

"Where Acids Reign." by Janet Raloff, in the July 22, 1989 issue of *Science News*, tells of the mysterious increase in tree mortality in West Germany affecting

Norway spruce in the Fichtelgebirge forests high in Bavaria, beginning about 10 years ago and now affecting some 52 percent of all West Germany's trees. In some stands, all mature trees have died. Ernst-Detlef Schulze of the University of Bayreuth has unearthed new clues to the complex, synergistic web of agents responsible.

The problem is far more complex than direct pollutant poisoning from industrial fallout. The trees are sickened and weakened by the air-carried pollutants and then fall victim to opportunistic blights. Nitrogen compounds and sulfates – both the stuff of acid rain – start the imbalance by acidifying the soil, Schulze contends. The forest floor's acidity then frees toxic aluminum to compete with other positively charged ions (cations) for entrance into the thread-like, nutrient-absorbing roots of trees. Some of these cations are crucial to tree nutrition – notably calcium and magnesium.

The trees gradually develop serious deficiencies of magnesium, potassium, manganese and iron, and an acceleration of nitrogen aerosols raining into the trees' foliage and into their roots act as fertilizers – spurring the cation-starved trees to attempt further growth. In this highly stressed state, the conifers succumb to otherwise non-lethal pests and turns of weather.

The slower decline of U.S. forest suggests this country may still have time to avert a similar wholesale dieback of woodlands, but Schulze and others suggest such intervention will require stricter controls on air pollutants, especially on nitrogenous ones.