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Forests in Decline

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March/April 1985

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The other main progenitors of acid rain, nitrogen oxides, can also, in their gaseous phase, damage trees. Nitrogen is a powerful fertilizer, and both NO x and nitric acid can be absorbed through leaf tissue and put to work as nutrients. But when a plant is presented with an *overabundance* of food, two problems can afflict it. First, the roots may reduce their uptake of water and minerals from the soil, which may lead to drought sensitivity and mineral deficiencies. And second, to compound the initial problem, a tree may produce tender new growth after receiving a breath of NO x — even though autumn has arrived and a killing frost is on its way. The normal (protective) dormancy periods may be disrupted.

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Another clue to the puzzle of forest decline is that soils in many areas of heavy damage contain abnormally high levels of toxic heavy metals. We've already mentioned aluminum, but lead, cadmium, zinc, arsenic, copper, and chromium are also prevalent and harmful. On Camel's Hump in Vermont, lead has doubled, zinc is up 70%, and copper concentrations have risen 40% since monitoring began about 20 years ago. The Oak Ridge National Laboratory has identified toxic levels of zinc, copper, chromium, and aluminum in trees. Tentative results from soil tests on Mount Mitchell show concentrations of lead more than five times higher than would be normal for an *urban* area. All of these metals can stunt the growth of trees, make them more susceptible to disease, or even kill them outright.

The major sources of heavy metals are industry (largely smelters) and vehicles, and it's known that metallic compounds thrown into the air from smokestacks and tail pipes can travel some distance from their sources. Studies of the emissions from International Nickel's 1,250-foot-high stack show that 40% of the heavy metals that leave the chimney travel at least 35 miles before being deposited on the ground. Their mobility is probably linked to the acidity of moisture in clouds, which allows the metals to react with other compounds to form transportable molecules. Thus acid rain and toxic metals may again be "working together" in a damaging manner. There's also the possibility, however, that cars and trucks closer to the damaged trees are causing much of the problem.

I FEAR THAT WE SHALL NO MORE SEE . . .

It's clear, then, that there's little likelihood that the decline of forests around the world can be rightly attributed to a single pollutant. Scientists generally agree that the destruction is being brought on by an amalgam of atmospheric contaminants spewed forth by power plants, industry, and vehicles. It's true that this trend began in the U.S. before the Clean Air Act's provisions were in place, but there's quite a bit of evidence that the improvement in air quality since 1970 hasn't been sufficient to halt forest decline.

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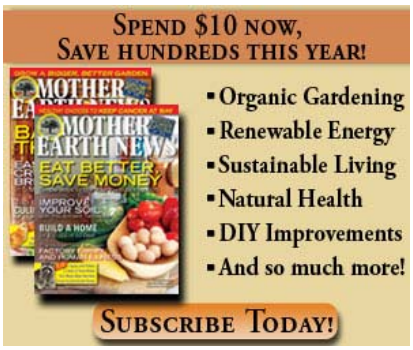

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