
Expanding and Improving Geoscience in Higher Education

Position Statement. The Geological Society of America (GSA) affirms the need for strong support to geoscience departments and programs at all institutions of higher learning. This commitment will help ensure that future generations of students receive the Earth-science education they will need to address crucial societal issues that have the potential to impact global economic security and the well-being of human populations over the next century or more. More broadly, sustaining strong geoscience programs accessible to all higher education students is vital to developing the Earth-science literacy that all global citizens need to make informed decisions about the significant challenges facing the planet.

Purpose. The purpose of this position statement is to (1) summarize the consensus views of the GSA 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 global future prosperity.

RATIONALE

Natural and human-induced events in the early twenty-first century have significantly increased the visibility of the Earth sciences to the general public. Events such as Hurricane Katrina in 2005, the March 2011 Tohoku-Oki earthquake, and the 2010 Deepwater Horizon oil spill have enhanced the recognition and understanding of the role of geologists in a spectrum of hazard and natural resource issues of global importance. Awareness of the implications of climate change, sea-level rise and natural hazards, the availability of affordable energy, and the dwindling supplies of clean water has increased among citizens and our representatives. These issues challenge our technology and infrastructure and require solutions by integrated teams that rely on highly educated geoscientists. All these concerns have raised the stakes for education across the Earth sciences and underscore the importance of geoscience literacy among all citizens.

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 societal needs for natural resource development and management, natural hazards mitigation, environmental protection, and ecosystem restoration. The majority of geoscientists in the workforce are within 15 years of retirement age, indicating that there will be a particularly critical need for new geoscientists in the coming two decades.
- 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 integrated 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 who 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.
- Undergraduate research experience as part of a geoscience education provides a strong foundation in the scientific method and enhances the student's ability and desire to continue on in a geoscience career.

SOCIETAL AND PUBLIC POLICY ASPECTS OF EARTH-SCIENCE EDUCATION

As the challenges facing Earth 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 solve these problems through innovative research, public awareness, 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:

- Geologists play a vital role 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, identification of exploration opportunities is becoming increasingly challenging and resources are becoming more difficult to recover.
- Geologists are essential to the mining industry, providing the underlying geologic mapping, geophysics, and geochemistry 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.
- Hydrogeologists are critical in identifying and preserving clean drinking water. Aquifers are coming under increasing pressure as population grows and climate change leads to slow replenishment in arid parts of the country. Environmental geologists play a vital role in clean-up efforts for contaminated aquifers.
- Geological engineers perform many vital tasks, including locating facilities such as dams, toxic waste repository sites, and nuclear power plants. An area of great future potential for geological engineers will be locating sites for carbon capture and sequestration, as well as upgrading aging infrastructure such as highways, bridges, and water systems.
- Geologists play a lead role in understanding how to best mitigate natural hazards such as earthquakes, floods, volcanic eruptions, tsunamis, landslides, and avalanches. Natural hazards pose an especially large threat for 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 underpin maintaining a robust food supply and healthy environment needed for our basic survival.
- Geoscience education is very important for college students studying to become K–12 teachers. Faculty educated in Earth sciences can promote appreciation 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.

- Geoscientists and geoscience education have a role in informing students and citizens about the geoscience implications of Earth hazards and resource supplies.

RECOMMENDATIONS

- College and university administrators must sustain geoscience programs so that they can educate non-majors and the general public, train future Earth-science educators at all levels, from K–12 to collegiate, as well as educate the next generation of the geoscience workforce. Administrators should view geoscience education and literacy as an essential component of higher education given its clear relevance in many aspects of society.
- Policy makers must make available new sources of funding for programs to educate the next generation of Earth scientists that will be vital to public health, strong economies, and global security.
- Industries in the private sector, such as oil and natural gas companies, minerals extraction and environmental and engineering companies rely heavily on the expertise developed by geoscience programs in institutions of higher education. These industries must advocate for increased funds which are critical for the continuation and enhancement of geoscience education, and, whenever possible, directly support the geoscience departments and initiatives that are responsible for training their future workforce.
- Science agencies, institutions, and non-profit organizations need to enhance and sustain their geoscience programs and partner with colleges and universities to provide internships and career pathways for the next generation of geoscientists.

ABOUT THE GEOLOGICAL SOCIETY OF AMERICA

The Geological Society of America (GSA), founded in 1888, is a scientific society with over 24,000 members from academia, government, and industry in more than 95 countries. Through its meetings, publications, and programs, GSA 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 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, natural and water resources issues, and natural 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 can partner with K–12 institutions to encourage early awareness of the 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, 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 DGP, 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.