Global threats from a warming Arctic
The case for an Arctic Carbon Monitoring and Prediction System

Introduction

Changes underway in the Arctic threaten to have calamitous consequences both in the region and globally, yet our understanding of Arctic processes is insufficient to adequately project, manage, or attenuate these risks. The Woods Hole Research Center (WHRC), in partnership with the Arctic Initiative at the Harvard Kennedy School’s Belfer Center for Science and International Affairs (BCSIA), aims to develop a comprehensive monitoring and projection system for Arctic carbon cycling, complete with interactive web visualization, modeling, and policy engagement. The overarching goals of the proposed program are (1) to develop an early warning system for carbon emissions from Arctic permafrost and wildfire and (2) to have these carbon emissions considered in the next round of international climate commitments. Achieving this requires an integrated and targeted approach to quantify current emissions, project future release of greenhouse gases from the Arctic, and, importantly, develop a strategic approach that links this scientific understanding to policy action.

Permafrost: The sleeping giant

One of the most important global threats is thawing permafrost (frozen Arctic soil) which stores a vast amount of carbon that threatens to amplify global warming through decomposition and release into the atmosphere of carbon dioxide and methane. Greenhouse gas emissions from thawing permafrost may contribute substantially to global climate change. For example, permafrost carbon emissions alone are estimated at 130–160 Pg C by 2100, assuming weak climate policies. To put this in context, to have a 66% probability of limiting global warming to 1.5 °C, remaining allowable global emissions are about 115 Pg C and for 2 °C are 101–221 Pg C. If emissions from permafrost are not planned for, our chances of achieving this goal are non-existent.
A gaping hole in climate policy

Carbon emissions from thawing permafrost are omitted from the models and reports that inform international climate policy formulation by the United Nations Framework Convention on Climate Change (UNFCCC). Considering that permafrost carbon emissions will likely “use up” much of the remaining allowable carbon budget, incorporating these emissions into a policy framework is an immediate priority and will probably reveal the need for substantial reductions in allowable emissions from other sources.

The ability to model and predict this potentially ruinous climate feedback is far from adequate today because of poor understanding of the processes that govern permafrost thaw and subsequent carbon emissions. These monitoring gaps severely limit the ability to integrate observations across the Arctic using remote sensing and modeling and thus to provide scientists and policy makers with reliable assessments and projections of current and future carbon emissions from a warming Arctic.

Addressing this gap is within reach

Achieving an international climate policy framework that incorporates emissions from permafrost thaw is possible with the right combination of climate science and policy engagement. Addressing the gaps in data starts with field observation, data collection, and better coordination of the results among key policy-makers. This requires an integrated and targeted method to quantify current emissions and project future release.
of greenhouse gases from the Arctic, and, importantly, to develop a strategic approach that links this scientific understanding to policy action. WHRC and BCSIA have joined forces to make this happen.

Synthesis of existing and collection of new ground measurements will help us understand fundamental processes that determine the timing, magnitude, and form of carbon release from Arctic permafrost. These observations will be linked with satellite remote sensing and process modeling in a coordinated effort, allowing us to develop policy-relevant predictions on seasonal and decadal timescales. WHRC will lead the scientific aspects of the work, with BCSIA’s Arctic Initiative overseeing the policy components.

Here is how WHRC will do it: Science

We propose to establish an Arctic Carbon Monitoring and Prediction System that comprises: (i) observational research to advance understanding of key processes; (ii) ground-based and remotely-sensed monitoring to fill critical data gaps; (iii) scaling and modeling to quantify current and future carbon emissions from the Arctic; and (iv) in partnership with Harvard University, integration of results into a policy framework that considers permafrost thaw and its global impacts.

WHRC will conduct the following activities:

➢ Field research, including in-depth observations at a flagship site, to understand the processes driving carbon emissions from permafrost thaw and fire, as well as monitoring of key variables in under-sampled regions to allow scaling of observations across the Arctic.

➢ Remote sensing to scale field-based observations to the full Arctic region, with a focus on monitoring disturbance and its impacts on carbon cycling.

➢ Data-assimilation modeling to assess and project changes in Arctic carbon cycling on seasonal and decadal timescales, and to identify policy-relevant thresholds.

➢ Modeling to evaluate the implications of carbon emissions from Arctic permafrost for global climate policy.

➢ Development of a high-powered and interactive web visualization platform to communicate Arctic change to the public, policy makers, and Arctic residents.

WHRC is uniquely qualified to lead this work as we are recognized as experts in the science of permafrost and, through our senior leadership, are well connected in climate policy circles. Since 1985, our scientists have been investigating the urgent issues of the warming Arctic to understand the dynamics of climate tipping points and educate policy makers and the public. In 2018 alone, WHRC scientists published 83 papers in
prestigious scientific journals. They also maintain leadership positions in national and international arctic programs, such as within the National Science Foundation and the NASA. Finally, our scientists are often invited to testify in front of Congressional committees such as at the U.S. House of Representatives Committee on Science, Space, & Technology, Furthermore, and to present their work at conferences and panels throughout the world like the Arctic Circle Assembly.

Here is how BCSIA’s Arctic Initiative will do it: Policy

The primary policy goal is to have carbon emissions from Arctic permafrost and wildfire considered in global climate policy, including the next round of Paris commitments in 2025. Harvard will conduct the following activities:

➢ Convene policy-makers and researchers, at venues such as the Arctic Research Forum and Harvard University, to understand ongoing efforts, gaps and opportunities regarding permafrost thaw on the global climate.

➢ Communicate findings to key policy makers and opinion leaders in key nations and the Arctic Council.

➢ Link Harvard teaching and fellowship programs to these efforts to help train a new generation of Arctic policy leaders.

BCSIA’S Arctic Initiative is the ideal project partner. The Initiative is focused on policy innovation to address the challenges posed by Arctic climate change inside and outside the region. The BCSIA Arctic team has developed working relationships with Arctic policy leaders across all of the members of the eight-nation Arctic Council, including Iceland (which will chair the Council from May 2019 until May 2021) and Russia (which will chair it from May 2021 until May 2023). The team also has exceptional connections with leaders in the Conference of the Parties to the UNFCCC and with intergovernmental collaborations on Arctic science and monitoring.

Conclusion

The WHRC-BCSIA partnership will provide a powerful symbiosis of scientific and policy capabilities that will seamlessly link science and policy analysis and will inject the results directly into regional and global policy processes at the highest levels. We are now seeking funding partners and hope you might consider joining our project by inviting a full proposal.

For more information about this project

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