MICROBIOLOGY

Neither Cold Nor Snow Stops Tundra Fungi

A team of researchers has discovered a winter wonderland under the snow, populated by huge numbers and new kinds of microscopic fungi. These organisms are powerful, underappreciated drivers of tundra ecosystems, says Steven Schmidt, a microbiologist at the University of Colorado, Boulder. Their presence could force researchers looking at global climate change to revisit their models of where and how much carbon dioxide, nitrogen, and other substances are produced, he adds.

Until recently, researchers thought that cold temperatures suspended metabolism and growth of microorganisms in soil communities under the white blanket of snow. Schmidt, however, was puzzled to find that melting Colorado tundra snow released large amounts of organic nitrogen in the spring. Over the past 20 years, other biogeochemists had come across signs of life under the snow, such as unexpected quantities of methane and carbon dioxide. But only with the new study, on page 1359, is the extent of this hidden community revealed. Schmidt and his colleagues "demonstrate for the first time that undersnow soils are physiologically a very active environment," says Ursula Peintner, a mycologist at the University of Innsbruck, Austria.

Schmidt's graduate student, Christopher Schadt, made visits to a snow-covered grass meadow in the Rocky Mountains for 3 years. He took soil samples during winter, the spring snowmelt, and the dry, sunny summer. With the help of microbial ecologist David Lipson, now at San Diego State University in California, Schadt found that the weight and volume of the fungi—their biomass—fluctuated seasonally, reaching the highest level during winter. "That this peak of biomass production is reached under the snow is an amazing result," says Peintner.

Snowmass. In wintry alpine and tundra environments, fungi are hard at work despite the cold.

Bacteria are the other abundant microbes in most soil communities. The proportion of fungi to bacteria varied seasonally, the samples revealed. In winter, fungal biomass was about 15 times that of bacteria, whereas in the summer the fungi were about six times more productive. The biomass of the fungi alone was about three times higher during the winter than the summer, and as the dominant organism, the fungi produced most of the carbon dioxide emanating from the snow-covered soil, Schmidt's team reports.

The seasonal changes make sense, says Cathy Cripps, a mycologist at Montana State University, Bozeman. During the winter, microbes must make do with cellulose-rich grass. Fungi are much more adept than bacteria at digesting cellulose, so they dominate the soil ecosystem. By summer, plant growth floods the soil with the starches and sugars that bacteria thrive on, and they catch up to fungi in abundance.

The researchers then determined what fungi they had gathered. "We expected these fungi would be the ones that people had studied before," says Schmidt. But the DNA isolated from the soil samples told a different story. After matching 125 sequences against known fungal DNA, they discovered they had about 100 different kinds of fungi. These included specimens that represented three major new branches on the fungal tree, an amazing number that speaks to how much biologists have yet to learn about fungi, says Cripps: "These are really harsh environments, and yet there's still all this diversity." —ELIZABETH PENNISI

SCIENCE AND REGULATION

A White House Mandate for More Peer Review

Is the government intent on improving its technical decisions or merely slowing down the regulatory process? That's a question critics raise about a new proposal from the Bush Administration to require agencies to peer review all scientific evidence that shapes a major regulatory decision. The guidelines, due out this week in the *Federal Register*, detail exhaustive procedures that agencies must follow, from tallying which documents will be reviewed to screening out anyone with a potential conflict of interest.

The new guidelines should raise the quality of federal rulemaking and lower the chances that the rules will be overturned in court, says John Graham, chief of the White House Office of Management and Budget's Office of Information and Regulatory Affairs. That's "good for consumers and businesses." Some scientific experts take Graham at his word, noting that the proposal enshrines a basic scientific process. It's "an excellent idea," says Harvey Fineberg, president of the Institute of Medicine. "Peer review is not going to eliminate controversy, but [it can] defuse one kind of criticism."

But others worry that the changes will make it much harder for government agencies to issue new regulations. "Is it just another attempt to slow regulation?" wonders Ellen Paul of the nonprofit Ornithological Council. The notice discusses at length the potential corrupting influence of agency funding on academic scientists but is almost silent on industry-funded researchers, complains law professor Rena Steinzor of the University of Maryland School of Law in Baltimore: "This tilts the playing field."

The draft guidelines supplement the Data Quality Act, a 2001 law championed by industry that sets out new standards for information released by government agencies. The rules apply to documents issued after 1 January 2004.

In suggesting that agencies do a better job of applying peer review, the draft bulletin proposes a sliding scale. For some documents, publication in a peer-reviewed journal might be sufficient. For "especially significant information," however, an agency might need to assemble outside experts.

Agencies should also pay more attention to possible conflicts of interest. "Substantial funding" from an agency could disqualify a scientist, according to the guidelines, as well as publicly advocating a position on the matter at hand. A "biased" reviewer should be balanced by someone "with a contrary bias."

The Environmental Protection Agency (EPA) is already following most of these steps, says science adviser Paul Gilman. "This is pretty standard stuff," agrees Vanessa Vu, staff director for EPA's Science Advisory Board, which reviews the agency's major scientific documents. But Graham says the rules could require major changes at agencies such as the Department of Agriculture and the Army Corps of Engineers. The comment period ends 28 October. —JOCELYN KAISER

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