Critical Needs - Public Comment Form

The American Geosciences Institute (AGI) is reviewing its "Geoscience for America's Critical Needs" document in preparation for the 2020 election cycle. AGI seeks input from the geoscience community to determine whether revisions are warranted and what other topics should be considered for the 2020 document.

As a reviewer of the document, we request that you consider several questions:

- The intent of the Geoscience for America's Critical Needs document is to outline the major geoscience issues facing society now and into the future. This document is intended for policy and decision makers at the federal, state, and local level. The document outlines high-level actions that address major policy issues where the geosciences play a significant role. Are revisions needed to the text that was last updated in 2016?
- Are there emerging issues at the interface of society and geoscience that are not appropriately represented in the current document? What is the time horizon for which action is required on said issue?
- Are there fundamental issues impacting the geosciences that cut across each of the topical areas in the existing document? If so, should they be elevated as topics on par with the current portfolio, embedded within the current narrative, or be considered as part of more general policy concerns best voiced elsewhere?
- Will the workplace of the future impact how the geosciences address these critical needs? Conversely, will critical needs result in changing demands on the geoscience workforce? In particular, how might an increasingly digital workplace impact the geoscience workforce? How might the geoscience professions best prepare the geoscience workforce of today and tomorrow for coming changes in the workplace?
- Infrastructure is referred to in places throughout the document but continues to be a key vulnerability for many societal needs, particularly in the energy, water, and transportation sectors. Infrastructure can impact and be impacted by raw materials availability and supply chains, both domestic and global, and weather events and natural hazards. Are infrastructure needs great enough to elevate this to its own topic area in the document? What other infrastructure needs are relevant to the geosciences?

AGI and the committees associated with its Critical Issues Program will review all comments and take them into consideration relative to the revision of the Critical Needs document.

- To be considered, your comments must either be submitted via the webform on this page, or sent via E-Mail to criticalneeds@americangeosciences.org.
- Individual comments will be kept confidential, but we request you provide contact information should we need clarification regarding your comment(s).
- If you are referring to specific text in the existing document, please refer to the paragraph number.
- If you would like to refer to specific references, please include a full citation in the webform or email.

For reference and for your convenience, a full PDF of the document is available for download.

This public comment period will close on 5 July 2019.

[1] Water

Ensuring Sufficient Supplies of Clean Water

Clean water is fundamental to life and is essential for economic prosperity. However, the long-term security of water supplies is threatened by overuse, pollution, and climatic variability. Long-term planning and water manage-ment are critical for agriculture, electricity generation, fisheries, industry, transportation, recreation, municipal supplies, and healthy ecosystems.

[2] Geoscientists provide the expertise necessary for effective water resource planning and management, and they conduct research to better understand and predict changes in the amount, quality, and location of water resources.
[3] To optimize availability of clean water:
Increase monitoring of both the quantity and quality of surface water and groundwater. Knowledge of the state of water resources and how they are changing is critical for protecting, maintaining, and restoring the nation’s water resources. It is important to collect and manage this information effectively and share it widely.
[4] Improve understanding of connections within the hydrologic cycle and between water resources and other critical issues. We need to better under-stand the interaction between surface water and groundwater and integrate that knowledge into water and land management practices. Understanding links between water and other critical issues, including energy, agriculture, natural hazards, and waste disposal, will facilitate integrated planning and optimal decision making.
[5] Balance water use with ecosystem needs. Healthy ecosystems purify water and air, mitigate floods, reduce erosion, and perform many other vital services, but ecosystem health depends on a sufficient water supply.
[6] Develop and maintain infrastructure to collect, treat, store, and deliver safe water and ensure sufficient capacity to meet changing needs. The high costs of infrastructure development, maintenance, and replacement impose growing financial burdens and require long-term planning based on geoscience understanding and innovative engineering.
[7] Address persistent sources of contamination and identify threats to water quality in a timely manner. Water quality is threatened by long-recognized contaminants, such as trace elements, pesticides, industrial spills, and excess salt and nutrients primarily from agricultural sources. Newly understood threats include naturally occurring contaminants, pharmaceuticals, and nanoparticles.
[8] Energy
Developing Energy to Power the Nation
Energy supports economic growth, national security, and all the elements of daily life—food, water, transportation, communication, and entertain-ment. The United States’ historically robust and secure energy systems have contributed to our high quality of life.
[9] Geoscientists find and develop earth- and ocean-sourced energy, such as oil, natural gas, coal, uranium, and geothermal. They also find and develop the raw materials needed for renewable energy sources, such as cement and metals for dams, and rare earth elements for wind turbines and solar installations. In addition, geoscientists help determine suitable locations for energy infra-structure, including refineries, transmission lines, dams, and wind farms.
[10] For an energy-secure nation:
Assess the quantity and location of energy resources. Geoscientists improve understanding of energy resources, helping decision makers to create robust energy policies and allowing energy producers to develop resources more efficiently.
[11] Develop the nation’s diverse energy sources. The United States relies on a variety of energy sources including petroleum, natural gas, coal, nuclear, hydroelectric, geo-thermal, and other renewables, like wind and solar. The continued responsible development of these resources, and the advancement of emerging energy sources, will ensure reliable supplies for the future.
[12] Study and develop solutions that reduce the environ-mental impacts of energy extraction and generation. Geoscientists perform life-cycle analyses of the short- and long-term impacts of energy development, use, and waste disposal that help inform energy policy decisions.
[13] Natural Hazards
Building Resiliency to Natural Hazards
Natural hazards affect every state in the nation. Earthquakes, volcanoes, landslides, sinkholes, wildfires, tornadoes, hurricanes, floods, extreme heat and cold, and drought, among others, result in billions of dollars in annualized losses to the United States. These hazards threaten lives and property, disrupt services, damage infrastructure, and weaken economies. A thriving nation requires resilient communities that help protect citizens from economic and social disruptions related to natural hazards.
[14] Geoscientists help communities identify, mitigate, prepare for, respond to, and recover from natural disasters. In coordination with engineers, social scientists, public safety professionals, and emergency managers, geoscientists conduct natural hazards research, monitoring, training, education, and public outreach to create an integrated approach to developing resilient communities.

[15] To minimize the potential impact of natural hazards:
Encourage basic and applied research to strengthen community resilience. Geoscientists study the links between natural hazards and Earth processes and the ways natural hazards impact society. They identify haz-ard-prone areas through geologic mapping, seismic monitoring, and other investigations.
[16] Prioritize natural hazard monitoring. Geospatial tools such as satellites, lidar, seismic networks, and stream gauges help geoscientists collect data to assist in disaster assessment and response and develop better models, forecasts, and warnings.
[17] Support communication of the risks and vulnerabil-ities associated with natural hazards to the public. Geoscientists translate technical data into actionable information, helping to include science in mitigation, preparedness, response, and recovery efforts.
[18] Mitigate hazard impacts on people, buildings, and infrastructure. Geoscience research informs trans-portation planning, land-use practices, and building codes, leading to more resilient communities.
[19] Soils
Managing Healthy Soils
The ability of soil to support plant life is vital to the food we eat and the air we breathe. Soils are primarily made of a complex and variable combi-nation of minerals from rocks, organic matter from plants and animals, air, and water.
[20] Geoscientists study the characteristics, history, and efficient management of soils to improve agricultural yields, purify water, treat waste, supply industrial and pharmaceutical goods, evaluate foundation stability for infrastructure, and reduce impacts from natural disasters.
[21] To manage the nation’s soils efficiently:
Encourage monitoring of soil quality and moisture for optimal agricul-tural production. Soil fertility and its ability to produce crops depend on the nutrients it contains. Better monitoring and management can improve crop yields and potentially reduce offsite contamination.
[22] Incorporate knowledge of soil characteristics and properties into the planning, design, construction, and modification of critical infrastructure. Soil and rock provide the foundation for our nation’s buildings, roads, bridges, water systems, and pipelines. Understanding soil properties and how they relate to the underlying geology can lead to more resilient infrastructure.
[23] Expand the use of soil as a filter to remove pollutants from water. Environmental geoscientists use soil filtration as a natural and relatively inexpensive means to mitigate pollution and improve water quality, par-ticularly for fertilizer application in agricultural settings.
[24] Characterize soil biodiversity and its relation to essential ecosystem functions. Healthy soil supports a wealth of biotic diversity. Geoscientists help understand the link between soil microorganisms and the functions they provide to support plant growth, remediate contaminants, and con-tribute to a drought- and flood-resilient ecosystem.
[25] Improve soil characterization and geologic mapping to identify under-lying hazards. Earthquakes, landslides, wildfires, droughts, and floods all affect soil stability, occasionally leading to loss of life and property. Identifying and mitigating potential weaknesses in soil layers will benefit society by reducing the likelihood and impact of disasters.
[26] Mineral Resources
Providing Raw Materials for Modern Society
Daily activities, national security, and the greater economy all depend on an abundant supply of minerals — from gold for cell phones, to potassium for crop fertilizers, to rare earth elements for missile guidance and clean energy technology, to crushed stone in concrete for buildings and roads.
[27] Despite the pervasiveness of minerals in everyday life, the full extent and accessibility of the nation’s mineral resources is not known; supplies of some critical minerals are vulnerable to disruption; and mineral extraction, use, and disposal have environmental impacts that should be better under-stood and mitigated.
[28] Geoscientists locate and characterize mineral deposits and provide essential information for efficient resource extraction and effective envi-ronmental stewardship.
[29] To support a secure supply of minerals:
Assess the nature and distribution of domestic mineral resources. This basic information on the nation’s natural wealth is essential for government, industry, environmental, investment, and community decision making.
[30] Quantify domestic and global supply of, demand for, and flow of min-erals. Industry relies on a stable supply of raw materials. Understanding and predicting the market forces that impact mineral supply is essential to anticipate and avoid supply disruptions and to make well-informed financial and policy decisions.
[31] Support socially, economically, and environmentally responsible domes-tic mineral production. The United States relies on imports for more than one-half of its apparent consumption1 of 43 mineral commodities,2 including several that are considered

critical to the national interest, such as rare earth elements.
[32] Foster innovative solutions to lessen the environmental impact of mining and mineral use. Recycling and substitution are increasing, but mining is, and will continue to be, the primary source for most materials. New approaches to mining, mineral use, and product disposal can mitigate the impacts of mineral production and consumption.
[33] 1 Apparent consumption is usually defined as (production + imports) – exports.
2 Mineral Commodity Summaries 2015. U.S. Geological Survey.
[34] Ocean & Coasts
Expanding Opportunities and Mitigating Threats
The United States depends on the ocean and the Great Lakes for food, national security, energy resources, transportation, recreation, and myriad other critical needs. More than half of the United States population lives in coastal watershed counties that generate 58 percent of the nation’s gross domestic product.1 The United States has jurisdiction over 3.4 million square miles of ocean, more than the land area of all 50 states combined. This vast marine area offers environmental resources and economic opportunities. However, coastal communities are also threatened by tsunamis, hurricanes, industrial accidents, and water-borne pathogens. A better understanding of our ocean and coastal areas will strengthen our economy and protect our people.
[35] Geoscientists provide information about how our planet’s coasts, ocean, and seafloor operate now and how they have functioned in the past. They conduct research on marine energy and mineral resources, natural hazards, rising seas, and ocean acidification.
[36] National Coastal Population Report: Population Trends from 1970 to 2020. National Oceanic and Atmo-spheric Administration. < http://stateofthecoast.noaa.gov/features/coastal-population-report.pdf>
[37] To ensure the long-term sustainable use of our ocean and coastal resources:
Support basic and applied research on ocean and coastal issues. Better knowledge of the ocean and its role in global processes now and in the past allows scientists to forecast for the future. An improved understanding of ocean and coastal processes will reduce damage and promote responsible growth of coastal communities.
[38] Enhance ocean observations. The ocean drives global water and weather systems by absorbing, holding, and moving vast amounts of the Earth’s heat, water, and CO2. A resilient nation needs sustained ocean observations from space, from the ocean surface, and at depth.
[39] Monitor, research, and respond to sea-level rise. Sea level is rising at an increasing rate, changing coastal ecosystems and making vital coastal communities vulnerable to erosion and flooding associated with storm surges and high tides.
[40] Assess marine energy and mineral resources, and their envi-ronmental context. The ocean not only hosts energy and mineral resources but also is a source of energy itself. Most of the marine world remains unexplored, making informed policy a challenge.
[41] Climate Change
Confronting Climate Variability
Decades of scientific research show that Earth’s climate, the long-term seasonal averages of weather on a regional or global scale, changes as a result of both natural and human causes. Over the past century, global average temperatures have increased significantly.1 These changes drive sea level rise and exacerbate ocean acidification. Climate change will likely lead to greater storm surges, droughts, heat waves, flooding, and other events that could cost the nation billions of dollars and affect domestic and global security.
[42] Geoscientists use rock and ice cores to study records of past climate, satellites and weather stations to monitor current climate, and sophisticated computer models to project future conditions. This information supports decisions about agriculture, human health, and critical infrastructure.
[43] 1 Temperature Anomalies Time Series, June 2015. National Oceanic and Atmo-spheric Administration.
[44] To better equip society for a changing climate:
Encourage research and improve models to understand the connection between Earth’s systems, human activity, and climate change. For more than four billion years, land, water, ice, and the ocean have helped shape, and have been shaped by, a changing climate. Understanding past climates through evidence preserved in the geologic record increases the accuracy of today’s climate models and the ability to forecast how ecosystems will respond to climate change.

[45] Plan for the diverse and complex societal impacts of climate change. Holistic plans consider not just single weather events but extended effects, such as drought, crop failures, emerging diseases, and damage to ecosystems, which carry the potential for long-term social and economic impact. Information from geoscientists, who are familiar with the interrelated processes that impact climate, strengthens climate-change adaptation plans.
[46] Evaluate strategies for limiting carbon in the atmosphere. Scientific evidence indicates that carbon in the atmosphere is a key factor in rising global temperatures. Reducing carbon generation and storing it in geologic formations, also known as carbon capture and storage (CCS), are effective ways to limit atmospheric CO2.
[47] Waste Disposal
Managing Waste to Maintain a Healthy Environment
Waste is an inevitable byproduct of society. Waste types are as varied as human activities themselves, and many waste products are toxic. Protection of human health and the environment often relies on geoscience knowledge to isolate waste materials from people and ecosystems.
[48] Geoscientists translate their understanding of complex Earth systems into mean-ingful approaches for isolating waste streams and remediating waste sites.
[49] To optimize the balance between resource use and a healthy society:
Assess the safety of disposing of liquid waste in deep wells. This method of disposal is commonly used today to dispose of treated wastewater, chemicals, and oil field brines, but it can potentially induce earthquakes or contaminate groundwater. Geoscience investigations can help make disposal safer.
[50] Understand and minimize impacts of energy production and usage. Energy byproducts include solid wastes such as fly ash, thermal pollution of water from power plant cooling, liquid wastes, and gaseous byproducts such as CO2.
[51] Mitigate the high risk associated with nuclear waste. Large volumes of spent nuclear fuel are currently stored at multiple temporary sites in the United States, and more such waste continues to be generated. A long-term disposal option is still needed for this toxic radioactive waste, and a geologic repository may provide a long-term solution. Geoscientists provide information to help assess site suitability and selection.
[52] Support cleanup of abandoned mines, brownfields, and Superfund sites. Landfills, dumps, and spills can introduce a wide variety of toxic chemicals into the environment. Geoscience provides a basis for evaluating risks, setting priorities for remediation, and assuring that expenditures yield substantial benefits.
[53] Workforce & Education
Meeting the Future Demand for Geoscientists
The 300,000 geoscientists1 currently working in the U.S. private and public sectors help the nation ensure a clean and sustainable water supply; explore, access, and manage its energy and mineral resources both on land and under the sea; monitor, forecast, and mitigate terrestrial and marine natural hazards; support agricultural soil productivity; research land-sea-atmosphere interactions to understand the changing climate; and safely clean up environmental contamination and dispose of waste. By sharing their knowledge with students and the public, geoscientists help to create a society that understands Earth’s processes and recognizes resource, hazard, and environmental issues.
[54] The economic demand for geoscientists will continue to grow within the United States and worldwide, yet increasing numbers of U.S. geoscientists are reaching retirement age. AGI estimates a shortage of 135,000 geoscientists within the U.S. economy by 2022.2 The nation’s schools, colleges, and universities must be ready to educate and train this next generation of geoscientists.
[55] 1 Wilson, C.E., The Status of the Geoscience Workforce 2014. Alexandra, VA: American Geosciences Institute, 2014.
2 Ibid. geoscience careers.
[56] To develop a knowledgeable, experienced, and innovative geoscience workforce:
Sustain and grow programs to educate a diverse group of students in science, technology, engineering, and math (STEM). Geoscience educators ensure that students across the U.S. at all levels have opportunities to learn about the Earth. They recruit, teach, and retain talented students and encourage them to pursue careers in geoscience and related STEM disciplines.
[57] Support federal investments in basic and applied geoscience research. Federally funded research leads to scientific discovery and provides critical educational opportunities for students pursuing geoscience careers.

[58] Encourage partnerships between industry, government, and universities and colleges. Private-sector research and development is essential to maintaining America's globally competitive, knowledge-driven economy. Partnerships between government, industry, and higher education promote innovation while enhancing the educational environment and preparing students graduating from U.S. colleges and universities for the workforce.

[59] What do the Geosciences Include?

Water research to ensure water quality and quantity
Petroleum geology to identify and recover energy resources
Natural hazard science to help ensure safer, more resilient communities
Soil science to monitor soil quality and health for agriculture and construction
Environmental geology to protect and provide a healthy environment
Engineering geology to build stable infrastructure
Economic geology to locate and extract mineral resources
Coastal geology to support sustainable use of coastlines
Oceanography to protect maritime productivity and ocean commerce
Atmospheric research for weather forecasting and climate modeling
Planetary science to better understand Earth and other planets
Geoscience education to cultivate a society that understands the Earth

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Comments

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