

AMERICAN GEOGRAPHICAL SOCIETY POLICY STATEMENT ON MONITORING EARTH SYSTEMS

Overview

Earth systems are in constant change, at spatial scales from global to subatomic and at time scales from eons to infinitesimal fractions of a second. Likewise, societal systems evolve, act, and react in ways both intended and unintended. Although keeping track of all changes in all places at all times at all scales is neither realistic nor desirable, adequate monitoring is critical to human survival and prosperity. Adequate monitoring encompasses physical and biological variables that measure the health of the planet; forecast catastrophic events and describe their onset, progress, and results; portray the status of the goods and services provided by the earth; and depict the known and yet-to-be-discovered processes occurring in the earth system. It also comprises factors that affect the condition and dynamics of human populations and societies.

Because the need is so critical, the American Geographical Society (AGS) is committed to encouraging monitoring of the earth system, to advising government, business, and scientific communities, and to educating the general public about the physical and societal aspects of monitoring. The AGS emphasizes, however, that care must be taken to ensure that neither the monitoring process itself nor the use of its results causes inappropriate changes in the phenomena observed or infringes on people's freedom, privacy, or other rights.

Article

Introduction: Population growth and an improved standard of living for a large fraction of the populace have combined to increase stress on the physical and societal systems that sustain humankind. Population growth will exacerbate that stress and we can no longer be sure the planet's ecosystem will be able to provide a sustainable high quality of life for future generations. Thus the earth has entered the "anthropocene," the era in which humans are a major factor of change to the planet. Reducing stress on the earth system while improving the quality of life for all the planet's inhabitants is a tremendous challenge facing every nation on earth. In order to meet the challenge, people must observe the response of the earth system to the natural and human-induced forces that affect it. Understanding the earth system and learning about its responses will facilitate the adoption or adaptation of policies and management actions that improve the outcome for all humankind.

Understanding biophysical responses is not sufficient. We must also understand the responses of people and societies to physical and social changes, so that wise decisions can be made with regard to the use of natural goods and services, stewardship of the earth system, and enactment and application of society's policies. All of this requires monitor-

ing of the earth systems and societies in ways that build upon the monitoring techniques of the past and lead to improved monitoring in the future.

Why monitoring is necessary: More specifically, monitoring of the earth system is needed for a variety of critical purposes, some of which are:

- Evaluating natural and anthropogenic hazards, predicting potential disasters, reducing their impact, responding to their occurrences, and supporting recovery and sustainable reconstruction of the physical and social aspects of the affected society;
- Forecasting and providing advisories on weather, air quality, streamflow, field moisture, and other environmental factors of importance to health, well-being, and economic activity;
- Enhancing general and specific understanding of environmental processes and conditions that can or should affect decisions on public policy, from the local scale to the global scale;
- Promoting better understanding and wiser use of natural resources, including energy, minerals, land, forests, biodiversity, water, and the many other useful components of the earth system;
- Improving knowledge of climate variability and change and ability to monitor progress in identifying and reducing negative human effects on the environment;
- Providing a source of information with which to verify treaties and agreements;
- Meeting national security and defense needs;
- Providing information conducive to understanding short- and long-term conditions of economic health and social well-being; and
- Continually improving the quality of human and environmental health.

How monitoring is done: Monitoring of the earth system can take place in many ways, including automated monitoring tools, passive and active remote sensing systems, human observation, and even study of records, such as rock strata or tree rings, of the earth system itself. Monitoring of society can also take place in many ways, from examination of anthropological or historic records to more quantitative approaches, such as conducting censuses and maintaining population statistics, tracking economic activity, reporting medical incidents and evaluating medical records, and gathering tracked political or attitudinal data. Tools for collecting societal data include questionnaires, observation over time, visible or hidden cameras, and a myriad of other techniques that either exist or will be developed in the future.

Technical requirements for monitoring: The data and information acquired by monitoring biophysical and socioeconomic variables will be most valuable if they meet certain general technical requirements, adapted to the type of monitoring used. By no means is the list inclusive, for as technology and society grow and change, additional technical capabilities and requirements will arise. Nanotechnology, for example, has opened exciting

new opportunities for monitoring the biophysical environment as well as the engineered and social environments.

- Ease of sharing: The format and structure of data collected or stored by electronic means should be such that they are easily shared with others, compatible with widely accepted standards, and usable on widely available computing systems.
- Multiple uses for the same data: Wherever possible, data should be suited to multiple uses, in order to reduce redundant data collection.
- Periodic re-collection of data: For some variables, such as land cover, population, and certain economic indicators, global data must be obtained periodically, in order to understand the trends that may affect the health of the planet, its societies, and its communities of living organisms, including humans.
- Long-term sustainability of data: Information gathered should have both immediate and long-term value.
- Timely access: Monitoring systems must be regularly checked and maintained or repaired as needed, in order to not delay access to information.
- Open access: The data should be accessible to all users with a valid need, but critical information about individuals and national security issues must be protected.
- Minimal cost: Information gathered through monitoring should be available to valid users at the lowest possible cost. Private-sector entities should be afforded the opportunity to make a reasonable profit on data they collect. Public data collected with taxpayer funds should be available to taxpayers at the cost of reproducing and distributing the information, unless arrangements have been made for taxpayer funds to cover those costs as well.

Potential dangers in monitoring: Although monitoring of the earth system and of selected societal variables is necessary, institutional capabilities and technological advances raise the specter of potential abuses: for example, invasion of individuals' privacy, identity theft, and "geoslavery". Moreover, threats to civil liberty and unwarranted surveillance can damage the freedom needed for a democratic society. Thus, the monitoring itself must be monitored.

Opportunities for involvement in monitoring:

- Existing monitoring systems: The AGS encourages the continuation of existing monitoring procedures until alternative methods are established, in order to ensure continuity of compatible data and information.
- New monitoring systems: The AGS encourages the development and implementation of new ways of monitoring, in order to obtain at intervals the data and information with which to meet the above-described needs and others that may arise. However, the AGS discourages unnecessary duplication of effort.

- Capacity building: The AGS encourages organizations with superior skills and capabilities in monitoring and in analyzing data produced by monitoring to aid in building the capacity of those less skilled and capable.
- Education: The AGS encourages the use of data and information derived from monitoring in educational settings, so that students may understand societal and environmental changes and the issues related to them.
- Enhancing understanding, modeling, and prediction: For the betterment of society, its members, and the natural system, the AGS encourages the design and use of monitoring procedures to enhance the full spectrum of scientific activities, from describing and understanding phenomena, to creating better models of the earth system and its components, to predicting or forecasting of phenomena and their impacts.

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