



# The Ecological Society of America

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June 8, 1999

Dr. Rita Colwell  
Director, National Science Foundation  
4201 Wilson Boulevard  
Arlington, VA 22230

Dear Dr. Colwell:

In response to your request for information regarding research priorities for the coming years, the Ecological Society of America--guided by its Research Committee--has prepared the enclosed statement of recommended research priorities. We appreciate the invitation to contribute our perspective.

We recommend that over the next decade, emphasis be placed on fundamental research featuring:

- integration of social and natural systems
- ecosystem responses to global change
- adaptive management approaches
- cross-scale interactions

Given the substantial overlap between the goals of ecological science and the needs of society at large, we place a great deal of importance on better knowledge about relationships ranging from population to landscape and global processes.

The ecological community is ready to meet the challenge of the coming years. We see NSF as being on track in terms of the agency's proposed broad research agenda. However, current funding of ecological science does not match the increasingly important role that ecological understanding plays in human welfare.

We hope you will find the attached document useful in your considerations.

Sincerely,

A handwritten signature in black ink that reads "Katherine L. Gross".

Katherine L. Gross  
President

cc: Mary Clutter, Assistant Director, Biological Sciences Directorate

## Research Priorities in Ecology

Ecology is the science that addresses fundamental questions about humanity's life support system. Ecosystems provide humankind with services such as purification of air, water and soil, sequestration of pollutants, and pollination of crops. Ecosystems also provide goods such as timber, fish, and pharmaceutical products and precursors, as well as opportunities for spiritual renewal and recreation. Shortfalls in ecosystem goods and services are increasingly common, and are linked to growing public demand as well as diminishing supply. For example, humanity now exploits about half of earth's plant production and renewable, available freshwater. Most marine fisheries are fully exploited or overexploited. People are eliminating plant and animal species, the basic components of our life support system, at an extraordinary rate far greater than at any previous time in the history of humankind.

Policymakers have recognized that these changes jeopardize civilization, because reliable flows of ecosystem goods and services are crucial for economic welfare, human health, and social stability. Consequently, a number of treaties, principles, laws, regulations and incentives have been promulgated to protect and sustain ecosystems and the flow of goods and services that they provide. However, the basic science needed to achieve these goals is lacking. Wise stewardship of our life support system requires sound assessments of the current status, and reliable forecasts of future scenarios in response to possible management strategies. Without such information and forecasts, there is great risk to the national endowment of ecosystem goods and services.

Ecology is the basic science that provides answers to fundamental questions about current and future status of ecosystems. However, some critical needs and opportunities in ecology are underfunded and have therefore not reached their potential. Ecology is ready to make crucial advances in fundamental areas that collectively will enable us to assess and predict the status and future of ecosystem services. These opportunities for remarkable progress have the following elements:

1. Integration of social and natural systems: Humans are integral parts of ecosystems, and reliable forecasts of ecosystems require effective syntheses that integrate the biological, physical and social sciences. Ecologists are already successful in interdisciplinary collaborative research, yet new and even broader collaborations must be undertaken to address the current challenges.
2. Ecosystem responses to global change: Global changes ranging from climate warming and sea level rise to shifts in land use and urbanization will affect the flow of ecosystem goods and services and pose fundamental, yet tractable, challenges for basic ecological research.
3. Adaptive management: In an ever-changing world, management plans are hypotheses not final answers. Science and management go hand-in-hand in assessing ecosystem response to large-scale management manipulations, and in providing decision makers with the information needed to adapt policies to the evolving dynamics of ecosystems and shifting expectations of society. Ecologists are ready to work with managers to design approaches that minimize risk while maximizing the opportunities for learning and adaption to the inevitable future changes in both ecosystems and society.
4. Cross-scale interactions: Extrapolation across scales of space, time, and biotic organization is the main challenge of ecological forecasting. Indeed, cross-scale interactions are the fundamental problem in understanding and predicting all complex systems. Ecologists today are poised to make critical advances in scaling rules that will lead to reliable ecological indicators and forecasts.

The Ecological Society of America recommends that substantial initiatives in basic research be directed at these four areas. The overarching principle should be the development of the understanding needed to assess and forecast the nation's endowment of ecosystem goods and services, ranging from biochemical diversity of life-giving pharmaceuticals, to populations of critical species, to production of living resources, to purification of air and water, to cycles of essential nutrients, to the integrity and beauty of our landscapes.