

## ECOLOGICAL RESEARCH FUTURES

A GUEST EDITORIAL WRITTEN BY A LEADING CONSERVATION PROFESSIONAL

As humans contemplate the future of the world, at least three stories of nature have emerged. In one story, the earth's natural systems continue to be degraded as the human population grows and global system failure is the story's end. In a second more optimistic narrative, the possibility of recovery is envisioned—population sizes decline and we restore and return to times of the past. Yet a third narrative is one in which humans gain the power to manage nature and ecological problems through technology.

I prefer a fourth story. An intermediate story in which science is an essential element in enabling a future without permanent damage to the planet's living infrastructure. Our goal is a future in which natural ecosystems are sustained while providing essential services to a human population that shows no signs of a decrease in growth. For this to become a reality, many changes must be made and not only by societies, but by environmental researchers. Here, I focus on the latter.

The first change relates to the conceptual models that guide research. Ecologists have traditionally focused extensively on Earth's least disturbed areas such as wilderness areas, rain forests, and 'pristine' habitats. This focus has led to a tremendous understanding of how nature works, and how species interact to support ecosystems. But now we must build upon, and greatly extend, a newly emerging ecological framework that treats humans as components of that ecosystem.

After all, humans like all species influence their environment—they differ only in the extent of their influence. Our work must reflect an acceptance that people are integrated into nature, and always will be. All ecosystems must become fertile research ground, whether least impacted, managed, or highly degraded ecosystems.

**“Science is an essential element in enabling a future without permanent damage to the planet's living infrastructure.”**

—Margaret A. Palmer

The second major change that needs to occur, is the scope of research should expand. Ecologists must shift from a focus on the past—what ecosystems used to be and humans impact on nature—to a focus on the future. Ecologists must focus research on how to sustain ecosystem services given a future planet that over-exploits its resources (particularly the United States) and will continue to be over-populated. Conservation is no longer enough. Researchers must explore how best to restore ecosystems and design ecologically-sound solutions—essentially becoming inventors of the environment, responding rapidly to emerging problems.

This requires a deeper understanding of the ecological dynamics in human-dominated ecosystems. For example, biogeochemical cycles in urban watersheds must be vastly different than in undeveloped ('pristine') regions where the focus has typically been on water infiltration on vegetated lands and subsequent nutrient dynamics at the soil-plant interface. In cities, organic matter and nutrient cycling may be governed more by inputs from distant regions like stormwater networks or from atmospheric deposition.

The third, and perhaps the most important change needed, is ecological researchers must become proactive in translating and communicating their science for greater understanding and application. This will require breaking down barriers between researchers, the public, and policymakers. It will require collaboration with other disciplines and with the private, governmental, and non-governmental organizations. Ecologists are quite accustomed to working in interdisci-

plinary teams, but rarely have they worked side-by-side with engineers, landscape architects, city planners, etc. It's time for such collaborators to develop new tools when ecologists identify needs. It's no longer okay to say, 'we don't have enough data yet' if problems are pressing and a decision must be made immediately. Ecologists must provide the best available information and provide expert opinions based on his/her experience. This does not mean moving into an advocacy role. It simply means providing the best possible information and couching that in terms of appropriate levels of uncertainty.

Effective use of ecological knowledge also requires a public that is better educated ecologically. With such awareness, and with the changes outlined above, there is hope for that fourth story where we move closer to sustaining the world's ecosystems despite an over-populated and over-exploited planet. While environmental scientists alone cannot solve all the problems, they have much to contribute.



Margaret A. Palmer, is a professor of biology and entomology at the University of Maryland in College Park, Maryland. She recently chaired a 20-member panel of ecologists to develop an

action plan for the Ecological Society of America based on some of the ideas raised above ([www.esa.org/ecovisions](http://www.esa.org/ecovisions)). Her research is focused on stream and river restoration, particularly in urban settings.