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The entities lending their name to this statement recommend that the Congress provide NSF with an appropriation of $8.45 billion for FY 2019. This is consistent with recommendations contained in the Dear Colleague Letters led by Rep. G.K. Butterfield and Rep. David B. McKinley in the House and Senator Markey and others in the Senate, along with the Coalition for National Science Funding, the Association of American Universities, and the Association of Public and Land-grant Universities. Funding at this level will start to reverse the trend of the last 20 years that has left the United States on the verge of falling behind our international competitors.

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Investments in research and education are essential for maintaining technological innovations and advancements that will help our society and a global population survive in a rapidly changing world. Investing in research returns economic prosperity many times over. If the U.S. is to meet the
environmental and economic challenges facing this country, we must make the necessary investments in our research and education enterprise.

**Research and National Security**

In response to questions for the record from the Senate Armed Services Committee in early 2017, U.S. Secretary of Defense James Mattis said, “…climate change is a challenge that requires a broader, whole-of-government response. If confirmed, I will ensure that the Department of Defense plays its appropriate role within such a response by addressing national security aspects.” In making that statement, Secretary Mattis joined a long list of defense, national security, and intelligence leaders that have recognized the significant and unprecedented national and homeland security risks posed by the climate issue such as sea level rise and increased storm surges, which could inundate coastal military and civilian infrastructure. Drastic changes in food, water, and energy availability also increase the likelihood of instability and state failure across the globe. The gravity of these risks has been affirmed by a number of senior defense and intelligence leaders in the current Administration, in addition to Secretary of Defense Mattis. This list includes Vice Chairman of the Joint Chiefs of Staff, General Paul Selva; Secretary of the Navy, Richard Spencer; Assistant Secretary of Defense for Energy, Installations and Environment, Lucian Niemeyer; Chief of the National Guard Bureau, General Joseph Lengyel; Assistant Secretary of the Army for Civil Works, R. D. James; and Director of National Intelligence, Dan Coats. This issue was most recently addressed at the April 12, 2018 hearing before the House Appropriations Subcommittee on Military Construction and Veterans Affairs in an exchange between Subcommittee members and Assistant Secretary for Defense (Energy, Installations, and Environment) Lucian Niemeyer.

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Among federal agencies, NSF is unique in its ability to fund bottom-up research driven by the U.S. academic research community across the physical, biological, social, engineering and computational sciences. Arctic research also offers greater opportunity for the next generation of Arctic researchers.

NSF has issued a Dear Colleague Letter in FY 2018 inviting research proposals related to the NNA focusing on: establishment of observational research sites, observational platforms, or networks of sites to document key aspects of the changing Arctic; studies to understand and forecast changes in biogeochemical, geophysical, ecological and social processes occurring in the new Arctic; studies of feedbacks between the design and engineering of urban and rural civil infrastructure and changes in natural ecosystems such as thawing permafrost and sea ice retreat and social systems such as increasing marine commerce; and studies that advance STEM education through Arctic research activities.

**Geoscience Research – Vital for Economic Security and Public Safety**

A series of articles that appeared in *Pacific Standard* identify other ramifications stemming from changes to our environment. Potential health risks are estimated to rise significantly because of higher temperatures and complications from natural disasters. An additional 250,000 people are projected to die every year between 2030 and 2050 as a result of these health risks, according to the World Health Organization. Malnutrition could affect nearly half a million adults globally by 2050 as a result of food and nutrition scarcity. The economies of the states in the South, Midwest, and mid-Atlantic are expected to suffer from predicted gross domestic product losses of up to 28 percent because of the effects of greenhouse-gas emissions on field production. Marine fisheries globally, which have been estimated to support the livelihoods of 10 to 12 percent of the world's population, are projected to show decreased yields and profits. Islands, inhabited by hundreds of residents, such as the Tangier Islands in the Chesapeake Bay, could be entirely consumed by rising sea levels by 2050, or sooner.

The Federal Government has a responsibility to meet these future challenges. To fulfill this responsibility, one important step the Nation should take is to enhance its investment in basic research and related infrastructure through NSF, with a particular focus on the geosciences and related areas. This investment will help to create the new knowledge and technological capabilities – along with the educated and trained workforce to use these new tools – to address these challenges and seize the strategic opportunities presented by such efforts. Investing in basic research related to the geosciences will not just support national security efforts, it will also contribute to the development of new knowledge and technologies that will contribute to the nation’s economic competitiveness and public safety.

In minerals development, NSF-funded research on magma systems in Antarctica led to a genetic ore deposit model that was vital to the discovery of the significant Nokomis copper-nickel-platinum group element deposit in northern Minnesota. The Nokomis deposit contains estimated metal resources of approximately 10 billion pounds of copper, 3.1 billion pounds of nickel, 165 million pounds of cobalt, 4 million ounces of platinum, 9 million ounces of palladium, and 2 million ounces of gold. Meanwhile, geoscientists have created large, high-quality synthetic diamonds and determined how to manipulate their toughness, hardness, and color. Synthetic diamonds are significantly harder than real diamonds, making them suitable for industrial applications, such as the production of cutting tools and faster...

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Concluding Thoughts

Each day NSF-supported advancements such as those highlighted above make our lives better and safer. NSF provides financial support for our nation’s brightest minds to aid them in their endeavors to address challenging problems. Funding for the NSF results in investments that lead to the development of a competitive and resourceful workforce that will ensure our national security and enable our country to maintain and strengthen its leadership in science and technology. Therefore, we respectfully request your support to ensure that NSF receives at least $8.45 billion for Fiscal Year 2019. This level of funding will help ensure that future generations of Americans are prepared to help our nation remain a world economic leader.

Thank you for the opportunity to offer these recommendations.
Testimony for the Record
In Support of the National Science Foundation
and Its Investment
In Geoscience Research, Infrastructure, and Education
Before the
Subcommittee on Commerce, Justice, and Science
Committee on Appropriations
United States Senate
April 27, 2018

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Moss Landing Marine Laboratories
California State University Council on Ocean Affairs, Science & Technology
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Crop Science Society of America
Soil Science Society of America
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