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EDITORIAL

Big Questions for a Small Planet

One of the defining social themes of the decade has been ecological awareness. Consequently, ecology now stands at the interface between science and public policy. Pressure groups, citizens, and policy-makers can draw on ecological research to form opinions on the "big questions" facing the planet: what to do about climate change, biodiversity, population control, and other pressing matters. So the issue of how ecologists gather information, and how that information can be applied, becomes tremendously important. In a special section this week, we examine the status of large-scale ecology.

The discipline of ecology, once largely devoted to observing natural systems, now often seeks to understand them through experimentation. Two articles deal with diverse experimental approaches. Lawton examines model systems, focusing on his Ecotron facility (page 328), which can house up to 40 species of plants, herbivores, parasitoids, and decomposers; its beauty is that the role of individual components can be isolated. In contrast, on page 324, Carpenter and colleagues review large-scale modulation of entire ecosystems, such as large ocean areas. But this experimental zeal has also prompted a backlash from researchers who feel that many experiments are disconnected from natural history and teach us little about the real world. A news story on page 313 chronicles this debate.

Our understanding of the influences that shape ecosystems also depends on the scale at which we view them. There are, for instance, three traditional approaches to studying atmospheric changes and their ecological effects: (i) scale-down, (ii) scale-up, and (iii) scale-up with embedded scale-down components. Root and Schneider, on page 334, present a new paradigm, strategic cyclical scaling. This involves an alternation of big (global) and small (ecological) studies. If adopted, this approach will pull together research communities that rarely interact at present. Altering the "top-down" view of ecosystems to a broader perspective also has prompted ecologists to reformulate the classic concept of "keystone species," as detailed in a news story on page 316. Scale also looms large in Pickett's analysis of landscape ecology on page 331, which emphasizes human influence in shaping ecosystems.

That influence is also featured in three papers assessing our impact on the health of the planet. First, biodiversity. Pimm establishes a "background" rate of extinction (in the absence of people), then factors in the effect of humans, which is both negative and dramatic. Second, the vexing question of human population growth. Numerous predictions of Earth's carrying capacity have been made. On page 347, Cohen describes how they were arrived at and how much credibility they have. One limit on carrying capacity is the sustainable yield of crops, and in the third analysis Daily looks at the status of Earth's vegetated terrestrial surface. On page 350, she reports that 43 percent has been slightly or greatly diminished and summarizes steps that must be taken to reverse this unhappy trend.

Such steps imply large-scale conservation, of course, which in return requires large-scale public support. It seems to be there. On page 354, Bloom reports on two international public opinion surveys that revealed an overwhelming belief that it is the responsibility of governments to take action on ecological preservation issues, and a healthy majority who think that their government does not spend enough money doing so. Two attempts, with wide public support, to change this pattern—one successful conservation program in Florida and a less successful one in Europe—are contrasted in news stories on pages 318 and 320.

And if these patterns are not changed? Forecasting the future is hard, but Myers takes on this difficult task on page 358. He cites two possible sources of nasty surprise. First, environmental discontinuities: Ecosystems can absorb a certain amount of stress without noticeable effect, but once a critical level is reached the disruption may be cataclysmic. Second, synergies: the interaction of two or more environmental processes of which the outcome is not additive but multiplicative.

Emerging from this overview is a clear sense that ecologists have developed valid ways of exploring natural systems. Their conclusions about changes to those systems are not to be taken lightly.

Richard B. Gallagher, Joshua Fischman, and Pamela J. Hines