

An Earth Systems Science Agency

Mark Schaefer,* D. James Baker, John H. Gibbons, Charles G. Groat, Donald Kennedy, Charles F. Kennel, David Rejeski

Addressing serious environmental and economic challenges in the United States will require organizational changes at the federal level.

The United States faces unprecedented environmental and economic challenges in the decades ahead. Foremost among them will be climate change, sea-level rise, altered weather patterns, declines in freshwater availability and quality, and loss of biodiversity. Addressing these challenges will require well-conceived, science-based, simultaneous responses on multiple scales, from global and national, to regional and local. The executive and legislative branches of the federal government and of the states will have to transcend bureaucratic boundaries and become much more innovative in developing and implementing policy responses.

We strongly believe organizational changes must be made at the federal level to align our public institutional infrastructure to address these challenges. The most pressing organizational change that is required is the establishment of an independent Earth Systems Science Agency formed by merging the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Geological Survey (USGS).

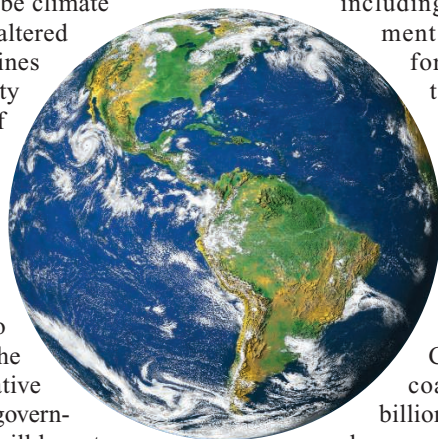
Current Organizational Structure

Two federal agencies, NOAA and USGS,

Each of the coauthors has held senior Earth and environmental science positions in the federal government, including M. Schaefer: Deputy Assistant Secretary of the Interior, Acting Director of the U.S. Geological Survey; D. J. Baker: Administrator, National Oceanic and Atmospheric Association; J. H. Gibbons: Director, White House Office of Science and Technology Policy, Science Adviser to the President; C. G. Groat: Director, U.S. Geological Survey; D. Kennedy: Commissioner, Food and Drug Administration; C. F. Kennel: Associate Administrator, National Aeronautics and Space Administration, Director of Mission to Planet Earth; D. Rejeski: Served at the Office of Science and Technology Policy and Council on Environmental Quality from 1994 to 2000.

Author contact e-mail: djamesbaker@comcast.net, jackgibbons@hughes.net, cgroat@mail.utexas.edu, kennedyd@stanford.edu, ckennel@ucsd.edu, david.rejeski@wilsoncenter.org

*Author for correspondence. E-mail: markschaefer24@msn.com



have missions solely directed to the Earth sciences. NOAA's mission is directed primarily to the atmosphere and the oceans, including the coastal environment. USGS is responsible for freshwater and the terrestrial environment and has an extensive biological program. NOAA has a budget of nearly \$4 billion and 12,000 employees, with research entities in the Washington, DC, area, in Boulder, Colorado, and along the coasts. USGS has a \$1 billion budget and 8500 employees with administrative and research entities throughout the United States. Together, the two agencies are responsible for the major Earth science elements: air, land, water, and all living things.

The National Aeronautics and Space Administration (NASA) Earth science program is responsible for developing space-based Earth observing systems and performing associated research. NASA's Earth Science Program (1) budget is about \$1.5 billion, with the bulk of its activities at the Goddard Space Flight Center in Maryland and Jet Propulsion Laboratory in California. Other important environmental research and development (R&D) activities take place in or through the National Science Foundation (NSF), the U.S. Environmental Protection Agency (EPA), the Department of Energy, the Department of Agriculture (USDA), the National Institutes of Health, and elsewhere.

Weaknesses in Federal Programs

Federal environmental research, development, and monitoring activities are not presently structured to respond to the challenges of today and tomorrow. To illustrate this, we point to Earth observation systems, one of several compelling examples.

Robust Earth-observing systems are critical to meeting national and international needs. Yet these systems have not kept pace with increasing demands of the public and private sectors for comprehensive, high-quality information on the

changing global environment. At a time when federal Earth-observing systems should have been ramping up, priorities have shifted to manned missions to the Moon and Mars. A recent study by the National Research Council found that NASA's Earth science budget had declined 30% since 2000 (2). The scientific importance and societal value of remote sensing systems has not been communicated effectively to the public and Congress; hence, there is little awareness of the shortfalls in our Earth-observing systems—and no driving force to address them. Yet these systems are critical to public safety, natural disaster response, and efficient transportation and they fuel multibillion-dollar industries.

The synergies among our research and monitoring programs, both space- and ground-based, are not being exploited effectively because they are not planned and implemented in an integrated fashion. Our problems include inadequate organizational structure, ineffective interagency collaboration, declines in funding, and blurred authority for program planning and implementation.

Earth observation programs cut across NOAA, the USGS, NASA, and other agencies including the NSF, EPA, and USDA. The total budget for federal environmental R&D programs is nearly \$8 billion. Despite the magnitude of the nation's environmental challenges, funding trends for federal programs have been downward or at best flat in recent years. The Administration's FY 2009 request for R&D Earth science funding for USGS and NOAA, as well as at EPA and USDA, includes further declines.

A Proposed Earth Systems Science Agency

We propose that an Earth Systems Science Agency (ESSA) be formed by combining NOAA and USGS and by building a strong policy, administrative, and collaborative research bridge to NASA's Earth sciences program. The agency should focus on research, monitoring, communication, and the advancement of applications, particularly decision support systems that inform policy-making and guide implementation. It should not have direct regulatory responsibilities. Although some NASA analysis and applications elements

could be incorporated into ESSA, most of NASA's Earth sciences research and observation program should remain in its present organizational location to allow it to continue to capitalize on NASA space technology. NASA has worked effectively with NOAA for decades, and it could work equally well with the new agency. However, NASA should be directed both to restore Earth systems science as a prime agency mission and to work collaboratively with ESSA. NASA's space technology is key to the success of ESSA. We believe NASA's satellite systems need to focus first and foremost on planet Earth, the planet that sustains human life.

ESSA should be an independent federal agency, which would allow it to support all federal departments and agencies and would give its director direct access to the Congress and the Executive Office of the President, including the Office of Science and Technology Policy and the Office of Management and Budget.

To be effective, ESSA must coordinate its research and development activities with those of the NSF, Department of Energy and its national laboratories, EPA, National Institute of Environmental Health Sciences, Department of the Interior, Department of Commerce, USDA, and other agencies. The White House Office of Science and Technology Policy, the Office of Management and Budget, and the National Science and Technology Council will need to foster interagency collaboration and to ensure adequate funding of Earth systems science programs. Also, mechanisms to link ESSA's activities with state agencies will be needed.

The core mission of ESSA should be to conduct and sponsor research, development, monitoring, educational, and communications activities in Earth systems science. Its portfolio should include ocean, atmospheric, terrestrial, cryosphere, freshwater, and ecological processes and the interactions among them. It should develop and communicate comprehensive information on Earth processes, including natural disasters and extreme weather events. It should generate information critical to the sustainable use of water, mineral, biomass, wind, and other resources. Also, it should provide information on the state and quality of freshwater, estuarine, and marine biological resources and nonrenewable materials resources to guide commercial and conservation activities.

The private sector already relies heavily on data and information products from NOAA and USGS. Information on weather, natural disasters, water quality, geology, geography, fisheries, and other biological resources fuels a large, multibillion-dollar private sector enterprise, as well as directly supports individuals and nonprofit organizations. A new generation of integrated products and services available under ESSA would foster private sector innovation and spur economic development.

ESSA's success will depend largely on its ability to generate and communicate reliable scientific information to the public and private sectors. This will require effective advisory bodies, internal and external peer review mechanisms, and communications and outreach capabilities.

Building on the excellent base already in place, ESSA can become a major home of world-class Earth sciences research, an institu-

tion that engages the best Earth and environmental scientists in the nation, and a focal point for collaboration with outstanding researchers internationally. Through its reputation and programs, the agency would attract a new generation of scientists and engineers.

No less than 25% of ESSA's budget should be devoted to grants, contracts, and cooperative agreements with academic and nonprofit institutions. ESSA should coordinate its extramural activities with the grant-making efforts of the NSF.

To be successful, the new agency will need to build on academia's basic research accomplishments, as well as its specialized organizational and technological capabilities. This includes high-performance computing, modeling, visualization, and monitoring expertise and technologies. In addition, we believe that a proportion of the new agency's R&D funding should be set aside and managed to target opportunities that cut across disciplinary boundaries and foster breakthrough technologies, along the lines of the Defense Advanced Research Projects Agency.

ESSA must be organized with the guidance and support of Congress. Committee and subcommittee responsibilities should be aligned to further congressional oversight responsibilities. Champions on Capitol Hill have been critical to the success of other federal agencies. ESSA will need congressional champions as well.

Creating new organizational entities within our federal government is rare, but not unprecedented. Between 1936 and 1973, six commissions were created to explore the reorganization of the executive branch. One of these entities, the Ash Council, laid the groundwork for the creation of the Environmental Protection Agency in 1970, which integrated a half-dozen functions from agencies such as Interior; Health, Education and Welfare; and USDA. As with EPA, new agencies often arise in response to a sudden or compelling national need.

We call on the next U.S. President and Congress to act quickly to realign federal Earth sciences R&D programs, provide them adequate funding, and ensure that they are closely linked to the wealth of talent in the nation's academic institutions. Convening a commission similar to the Ash Council would be an effective way to define a path forward.

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