climate-threatened Arctic communities
Project Lead: Dr. Susan Natali
This project will develop a new geospatial monitoring and change detection framework that will integrate Indigenous knowledge, in situ monitoring, and multi-scale and multi-sensor remote sensing to develop climate change indicators that are critically needed for adaptation decisions and actions.

Planning for and mitigating boreal wildfires: societal risks, management influence, policy opportunities, and strategic partnerships
Project Lead: Dr. Brendan Rogers
Wildfires are becoming more common and intense in boreal forests, with a myriad of negative impacts on local residents and global climate. This project will develop key partnerships and methods for assessing the potential for a new paradigm in wildfire management—one that considers the effects on human society, ecosystem services, and global carbon budgets.

A pattern recognition approach to connecting disruptions in the stratospheric polar vortex with extreme weather in mid-latitudes
Project Lead: Dr. Jennifer Francis
This research aims to develop a new way to detect disruptions in the stratospheric polar vortex, which will be used to better understand the connections between vortex disruptions and extreme weather in mid-latitudes.

A spatial bookkeeping model of land carbon
Project Lead: Dr. Skee Houghton
Using data from WHRC’s Carbon Monitoring System, Houghton will create a new model examining global gains and losses of woody biomass and soil carbon, calculating how much carbon is accumulating on land, how much is being lost, and where.

Developing a new geospatial approach for rangeland carbon monitoring
Project Lead: Dr. Jonathan Sanderman
This project will develop new tools for ranch managers to better understand the carbon balance of their range properties using a combination of remote sensing, on-the-ground measurements, and modeling.

In the news: highlights

Dorian’s Claim to Fame: 36 Hours of Pummeling Just One Spot. Bloomberg quotes Jennifer Francis. September 9

MSU research group travels to Alaska to examine climate trends. Bozeman Daily Chronicle features Jenny Watts. September 7

A summit to save the Amazon. Interview with Paulo Brando on PRI’s The World. September 6

Fires in Brazil’s Amazon have devastating consequences. Mongabay articles include Foster Brown. September 6


Can we stop stupid politics from ruining carbon farming? Grist quotes Jonathan Sanderman. September 3

How Amazon deforestation could push the climate to a ‘tipping point’. PBS NewsHour features Michael Coe, Andre Guimaraes, and Thomas Lovejoy. September 4


Arctic permafrost is thawing fast. That affects us all. National Geographic quotes Max Holmes. September 2019 issue

Local Researchers Say Amazon Fire Emissions Equal That of 22M Cars. NECN/NBC10 Boston quotes Wayne Walker and Paulo Moutinho. August 31


These Scientists Know How Bad The Amazon Fires Could Get. They Saw It Burn 20 Years Ago. Buzzfeed quotes Michael Coe and Paulo Brando. August 29

Amazon tribe warns future of the rainforest could be in jeopardy as fires burn. CBS News features Foster Brown. August 27

Why we should worry about the Arctic burning. BBC quotes Sue Natali. August 27

Trump should help save Greenland. Florida’s future depends on it. Rafe Pomerance’s op-ed is picked up by Sun Sentinel. August 27

Climate change deniers dominate YouTube searches on warming crisis, study finds. The Print (India) quotes Jennifer Francis. August 25

Why is part of the Amazon burning? Agence France-Presse (AFP) quotes Paulo Brando. August 23

Humans, more than drought, are fueling the Amazon’s flames. Wired quotes Paulo Brando. August 22

For more information about the Fund for Climate Solutions, contact Alison Smart, Vice President for Strategy & Advancement, at asmart@whrc.org.
Dr. Glenn Bush is an economist at WHRC specializing in behavioral economics, resource valuation and environmental cost-benefit analysis, to conserve tropical forests.

“I lead Projet Equateur, a program that works to conserve forests and promote sustainable economic development in the Democratic Republic of the Congo (DRC). Much of what I do requires work in the field; in this photo, my colleagues and I are inspecting the quality of rice as part of a rice intensification demonstration plot in the DRC. We’re trying to show how a new technology can improve yield over traditional wetland production systems and help us to understand the local social costs and benefits. People might not like it and we need to know why.” 