

plants dominate in North America.

Parsimonious in their use of nitrogen, prairie grasses can thrive where access to this nutrient is limited, Wedin observes. Adding this nutrient gave the C3 weeds—nitrogen hogs by nature—the toehold they needed to begin invading prairie plots, he and David Tilman of the University of Minnesota in St. Paul report in the Dec. 6 SCIENCE.

As the weedy immigrants died, their considerable nitrogen stores spurred the growth of nitrogen-starved soil microbes that break down plant matter. These microbes, in turn, rapidly released much of the weeds' building blocks into the environment, permitting nitrogen to run off as water pollution and carbon to

reenter the air.

The naturally slow decomposition of prairie plants, in contrast, ensures that most of their constituents become stored in the earth. Indeed, this is how prairies built the U.S. farm belt's rich soils.

The rapid decomposition of weeds should dampen the spirits of energy policy analysts, says plant ecologist Ernst-Detlef Schulze of Bayreuth University in Germany. These "technocrats" had argued that by spurring plant growth, the nitrogen in acid rain would help industrialized nations sop up more of the carbon that their fossil-fuel burning is emitting as carbon dioxide, he says. Such carbon releases threaten to trigger a global warming.

The new study now shows the fallacy in that reasoning, Schulze says.

He notes that the loss of prairie species provoked by adding nitrogen "in many cases caused carbon storage to be more than halved."

Adds Tim Seastedt of the University of Colorado at Boulder, "this is a beautiful example of an ecosystem feedback," where pollution can "induce changes in species composition that alter the ecosystem to guarantee the new species will persist." Globally, however, other human activities may compensate for these changes, Seastedt notes. For instance, some Mexican C3 shrub lands are now being converted to C4 grasslands.

— J. Raloff

Radio search finds few distant quasars

They lie far away and can reveal what the universe looked like long ago, yet the stars of distant galaxies are often too faint to be seen. In contrast, quasars, the brilliant searchlights that reside at the heart of some galaxies, stand out prominently. So for several decades, astronomers have sought to map the distribution of galaxies by tracking distant quasars.

As astronomers have used quasars to probe further back in time, they have found that these powerhouses are increasingly scarce beyond a certain distance, referred to as a redshift of 3. This distance corresponds to a time when the universe was about one-fourth its current age and may mark a significant epoch in galaxy formation or development, many astronomers speculate.

Other researchers find that reasoning flawed. Visible light emitted even by the brightest quasars, if they are extremely remote, can be quenched by dust lying between those bright bodies and Earth. These researchers argue that a large, unseen population of distant quasars may exist behind intergalactic dust.

Now, Peter A. Shaver of the European Southern Observatory in Garching, Germany, and his international team of colleagues say they have closed that loophole. By observing quasars at radio wavelengths, a part of the electromagnetic spectrum unaffected by dust, they have confirmed previous findings that the number of quasars starts dwindling beyond a redshift of 3.

In particular, although they identified

25 radio-emitting quasars corresponding to the time when the universe was about 20 percent of its current age, they found none representing the period when the universe was half as old.

Fewer than 10 percent of all known quasars are strong radio emitters, but Shaver believes they may be representative of the total quasar population. He and his colleagues report the results of their 4-year study in the Dec. 5 NATURE.

"It seems that the decline is real, and we are seeing the epoch when quasar

activity began," comments Patrick S. Osmer of Ohio State University in Columbus.

The significance of the finding is still open to interpretation, notes Shaver. The era when quasars first began forming may indicate the time when most galaxies began making stars and had concentrated enough matter at their cores to produce quasars. However, if quasars are primarily the product of galactic collisions (SN: 11/23/96, p. 326), then their debut may signal the onset of a later stage of cosmic evolution, when fully formed galaxies began to gather into clusters and merge.

— R. Cowen



John Barvain/NASA

Visible-light image of a nearby, radio-wave-emitting quasar.

Smallest frog leaps into the limelight

While hunting for a rare woodpecker in the Cuban rain forest, a team of biologists halted to listen to an unfamiliar chirping coming from the forest floor. Although their avian quarry eluded them, they returned with a member of what they now report is the smallest frog species in the Northern Hemisphere. Shown here at 3.5 times life size, the frog rests on a Cuban coin the size of a U.S. nickel.

"We got down on our hands and knees to find them," says S. Blair Hedges of Pennsylvania State University in State College. Hedges credits his colleague Alberto R. Estrada of the Institute of Forest Investigations in Havana with finding the first of the new species, which they informally call the eleuth frog after its genus, *Eleutherodactylus*. The scientists will give the species a formal Latin name in an upcoming issue of COPEIA.

"This frog is probably at the limit of how small they can get," says Hedges. Less than 10 millimeters long, it shares the title of world's smallest frog with a distantly related Brazilian cousin.

The eleuth frog shows many traits typical of miniaturized species, says James Hanken of the University of Colorado at Boulder. For example, it produces only one egg at a time. Moreover, it lays its eggs out of the water and they hatch into developed frogs instead of tadpoles.

"This allows tiny species to avoid predation in ponds and streams as larvae," he says.

Hedges plans to return to Cuba this summer. The island sports many other tiny species, including a bee hummingbird, the smallest bird.

— D. Vergano



M. Lammertink/COPEIA