Who knew that Scott Pruitt has such empathy? In the aftermath of Hurricanes Harvey and Irma, the EPA head complained that it is “insensitive” on the part of folks like me to point out that climate change makes powerful hurricanes – like those just experienced – more frequent and more damaging. Maybe he’s worried that victims might be upset to learn that their government is not fulfilling its responsibility to protect them against extreme weather and other risks associated with climate change. Well, they should be upset, and this is a great time to talk about links between climate change and hurricanes, because while the victims will be recovering for years, the news cycle will soon move on.

So what does science tell us about climate change and hurricanes?

Basic theory and computer models of climate both find that the strongest and most destructive hurricanes will occur more frequently as a result of climate change. This has been observed in the Atlantic basin, where observational records are more complete than in other ocean basins.

Theory, models, and observations all indicate that there’s more extreme precipitation in a warmer climate. This means that hurricanes will tend to dump more rain as a result of climate change. The enormous precipitation totals from Hurricane Harvey are consistent with this expectation.

As sea levels continue to rise, damage from storm surges will get worse, because the ocean level is higher to begin with. Higher wind speeds of course will also contribute to higher storm surges.

Some scientists have theorized that climate change (specifically the rapid warming of Arctic) results in weaker “steering currents,” which can result in hurricanes lingering for a long time over one location. We saw this with Harvey in Texas, and it’s a big reason why the precipitation totals were so high and the storm was so damaging.

In summary, there is plenty of reason to expect that very damaging storms like those just seen will happen more often in the future.

So what should we be doing?

The experience in Houston, especially, showed that we need better preparedness. This means mundane things like building codes, evacuation routes, and other things that seem unimportant until the day you need them.

The National Flood Insurance Program urgently needs reform. Specifically, it needs to be put on a sound actuarial basis, where premiums reflect true risk. The Program is now $25 billion in debt because Congress has not allowed this. It might also be a good idea to exclude from the Program properties that have repeatedly flooded and collected benefits. The program will expire on December 8, which provides our legislators with a timely opportunity to address these issues.

INSENSITIVE ESSAY continued on inside back page...
The first effort to spatially quantify global soil carbon loss revealed that agriculture has removed 133 billion tons of carbon from the top two meters of soil, with the rate of loss increasing dramatically in the past 200 years.

Those soil carbon losses are nearly equal to total carbon emissions due to forest clearing.

The study was published in August in *PNAS* (www.pnas.org/content/114/36/9575.abstract), and was led by WHRC’s Jonathan Sanderman and Tom Hengl of the International Soil Reference and Information Centre (ISRIC). WHRC Senior Geospatial Analyst Greg Fiske was also an author on the study.

“The spread of agriculture has created a large carbon debt in soils,” Dr. Sanderman said. “It has been difficult to estimate the size and spatial distribution of soil organic carbon loss from land use and land cover change but that is a critical step in understanding whether soil carbon sequestration can be an effective climate mitigation strategy.”

The large soil carbon debt can be thought of as the maximum potential for soils to remove carbon from the atmosphere and act as a natural climate solution. Even realizing only a fraction of this potential would be an important climate mitigation strategy, Sanderman said.

The study also showed that cropping causes more soil carbon loss on a particular parcel of land but because grazing covers so much land surface, total losses from cropping and grazing are nearly equal.

For the study, the scientists used a machine learning-based model, a global compilation of soil carbon data, and the History Database of the Global Environment (HYDE) land use data.

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**WHRC receives grant to study Amazon food production vs. tropical forest conservation**

The National Science Foundation awarded a major grant to WHRC’s Amazon team to study the balance between food and energy production and tropical forest conservation in the Brazilian Amazon. The four-year project, led by WHRC’s Michael Coe, will examine the relationship between clearing of native tropical forests for agriculture and regional climate.

Brazil has linked national agricultural development and low carbon emission goals—aiming to simultaneously double food production and end deforestation before 2030. But the problem is complex, according to Dr. Coe. For example, clearing native forests to increase agricultural production will decrease water recycling to the atmosphere, increasing surface temperatures, and decreasing rainfall. Intensifying agriculture will require much more fertilizer and energy use, which can have significant environmental consequences. The project’s goal is to help Brazilian officials determine how to accomplish agricultural goals with minimal environmental impact.

The team of scientists also includes WHRC’s Paulo Brando, Marcia Macedo, Christopher Neill, Linda Deegan, and Paul Lefebvre.

The project consists of three main parts. In the initial phase, farm-scale field experiments will take place to evaluate how more intensive crop management influences emissions of greenhouse gases from soils, water quality and habitats in streams, and demands for energy. Next, there will be an investigation as to how crops respond to farm management decisions, government policies, global greenhouse gas concentrations, and climate. Finally, computer models will be used to probe the potential responses of the food production system, the water cycle, and energy use and demand to changing climate and different potential pathways of agricultural intensification.

It is a complex project that will address the overarching issue of protecting and sustaining tropical agriculture, climate and forest cover. Its outcomes will have far-reaching implications for policy makers concerned with climate, land use and regional development. “Brazilian agriculture is going through a rapid transition to a much more intensive mechanized system,” Dr. Coe said. “Through this project we are hoping to help them achieve this transition while avoiding the large environmental costs that other parts of the world, such as the United States, have suffered.”
WHRC welcomes new researchers

WHRC has welcomed a significant influx of new staff members in recent months. Here is a brief look at who they are and what they will be working on at the Center.

Christina Minions is a research assistant working with a team that measures carbon dioxide emissions from the Arctic and on a project examining the seasonal amplitude of CO₂ concentrations in the Arctic. Some of her previous work in the Arctic included developing automated systems to measure CO₂ in various field sites. “It is wonderful to be a part of the WHRC community. To work among such talented and passionate scientists every day is nothing short of inspiring,” Ms. Minions said.

Research Assistant Stefano Potter, who hails from North Dakota, utilizes remote sensing to evaluate the change in wildfire severity and frequency in Alaskan and Canadian boreal forests. “I enjoy working at WHRC for many reasons,” he said, “but more than any other because I know that my work will help to understand the effects of climate change at a time when it is becoming increasingly important to do so.”

Postdoctoral Fellow Shree Dangal is an ecosystem modeler interested in understanding the impacts of multiple environmental changes on terrestrial ecosystems. In particular, his research focuses on developing and applying land models to investigate the role of climate, disturbance and land use change on net primary productivity and soil organic carbon. Dr. Dangal, who is originally from Nepal, said that “WHRC has been the top climate change think tank for four consecutive years. As my research broadly focuses on understanding the impacts of climate and multiple environmental changes on terrestrial ecosystem productivity and greenhouse gas balance, I am very fortunate to be part of the institution that promotes cutting edge research on climate change, its impacts on terrestrial ecosystems, and adaptation and mitigation strategies in response.”

“WHRC provides an outstanding environment for developing innovative tools and pursuing ambitious research goals,” said John Clark, adding, “I’m thrilled to join the team.” Mr. Clark is a research assistant who contributes to the measuring and mapping of aboveground carbon dynamics and analyzing large datasets. In the past, he has studied invasive species habitats and algal blooms.

Research Assistant Seth Gorelik is a geographer who measures and maps aboveground carbon dynamics using remote sensing techniques, statistical modeling, and geospatial programming. This effort, he said, “is critical for the restoration of land carbon reservoirs from local to global scales. I am excited to join WHRC to contribute to the advancement of this important work.”

Postdoctoral Fellow and earth system ecologist Jennifer Watts is “excited to be working at WHRC, an organization dedicated to building a better global environment. My research here will be focused on understanding the mechanisms and patterns driving cold season CO₂ release from soils in the arctic-boreal regions of Alaska and western Canada.” Dr. Watts, who is from Montana, uses a combination of remote sensing, field measurements, and modeling to understand ecosystem processes and change.

WHRC research featured in The New York Times

WHRC’s permafrost research was the subject of a front page New York Times article on August 24, with quotes from Drs. Max Holmes and Sue Natali.

New York Times reporter Henry Fountain joined WHRC’s Polaris Project in Alaska’s Yukon Delta for several days in July. Mr. Fountain flew into the camp by helicopter, and then took part in the research, side by side with the scientists. The visit resulted in the extensive article, which was featured at the top of the Times’ website on August 24, and then in the hard copy newspaper the next day.

WHRC’s Greg Fiske and Dr. Brendan Rogers helped develop the featured maps showing the threat of thawing permafrost. The paper also used several photos from WHRC’s Distinguished Visiting Scientist Dr. John Schade, and included photos of WHRC scientist Sarah Ludwig and Polaris Project student Laura Jardine.
Visiting scholars from Brazil

Visiting scholar Ludmila Rattis, from Canarana, Mato Grosso, received a postdoctoral scholarship from CAPES (Coordenação de Aperfeiçoamento para o Ensino Superior - Coordination for the Improvement of Higher Education Personnel). Dr. Rattis works with the Amazon group and studies ways in which continued deforestation and increasing greenhouse gases will affect the climate of the Amazon and Brazilian agricultural food production. “My academic trajectory is positively impacted through fruitful discussions with the scientists at WHRC,” said Dr. Rattis. “The excellent infrastructure and atmosphere of the Center provide me with the confidence to continue my research in order to show the value of the standing Amazonian forest in mitigating local climate change, while at the same time enhancing food production.”

Visiting scholar Irene Cibelle Gonçalves Sampaio is spending six months at WHRC to work with Deputy Director Max Holmes and others on the Global Rivers Observatory. Ms. Sampaio is a biologist and doctoral student with WHRC colleague Jose Mauro Moura at Universidade Federal do Oeste do Pará (UFOPA) in Santarem, Brazil. Her research focuses on dissolved organic carbon dynamics in the Amazon River. While in Woods Hole, she is analyzing samples and data, both at WHRC and at WHOI (where she will work with Dr. Bernhard Peucker-Ehrenbrink), and writing her doctoral dissertation. “At WHRC I am interacting with experienced and knowledgeable researchers,” said Ms. Sampaio. “I appreciate their warm reception, and I am grateful to all who have shared their knowledge and provided me with an ideal environment for my training.”

WHRC in the News

The New York Times featured WHRC’s Max Holmes and Sue Natali for the extensive article, Alaska’s permafrost is thawing, and several other WHRC staff members aided the Times’ staff with maps and photos. August 23. http://nyti.ms/2y9Ej5Y

The New York Times’ Quotation of the Day from Deputy Director Max Holmes, who said, “There’s a massive amount of carbon that’s in the ground, that’s built up slowly over thousands and thousands of years. It’s been in a freezer, and that freezer is now turning into a refrigerator.” August 23. http://nyti.ms/2w3Jyng


Sue Natali was interviewed by Circa.com for the story, The Arctic’s permafrost is melting. Here’s why it’s a pretty big deal. August 28. http://bit.ly/2w8FK0w


Film Screening at WHRC

The Woods Hole Research Center is proud to present the short film, Tipping Point, as part of its Fall Film Series. Tipping Point showcases our planet’s next generation of change-makers — kids who are inspiring hope by making a positive difference all over the world. Among the experts and activists featured in Tipping Point are WHRC Founder George Woodwell, WHRC Deputy Director Max Holmes and Mass. State Rep. Dylan Fernandes. For more information and reservations, visit whrc.org/tipping-point-film
President Obama’s executive order #13690, which sought to improve resilience to flood risk, should be restored. In a perfectly-timed move, Trump rescinded this order on August 15. Of course, we also need to do everything possible to keep carbon out of the atmosphere. This means stopping deforestation and fossil fuel burning, and taking steps to remove CO₂ from the atmosphere.

And while it doesn’t directly address climate change, it is important to support the victims of Harvey and Irma. If there’s ever a situation where we need “big government,” this is it, but federal aid is not enough to make victims whole. As more climate change-driven disasters unfold, we will need stronger communities that help each other in time of need.

Thanks as always for your interest and support.
Spectators photographing the Climate Barge performance on September 5.