Air pollution and forests: A study still in its infancy

Despite widespread concern over the effects of pollution on living systems, one area, according to William H. Smith of Yale University, has been sadly neglected: the forest. The earth's forests play a major role in the hydrologic cycle, contribute many of the atmosphere's constituents, prevent soil erosion, harbor a large proportion of the wildlife and even regulate climate. Smith concludes that in spite of the acknowledged importance of the forest, little research has been done on the effects of air pollution on the forest ecosystem, and what research there is, he told the AAAS, is concentrated in the wrong places.

Smith divides the potential effects of pollution on trees into three categories. At low pollution levels, trees undergo no detectable change. Instead, the forest acts as a sink for contaminants. At higher pollution levels, individual plants may suffer subtle damage in the form of reduced growth, impaired reproduction, or greater susceptibility to disease. In the final, extreme case, trees are actually killed, and soil erosion, climate change or changes in the hydrologic cycle may ensue.

What little can be inferred about the forest's role as a pollutant sink, says Smith, is based largely on calculation. It has been suggested that vegetation is an important sink for ammonia, hydrogen fluoride, sulfur dioxide and ozone. A square mile of alfalfa, for example, can theoretically remove over 3,600 tons of sulfur dioxide from the atmosphere each year. The implications of a sink role for forests are even more speculative. Nitrogen gases could stimulate growth, says Smith. Chloride, fluoride and heavy metals may harm insects that feed on leaves or twigs. But they can also harm pollinators. It is impossible even to tell from present information whether a pollutant may be harmful or beneficial, he concludes.

Intermediate pollution levels might depress growth in a number of ways. Decomposition of forest litter is a source of nutrients, and there is evidence that heavy metal pollution depresses decomposition rates. Studies of agricultural plants have shown that ozone and nitrogen oxides suppress photosynthesis.

Other pollutants impair reproduction. Photochemical oxidants have reduced fruit yield of citrus trees. Ozone tends to reduce pollen germination in tobacco and corn. There has been little research on pollution's effects on growth and reproduction in forest trees, but Smith infers similar results.

Smith says evidence has accumulated to show that atmospheric contaminants predispose ponderosa pine to infestation by bark beetles. Sulfur dioxide causes the pores in the leaves to expand, admitting disease-causing microbes.

Finally, he lists a number of cases where pollution became so intense that great expanses of forest were wiped out. At the turn of the century, smelters at Copper Hill in Tennessee destroyed 7,000 acres of deciduous forest. Pines in the San Bernardino National Forest are now threatened by oxidants from nearby Los Angeles basin, and Smith predicts that if pollution continues unabated, ponderosa pine may be all but eliminated as a species.

Smith believes study of low and intermediate pollution levels should have highest priority as these levels are already at work on forests. □

Off the record . . .

Notably conspicuous by their absence from the AAAS meeting were some of the most prominent public officials of American science. Presidential Science Adviser Edward E. David Jr., National Science Foundation Director H. Guyford Stever, and National Academy of Sciences President Philip Handler, for example, were nowhere to be seen, even though the meeting was in Washington only a few miles from their offices.

There are several views on the subject. One is that these scientific-political illuminaries find little of use to them at such a meeting. Another reason advanced, probably a more important factor, is that the demonstrations and disruptions that have marked previous AAAS meetings have produced an unfriendly climate for heads of governmental and quasi-governmental institutions potentially the target of anti-establishment critics. One holder of such a view suggests that although the organization heads would be more than a match for the dissidents in an intellectual debate, they have no inclination to be the subject of tactics of disruption.

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Several attendees took note that Philip Handler shunned a reception for science writers covering the AAAS meeting, even though his Academy was one of 10 science institutions sponsoring the reception and it was held in the Academy's Great Hall.

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Of a panel of meteorologists speaking at AAAS on weather modification, none knew, or would venture an estimate, how much the Department of Defense is spending on weather modification or whether weather modification is being used in Vietnam. When asked whether they ever get together with fellow meteorologists in the Defense Department, the response was "yes, but. . . ." □

The orange glass and the lunar highlands

That "orange" soil collected at Taurus-Littrow by astronauts Eugene Cernan and Harrison Schmitt (SN: 12/23/72, p. 404) is characteristically lunar at first glance: It's a puzzle.

Last week, scientists at NASA's Manned Spacecraft Center in Houston got their first look at the material (SN: 12/30/72, p. 420). "My first impression, to be honest, was that it wasn't orange," said William Phinney, head of the Preliminary Examination Team. "It's more of a brownish-ochre shade, but with a distinctly orange cast to it."

Physically, the soil is the finest-grained material ever examined from the moon. The grain size is about 40 microns; the average for lunar material is more like 70 to 80 microns. There are numerous clods about three to four centimeters in diameter in the material, and the clods themselves have color zones ranging from the gray to the brownish-orange. The soil is 90 percent glass. "It looks like you have a layer of orange glass laid in a band horizontally around the crater—like a marble cake structure," says Paul Gast, also of MSC. The soil is not rich in water or sulfur but it has the highest zinc content of any lunar material so far. "I think we can throw out the hypothesis that this was the result of hydrous alteration [as might be the case in volcanic fumarole alterations on earth]," Gast says. But this does not rule out the possibility that the glass was formed by a volcanic process, Gast stressed. The glass doesn't appear to have been formed by an impact event. "But how do you get orange glass on the moon?" he asks. The answer, Gast says, may also help answer the question of the green glass of Apollo 15 (SN: 1/29/72, p. 73) and the reddish glass in the Apollo 11 samples.

Radiation counting of one rock from the massif suggests that the highland material at the Apollo 17 site is fairly high in radioactive materials. The radioactive content is higher than what is found in typical anorthosites, but not as high as the Apollo 12 material dubbed KREEP. "When you tie the material from the North Massif to the Apollo 16 and Luna 20 results," Gast says, "you have an increasing suspicion that the highlands were formed by processes considerably more complex than we originally thought." The original explanation was that the highlands formed by melting and floating of the light material such as plagioclase (high in aluminum) to the top. Now it appears as though after this original crust was formed, other volcanic material was intruded on top of that crust. □