



**Testimony Submitted by
American Geosciences Institute**
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**To the United States House
Committee on Natural Resources
Subcommittee on Energy and Mineral Resources**

Regarding the Legislative Hearing on Geothermal Exploration, 3 Other Bills

November 30, 2017

Chairman Gosar, Ranking Member Lowenthal, and Members of the Subcommittee:

Thank you for the opportunity to provide remarks on behalf of the American Geosciences Institute (AGI) regarding the role and importance of critical geoscience initiatives to the nation. I appreciate the opportunity to contribute our thoughts today on the important work that you are undertaking in this legislative hearing. My name is Allyson Anderson Book, and I am the Executive Director of AGI.

AGI is a nonprofit federation of 52 member societies that represents more than 250,000 geoscientists across the nation. Geoscientists study all aspects of the Earth system, including resource exploration and development, environmental geology, weather, and natural hazards, and they work at various levels in industry, academia, government, and K-12 education. Founded in 1948, AGI provides information services to geoscientists, serves as a voice of shared interests in our profession, plays a major role in strengthening geoscience education, and strives to increase public awareness of the vital role the geosciences play in society's use of resources, resilience to natural hazards, and the health of the environment.

My testimony today emphasizes the real-world and investment value of your support for a number of critical and innovative programs that are the focus of this hearing today: geologic and surface mapping, hazards research, monitoring, and warning systems, and understanding geothermal energy systems. These programs, top initiatives of the United States Geological Survey (USGS) and other federal agencies, are essential for protecting American life and property, ensuring robust infrastructure, and advancing our energy security.

Geologic mapping is fundamental for making decisions related to natural resources, natural hazards, infrastructure planning, public safety, and environmental stewardship, yet less than one-third of the nation is mapped at the scale of detail necessary for informed decision making.¹

¹ U.S. Senate, Office of Senator Lisa Murkowski. 2017. [Murkowski, King Introduce Bill to Continue Geologic Mapping](#).

Detailed knowledge of the land under our feet is critical for knowing where and how to build infrastructure, such as roads, homes, buildings, energy corridors, and more. Without geologic maps, we would not be able to locate and source vital resources (Figure 1) that are required for a range of technologies that we use everyday – from cell phones to sophisticated medical imaging equipment.

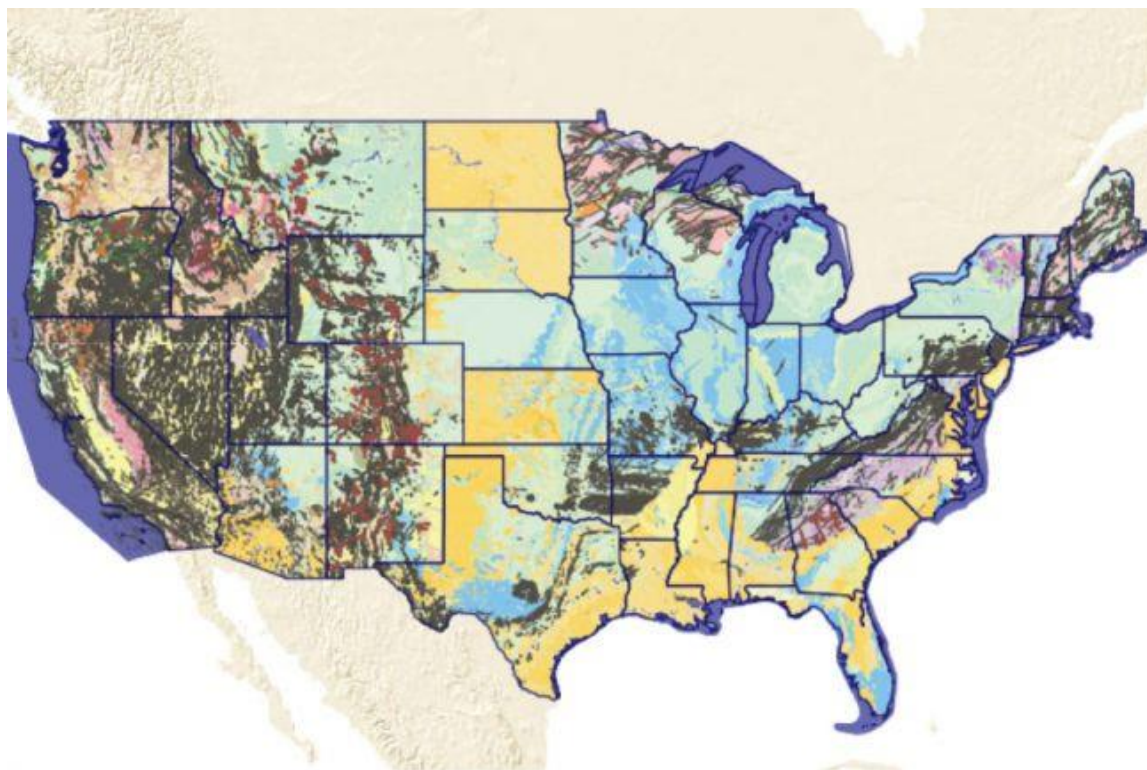


Figure 1: Interactive geologic map of the conterminous United States produced by the USGS Mineral Resources Program that provides useful information on surface and bedrock geology, natural resources, and geochemical, geophysical, and other environmental data throughout the nation. (Image source: <https://mrdata.usgs.gov/geology/state/>)

The USGS National Cooperative Geologic Mapping Program (NCGMP)² works collaboratively with federal, state, and university partners, as well as other external stakeholders, to produce geologic mapping data through the FEDMAP³, STATEMAP⁴, and EDMAP⁵ program

² U.S. Geological Survey. 2017. [National Cooperative Geologic Mapping Program](#)

³ U.S. Geological Survey. 2017. [The Federal Geologic Mapping Component — FEDMAP](#): FEDMAP develops new ways to understand basic earth science processes and produces high-quality, multipurpose digital geologic maps, regional analyses, and multidimensional geologic models.

⁴ U.S. Geological Survey. 2017. [State Geologic Survey Mapping \(STATEMAP\) Component](#): The primary objective of the STATEMAP component of the NCGMP is to establish the geologic framework of areas that are priorities to individual states determined by each State Geologist. STATEMAP receives funds through an annual competitive grant process, and every federal dollar awarded to a state geological survey is matched by a state dollar. The NCGMP is currently funding 127 projects from 45 states.

⁵ U.S. Geological Survey. 2017. [EDMAP — University Geologic Mapping Component](#): EDMAP allocates funds to colleges and universities in the United States and Puerto Rico through an annual competitive grant process. Every federal dollar awarded is matched with university funds. EDMAP funding supports undergraduate and graduate students in a one-year, mentored geologic mapping project.

components. The maps created by the USGS are used by decision makers at every level of government, academic scientists, and private industry for a variety of earth-science applications.

A noteworthy example comes from Lake County, Illinois, where maps created with support from STATEMAP informed a \$250-million-dollar water planning decision in 2011.⁶ Lake County officials needed to determine if their current groundwater resources could support long-term population and economic growth in their communities. Officials and consultants analyzed groundwater resources using geologic maps, considering a variety of geologic and economic factors. Based on the available data and analyses, officials requested allocations of water from Lake Michigan as their primary water source rather than local groundwater. This decision led to the creation of jobs through contracts awarded for construction and management of the new water infrastructure – including a 57-mile water pipeline that is expected to be completed in 2019.⁷ Most importantly, this cooperative program ensured a dependable water source for the future of Lake County. This multi-year process is just one example of how mapping done with the NCGMP is foundational to American safety and prosperity.

The American Geosciences Institute supports the reauthorization of the National Cooperative Geologic Mapping Program because of its significance to all of our member societies and the geosciences community. The program has been flat-funded at \$24.4 million since FY 2014, and we would be pleased to see an increase in support for this program, which provides essential information to the public and private sectors.

Natural hazards can cause substantial damage throughout the nation, but if armed with the appropriate information, communities can take action to avoid and mitigate potential harm. The USGS earthquake, landslide, and volcano programs help to strengthen our national resilience to these hazards and protect our communities and citizens from harm.

Landslides occur in all 50 states and U.S. territories, causing estimated damages exceeding \$2 billion and between 25 to 50 fatalities annually.⁸ They are commonly triggered by other natural disasters, such as; severe storms, earthquakes, volcanic activity, coastal wave erosion, and wildfires. In March 2014, immediately after a three-week period of unusually high levels of local rainfall, a massive landslide struck the community of Oso, Washington. That landslide event claimed the lives of 43 people, making it the deadliest known landslide event in United States history.⁹ The Oso landslide didn't limit itself to loss of life, but also destroyed numerous homes, resulted in the closure of major transportation routes, and resulted in economic damages in excess of \$50 million.

Despite advances in science and technology, these events continue to result in human suffering, billions of dollars in property losses, and environmental degradation. The economic impacts of landslides and other ground failures on our growing industries, agriculture production, and urban development will continue to rise as our population increases and our society and infrastructure

⁶ Lake County Department of Public Works. 2017. Lake Michigan Water Project: [Project Materials](#).

⁷ Central Lake County Joint Action Water Agency. 2017. [Construction Information & Updates](#).

⁸ U.S. Geological Survey. 2005. Fact Sheet 2005-3156: [Landslide Hazards – A National Threat](#).

⁹ Geotechnical Extreme Events Reconnaissance. 2014. Report GEER-036: [The 22 March 2014 Oso Landslide, Snohomish County, Washington](#).

become even more complex.¹⁰ A destructive landslide can result in financial ruin for property owners because landslide insurance or other means to offset damage costs are typically not available. There is an urgent need for a comprehensive national strategy for reducing losses from landslides, which is exactly what H.R.1675, the National Landslide Preparedness Act mandates.

State and local entities take significant responsibility for landslide hazards mitigation, but a lack of national coordination hinders the sharing of information and best practices. A number of state geological surveys, for instance, have landslide inventory programs, though data collection techniques are not standardized, nor are they complete across all of the states. Due to the variation in institutional capabilities and responsibility at the regional and local levels, a cooperative national landslide strategy could provide the tools and information necessary to address this problem, and reduce landslide losses through strengthened federal, state, local, academic, and private partnerships.¹¹

In addition to establishing a national program to identify and reduce losses from landslide hazards, H.R.1675 directs the USGS to create a national 3D Elevation Program (3DEP) to update and produce standard, publicly-accessible 3D elevation data for the United States, in coordination with other federal agencies and nonfederal entities. High-resolution 3D elevation data is produced by LiDAR (Light Detection and Ranging), and is currently used to identify existing landforms that are at high risk for sliding and to document the topographic conditions following significant geologic disasters.¹² This high-resolution data significantly aids in the refinement of assessments of where and when landslides will occur, therefore providing better information to decision-makers and the public so that communities can live, work, travel, and build safely.

Acquiring high-quality topographic coverage of the entire country in a cost-efficient, coordinated manner should lead to greater public safety and presumably generate new economic benefits. According to a 2012 assessment of the benefits and costs of meeting requirements for enhanced elevation data, an improved national program for 3DEP could provide conservatively-estimated net benefits between \$116 million and \$620 million per year, and has the potential to generate \$1.2 billion to \$13 billion per year in new benefits through applications that span the economy once fully operational.¹³

The American Geosciences Institute supports the bill to establish a National Landslide Hazards Reduction Program and a national 3D Elevation Program. A national strategy to address landslide hazards and reduce risk, coupled with better coordinated emergency response planning, would help protect communities and reduce the losses of lives and economic impacts of landslides. Furthermore, a nationwide program to provide a baseline of high-quality 3D elevation data is essential for supporting improved hazard assessments, response preparation, and effective response execution.

¹⁰ U.S. Geological Survey. 2003. [National Landslide Hazards Mitigation Strategy – A Framework for Loss Reduction](#).

¹¹ National Research Council. 2004. [Partnerships for Reducing Landslide Risk: Assessment of the National Landslide Hazards Mitigation Strategy](#).

¹² U.S. Geological Survey. 2017. Fact Sheet 2016-3094: [The 3D Elevation Program—Landslide recognition, hazard assessment, and mitigation support](#).

¹³ Dewberry. 2012. [National Enhanced Elevation Assessment](#).

Volcanoes also threaten the lives and property of Americans, particularly in Alaska, California, Wyoming, Montana, Idaho, Hawaii, and the Cascade region of Washington and Oregon. These communities, among others throughout the nation, rely on agency coordination and advanced geoscience technologies to monitor and transmit early warnings for volcanic eruptions, which can directly impact land for miles around the source. The impacts of eruptions can also ripple indirectly through the country's infrastructure and commerce by compromising industrial plants, transportation systems, electrical grids, and food production.

One particularly vulnerable industry is aviation. In 1989, the eruption of Redoubt Volcano in Alaska caused an in-flight failure of all four engines of a passenger Boeing 747 aircraft. Thankfully, there were no fatalities from that instance of engine failure, but it did result in nearly \$80 million in damage to the aircraft.¹⁴ The Federal Aviation Administration reports that over 80,000 large aircraft per year, carrying more than 30,000 passengers per day, fly near Alaska's volcanoes on routes between Europe, North America, and Asia.¹⁵ The establishment of the National Volcano Early Warning and Monitoring System is critical for warning and protecting our citizens from undue and avoidable harm.

Volcanoes exhibit precursory activity that, when detected and analyzed in due time, allows eruptions to be anticipated and communities forewarned. Modern technology, in the form of geophysical monitoring networks on the ground and the use of near-time satellite data, enables geoscientists to detect and warn the public of volcanic hazards, typically weeks or months before the eruption occurs.¹⁶

The American Geosciences Institute supports the National Volcano Early Warning and Monitoring System in the draft legislation proposed today. The program would upgrade existing networks, employ emerging technologies, consolidate resources, and leverage partnerships to detect the earliest signals of volcanic unrest and activate coordinated emergency response plans.

Finally, we must recognize that the next great frontier lies under our feet. We know relatively little information about the two miles of Earth's crust immediately below the surface, even though we rely heavily on this section of Earth for many of our energy, mineral, and water supplies; it is also used as a disposal site for a variety of waste products, and it is the source of damaging earthquake and volcanic hazards.

Scientific and technological innovations now equip us with the ability to identify subsurface resources, such as geothermal energy. Geothermal power uses natural steam or very hot water trapped in deep rock formation. Extraction wells – often more than a mile deep – are drilled into hot rocks, allowing the steam or hot water to flow up to the surface.¹⁷ Private firms and public entities can then utilize the steam for electricity generation. Both conventional geothermal

¹⁴ T.J. Casadevall. 1994. [The 1989-1990 eruption of Redoubt Volcano, Alaska: impacts on aircraft operations](#). *Journal of Volcanology and Geothermal Research*, 62:301-316.

¹⁵ Alaska Volcano Observatory. 2016. [About Alaska's Volcanoes](#).

¹⁶ U.S. Geological Survey. 2016. Volcano Hazards Program: [Eruption Forecasts](#).

¹⁷ U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy. 2011 [Geothermal Basics](#).

systems and enhanced or engineered geothermal systems have the potential to power tens of millions of American homes and businesses.¹⁸

Although our society relies predominantly on traditional energy sources, like coal, oil and natural gas, to power the U.S. economy and sustain the lifestyles to which we are accustomed, diversification of our domestic energy portfolio could ensure secure energy sources for generations to come.¹⁹ The proposed language in the draft of the Enhancing Geothermal Production on Federal Lands Act would remove the standard environmental siting practices required of other domestic energy projects. The Institute is very supportive of the development of geothermal energy resources. However, we do not think that a waiver of NEPA review is necessary at this time. Although we face many uncertainties about future energy supplies in the world, we have the potential to tap into the Earth's abundant, natural heat in our backyard to benefit mankind in the 21st century and beyond. We support the robust analysis of scientific data in all facets of energy projects, from exploration and production to the assessment of environmental impacts. Fact-based analyses support well-informed decision making by community, corporate, and government participants and stakeholders.

I hope my testimony demonstrates the vital role of the geosciences and the federal programs that ensure resiliency and safety for our country. Thank you for the opportunity to testify today, and I look forward to answering any further questions you may have.

For more information, please visit the AGI website at www.americangeosciences.org, or contact Maeve Boland, Director of Geoscience Policy, at 703-379-2480 or mboland@agiweb.org.

¹⁸ U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy. 2017. [Enhanced Geothermal Systems](#).

¹⁹ U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy. 2015. [2016-2020 Strategic Plan and Implementing Framework](#).