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Geography is Key Player in NSF 10-Year Outlook

The National Science Foundation's remarkable new report, *Complex Environmental Systems: Synthesis for Earth, Life and Society in the 21st Century*, establishes a tone and direction at NSF that should be very encouraging to geographers. Subtitled "A 10-Year Outlook for the National Science Foundation," the report is a clarion call for a greater emphasis on integrative science, collaboration between the natural and social sciences, "regional and place-based" approaches, and the importance of "spatially explicit information" in science and research.

The report echoes key perspectives and research themes in geography in its plan for increased emphasis on three inter-related areas: (A) coupled human and natural systems; (B) coupled biological and physical systems; and (C) people and technology, as a means "to advance the fundamental knowledge necessary to address critical environmental challenges."

NSF also acknowledges in its 10-year outlook the centrality of the revolutionary new geographic technologies that are now transforming scientific research well beyond geography: "Spatially explicit information in increasingly compatible formats and scales is now becoming available to researchers from the natural and social sciences. This is creating new opportunities for collaboration among scientists and engineers, the potential to move across disciplinary boundaries, and even the prospect of developing entirely new methodologies and fields of knowledge. These new instrumentation, data-handling, and methodological capabilities have expanded the horizons of what we can study and understand about the terrestrial, freshwater, marine, and sedimentary environments, the atmosphere, and

near-Earth environments in space. These tools are helping us address long-standing scientific questions as well as issues of immediate societal concern."

To meet these complex challenges as well as urgent human needs, the report notes, we need to develop an environmen-

tal synthesis to frame integrated interdisciplinary research questions and activities and to merge data, approaches, and ideas across spatial, temporal, and societal scales. It is clear from the language above that geographers have played important roles in working with NSF to provide insight and assistance during the devel-



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opment of this landmark study and report. David Skole of Michigan State University served on the NSF Advisory Committee for Environmental Research and Education (AC-ERE), which was charged with developing the strategy, and David will now assume the chairmanship of this committee during the crucial initial implementation stages of the report's recommendations. AAG staff and NSF Geography and Regional Science program staff also provided input and comments on the study as it evolved. Examples of model research by several geographers, including Will Graf and Timothy Nyerges, were also featured prominently in the report.

In addition to research, the NSF 10-year outlook also addresses education and outreach, stressing the critical need for quality undergraduate and graduate programs that can create a next-generation workforce capable of bridging multiple disciplines and working collaboratively in teams. "While synthesis of data and ideas has historically occurred within disciplines, integrated synthesis

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across disciplines is a relatively new and evolving frontier,” the report states. “An integral part of this approach is the collection of environmental information across spatial, temporal, and organizational scales and the effective communication of this knowledge to and among researchers, educators, students, resource and industrial managers, policy makers and the public.” Disciplinary fields of study will of course remain important, and new interdisciplinary programs will develop, but tomorrow’s scientists will need to be prepared to contribute effectively to collaborative teams that include researchers with many disciplinary backgrounds, resource managers, and policy makers. “Faculty members will be called on to partner across institutional boundaries to develop innovative programs that provide a continuous route of advancement for students.”

In her comments on new developments at the horizons of science at the recent National Council for Science and the Environment conference, in which the AAG participated, NSF Director Rita Colwell observed that, “Discovery and innovation are the heart and soul of the scientific endeavor. Although the details may not be clear, we can still discern the shape of the landscape that’s ahead. Our new information and communication technologies have transformed the very conduct of research, helping us to handle huge amounts of data, enabling new ways to communicate and collaborate around the globe....To the traditional methods of theory and observation, we now have the added sophisticated modeling and simulation techniques that allow us to probe the complexities and the dynamics of environmental systems at all levels. Increasingly, we’re able to predict some of the consequences of environmental change.” However, as the NSF 10-Year Outlook also pointed out, “Imagination, diversity, and the capacity to adapt quickly have become essential qualities for both institutions and individuals, not only to facilitate research, but also to ensure the immediate and broad-based application of research results to the environment.” NSF’s outlook for the next decade reflects significant opportunities for both geography’s traditions and its recent innovations, not only for greater funding for geographic research from NSF, but also for greater contributions to the needs of society, provided we can move forward quickly and

surely and creatively enough to realize the potential now before us.

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Copies of the NSF report cited above are available by contacting ere-info@nsf.gov.