

NSF AT WORK

## World's Largest Lake is Heating Up



A view of Lake Baikal.  
Credit: Nicholas Rodehouse

Lake Baikal in Siberia, the oldest, largest and deepest freshwater lake on the planet, is responding much more strongly to climate change than once thought. A National Science Foundation [\(NSF\)-sponsored collaboration](#) between American and Russian researchers reveals a significant impact on this unique ecosystem, despite the lake's immense size and remote location. Analyzing a 60-year dataset, the researchers found that Lake Baikal's average water [temperature has increased](#) 1.2 degrees Celsius over the last 100 years (three times faster than global air temperature) and the number of ice-free days has increased by 18. This last point is particularly significant because several species in the lake depend on ice to complete their life cycle. These trends raise serious concern over the future of the world's most biologically diverse lake.

Lake Baikal was designated a UNESCO World Heritage Site in 1996 because of its stunning diversity of flora and fauna (2,500 animal species, including the planet's only freshwater seal), a large portion of which are found nowhere else in the world. It was thought that the lake's volume (20 percent of the world's surface water) and unique current patterns might buffer it from the effects of global warming. However, the most recent data indicate that this is not the case.

The [tale](#) behind this study begins in 1945, when a Siberian researcher began collecting water samples and other environmental data from the lake. His daughter followed in his footsteps, and now his granddaughter continues the work in her position at Irkutsk State University. The data first came to international attention when Marianne Moore, an instructor from Wellesley College, took her students on an ecology field trip to the lake. A collaboration was formed with Stephanie Hampton, director of the NSF-funded National Center for Ecological Analysis and Synthesis. The joint U.S.-Russian team continues to analyze the data to predict future effects of climate change and other human impacts.

## Arctic Tundra May Warm the World

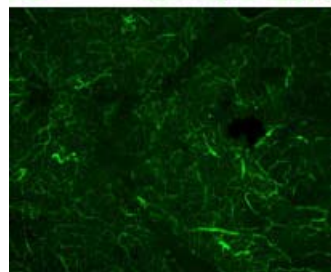
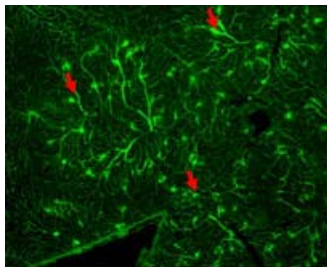
An NSF-funded [study](#) published in a recent issue of the journal *Science* has helped define the potentially significant contribution of thawing permafrost to atmospheric concentrations of carbon, which have already reached unprecedented levels. A large amount of carbon in the tundra is stored in the soil and permafrost. In recent years, this area began to thaw, providing increased access to plants and microbes that could shift the carbon from the land to the atmosphere, potentially increasing the global surface temperature. This can result in a snowball effect, whereby a warmer climate permits more permafrost thaw, releasing more carbon into the atmosphere, further increasing surface temperatures, and further melting the permafrost.



An arctic landscape. Credit: Peter West, NSF

Ted Schuur, an ecologist at the University of Florida and the lead author of the study, worked on a team that tracked the movement of organic carbon accumulated within the permafrost at an Alaskan site. The team tracked current metabolism of old carbon in an area where permafrost thaw is increasing. This research revealed that, although photosynthesis by plants initially offsets the effects of permafrost thaw, the thawing could annually add as much carbon to the atmosphere as other significant sources. Overall, this research allows a comprehensive picture of the dynamics of carbon exchange which, according to Schuur, provides "a basis for making long term predictions about ecosystem carbon balance with increased confidence." Read more about Schuur's work [here](#).

## Nanoparticles May Help Prevent Blindness



Lesions appear as green dots in an untreated retina (top) and a retina treated with nanocerium (bottom). Credit: James McGinnis, OUHSC

Researchers have discovered that treating retinas of mice with nanocerium, a type of engineered nanoparticle, reduces the signs of a condition thought to cause several incurable blinding diseases. The [NSF-funded study](#) also found that tuning the properties of the nanoparticles may enable them to deliver medical treatments directly into the cells where they are needed.

In patients with age-related macular degeneration, a major cause of blindness in older adults, an event known as oxidative stress causes excessive blood vessels to grow in the retina, usually leading to loss of vision. Sudipta Seal and colleagues William Self and Artem Masunov at the University of Central Florida, in collaboration with James McGinnis at the University of Oklahoma Health Sciences Center (OUHSC), found that nanocerium treatment prevented about 85 percent of such damage to the retinal cells of mice.

Seal and colleagues have obtained two patents ([7347987](#) and [7504356](#)) related to these promising nanoparticles. In addition, McGinnis has launched a new company to develop medical applications for nanocerium. The company is currently performing preclinical studies on a treatment for *retinitis pigmentosa* and plans to investigate treatments for other causes of vision loss. Seal's team is continuing to investigate cerium oxide (CeO<sub>2</sub>), from which the nanocerium are developed, and other rare earth metal compounds to determine which forms have the most potential for other applications in medicine and energy.

## Science Promotes Economic Recovery

The National Science Foundation (NSF) made its [first major award](#) under the American Recovery and Reinvestment Act to provide funds for construction of the Alaska Region Research Vessel (ARRV). This project will not only produce a technologically advanced tool for science, but also help preserve jobs and promote economic recovery.

The ARRV is a 242-foot research ship with a hull specifically designed to operate in seasonal Arctic sea ice and open waters surrounding Alaska. The three-year construction phase of the project, led by the University of Alaska, Fairbanks, will support 4,350 total jobs--750 directly at the shipyard and as many as 3,600 in the broader economy.



Artist's rendition of the Alaskan Region Research Vessel (ARRV). Credit: The Glosten Associates, Incorporated

The ship is designed for low environmental impact, and its handling systems for science equipment will improve safety and efficiency. Examples of the ARRV's research expeditions include investigation of sea ice recession, changing ocean currents and Arctic habitats and ocean acidification. The ship will carry more than 500 researchers and students annually and spend as many as 300 days per year at sea. It will be operational in support of oceanographic research for at least 30 years.

### DID YOU KNOW?

NSF recently launched pages in [Facebook](#) and [Twitter](#), giving followers access to NSF news updates and information on scientific breakthroughs funded by the NSF. These social networking tools are gaining popularity in government agencies that seek to develop a more interactive relationship with the general public. The NSF Twitter page features short updates with links to news and announcements of funding opportunities, while the Facebook page displays event information, videos, and even news articles relating to NSF research. In addition, Twitter and Facebook followers can join discussions and post comments that give feedback to the agency.



## FACES OF NSF RESEARCH

## Scientist Serves NSF and the Nation



Credit: Sam Kittner

Cybersecurity has recently been highlighted by the Obama Administration as a major priority and a matter of international concern. As the nation broadens its focus on cyberspace security, the expertise of Dr. Jeannette Wing, NSF's Assistant Director for Computer and Information Science and Engineering (CISE) and the President's Professor of Computer Science at Carnegie Mellon University (CMU), has become an invaluable national resource.

Dr. Wing is an alumna of the Massachusetts Institute of Technology, where she earned bachelor's and master's degrees in computer science and engineering, and a doctorate in computer science. She joined the CMU faculty in 1985, where she made internationally respected contributions as both a computer scientist and an administrative leader. She served as head of the computer science department and is on leave from her position as director of the Specification and Verification Center and the Microsoft-Carnegie Mellon Center for Computational Thinking. Intent on giving back to the community, Wing began her post in NSF's CISE Directorate in July 2007, where she manages funding for research and education of computer scientists and engineers. More importantly, Wing serves as an ambassador between academia and the federal government.

Wing is passionate about promoting computing for everyone. She encourages what she calls "[computational thinking](#)", or using conceptual foundations of computation to efficiently and thoroughly solve real-life problems. She believes in building stronger computational backgrounds in early education and transforming the public's stereotypes of computer science to increase general participation in the field. Her ambitious, bottom-up vision for tackling current and future problems can help shape both NSF and the nation.

In February, President Obama requested a 60-day cyberspace security policy review by Melissa Hathaway of the National Security Council. Shortly thereafter, Wing was asked to reach out to the computing research community to assist Hathaway. Wing [facilitated a teleconference](#) between Hathaway and over 30 researchers, which culminated in the [academic community producing two documents, both providing technical input to the "Cyberspace Policy Review"](#). This collaboration between scientists and policy-makers may become standard, as the most overarching message reflected in the "Cyberspace Policy Review" is a need for cooperation across the board. In the words of Wing herself, cybersecurity efforts have "got to be an academia-industry-government ecosystem."

NSF provides 84 percent of all federally funded research in computer science, and has been supporting cybersecurity for years by funding institutional research and collaborative structures devoted to developing trustworthy computing systems. Wing recently [testified](#) before the House of Representatives Committee on Science and Technology regarding these efforts, again acting as a facilitator between the nation's scientists and policy-makers. In two years at NSF, Wing has been widely recognized for her passionate leadership of efforts to support critical research and for serving as an exceptional scientist driven to lend her mind and leadership capabilities to the betterment of our country.

## NSF IN THE NEWS

[Writing on Air?](#) (*The Herald Sun, SC*) Researchers at Duke University have created a cell phone application that allows users to write notes in the air with their phones and have the messages sent to their e-mail. This project was funded by NSF.

[New Orleans Levee System Making Strides](#) (*The Times-Picayune*) An NSF-funded study evaluated how the levee system in the New Orleans region weathered 2008's Hurricane Gustav and its storm surge. The report concluded that the levee system performed well under the surges by Gustav.

[Exploring Earth's Darkest and Coldest Places](#) (*Baltimore Sun*) *Nereus*, a robotic submersible funded partly by the NSF, was guided by remote to the depths of the Mariana Trench--one of the deepest, darkest places on Earth. *Nereus* allows researchers to explore diverse geological and biological systems.



## THE RIPPLE EFFECT

### Arctic Observing Network Project

The summer months are a time of transformation and change in the Arctic. Plants and wildlife take advantage of the long days and higher temperatures, while the sea ice cover retreats. In recent years, however, the amount of summer ice in the Arctic has decreased dramatically, and the complex Arctic ecosystem is showing other changes throughout the year as global temperatures rise. These changes may have a host of consequences ranging from shifting shipping lanes and international land claims to disruptions in ocean currents and weather patterns.



Artist's rendition of AON.  
Credit: NSF

To gain a better understanding of these changes in the Arctic environmental system, NSF created the [Arctic Observing Network \(AON\)](#) initiative that gives scientists timely and comprehensive information about what is happening in the Arctic. AON is a system of environmental monitors and sensors that includes satellites in outer space, airplane-based sensors, ground-based monitoring stations and buoys, moorings and gliders in the ocean. The data collected through AON are being made available to scientists as quickly as possible, sometimes in near real time, allowing researchers from around the world to study how the complex Arctic phenomena are changing and what it may mean for the future. Find out more about the Arctic Observing Network [here](#).

### First Successful Chase for Tornado Hunters



This tornado was the first captured by the National Severe Storms Laboratory Doppler radar and chase personnel. Credit: NOAA

The Verification of the Origin of Rotation in Tornadoes ([VORTEX2](#)) team, an [NSF funded project](#) concerned with the study of tornado structure, development, and detection, had its first successful encounter on June 7, 2009, when an EF-1 tornado touched down in Wyoming.

The team intercepted the storm, and captured the complete evolution and dissipation of the tornado. They also filmed, from directly below, the residual spin after the tornado had dissipated. The research season for the VORTEX2 project ended on June 13, 2009, and will continue next spring. The [video](#) of the Wyoming tornado can be found on the VORTEX2 Web site.

### Science for the People

On June 1st, NSF released the first in a series of online video programs called [Science Nation](#). The programs, which feature both short and full videos, examine breakthroughs and the possibilities for new discoveries about our planet, our universe and ourselves. Every weekly edition includes a written piece and links to related articles and multimedia. Topics explored so far include: extremophiles (organisms that thrive in extreme environments), artificial retinas used to restore sight, and research into perfecting how we anticipate tornadoes.



Credit: NSF

The programs, released every Monday, serve to educate people with an entertaining look at the research--and the researchers--that will change our lives. Some upcoming episodes will highlight advances in hydrogen cars, research on climate change in Greenland ice cores, and biofuels. Science Nation is one of several online features that will increase public awareness of NSF-funded research and promote engagement in the progress and issues of science today. Science Nation has the potential to shape the accessibility of science and research information for years to come.



The National Science Foundation (NSF) is an independent federal agency that supports fundamental research and education across all fields of science and engineering. In fiscal year 2009, its budget is \$9.5 billion, which includes \$3.0 billion provided through the American Recovery and Reinvestment Act. NSF funds reach all 50 states through grants to over 1,900 universities and institutions. Each year, NSF receives about 44,400 competitive requests for funding, and makes over 11,500 new funding awards. NSF also awards over \$400 million in professional and service contracts yearly. NSF expects to make an additional 3,000 awards with the Recovery Act funds. Contact [NSF's Office of Legislative and Public Affairs](#) for more information, to unsubscribe or for permission to reuse newsletter images.