



**Woodwell
Climate
Research
Center**



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Notes from the Field

Month in Review • January 2026
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What did 2025 have in common with 2012?

As the calendar flips from one year to the next, I find myself reflecting not only on the many challenges faced in 2025, but also on lessons learned during difficult moments further in the past. One such time was more than a decade ago, deep in the Siberian Arctic, when weather threatened to delay the conclusion of a weeks-long research expedition. As I wrote on July 23, 2012:

“I’m sitting on the barge, drinking a cup of coffee, watching snow whip across the Panteleikha River. More than 24 hours of rain and snow have turned the dirt runway in Cherskiy to mud, threatening to delay our trip home (which is supposed to begin later today as we fly from Cherskiy to Yakutsk, and then to Moscow). A delayed flight out of Cherskiy would have many ripple effects (lots of rebooking of flights, hotels, buses, etc.; lots of disappointment as our reunions with family and friends are postponed; and lots of additional expenses).

*There are many easier things to do in life than to lead a group of 33 people to the Siberian Arctic, so **why do I do this?** I’ve been asking myself that question this morning, intertwined with thoughts about missing my 6-year-old son and 3-year-old daughter, and facing the prospect of missing my wife’s 40th birthday.*

*Fortunately, there is an easy answer: **This is the most important thing I can imagine doing.** I’ll keep hoping that our flight departs as scheduled this afternoon, but if not, I-and the larger group-will rally and use our extra time here to pry a few more secrets from this remarkable, challenging, critical, and beautiful environment.”*

As it turned out, our flight out of Cherskiy was canceled, we had to spend an additional \$30,000 on plane tickets, and I missed my wife’s 40th birthday. Experiences like this are not unusual when working in challenging environments such as the Arctic, and Woodwell scientists have long been tested by such obstacles.

Fast forward to 2025 and all of the challenges it brought. And yes, as in 2012, there have been moments when I’ve asked myself that same question:

“Why do I do this?”

My answer remains exactly what it was then:

“This is the most important thing I can imagine doing.”

I know that most Woodwell staff feel the same way. This is hard work, and at times, there are more losses than wins. But it is essential work, and we will continue to forge ahead.

I’m certain that 2026 will bring new challenges, but I am confident that Woodwell Climate Research Center will continue to stand tall, doing our science, using our voice, and staying focused on charting a course toward a positive future, no matter the obstacles in our way.

In fact, we are doing much more than simply holding our own; we are forging ahead. In the coming months, you’ll hear about Woodwell’s new office in Washington, DC; our new scientific impact strategy; and how we are continuing to pursue our highest priorities without being beholden to federal government agendas.

Thank you to all our friends, supporters, collaborators, and partners. This is a true team effort. We wouldn’t be able to continue to stand tall without you.

Onward,



Max

Dr. Max Holmes
President & CEO

Are stratospheric polar vortex disruptions what they seem?

Researchers demonstrate a new method, excluding tropospheric influences to more precisely identify patterns and behaviors of the stratospheric polar vortex

Dr. Jennifer A. Francis Senior Scientist

A weak or distorted stratospheric polar vortex (SPV) is often associated with severe winter weather in Northern Hemisphere continents. Traditional metrics of the SPV state, however, may conflate influences from both the stratosphere and the troposphere below, obfuscating attribution of weather extremes. In a new paper, published this month by Climate Dynamics, researchers present a new method that more clearly separates variations in the two atmospheric layers and their contributions to severe winter weather.

Depending on your feelings toward cold and snow, the headline “The Polar Vortex is Coming!” may instill dread or delight. The Polar Vortex first entered dinner-table conversations during the extreme winter of 2013/14, the coldest North American winter of the 21st century, and has since been used—often incorrectly—as shorthand for any cold or snowy spell. The polar vortex is a pool of frigid air encircled by strong westerly winds that sits high above the polar regions during winter only, and normally it has little influence on weather at the surface. But when it becomes disrupted from its typically circular shape—either stretched to an oblong, split into separate swirls, or greatly weakened—extreme winter weather can ensue, including severe cold, snow, and even winter heat waves.

One of the ways scientists track the behavior of the stratospheric polar vortex is to monitor the height of a constant pressure surface that exists within the stratosphere. Pressure decreases at higher altitudes because there are few air molecules above that level. The height of a pressure surface bulges and shrinks depending mainly on the temperature of the air below it: warmer air expands and cooler air contracts. Height fluctuations of a level in the stratosphere, then, are caused by temperature



changes in the whole column of atmosphere below that level, not only in the stratosphere. Disruptions to the SPV detected using pressure heights, therefore, may be misleading as to their cause.

“As I explored the role of stratospheric disruptions on extreme winter weather, it occurred to me that there might be a better way to measure those disruptions,” said Dr. Jennifer Francis, Senior Scientist at Woodwell Climate Research Center and lead author. “Focusing on the stratosphere itself rather than the whole atmospheric column helps separate the influences from the two layers, which often behave independently.”

The authors analyzed the thickness of a layer in the stratosphere using an AI-based approach to identify representative patterns in the SPV, including various types of disruptions.

“The new metric revealed an increased occurrence of strong and abnormally cold SPV patterns,” added co-author Natasa Skific, Researcher at the Woodwell Climate Research Center. “This is different from findings in earlier studies based on pressure heights. Our findings make sense because higher concentrations of greenhouse gases cool the stratosphere, causing a stronger SPV.”

Paper co-author Dr. Judah Cohen, Research Scientist at MIT Parsons Lab and Director of Seasonal Forecasting at Atmospheric and Environmental Research, noted the previously underappreciated common occurrence of vortex stretching, which often contributes to cold spells in the U.S. and central Eurasia.

“The results of our study fit with other work highlighting the importance of stretched-vortex states on severe winter weather. Our new metric helps isolate the stratosphere so we can better understand its dynamics and connections with weather extremes, atmospheric blocking, and amplified Arctic warming.”

Submitted comment on the updated definition of “Waters of the United States”



On January 5, Woodwell Climate submitted public comment to the U.S. Environmental Protection Agency’s (EPA) and U.S. Army Corps of Engineers’ (Army Corps) proposed rule to update the definition of “Waters of the United States” (WOTUS).

Introduction

The *Sackett v. EPA* decision in 2023 substantially limited federal protections for many wetlands and streams under the Clean Water Act (CWA). Further narrowing the definition of WOTUS would reduce vital protections that aid local communities and economies by improving resilience and reducing flooding, improving water quality, protecting fish and wildlife, and sequestering carbon. Woodwell strongly opposes narrowing the definition of WOTUS beyond what is legally required by *Sackett*. This proposed rule rejects the science, the critical role of wetlands related to carbon sequestration, and the impact of wetlands on resilience. Failing to protect these waters will result in long-term economic and environmental costs that far outweigh any short-term “regulatory certainty.”

Scientific objection to the “continuous surface connection” requirement

The proposed rule seeks to codify a requirement that wetlands must possess a continuous surface connection, “abutting” or “touching” a jurisdictional water and holding surface water during the “wet season,” to be protected under CWA. However, hydrological connectivity is not just surface level.

Woodwell’s research in watersheds across the globe demonstrates that “isolated” wetlands are often anything but. In our studies of river chemistry and watershed discharge, we have consistently found that wetlands lacking a visible surface connection often maintain robust subsurface hydrological links to larger water bodies. These wetlands serve as critical filters for nutrients like nitrogen and phosphorus.

For example, Woodwell’s TIDE Project¹ spent over two decades studying the Plum Island Estuary. The research shows that nutrient runoff from agriculture and development—even if it originates near seemingly “isolated” wetlands—eventually impacts the health of the entire estuary. By removing federal protections from wetlands that do not “touch” navigable water, the agencies are inviting a surge in nutrient pollution that will lead to eutrophication, algal blooms, and the eventual collapse of downstream aquatic ecosystems.



The critical role of wetlands in carbon sequestration

The proposed rule fails to account for the immense value of wetlands as carbon sinks. Terrestrial and tidal wetlands sequester and store more carbon per unit area than almost any other ecosystem on Earth, including forests.

Woodwell’s research identifies wetlands as high-carbon ecosystems that provide immediate climate benefits. “Terrestrial wetlands (i.e. non-tidal freshwater wetlands) cover about 71 million hectares in the U.S. About half of this area is forested wetland and 23% is peatland, which contains very high carbon stocks (Kolka et al. 2018). Terrestrial wetlands are significant carbon sinks, sequestering about 55 million metric tons of carbon per year both above- and belowground.”² Protecting these areas is a top priority for global carbon management because the carbon stored in wetland soils and biomass can be lost rapidly through drainage or surface hardening³—actions that become much more likely without federal CWA oversight.

Impacts on climate resilience and risk mitigation

The proposal argues that narrowing the definition will provide “regulatory certainty.” However, it creates profound environmental uncertainty by increasing the risk of catastrophic flooding and storm surges.

Wetlands absorb excess rainfall and buffer communities from the intensified flooding events caused by climate change. Woodwell scientists have documented how the loss of wetland capacity exacerbates flood risks for homes and businesses. The proposed “wet season” criteria for jurisdiction is particularly dangerous, as it ignores the fact that ephemeral and seasonal wetlands provide their most vital flood-attenuation services during extreme weather events—precisely when they may not meet the proposed “relatively permanent” test.

Coastal marshes are the first line of defense against rising sea levels. Woodwell’s research has shown that excess nitrogen (often filtered by upstream wetlands) causes marsh edges to collapse.⁴ By deregulating upstream “non-permanent” waters, the agencies will increase the nutrient load reaching the coast, weakening the very marshes that protect coastal infrastructure from storm surges.

Further, Woodwell is concerned by the proposal’s intent to limit the scope of “permafrost wetlands” through the “wet season” and “abutting” tests. The Arctic is warming three to four times faster than the rest of the planet. Permafrost wetlands are critical for stabilizing the soil and sequestering vast stores of carbon.

Conclusion

The proposed rule rejects scientific evidence and treats the landscape as a collection of disconnected parts rather than a single, integrated hydrological and biological system. Woodwell Climate Research Center urges the EPA and Army Corps to:

- ① Reevaluate “continuous surface connection” test in favor of a definition that recognizes subsurface and biological connectivity
- ② Incorporate the value of carbon sequestration and climate resilience into the Regulatory Impact Analysis
- ③ Maintain protections for ephemeral and seasonal waters, which are essential for water quality and flood control in a changing climate

Again, failing to protect these waters will result in long-term economic and environmental costs that far outweigh any short-term “regulatory certainty.”

¹ The TIDE Project: <https://thetideproject.org/>

² Woodwell Climate Research Center (2023). Principles and Safeguards for Natural Climate Solutions: <https://www.woodwellclimate.org/our-impact/ncs-principles/>

³ Ibid.

⁴ The TIDE Project: <https://thetideproject.org/>

3 projects that grew out of the Fund for Climate Solutions

These projects started with a small FCS grant and are now integral to Woodwell's climate solutions work

Sarah Ruiz Editorial Manager

Sometimes it only takes a small push to start gathering momentum. That's the idea behind the Fund for Climate Solutions (FCS) at Woodwell Climate. Launched in 2018, FCS is a competitive internal grant program that funds Woodwell Climate scientists to explore research projects that test out innovative ideas for climate solutions. Though each individual project starts small, nearly all FCS projects lead to new lines of inquiry, and a few have grown from their initial seed funding into some of our biggest research projects. From carbon monitoring to wildfire management to thawing permafrost, these three projects exemplify the surprising power of starting small.



① Monitoring Rangeland Carbon

Rangelands represent a massive untapped natural climate solution, making up more than 30% of the land in the United States and holding 30% of the global soil carbon stock. Conservation practices, including adaptive livestock management, have the potential to enhance that carbon storage— but data was limited on just how grazing systems would respond to different techniques. Senior scientist Dr. Jon Sanderman and Associate Scientist Dr. Jennifer Watts applied for an FCS grant in 2019 to expand scientific understanding in a way that would prove useful for making management decisions.

That first project was successful, and today, Woodwell's studies of rangeland carbon and other ecological co-benefits have expanded into a multifaceted research project that has received several subsequent grants. Watts and Sanderman

are building tools that map and model carbon storage and the overall ecological health of rangelands across the U.S. and show how that storage could change under different management practices. Those tools have been adopted by both conservation groups and corporate partners to better understand the climate benefits of improved range management. They have continued engagement with ranchers and conservation communities across the American West, hosting workshops that bring land managers together to discuss the benefits—both environmental and economic—of improving carbon storage on rangelands.

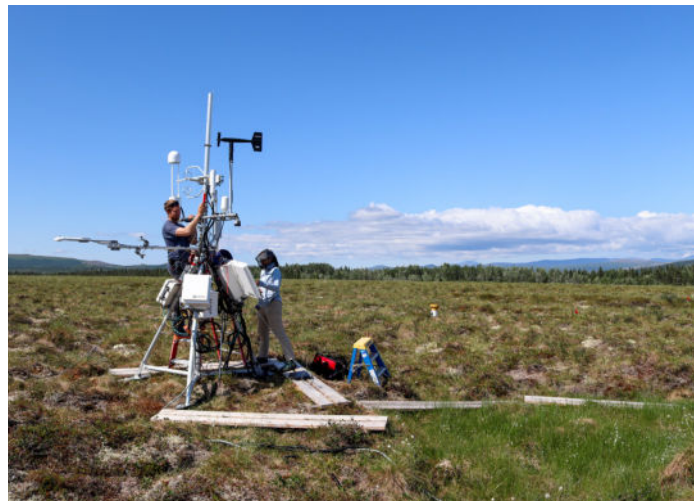


② Planning for Intensifying Wildfires

In Summer of 2018, Senior Scientist Dr. Brendan Rogers received an FCS grant to explore the possibility of fire management to mitigate carbon emissions from boreal wildfire. Though fires are a natural part of the northern landscape, wildfires in Alaska and Canada have been growing more frequent and intense as the Arctic rapidly warms. Left unchecked, these northern fires represent a large and broadly unaccounted for threat to emissions reduction goals.

Bringing fires under control as a climate mitigation tactic is now one of the Center's core scientific goals. Collaborations with the US Fish and Wildlife Service and the Alaska Fire Service are underway to pilot fire suppression as a cost-effective method to keep carbon from entering the atmosphere. Senior Arctic Lead, Edward Alexander, has joined the Center to elevate Indigenous mitigation practices as practical policy solutions to address

accelerating northern fires, and strategies are being shared across geographies to inform fire management in temperate and tropical forests as well. Woodwell Climate has also now joined Google's AI Collaborative on Wildfires and has become an early adopter for the FireSat program led by EarthFire Alliance.



③ Permafrost Pathways

In the summer of 2018 Senior scientists, Drs. Sue Natali, Rogers, Linda Deegan, and Sanderman received an FCS grant to start work on an Arctic change and carbon observatory. Natali observed that while the Arctic was warming at a rapid pace, causing typically-frozen permafrost soils to thaw and erode, actual measurements of carbon emissions from thawing

permafrost were sparse. She proposed constructing new carbon-monitoring towers to fill data gaps, starting with a field site in the Yukon-Kuskokwim Delta.

From there, the project gained momentum, and in 2022, Natali was awarded a \$41 million grant from the TED Audacious Project to launch Permafrost Pathways. The expanded project not only continued and enhanced carbon monitoring across the Arctic, but also partnered with 10 Alaska Native Tribes and policy experts to advocate for change. Permafrost Pathways supports community-led environmental monitoring of permafrost thaw to help tribes develop a long-term adaptation plan, including relocation. In addition, project experts have been working to influence international policy and get permafrost emissions factored into global emissions models.

Since its launch in 2018, the Fund for Climate Solutions has funded 80+ projects that push the boundaries of scientific knowledge, influence decision makers, and attract additional funding for critically important work.

Multiply your impact even more with a gift to the Fund for Climate Solutions—through June 30, for every \$3 contributed, an additional \$1 will be unlocked by an anonymous donor, up to \$250,000.



Selected news coverage

TIME interviewed Dr. Max Holmes for an article about the Trump administration leaving UN environmental bodies. A quote from Max closed out the article: "Just because the federal government tries to stop things doesn't mean everything stops...The U.S. government is by no means the only show in town."

Dr. Jennifer Francis was quoted in a *Boston Globe* article about the connections between climate change and recent cold weather in the northeast U.S., in which she said scientists are still trying to untangle the ways these interactions happen in the atmosphere. She was also quoted in a *Memesita* article about how a weakening polar vortex is like "poking a sleeping bear."

Many Massachusetts news outlets, including *The Cape Cod Times* and *The Enterprise*, published an article listing all of the Massachusetts projects that would be funded under a trio of bills passed by the House and Senate. One of these is a Woodwell Climate project, which would dedicate \$800,000 to the development of a soil carbon measurement program.

An article from NASA quoted Dr. Brendan Rogers on the importance of NASA satellite data in understanding and developing solutions around changing boreal wildfire regimes.

EurekAlert! published a press release from Northern Arizona University announcing the results of a study on wildfire carbon losses in boreal forests—Dr. Brendan Rogers, Dr. Anna Talucci, Stefano Potter, and Jackie Dean were co-authors.

The University of Utah published a press release covering a recently-published study on what past global warming reveals about future rainfall, which Dr. Daniel Baldassare contributed to as a graduate student.

An article from *The New Hampshire Bulletin* covered a pending bill in the New Hampshire state legislature which would bar county or state-owned land from being enrolled in carbon sequestration programs. The story cited Woodwell Climate research on the importance of mature and old-growth forests for carbon storage.

cover: Not all field work happens in farflung locations or with beautiful scenery. Dominick Dusseau takes notes (and many photos) on flood infrastructure to use in conjunction with datasets, regional weather history, and urban maps, in crafting a climate risk assessment. / photo by Sarah Ruiz

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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