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The nature and scale of ecosystem functions, such as carbon-fixation and nutrient cycling in a freshwater pond, appear to be governed by complex reciprocal interactions involving physical, chemical and microbiological factors. Moreover, these interactions continuously create new microbial niches that are quickly filled from the resident pool of rare and 'cryptic' (and probably cosmopolitan) microbial species. This could mean that microbial activity and diversity are both a part of, and inseparable from, pond ecosystem function, and that concepts such as 'redundancy' of microbial species, and the 'value' of conserving biodiversity at the microbial level have little meaning.

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A substantial worldwide scientific effort is currently directed at understanding the role of biodiversity in the natural environment. This area of science is, however, not new. Darwin believed that species-rich plant communities were more productive, Elton (1958) advanced the hypothesis that "diversity begets stability" and, from the early 1970's, much theoretical and experimental work has probed the tangled web of biodiversity–stability–productivity relationships, in terrestrial ecosystems in particular. What *is* new is that the questions have become more specific. Specific ecosystem functions such as carbon-fixation and nutrient cycling are identified and quantified, and the relation of these functions to the species richness of natural and manipulated communities is examined in detail. At the heart of all such studies is the desire to discover if it makes any difference how many species are present: perhaps some species are 'redundant', and ecosystems perform just as well with fewer species.

There is now a consensus, drawn largely from work with manipulated terrestrial systems (Naeem et al. 1994, abundance of individual species, ecosystem functions that are more stable over time, and productivity that tends to be higher. There is some doubt, however, that this general picture also applies to the real biodiversity of real ecosystems, in which many hundreds of species are involved. Tilman's work with terrestrial plant communities indicates that the biggest gains in stability and productivity come with the first ten species. Additional species do not appear to bring significant additional 'benefits', perhaps because all available functional niches are already filled. This could indicate that natural ecosystems, often containing very large numbers of species, have much greater diversity than is ever likely to be needed to reach peak productivity. Does the apparent surfeit of plant species have any role to play with respect to ecosystem function?

This question is difficult to answer for terrestrial communities of higher plants and animals, and the problem is essentially one of spatial and temporal scale. For example, we may suspect that niche diversification in a forest is more intricate than can easily be observed

Tilman 1996, Tilman et al. 1996), that increased species-richness brings increased variation in population because of small spatial differences in environmental conditions in the soil or canopy: the 'redundant' species

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Abstract:

The nature and scale of ecosystem functions, such as carbon-fixation and nutrient cycling in a freshwater pond, appear to be governed by complex reciprocal interactions involving physical, chemical and microbiological factors. Moreover, these interactions continuously create new microbial niches that are quickly filled from the resident pool of rare and 'cryptic' (and probably cosmopolitan) microbial species. This could mean that microbial activity and diversity are both a part of, and inseparable from, pond ecosystem function, and that concepts such as 'redundancy' of microbial species, and the 'value' of conserving biodiversity at the microbial level have little meaning.