Evidence for Biodiversity Action

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The imperative to protect species from extinction is one that to most readers of *BioScience* will hardly seem to need justification. Yet in the broader battle of ideas over how government should interact with citizens and deploy its resources, robust and up-to-date arguments about the importance of protecting the biosphere are essential. The value of individual species is not apparent to everyone.

In recent decades, the notion of ecosystem services has done much to bring home the importance of natural capital to a broader public. And despite the objections of thinkers who maintain that putting dollar values on such services misrepresents humans' relationship with nature, the potential importance of this idea for justifying conservation in policymaking seems beyond dispute.

A recent study published in *Nature* provides important quantitative support for the general importance of biodiversity in key ecosystem processes that, in turn, govern the provision of ecosystem services. David U. Hooper and his coauthors (doi:10.1038/nature11118) combined previous meta-analyses, a new assessment of 192 studies of the effects of species richness on ecosystem processes, and 16 published experimental studies in which plant species richness and an environmental variable were factorially manipulated. The specific measures that Hooper and colleagues examined were primary productivity and decomposition, which profoundly affect ecosystem function almost everywhere. They then compared the magnitude of the effects of species richness with those of other environmental influences.

The results, in a nutshell, showed that both productivity and decomposition—particularly productivity—will be strongly affected by credible levels of biodiversity loss in the coming decades. Depending on the proportion of species lost, the effects on these measures were comparable in magnitude to acidification, increased ultraviolet light, warming, excessive nutrients, and increased carbon dioxide. Moreover, Peter B. Reich and his colleagues (doi:10.1126/science.1217909) demonstrate that in two long-term studies, the effects of biodiversity on productivity became more linear—and therefore important—over time.

These studies are significant steps toward understanding the importance of biodiversity for ecosystem functioning in quantitative terms, although much remains to be done. Ecosystems vary, for one thing. Understanding thoroughly how their functions typically translate into services valuable to humans will be more work still. However, the new work solidifies the case for effective government action as a default mode to conserve species.

In principle, such action is already mandated in the United States, chiefly by the Endangered Species Act, but the complexities and weaknesses of implementation of the act are legion. Some of them are illustrated by Maile C. Neel and her colleagues in their study of delisting decisions in this issue of *BioScience* (p. 646). The same might be said of the examination of specific conservation actions by D. Noah Greenwald and his coauthors (p. 686); peer review by scientists is, it seems, often given short shrift in actual decisions. Such scrutiny of the effectiveness of government action in conserving biodiversity in particular cases is as vital as big-picture evaluations of biodiversity's relevance. Combining the two approaches will be essential to winning in the battle of ideas.

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