Earth Science

Where has all the carbon gone?

Like a continent-size sponge, the forests, wetlands, and lakes of North America may be sopping up more than a billion tons of carbon from the air each year, thereby helping to slow down the rate of global warming, according to a controversial report issued last month by a team of atmospheric scientists.

The group, led by researchers at Princeton University, was seeking to ferret out the secret hiding places for much of the carbon dioxide emitted into the atmosphere each year. The burning of fossil fuels spews about 5.5 billion tons (gigatons) of carbon into the air annually, supplemented by another 1.6 Gt from tropical deforestation. Less than half of that total stays in the atmosphere, however. Roughly 2 Gt get stored in the ocean, and the rest has been disappearing somewhere on land.

Past studies have steered researchers toward the Northern Hemisphere. To pinpoint the secret carbon sink, the Princeton researchers and their colleagues analyzed measurements of carbon dioxide concentrations upwind and downwind of each continent. In the Pacific, upwind of North America, concentrations tended to be higher than in the Atlantic, say the researchers. By feeding these data into models of atmospheric circulation, the researchers found indications that North America is taking up 1.2 to 2.2 Gt per year, whereas other regions are absorbing little, they report in the Oct. 16 SCIENCE. That whopping amount for North America roughly equals the greenhouse gas pollution from the continent, says coauthor Pieter P. Tans of the National Center for Atmospheric Research in Boulder, Colo.

The news comes as a shock to ecologists. "It's very hard to understand ecologically why North America's forests are acting this way and the rest of the world's forests are not," says Yadvinder Malhi of the University of Edinburgh in Scotland. In the same issue of SCIENCE, Malhi and his colleagues report results from a study of carbon storage in tropical forests. Their analysis, which collated 600,000 measurements of tree diameters, indicates that South American forests are taking in 0.3 to 0.9 Gt of carbon a year, about the same amount lost through deforestation. It is hard to reconcile the results of these two studies, says Malhi, because when the numbers for North America and South America are added together, they equal or exceed the presumed size of the missing sink.

One way out would be if North America stores less carbon than the new report suggests. That is in fact the finding of Peter Rayner of Monash University in Melbourne, Australia, who calculates that North America absorbs only about 0.5 Gt a year.

Tans says that researchers need to perform more studies, especially those that analyze soils, forests, and wetlands, to see how much carbon these regions are storing. —*R.M.*

A rock that lies about its age

The age of some rocks in India has proved more elusive than that of a Hollywood starlet. Last month, paleontologists reported finding worm burrows in a 1.1-billion-year-old sandstone. These marks are more than a half-billion years older than any other signs of animal life. An Indian geologist then challenged this discovery when he reported finding shells that date the rocks to less than 545 million years old (SN: 10/17/98, p. 255).

Now, the younger age has drawn criticism. At a meeting of the Geological Society of America in Toronto last month, Nicholas J. Butterfield of the University of Cambridge in England announced that he had taken a look at the supposed shells and dismissed them as artifacts created when the rock was dissolved in acid during the laboratory analysis.

The new turn of events suggests that the rocks may indeed be ancient, but it doesn't resolve whether animals made the traces. "I've got a problem with these traces because there's a missing 500 million years" during which there is no other evidence for animal life, says Butterfield. —*R.M.*

Environment

Alien seaweed is aquarium escapee

New genetic tests confirm what biologists had long suspected: Aggressive alien algae blanketing ever larger patches of the Mediterranean seafloor (SN: 7/4/98, p. 8) appear to be clones of specimens in several major aquariums—and demonstrably different from any wild members of their species. This *Caulerpa taxifolia* appears to be so genetically distinct from its brethren elsewhere in the wild that it likely constitutes a new strain, European researchers say.

Olivier Jousson of the Marseille Center for Oceanology in France and his coworkers deciphered a characteristic stretch of the DNA sequence from 18 separate specimens of the species: 2 from the Caribbean; 1 from Japan; 10 from the Mediterranean; 4 from public aquariums around the world, including one in Hawaii; and 1 from an aquarium shop in Geneva. They also sequenced the same genetic span from four other species of wild *Caulerpa*.

In the Oct. 22 MARINE ECOLOGY PROGRESS SERIES, Jousson's team reports that its analyses "revealed the presence of a striking similarity between all of the Mediterranean and aquarium *C. taxifolia*." Asked to elaborate, the Marseille Center's team leader, Charles F. Boudouresque, told SCIENCE NEWS that the analyzed DNA sequences in all 14 plants in the Mediterranean and aquariums are identical and likely trace to a common aquarium source. His team has since found the identical seaweed in two more aquarium shops, suggesting the alga is still being sold in the aquarium trade despite calls for bans (see following story). —*J.R.*

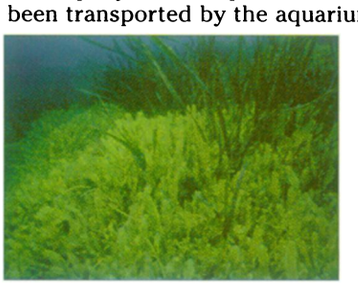
U.S. ban urged for alien alga

France, Spain, and Australia have banned the possession of the aquarium-bred *Caulerpa taxifolia* out of fear that accidental releases of this seaweed into open waters could lead to the ruin of local ecosystems, much as it is overtaking and smothering the northern Mediterranean seafloor. Last month, 107 ecologists and exotic-species research scientists petitioned the Interior Department to institute a similar U.S. ban on the alga.

"It seems pretty clear that the Monaco aquarium was responsible for introducing this [alga] into the Mediterranean," says petition organizer Andrew N. Cohen of the San Francisco Estuary Institute in Richmond, Calif. Because even a shard of the seaweed can spawn a new specimen, *C. taxifolia* rapidly established itself in the Mediterranean, the petition notes, forming "monoculture stands whose impact has been compared to unrolling a carpet of Astroturf across the bottom of the sea."

U.S. regulators are aware of the seaweed's threat and are exploring ways to ban it, says Robert Peoples of the U.S. Fish and Wildlife Service in Arlington, Va. The Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 probably offers the best legal basis for such an action, he says. He expects that in a few weeks, the task force that decides what species to list under the law will consider adding this alga. If a case can be made that its introduction would be deleterious, a ban might be possible "in 6 months or even less," Peoples says.

That's none too soon, Cohen says. A report he prepared to accompany the new petition lists 244 organisms that have been transported by the aquarium trade and released into U.S. waters outside their native range—in many cases, allowing species free of predators to endanger or extinguish native species. —*J.R.*



Alexandre Meinesz/Univ. of Nice

Alien algae smothering indigenous Mediterranean-floor ecosystems.