
Expanding and Improving Geoscience in Higher Education

Position Statement. The Geological Society of America (GSA) affirms the need for strong support for geoscience departments and programs at all institutions of higher learning. Robust geoscience programs equip students with the scientific literacy required to address crucial societal issues and planetary challenges, including the rising demand for minerals and energy, guaranteeing ample supplies of clean water, protecting communities from natural hazards, managing soils to ensure secure food supplies and resilient infrastructure, the opportunities and threats from a changing ocean, confronting climate variability, and managing waste to maintain a healthy environment. Providing geoscience instruction that is accessible to all higher-education students is vital to developing the scientific literacy that all of society needs in order to address the significant challenges facing the planet.

Purpose. The purpose of this position statement is to (1) summarize GSA's consensus views on the role of geoscience education in institutions of higher learning; (2) highlight future environmental and resource issues that will provide great impetus and opportunity for geoscience programs to significantly increase enrollments; (3) stress the importance of investment from governments, the private sector, and higher education institutions in collegiate earth-science education; and (4) provide a communication tool for use by GSA and its members to discuss why a strengthened commitment to geoscience education is critical to future global prosperity.

RATIONALE

Natural and human-induced hazardous events in the early twenty-first century have significantly increased the visibility of the earth sciences to the general public. The occurrence of Hurricane Katrina in 2005, the Deepwater Horizon oil spill in 2010, the Tohoku-Oki earthquake and tsunami (which triggered the Fukushima nuclear disaster) in 2011, and the recognition in 2015 that human-induced earthquakes have led to a previously unforeseen hazard to Oklahoma have increased public understanding of the important roles filled by geologists. Citizens and public officials also increasingly recognize the implications of climate change, the development and finite supply of mineral and energy resources, and dwindling supplies of clean water. These issues challenge our technology and infrastructure, and they require solutions by integrated teams that rely on geoscientists, thus underscoring the importance of strong education, professional competency, and widespread literacy in the geosciences.

The importance of geoscience education in institutions of higher education (2-year college through 4-year college/university level) is multifaceted.

- All graduates should have at least some foundation in geoscience so they are equipped to make informed decisions about key environmental problems facing Earth.
- Geoscience education is essential to prepare the next generation of skilled geoscience workers to address important challenges in natural-resource development and management, natural-hazards mitigation, environmental protection, and ecosystem restoration.
- Considering Bureau of Labor Statistics data, the American Geosciences Institute has projected a shortage of 135,000 geoscientists by 2022.
- Geoscience courses are essential for educating pre-service K–12 science teachers and for their continued professional development. These teachers will in turn use an updated and informed approach to educating their students.
- Geoscience education is important in related fields, including civil and environmental engineering, environmental studies, agricultural sciences, atmospheric and ocean sciences, life sciences, materials research, homeland security and emergency services, medicine, law, and public administration.
- Geoscience also plays an increasing role in disciplines such as public health and economics, fields that have not traditionally relied on geoscience expertise but that recognize the dependence of a healthy society on our soils, rocks, and water.
- Field and laboratory activities that are essential to geoscience education provide spatial and observational skills not only to geoscientists but also to professionals in a range of related careers.

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- Undergraduate research experience as part of a geoscience education program provides a strong foundation in the scientific method and enhances the student’s ability and desire to continue in a geoscience career.

SOCIETAL AND PUBLIC POLICY ASPECTS OF EARTH-SCIENCE EDUCATION

As the challenges facing our planet increase in magnitude and urgency, there will be a pressing need for science-based decisions to maintain the well-being of citizens, sustainability of vital resources, and the economic security of all nations. Geoscientists play an important role in helping to solve these problems through innovative research, public communication, and interdisciplinary work with specialists in other fields. GSA supports strong and increasing public investment in geoscience education by government. Current public investment in geoscience education is insufficient to meet future demands for skilled geoscientists. State and federal governments have a responsibility to increase funding for earth-science education to ensure that the necessary expertise exists in the future. Higher institution geoscience education is crucial for workforce development in key fields that face a significant shortage of highly qualified geologists ready for employment:

- Hydrogeologists are critical in identifying and protecting clean drinking water supplies. Aquifers are increasingly stressed as population grows and as climate change diminishes water replenishment in arid parts of the country. Environmental geologists play a vital role in clean-up efforts for contaminated aquifers.
- Geologists play vital roles in the petroleum industry, including identifying and assessing potential hydrocarbon reservoirs and overseeing the drilling and production of oil and gas wells. As oil and gas become scarcer, their recovery becomes more challenging, as does the identification of new sources.
- Geologists are essential to the mining industry, providing the geochemical and geophysical knowledge necessary to identify and understand critical mineral deposits. As the development of green technology and clean energy advances, the need for specialty minerals such as radionuclides, rare earths, and precious metals will increase.
- Engineering geologists perform many vital tasks, including the siting of facilities such as dams, toxic waste repository sites, and nuclear power plants. Areas of great future potential for engineering geologists include identifying sites for carbon capture and sequestration and upgrading aging infrastructure such as highways, bridges, and water systems.
- Geologists play a lead role in understanding how to best mitigate, and to inform citizens about, natural hazards such as earthquakes, floods, volcanic eruptions, tsunamis, landslides, and avalanches. Natural hazards pose an especially large threat to vulnerable urban areas where the economic and human risk is potentially catastrophic.
- Geologists, geochemists, soil geologists, and geomicrobiologists provide the basic understanding needed to support ecosystem and agricultural sciences, which are important prerequisites for a robust food supply and healthy environment.
- Geoscience education is very important for college students studying to become K–12 teachers. Faculty educated in the earth sciences can promote appreciation of and respect for our natural resources, leading to more students deciding to pursue geoscience careers and to an increase in overall public awareness of the key issues involving earth science.

RECOMMENDATIONS

- College and university administrators must sustain geoscience programs in order to educate non-majors and the general public, train future earth-science educators at all levels (K-12 to collegiate), and prepare the next generation of geoscience workers. Administrators should view geoscience education and literacy as essential components of higher education, given their clear relevance to society.
- Policy makers must make available new sources of funding for programs to educate the next generation of earth scientists, whose efforts will be vital to the maintenance of public health, economic strength, and global security.
- Industries in the private sector, such as those involved in energy development, mineral extraction, or environmental engineering rely, heavily on the expertise developed by geoscience programs in institutions of higher education. These industries must advocate for increased funds to support and enhance geoscience education, and, whenever possible, directly support the geoscience departments and initiatives that are responsible for training their future workforce.
- Colleges and universities need to sustain and enhance their geoscience programs through continued integration of field and laboratory experiences given the pivotal role they play in professional development as well as partnering with science agencies, institutions, and non-profit organizations committed to the geosciences to provide internships and career pathways for the next generation of geoscientists.

ABOUT THE GEOLOGICAL SOCIETY OF AMERICA

The Geological Society of America, founded in 1888, is a scientific society with over 26,000 members from academia, government, and industry in 115 countries. Through its meetings, publications, and programs, GSA advances the geosciences, enhances the professional growth of its members, and promotes the geosciences in the service of humankind. GSA encourages cooperative research among Earth, life, planetary, and social scientists, fosters public dialogue on geoscience issues, and supports all levels of earth-science education. Inquiries about the GSA or this position statement should be directed to GSA’s Director for Geoscience Policy, Kasey S. White, at +1-202-669-0466 or kwhite@geosociety.org.

OPPORTUNITIES FOR GSA AND ITS MEMBERS TO HELP IMPLEMENT RECOMMENDATIONS

To strengthen geoscience programs at colleges and universities, The Geological Society of America recommends that:

- Faculty continually stress the importance of geoscience awareness and literacy across the student body, among the general public, and to university administrators and elected officials by focusing courses, curricula, and outreach activities on the crucial issues that will face the planet in coming decades, including climate change, supply and quality of natural and water resources, and geologic hazards.
- All stakeholders (faculty, students, and alumni) educate policy makers and university administrators about changing demographics in the geoscience workforce and the increasing potential for employment.
- Geoscience departments and programs at all institutions of higher learning partner with K–12 institutions to encourage early awareness of geoscience as an important field of study, provide field and laboratory experiences, and enhance the diversity of students entering as geoscience majors.
- Stakeholders advocate for public support and public investment in geoscience programs at institutions of higher education.
- Identify legislation that affects public investments in earth science education and alert GSA’s Geology and Public Policy Committee (GPPC), GSA’s Geology and Society Division, and GSA’s Associated Societies if action by the GSA membership and affiliated organizations can help improve the scientific basis for any particular decision. The GPPC, Geology and Society Division, and the Director of Geoscience Policy, often working with GSA members, can also bring this Position Statement to the attention of lawmakers when legislation affects public investments in earth-science education.