MEETING ECOLOGICAL SOCIETY OF AMERICA

Superweeds, and a Sinking Feeling on Carbon Sinks

MADISON, WISCONSIN—More than 3000 ecologists gathered here from 5 to 10 August for the 86th annual meeting of the Ecological Society of America (ESA). Hot topics included trees and global warming, the risks of transgenic crops, and vanishing tropical mammals.

Forests: No Greenhouse Antidote?

Some experts claim that the world's forests can absorb enough carbon dioxide to reduce the impact of further global warming. But at least one type of hardwood forest may not be up to the job. Rather than storing extra carbon in long-lasting trunks and branches, an experimental sweetgum stand in Tennessee socks most of the CO_2 in tiny roots that rapidly die and decompose. That process sends the gas right back into the atmosphere.

Researchers have long wrangled over the ability of forests to serve as carbon sinks for excess greenhouse gases. It's clear that saplings in open-top enclosures respond to high CO_2 with growth spurts, stepping up photosynthesis and making more leaves and wood than would trees sucking unadulterated air. But what's true for a stand of saplings may not be true for a mature forest, says ecologist Rich Norby of Oak Ridge National Laboratory in Tennessee. That's because leaf coverage maxes out as a tree matures—putting limits on photosynthesis and, thus, on its capacity to soak up excess CO_2.

To find out how much CO_2 mature trees can absorb, Norby and colleagues built towers 4 years ago to pump CO_2 into the canopies of four stands of young sweetgums. As Norby reported at the meeting, during the first year most of the extra carbon went into wood, with the gassed-up sweetgums accumulating 35% more carbon than control trees grown in unsupplemented air. But 2 years later, that wood differential had narrowed to 7%. More than twice as much carbon as in the controls ended up in the fine roots—thin structures that fall off and die each year. Soil organisms quickly consume the detritus, releasing CO_2 that diffuses out into the air.

Leaky sponge. Sweetgum forests like this one may not do much to curb greenhouse warming.

CREDIT: ORNL

Forest ecologist Adrien Finzi of Boston University calls the results "really interesting" but cautions that they may not hold true in other forests. The mechanism of carbon storage certainly differs in an experimental pine stand he studies in North Carolina. Although the loblolly pines there exposed to extra CO_2 also store less extra carbon in wood after a few years as they run short on nutrients such as nitrogen (*Science*, 6 April, p. 36), the carbon ends up primarily in leaf litter, not the fine roots. That suggests to Finzi that researchers must check more than a couple of stands to understand how different forest types respond to high CO_2 levels.

The bottom line for sweetgum and loblolly pine, anyway, is that neither leaf litter nor fine roots offer long-term carbon storage. For that reason, says biogeochemist William Schlesinger of Duke University, planners shouldn't count on forests as CO_2 saviors. "These terrestrial sinks," he contends, "are just not adding up to much."

—DAN FERBER

Breeding a Hardier Weed

In the vitriolic debate over the potential risks of transgenic crops, one big concern is that wild relatives may commandeer valuable traits and turn into "superweeds" that spread, unchecked, across the land. Two new studies add hard data to what has been mostly a theoretical discussion. One finds that genes from a crop can persist in a weed for many generations, while a second supports the idea that if genes that protect against viral infection slip into wild plants, there could be serious consequences.

Although neither finding pins down the risks, these and other studies have convinced some ecologists that genetically modified (GM) crops are being rolled out too hastily. "We really need a lot more data before we make assumptions" about safety, says Alison Power of Cornell University in Ithaca, New York, who presented her work on viruses.

Conventional wisdom says that crop traits are unlikely to persist in the wild in part because crossbreeding crops and weeds yields hybrids that tend to reproduce poorly. "In the crop-breeding and weed science world, there's always been a feeling that crop genes would not persist," says Allison Snow of Ohio State University in Columbus, who described a 6-year experiment on half-wild, half-crop radishes planted next to wild radishes in Michigan. Snow's group found that crop genes had no trouble sneaking into the weeds—and staying there.

While the first cross between these relatives (the F1 generation) had low fertility—as few as 60% made seeds—several traits, including white flowers and variants of two enzymes, showed up in subsequent generations of wild radishes. And second-generation hybrids—crosses between F1 and wild plants—grew almost as well as the wild radish. Although it's not a big surprise that traits showed up in the wild radishes, "it's important to quantify persistence," says plant scientist Neal Stewart of the University of North Carolina, Greensboro. Radish, he notes, "is a very nasty weed."

But whiter flowers and a more croplike metabolism are hardly the makings of superweeds. What might help weeds outlast the competition, however, is if a jumping gene they acquired were able to help them fend off viral attack, says Power.

Her test case is crops modified to resist the barley yellow dwarf virus. To find out whether the trait could give a leg up to wild plants, Power first looked at whether the virus shows up much in nonagricultural ecosystems. The team tested for virus in wild grasses near Ithaca. Surprisingly, up to 60% of samples of 16 grasses, including