
Integrating Geoscience with Sustainable Land-Use Management

Position Statement. To ensure sustainable land-management practices that meet present and future needs of people and the natural systems on which they depend, The Geological Society of America (GSA) advocates use of comprehensive earth-science information in land-use planning and decision making. The geosciences address the origin, character, and interconnection of natural resources, as well as the natural and human-induced processes that affect these resources. Geoscience information is critical to addressing natural and human-induced hazards, such as landslides, earthquakes, subsidence and sinkholes, floods, or droughts; natural resource availability, such as energy, water, soils, and mineral resources; and environmental issues, such as soil erosion, changes to surface- and groundwater quantity and quality, and wetland destruction. Therefore, geoscience should be incorporated into all land and natural resources management decisions to enhance their integrity and sustainability.

Purpose. This position statement: (1) summarizes the consensus view of GSA regarding integration of geoscience into land-use management; (2) provides information to policy makers and land managers showing the vital contributions geoscientists can make to strong and effective policies for sustainable land use; and (3) encourages geoscientists to participate in land-use decision making at local, regional, state, and national levels.

RATIONALE

Land generates most of humanity's food and wood; provides the mineral, energy, water, and soil resources vital to functioning communities and society; and serves as a major carbon sink. The land surface provides aesthetic and recreational value and affects the quality and amount of water delivered to streams, aquifers, lakes, and coastal waters. The land surface also affects air quality. Changing land-use policies and practices as well as climate change dramatically affect land, water, and air, which are closely interlinked both in their mutual, complex interactions and in their impacts on us. Land use practices can also create new hazards (e.g. dam failure) as well as increase risk in areas such as floodplains and coastal areas that are already susceptible to hazards. Land stewardship will be critical for the needs of future generations, and geoscientists play a key role in guiding wise land-use policy and practice.

The needs of municipalities, industry, agriculture, and recreation are served through groundwater, lakes, rivers, and coastal waters. These waters support transportation, power generation, recreation, and food resources, and sustain natural freshwater and marine ecosystems. Uncontaminated land surfaces help preserve the quality of our water resources, while stable physical features such as dunes and marshes protect communities from storm surges and tides.

Air quality is determined by interactions between natural and human activities on Earth's surface and the atmosphere. Examples include: dust produced via agriculture or construction, smoke produced via human-influenced forest fires, and industrial pollutants. These airborne particulates can degrade air quality far from sources as they travel long distances on global wind currents.

Changes in land use can benefit or endanger the current integrity and future availability of Earth's vital resources and ecosystems. Land-use practices include:

- agriculture, ranching, logging, mining, river management (such as dams, reservoirs, levees, and canals for water diversion and storage);
- infrastructure development (such as roads, highways, and pipelines);

SCIENCE - STEWARDSHIP - SERVICE

- groundwater withdrawals and recharge, waste disposal, and urban/suburban development; and
- housing, commercial land use, and community development.

These practices affect soil stability and erosion, hydrologic and biogeochemical cycles and processes, as well as the structure of ecosystems, such as croplands, forests, wetlands, streams, shorelines, and estuaries and bays. Land-use practice can also mitigate or intensify risks of natural hazards.

Human activities continually interact with Earth’s natural processes, and expanding populations are increasingly impacting Earth’s systems. Diverse natural and anthropogenic changes to land resources require multifaceted and interdisciplinary land-management decisions. The geosciences provide an understanding of potential short- and long-term effects of past, present, and future land-use practices on other natural resources. Conservation, protection of human and ecologic health and safety, and sustainable socioeconomic growth require integration of geoscience information with land-use planning.

PUBLIC POLICY ASPECTS OF INTEGRATING GEOSCIENCE WITH LAND-USE DECISION MAKING

The geosciences uniquely inform land-use issues because geoscientists address the origin, character, distribution, availability, vulnerability, and connectivity of natural resources. Ensuring sustainable land resources requires land-use planning and management decisions based on (1) an understanding of the impacts, both immediate and long term, on natural resources that sustain communities; and (2) stewardship of natural resources to ensure the needs of future generations are protected by avoiding over-allocation, chronic depletion, and/or degradation of those resources. Geoscience studies and data also help decision makers optimize resource use while minimizing unacceptable environmental impacts. Finally, as human population grows, demand for land and associated resources will increase, as will the need for more science to inform land-management decisions in a sustainable manner and develop strategies for mitigating unacceptable and irreversible changes.

CONCLUSIONS AND RECOMMENDATIONS

Protecting land and natural resources requires geosciences input into management decisions.

To effectively address natural and human-induced hazards, natural resource availability, and environmental issues, government agencies at local, state, national, and international levels should integrate geoscience information into land-use planning.

To improve the scientific basis for land-use decisions, public investments in geoscience research should be maintained or increased.

To reduce potential risk and liability in areas of natural or anthropogenic hazards, reliable geoscience data and information should be readily accessible to policy makers, private developers, land managers, individuals, and community groups.

To enable the public to understand land-use decision making, easy-to-comprehend geoscience information should be readily accessible, especially in areas susceptible to earthquakes, landslides, flooding, fire, erosion, and other hazards.

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ABOUT THE GEOLOGICAL SOCIETY OF AMERICA

The Geological Society of America, founded in 1888, is a scientific society with more than 20,000 members from academia, government, and industry in more than 100 countries. Through its meetings, publications, and programs, GSA enhances the professional growth of its members and promotes the geosciences in the service of humankind. Headquartered in Boulder, Colorado, 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.

OPPORTUNITIES FOR GSA AND GSA MEMBERS TO HELP IMPLEMENT RECOMMENDATIONS

To improve implementation of the goals of this position statement, GSA recommends the following actions.

- GSA members should seek opportunities to communicate the value of integrating geoscience with sustainable natural resources management to governing bodies at all levels, government agencies, private developers, economic development corporations, professional land-use planners, chambers of commerce, and other local decision makers.
- GSA members are encouraged to work with print, electronic, social, and broadcast media to promote the value of science in addressing critical land-use issues.
- GSA members who participate in land-use and associated natural resources planning are encouraged to share their experiences at GSA meetings and with GSA's Director for Geoscience Policy. Local examples of geoscience contributions to land-use planning are essential to this effort.
- GSA members must clearly communicate with decision makers that a lack of geoscience information has often resulted in costly adverse land-use activities, worsened the consequences of natural disasters, and allowed for needless human-induced disasters.
- GSA members should identify legislation that affects land use and alert GSA's Geology and Public Policy Committee, the Geology and Society Division, and GSA's Associated Societies so they can help improve the scientific basis for land-management decisions and bring this Position Statement to the attention of lawmakers.
- GSA should raise awareness of land-use issues by publishing articles in popular outlets on the links between geoscience, land-use planning, and sustainable resource management decisions.
- GSA should encourage interaction among geoscientists at all levels who work with land and natural resources management issues or are interested in incorporating geoscience into land-use decision making.
- GSA should sponsor symposia or town-hall meetings, particularly at the GSA sectional or annual meetings, that bring together geoscientists from land management agencies, the U.S. Geological Survey, universities, and private industry to share ideas about how geoscience has been and can be successfully integrated into land use and natural resources policies.