



**Woodwell
Climate
Research
Center**



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Notes from the Field

Month in Review • September 2022
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Teams tackle climate policy on two fronts in one week

Woodwell Climate scientists kick off fall push with testimony, meetings, and events in DC and NYC

Dr. Heather Goldstone Chief Communications Officer

We are nearly one fifth of the way through what has been called the decisive decade for climate change, and just weeks from the next round of UN climate negotiations at COP27 in Egypt. In recent months, powerful storms, devastating flooding, and lethal heat waves have all driven home the severity of the threat and the urgent need for action.

At this critical juncture, Woodwell Climate scientists are ramping up efforts to see natural systems—both the risks and the solutions they present—fully and fairly accounted for in climate policy. This week, more than a dozen Woodwell Climate staff, board members, and partners traveled to both Washington, D.C. and New York, NY to connect with decision-makers.

Congressional testimony

On Tuesday, September 20, 2022, Woodwell Arctic Program Director and Permafrost Pathways lead Dr. Sue Natali testified before the House Committee on Science, Space, and Technology. The subject of the hearing was “Strengthening Science to Respond to a Rapidly Changing Arctic.” Dr. Natali highlighted the devastating impacts of rapid landscape change facing Northern communities and the global climate threat posed by greenhouse gas emissions from permafrost thaw.

“Greenhouse gas emissions from thawing permafrost could use up 25 to 40% of the remaining carbon budget to stay below 2°C warming,” Natali told the Committee. “Yet these emissions are generally underaccounted, in part, due to major gaps in Arctic carbon monitoring and modeling. The failure to accurately account for permafrost thaw undermines the integrity and efficacy of global mitigation policy.”

The Permafrost Pathways project that Dr. Natali launched in April with support through the TED Audacious Project is partnering with Alaska Native communities to co-develop strategies for responding to climate hazards, while also working with high-level policymakers to incorporate permafrost thaw

emissions and impacts into federal and international climate policy.

Dr. Natali called for increased federal research support to expand the scope and timeframe of research, improve interagency coordination and international collaboration, and support Alaska Native tribes to coproduce knowledge and lead climate change research.

Congresswoman Haley Stevens summed up the impact of the testimony, saying “I came into this hearing thinking ‘ice, ice, ice.’ I’ve read a lot of articles about a world with ice. And now I’m leaving thinking ‘permafrost, permafrost, permafrost.’”

DC fly-in

Increasing research capacity was also a theme during Woodwell’s first DC fly-in. Together with our partners at the Niskanen Center, Woodwell Climate scientists, staff, and board members participated in fifteen meetings with elected officials and congressional offices, focusing on opportunities to support natural climate solutions through the next Farm Bill.

“This fly-in highlights Woodwell’s commitment to impact,” said Chief of External Affairs David McGlinchey. “We’re meeting with congressional offices on both sides of the aisle to offer our expertise and ensure they have the tools they need to make climate smart decisions. To affect change, it’s essential that our science gets into the hands of decision makers.”

Based on our expertise in soil and forest carbon storage, Woodwell has identified seven priorities for inclusion in the next Farm Bill, due for passage in 2023:

- 1 Ensure carbon markets are credible mechanisms for providing real climate benefits as well as financial benefits to producers.
- 2 Use the Conservation and Forestry titles of the Farm Bill to encourage natural climate solutions.

- ③ Maximize the carbon storage potential in U.S. forests while reducing wildfire risk and avoiding greenhouse gas emissions from fires.
- ④ Increase eligibility and usage of crop insurance to protect small-scale farmers from the increasing physical hazards of climate change.
- ⑤ Increase research capacity to meet the need for better monitoring and standardization, as well as building a natural lands and environmental data infrastructure, which are needed for carbon markets.
- ⑥ Incorporate Woodwell's safeguards and principals for the implementation of natural climate solutions.

Climate Week NYC

While one Woodwell delegation was in Washington, D.C., another was in New York for Climate Week NYC 2022. In addition to meeting with partners and participating in a range of events on natural climate solutions, Woodwell collaborated with One Earth to host a hybrid event at The Explorers Club on Wednesday evening.

Arctic Program Director Dr. Sue Natali and Tropics Program Director Dr. Mike Coe shared updates from Alaska and Brazil, highlighting climate connections between the two disparate regions. The inextricable human element in rapid landscape change and the importance of supporting Indigenous leadership was a common theme.

"Humans are not separate from nature. We are nature," said Dr. Natali. "It's critical, if we want to find solutions to climate change that are just and that are viable, that we have Indigenous people leading the charge and providing us with guidance."

Dr. Coe echoed that sentiment and emphasized the need to understand and work with the full range of land stewards to effectively conserve forests. His work has identified four key groups of landholders in the Brazilian Amazon whose needs and wellbeing must be centered in efforts to develop effective solutions to tropical deforestation. That includes bolstering the land tenure rights and resources of Indigenous communities, also providing technical support to small-scale farmers, incentivizing landholders to forgo legal rights to deforest, and preventing illegal deforestation and burning.

While both speakers were unflinching in their descriptions of Arctic warming and tropical deforestation, many attendees said the presentations left them feeling more connected and motivated. Dr. Heather Goldstone, who moderated the conversation, called on all those in attendance to continue that by sharing what they were learning with their own families, friends, and peers.



'Weather whiplash' occurrences will increase alongside global temperatures

Dr. Jennier Francis Acting Deputy Director, Senior Scientist
Sarah Ruiz Science Writer

A sudden flip in weather conditions—from a long hot and dry period to a parade of storms, for example, or from abnormally mild winter temperatures to extreme cold—can cause major disruptions to human activities, energy supplies, agriculture, and ecosystems. These shifts, dubbed “weather whiplash” events, are challenging to measure and define because of a lack of consistent definition. A new study demonstrates an approach to measuring the frequency of these events based on rapid changes in continent-wide weather regimes.

The study indicates that, while the frequency of whiplash events in recent decades has not changed substantially, future model projections indicate increases will occur as the globe continues

above: Oncoming storm cloud. / photo by Jerry Penry, NOAA

to warm under a thicker blanket of greenhouse gasses. In particular, the researchers find whiplash will increase most during times when the Arctic is abnormally warm, and decrease when the Arctic is in a cold regime—something that will occur less often as the planet warms.

Examples of weather whiplash during 2022 so far include a long, hot, drought in western U.S. states during early summer that was broken by record-breaking flash flooding; exceptionally wet and cool conditions during June in the Pacific Northwest replaced by a heat wave in July; a record-warm early winter for most south-central states followed by a cooler-than-average January and February; and a spell of 67 consecutive hot, dry days in Dallas, TX, broken by the heaviest rains in a century.

“The spring and summer of 2022 have been plagued by weather whiplash events,” said lead author, Dr. Jennifer Francis, Senior Scientist at the Woodwell Climate Research Center. “A warming planet increases the likelihood of longer, more intense droughts and heat waves, and we’re also seeing these spells broken suddenly by heavy bouts of precipitation, which are also fueled by the climate crisis. These sudden shifts are highly disruptive to all sorts of human activities and wildlife, and our study indicates they’ll occur more frequently as we continue to burn fossil fuels and clear-cut forests, causing greenhouse gas concentrations to rise further.”

Co-author Judah Cohen, Principal Scientist at Verisk AER noted that these phenomena are tightly linked to regional warming in the Arctic.

“We know the Arctic region is experiencing the most rapid changes in the global climate system. Evidence is growing that these profound changes are contributing to more extreme weather events outside the Arctic, and this influence will only increase in the future,” said Dr. Cohen.

Half of the Cerrado is already gone. Here’s what that means for the climate.

A new study quantifies the impacts of converting natural ecosystems to agriculture in Brazil’s Cerrado

Sarah Ruiz Science Writer

The Cerrado is a tropical savanna located just southeast of the Amazon rainforest. This biome is a patchwork of forests, savannas, and grasslands, nearly as biodiversity rich as the Amazon yet suffering more due to lax environmental protections. Over 46% of its original land cover has already been cleared for crops or pastures. A recent study assessed the impacts of this conversion on the temperature and water cycling in the region.

The study found that clearing of natural ecosystems resulted in increased land surface temperatures and reduced evapotranspiration—water evaporated to the atmosphere both from soils and as a byproduct of plant growth. Across the biome, land use changes caused a 10% reduction in water being cycled into the atmosphere annually, and almost 1°C of warming. Where native savanna vegetation was cleared, temperatures increased by 1.9°C and the water recycled to the atmosphere decreased by up to 27%. These changes don’t take into account the additional effects of atmospheric warming from greenhouse gas emissions.

The study also projects forward three potential future scenarios based on different levels of environmental protection. The worst-case scenario assumes an additional 64 million hectares of both legal and illegal deforestation, which would leave just

20% of native vegetation in the Cerrado by 2050. If illegal deforestation is prevented but legal deforestation still advances, an additional 28 million hectares of deforestation would continue to warm and dry out the region. Only in the most optimistic scenario, with enforced zero deforestation policies and restoration of over 5 million hectares of illegally cleared vegetation, would the impacts of past clearing begin to reverse.

“If we continue down this path of weakening environmental policies, we’re probably heading towards an uncontrolled increase in deforestation,” says Ariane Rodrigues, researcher at the University of Brasilia and lead author on the paper. “As a result, we could reach almost 1°C of temperature increase by 2050 from land use change alone. If we add the estimated temperature increase from global greenhouse gas emissions, we will have a critical situation for food production, biodiversity, water and wildfire risk, affecting areas located way beyond the biome’s limits.”

Understanding land use in the Cerrado

Incentives for large-scale commercial agriculture in the Cerrado date back to the 1970s. Despite its high biodiversity, only 11% of the Cerrado is protected and technological advancements provided favorable conditions for agriculture to expand rapidly.



The half of the biome that remains unconverted is considered prime agricultural land. The Cerrado alone is responsible for 12% of global soybean production and 10% of global beef exports. Growing demand for these agricultural products is pushing farmers and ranchers to expand into the Matopiba region in the Northeast Cerrado—one of the largest remaining areas of undisturbed native vegetation.

Hotspots of reduced evapotranspiration and increased temperatures can already be seen in areas of Matopiba with

intensifying agricultural activity. This means that farms will rely even more heavily on irrigation to combat drought, a strategy made less viable by the warming and drying caused by agriculture itself.

“That is the driest portion of the Cerrado, where there’s the most climate risk already,” says paper co-author and Woodwell Water program director, Dr. Marcia Macedo. “You can see that in the data—it’s getting hotter, and there’s less evapotranspiration, so we are really intensifying conflicts in areas that are already on the edge.”

What this means for protecting the Cerrado

The results of the paper highlight the urgent need for a paradigm shift that values the additional services the Cerrado provides beyond just crop production. Not only does it house unique ecosystems, but it plays a pivotal role in modulating the climate of the region. In the best-case scenario evaluated by the paper, zero-deforestation and restoration policies could avoid extensive warming and drying and begin compensating for the past transformation of Cerrado landscapes. Continued conversion of natural vegetation will jeopardize both biodiversity and agricultural stability in the Cerrado, as crops struggle to be productive under hotter and drier conditions.

Already, conflicts over water usage and irrigation are occurring in western Bahia state. As the region warms and dries, competition for a scarce resource will become more common and large-scale agriculture will become much less viable.

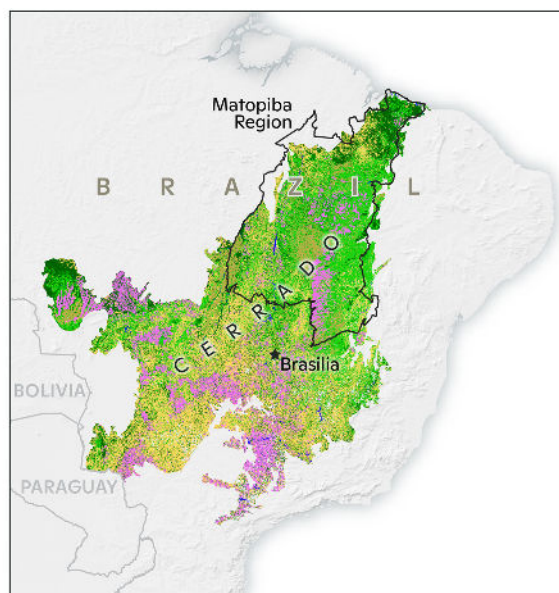
“We’re making some risky decisions in terms of land use,” says Dr. Macedo, “We’re losing a lot for short term gains in crop production, often in areas that will struggle to sustain large-scale agriculture as climate changes.”

Landcover in the Cerrado, 2019

- Forest
- Savanna
- Grassland
- Cropland
- Pasture
- Water



Croplands and pastures cover almost half of the Cerrado, equivalent to the combined area of Germany and France (over 900,000 square kilometers). Agriculture has quickly expanded over native Cerrado vegetation in Matopiba, an area of agricultural development. Matopiba is comprised of the areas where the Cerrado overlaps four states, including Maranhão, Tocantins, Piauí and Bahia states.



SHADES OF GREEN

Mapping forest stability

Not all forests are the same. New research has developed a way of distinguishing them from space.

Sarah Ruiz Science Writer

A recent paper offers new insight into the state of global forests. Using remote sensing imagery from MODIS satellites, researchers were able to categorize forest condition in two important biomes—the Amazon and the Siberian Taiga—differentiating between high stability, low stability, and non-forested areas. These “stability classes” provide another metric of assessing the conservation and carbon value of land, as high stability forests tend to be healthier, more resilient, primary forest stands that store large amounts of carbon and contribute to

cooling the planet more than lower stability forests.

“Mature forests have higher biodiversity and create their own microclimate,” says paper co-author and Woodwell Associate Scientist, Brendan Rogers. “They’re more resistant to drought and other types of disturbance. And then because of that, they tend to be more stable in the face of environmental perturbations over time.”

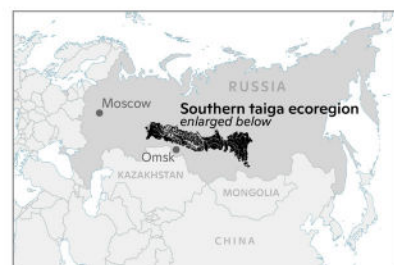
Understanding forest stability

To estimate forest stability, researchers analyzed satellite data that combined

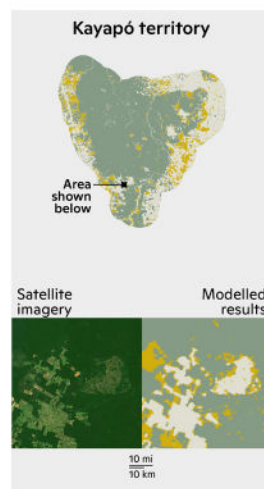
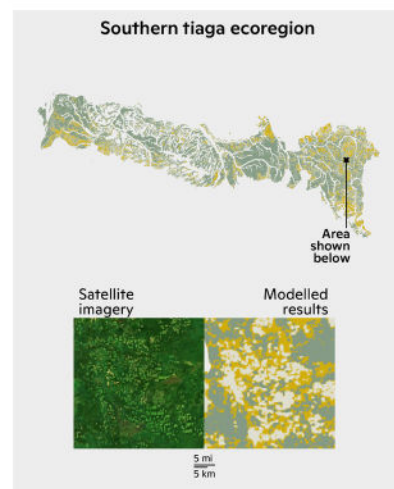
Mapping forest stability is accurate across different forest biomes.

This new approach to categorize forests into stability classes was tested in two forest biomes that vary climatically and latitudinally: wet tropical (Amazon) and boreal (Siberia).

Modeled forest regions



Forest — High stability
Low stability
Non-forest



In comparison to Sentinel 2 satellite imagery, the model results proved to be accurate in both forest biomes and therefore a useful method in identifying and conserving stable forests.

measures of photosynthetic radiation with a canopy water stress index. That new approach was able to identify whether or not a forest has been disturbed by either human land use (ex. logging) or natural processes (wildfire, insects outbreaks, etc.) and map the degradation level.

Co-author Dr. Brendan Mackey from Griffith University in Australia says that stability mapping is a first critical step in making an inventory of the world's remaining primary forests which store more carbon, support the most biodiversity, and deliver the cleanest water.

According to Dr. Rogers, the less interruption in the ecological processes of the forest, the more secure the carbon stored in both the trees and soils are. Further human interference in an unstable forest could tip it into decline.

"I think one of the problems for primary forest conservation globally has been

this idea that it's either a forest or not a forest. So, internationally agreed upon definitions of what constitutes a forest sets a pretty low bar. You can get away with calling a plantation with very young trees a forest, but that could have been converted from a high biomass mature forest, and they're simply not the same—not in terms of carbon, biodiversity, or ecosystem services," says Dr. Rogers.

What this means for forest conservation

Using a gradient of forest stability instead of a black and white definition of forest/not-forest allows for more nuanced decision-making where both carbon monitoring and conservation planning are concerned.

"The first priority is to protect stable forests from further human disturbance, as once an area is deforested, it takes decades to centuries—and in some cases millennia—for it to regrow to a primary

state. The second priority is to identify forest areas where restoration efforts will be most cost effective," says Dr. Mackey.

According to the paper's lead author, Dr. Tatiana Shestakova, this means places where a small investment could have bigger positive results.

"If you pick a forest that was degraded in some way, but it still keeps patches of more or less healthy forests, you can reinstate ecological processes faster and easier," says Dr. Shestakova.

Dr. Shestakova said she encourages other researchers to apply the methods to their particular regions of expertise and expand estimates of forest stability globally.

"The benefit of this approach is that it was tested in such contrasting ecoregions, and has been proven to be a simple and efficient way to assess this important dimension of forest condition," says Dr. Shestakova.

In the news: highlights

Dr. Jennifer Francis and *Miami Herald* reporter Alex Harris discussed the impact of climate change on the Atlantic hurricane season.

The *Atlanta Journal-Constitution* quoted Dr. Jen Francis on the connection between climate change and stronger storms, downpours, and flooding. She was also quoted in an article from *The Week* magazine on weather whiplash, and in a *Climate Feedback* article to explain how global average temperatures are calculated.

Dr. Christopher Schwalm is quoted in the first article of a series by *USA Today*, widely syndicated to outlets including *MSN* and *Cape Cod Times*. The article covers flooding and other climate impacts on the U.S. East Coast.

Anadolu Agency published an article about methane craters as a "canary in a coal mine for global climate," quoting both Dr. Scott Zolkos and Dr. Brendan Rogers.

Financial Times quoted Dr. Brendan Rogers in an article about the threats facing boreal forests.

The Washington Post quoted Dr. Jennifer Francis in an article on Europe's hottest summer on record.

Dr. Zach Zobel was quoted in an article from *Grist* on the threats of drought to Massachusetts' cranberry harvest, which was picked up in many other publications.

An article from *top1000funds.com* covered a panel discussion on climate risk at Conexus Financial's Sustainability in Practice Forum at Harvard University, quoting speakers Dr. Zach Zobel and Wellington's Chris Goolgasian.

Two different *O Globo* articles quoted Dr. Foster Brown this week: one on the incredibly high number of fires in Acre, Brazil, and the other on the record low levels of the Rio Acre due to drought.

IPAM published an article on research with Woodwell collaborators that showed that conversion of native areas of the Cerrado to pastures and agriculture has already made the climate in the region almost 1°C warmer and 10% drier.

Drs. Brendan Rogers and Sue Natali were quoted in a striking, widely-syndicated visual story from *Reuters* on why Arctic fires are releasing more carbon than ever.

Dr. Jennifer Francis was quoted in an article from the *New York Times* on how climate change is going to increase the likelihood of extreme weather (it was featured in its newsletter "The Morning" on Wednesday). She was also quoted in an article on Greenland's melting ice sheet from *DownToEarth*, as well as a *Global News* article, also about extreme weather.

An article in *O Globo* quotes Dr. Ludmila Rattis on how climate change has amplified the effects of both El Niño and La Niña (Portuguese).

cover: Woodwell Climate Research Center scientists, staff, and board members visit Capitol Hill in Washington, D.C. for a series of meetings with elected officials and congressional offices on September 21, 2022. / photo by Eric Lee

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