The next century of ecology

The science of ecology is about relationships—among organisms and habitats, on all scales—and how they provide information that helps us better understand our world. In the past 100 years, the field has moved from observations to experiments to forecasting. Next week, the Ecological Society of America (ESA), the world's largest ecological society, celebrates its centennial in Baltimore, an opportunity to reflect on the field's past and future. The gathering of international scientists, policy-makers, and students will not only explore the knowledge in hand, but consider what else is needed to chart a course over the next century in which humanity sustains and even improves the relationships that underpin life on Earth.

Characterized by a focus on interactions, from genes to global scales, and between living and nonliving components of ecosystems, basic ecological research has spawned important paradigm changes over the past 100 years. For example, we have learned that a simple graphical model of biogeography can explain species distribution patterns at many spatial scales. Another major change has been the development of our understanding of succession after disturbances, from major forest fires to the effects of antibiotics on intestinal microbial communities. As ecological science becomes more interdisciplinary, shifts in thinking and unexpected impacts will continue. Early ecologists who thought about principles governing plant and animal communities never imagined that their ideas would provide the foundation for understanding the human microbiome, affecting our nutrition, immune system, and even psychological state. The new field of synthetic ecology, in which ecologists and medical professionals design beneficial microbial communities, has its origins in century-old ecological field studies. These examples foretell how the roles of ecologists and the applications of ecological principles are likely to change in the next century, and why medical students and practitioners need to understand ecology.

The good news is that ecology's role in society has grown dramatically over the past century. Basic research on organism and environment interactions has had far-reaching impacts on legislation. In the United States, this knowledge has contributed the scientific basis for the landmark Endangered Species Act (1973) and Clean Water Act (1972). In this vein, in the 1990s, the ESAs Sustainable Biosphere Initiative encouraged the world's ecologists to identify major environmental challenges. Today, its Earth Stewardship Initiative frames a commitment by ecologists to make their science relevant to society through activities ranging from practical demonstrations to communication campaigns directed at other communities, including communities of faith. ESA's meeting in Baltimore will highlight ongoing studies of the city's urban ecology as a model to create more livable and sustainable cities, linking environmental stewardship to design and planning.

The international community also is placing more emphasis on ecology, as demonstrated by the new Intergovernmental Platform on Biodiversity and Ecosystem Services. Its first assessment, focused on pollinators, and reports will provide actionable science-based recommendations that should catalyze better incorporation of ecological science into management and legislation. The new U.S. National Ecological Observatory Network should elucidate the importance of the biosphere in Earth system dynamics and its governing role in climate, a resource for all countries. With newly developed tools, analytical methods, and models to forecast the future of the world's environment, ecologists can inform policy-makers and political leaders about how to prevent, mitigate, or adapt to environmental change.

From the microbes inhabiting the earth beneath our feet to environments of the universe unknown to us now, the next 100 years of ecological discoveries will influence our lives. We enter a time when society is armed with the scientific knowledge and ability to make responsible decisions.

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