Downing of the University of Montreal.

The plots with many species regained their productivity a year later; those with five or fewer species took more than four years to recover, the researchers report in the Jan. 27 NATURE.

"[This work] demonstrates clearly that species diversity can make a difference in ecosystem-level characteristics," comments Peter M. Vitousek, an ecologist at Stanford University.

Under the right conditions, a field with just one species can produce as much biomass as one with many plants. This observation had led some to suggest that the existence of lots of kinds of plants doesn't add much to the health of an ecosystem because those species are "redundant." This study shows otherwise.

"Biodiversity really is an insurance policy against catastrophe," Tilman says. "Areas with more species are more stable."

The presence of enough different plants ensures that some can withstand whatever stress nature provides, be it fire, flood, drought, disease, or insect pest, he holds. Diverse fields are more likely to include plants that can tolerate the stress. Those plants use nutrients freed up by the loss of less fit species and help maintain the overall productivity of the ecosystem.

Earlier, Tilman had examined the drought's effect on species diversity, restricting his analysis to the unaltered plots. In this subset, the average number of species present dropped from 13 before the drought to eight in 1988. Only in 1993 did they see those species numbers rise again, Tilman told SCIENCE NEWS.

The second study evaluated species diversity in normal conditions. For nine months, John H. Lawton maintained 16 1-square-meter plots in special chambers at the Natural Environment Research Council Center for Population Biology in Ascot, England. He subjected plots with two to 16 plant species and increasing numbers of soil critters and herbivores to controlled conditions, then monitored changes in ecosystem function.

Unpublished data from the study indicate that the simpler the ecosystem, the less able it was to take up carbon dioxide and the faster decomposition occurred. Species numbers also affect the cycling of water and nutrients, but in varying ways, Lawton told SCIENCE NEWS.

Previously, he had argued that species number may not matter much to ecosystem function. However, "diversity makes a hell of a difference," he says now.

Vitousek and Lawton note that these two studies deal with just a few dozen species. It is unclear whether the correlation between biodiversity and ecosystem health holds in situations where many species coexist. Lawton suspects that those species may be redundant in normal conditions, such as those he studied, but may prove vital in catastrophes.

Nevertheless, this information applies to all ecosystems, even managed ones. "I think it will probably affect how people manage resources," Vitousek says. "I suspect they will hedge their bets more than they did." — *E. Pennisi*

Gamma-ray bursts: A distant stretch?

Like firecrackers exploding in the night sky, gamma-ray bursts unleash a torrent of high-energy photons before fizzling out hundredths to tens of seconds later. These flashes of radiation rank among the most mysterious phenomena in the universe: No one has found the sources of the bursts, and it's uncertain whether the flashes originate within our galaxy or far beyond.

A new analysis of bursts detected by the Compton Gamma Ray Observatory (GRO) spacecraft adds to the evidence that the flashes originate billions of light-years beyond the Milky Way. The finding suggests that the bursts serve as probes of the distant cosmos and bear the imprint of the expanding universe, astronomers reported last month at a meeting of the American Astronomical Society in Arlington, Va.

GRO findings first made headlines in 1991, when a set of on-board detectors revealed that gamma-ray bursts are distributed uniformly across the sky (SN: 9/28/91, p.196). Sources in a giant, as yet unseen halo surrounding our galaxy might produce the uniform sprinkling. Alternatively, bursts scattered throughout the cosmos could account for the distribution. If the flashes do come from far away, then the most distant ones should last longer than those emitted closer to our galaxy, Bohdan Paczynski of Princeton University and Tsvi Piran of the Hebrew University of Jerusalem independently predicted in 1992.

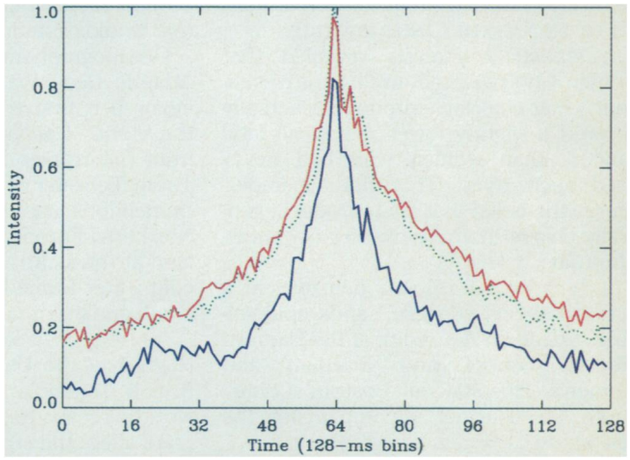
That stretching effect, known as time dilation, arises as a consequence of the expansion of the universe. Objects near the edge of the observable cosmos recede faster from Earth than objects nearby. Thus, according to Einstein's theory of relativity, observers should find that the more distant bursts last longer. These bursts will also be shifted to longer, or redder, wavelengths, a phenomenon called redshift.

In analyzing more than 700 bursts detected by GRO, astronomers now report that 60 relatively dim flashes last about twice as long, on average, as 46 of the brightest. Dim bursts also appear redshifted, says study collaborator Robert J. Nemiroff of George Mason University in Fairfax, Va.

If one assumes the bursts appear faint only because they lie farther from Earth, then the findings support the notion of an expanding universe and an origin for the dimmest GRO bursts several billion light-years beyond our galaxy, Nemiroff asserts.

Team leader Jay P. Norris of NASA's Goddard Space Flight Center in Greenbelt, Md., cautions that the findings do not prove that bursts lie outside our galaxy, but they show time dilation "does exist and must now be accounted for by any theory." This time dilation is the first found for any celestial radiation source, Paczynski adds.

Because bursts vary widely in shape and duration, the researchers couldn't directly compare individual flashes. Instead, they statistically analyzed groups of dim and bright bursts. In contrast, J. Patrick Lestrade of Mississippi State University in Starkville and his colleagues reported last year that they had seen direct hints of time dilation among a small group of 20 bursts detected by GRANAT, a Soviet-French satellite.



Dim gamma-ray bursts detected by GRO (red) last on average slightly longer than less-faint bursts (green) and about twice as long as the brightest ones (blue).

Norris *et al.*, ASTROPHYS. J. (April 1, 1994)

Paczynski says the new results, combined with the bursts' uniform distribution, offer compelling evidence that the flashes are extragalactic. But Stirling A. Colgate of the Los Alamos (N.M.) National Laboratory asserts that until astronomers observe the bursts at other wavelengths, it's too soon to make such pronouncements. — *R. Cowen*