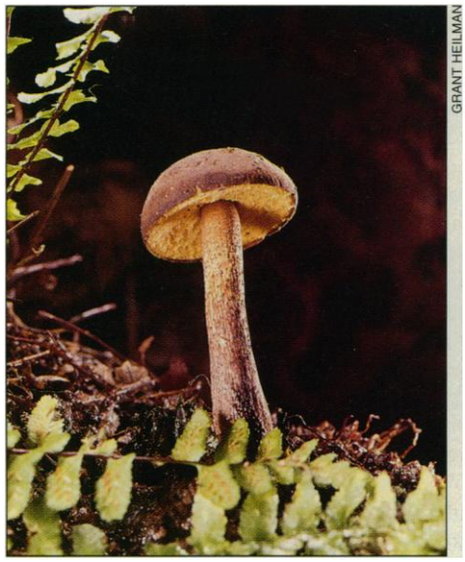
Disappearing Mushrooms: Another Mass Extinction?

As fungi vanish from Europe, scientists search for causes—and possible effects on forest ecology

ALL OVER EUROPE THIS YEAR, GOURMETS with a taste for the subtle flavors of fresh autumn mushrooms have been returning from their collecting trips with the same complaint: Where have all the fungi gone? Take the most prized fungus of all, the delicious, apricot-scented chanterelle: "A few years ago, it was easy to pick a basket in an afternoon," says Eef Arnolds, a fungal ecologist at the Agricultural University of the Netherlands. "Now, it's quite impossible. You can't find ten in one place."

If anyone can find the chanterelle, it should be Arnolds, who has spent two decades studying mushroom populations in Europe. Now, with his empty collecting basket and a grim set of data assembled from records of fungal foraging trips going back to 1912, he has come to the distressing conclusion that fungus species are in catastrophic decline throughout Europe. Other experts agree with him. "Mass extinction" is the term used by John Jaenike, an ecologist at the University of Rochester, who is concerned that fungi may also be vanishing from the United States. But no one knows for sure: As Arnolds points out, "There are no observations"—the United States does not have the long historical records of Europe.



GRANT HEILMAN

Shrinking crop. *Edible boletus mushrooms have become smaller and less numerous.*

Arnolds has ruled out overpicking as the culprit because both inedible and edible species are affected. And it isn't changing forest management practices, because fungi in all types of mature forest have shown a similar drop. And that, concludes Arnolds, leaves air pollution. Throughout Europe, there is a negative correlation between the abundance and diversity of fungi and levels of nitrogen, sulfur, and ozone in the air, he says. In Holland, the main offender appears to be farming, which uses prodigious quantities of nitrogen fertilizer, much of which is dispersed by the wind as hydrides and oxides of nitrogen and falls to Earth in nearby rainfall.

Any decline in the number of fungi has consequences that reach far beyond the disappointments suffered by a few gourmets: Without fungi, forests may not be able to survive. The fungi under threat mostly live in close symbiotic association with trees, providing water and minerals in exchange for carbohydrates. If trees lose their fungi, and the fine network of fungal filaments that extend the reach of their roots farther into the soil, they become much less resistant to stress. Thanks to the mass extinction of fungi, "severe frost or drought could lead to a mass dying of trees," Arnolds warns.

Quite how the excess nitrogen affects fungi is not clear. It could be an indirect impact of pollution on the tree, which does not grow as well, and hence cannot nourish a healthy crop of fungi, says Arnolds. Or it could be a direct effect of nitrogen and sulfur in the soil, which Arnolds' experiments show can prevent the fungus forming an association with the tree. Either way, the end result is an unhealthy tree.

The scale of the loss of fungi is vividly illustrated by Arnolds' records. Surveys carried out in the Netherlands between 1912 and 1954, for example, recorded an average of 71 species of fungus per foray. But by the period between 1973 and 1982, a matched series of 15 surveys could turn up only 38 species per foray. More recent field work tells the same story. Counting every fungal species in marked plots in Holland over the past 20 years, Arnolds found that the average number of species has dropped from 37 to 12 per 1000 square meters.

A half-dozen other fungus experts working in Germany, Austria, Czechoslovakia, Poland, and Hungary have charted similar declines. Johannes Schmitt, a mycologist at the University of Saarbrucken, has been visiting the city market since 1950 and weighing the annual crop of locally gathered wild mushrooms. The total weight on sale of chanterelle and bolete mushrooms—two species that form symbiotic relations with trees—has plummeted over the past four decades. So has the mushroom's average size: it took 50 times as many chanterelles to make up a kilogram in 1975 as it did in 1958.

England, too, may be facing a similar loss of fungi. A preliminary survey of 60 fungus species inspired by the dismal evidence from mainland Europe shows 20 species in decline. "There is a lot of concern," says mycologist Bruce Ing, conservation officer of the British Mycological Society, "and we feel we should be examining a lot more species with a lot more vigor."

Along with the decline in mushroom numbers is an equally worrying disruption in the way the pattern of association between fungi and trees changes over time. Normally, as a tree gets older, one species of fungus gives way to another in a steady progression. But something appears to have gone wrong. "The trees are getting older quicker," says Philip Mason, a mycologist at the Institute of Terrestrial Ecology outside Edinburgh in Scotland. "The tree is middle aged, but with old-age fungi," says Mason. The trees drop their leaves more readily and may die early.

Given that there appears to be an intimate two-way coupling between the health of the fungal population and the health of the tree population, the state of a forest's fungi could provide an "early warning signal of problems for trees," says Jaenike. He points out that "in Europe, fungi began to drop out before the trees," in areas where forests have been disappearing. That makes it sensible to begin monitoring fungal population in the United States too. He is hoping to get a project started with cooperation from amateur mycologists. But it won't be easy to monitor U.S. fungi.

"Many of the U.S. species are undescribed," says Jaenike. "Some genera are just very sketchily known, and there are no historical databases." That, Jaenike thinks, is because the United States does not have a long history of collecting—and eating—wild fungi. Europe's gourmets, it seems, can lay claim to a little credit for helping advance the science of mycology, even if they are now going hungry. ■ JEREMY CHERFAS