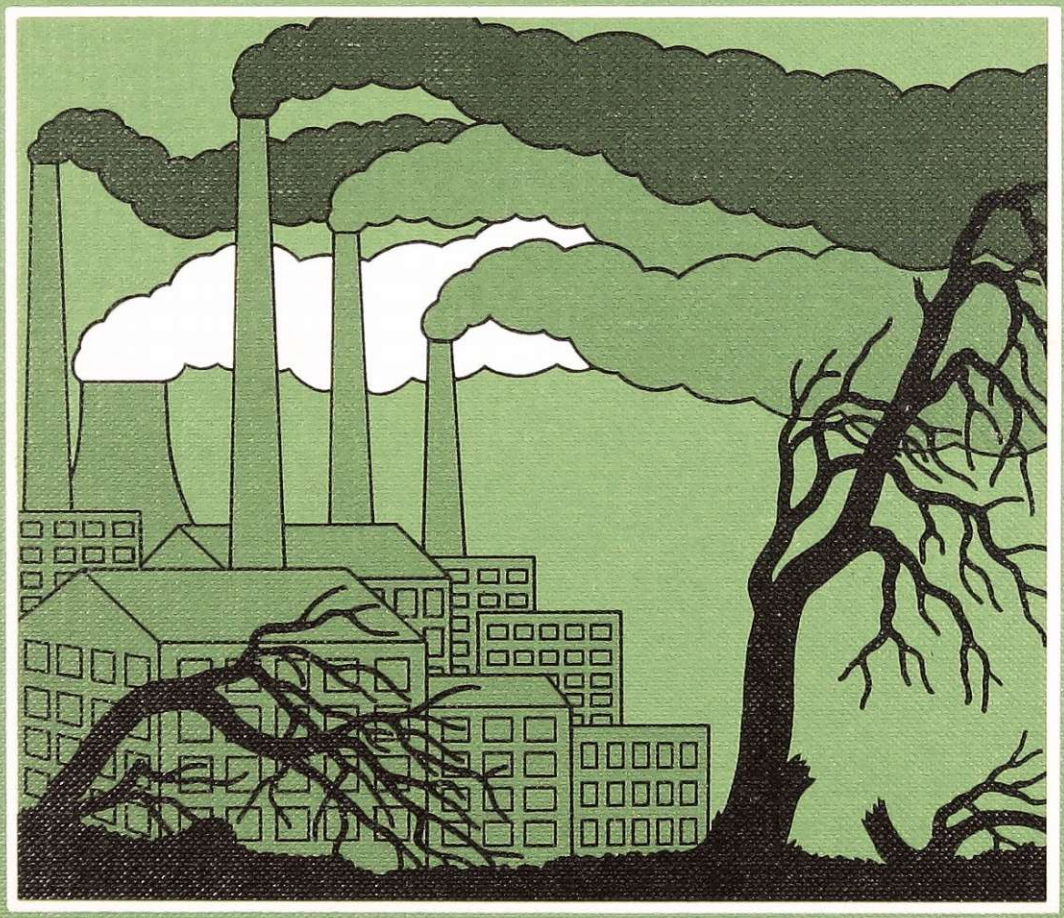
Ecological Studies 22

R. Guderian

Air Pollution

Phytotoxicity of Acidic Gases and Its Significance in Air Pollution Control



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Phytotoxicity of Acidic Gases and Its Significance in Air Pollution Control

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Introduction

Emissions of gaseous air pollutants have increased in the last years in spite of increased controls and concern for air quality. Predictions of future development also indicate that a further increase in emissions must be expected. From an extensive analysis of fuel use in conventional power plants in industry and for domestic heating, Brocke and Schade (1971) and Schade (1975) predict that sulfur dioxide (SO_2) emissions in the Federal Republic of Germany will increase from 3.5 million t in 1969, over 4.2 million t in 1973, to 4.6 million t in 1980. Rasch (1971) predicts that emission of hydrogen chloride (HCl) from burning of wastes will increase from a present 8000 t/year to about 100000 t in 1980. Emission of gaseous fluoride compounds, in North Rhine Westphalia alone, are expected to increase from 7500 t in 1969 to 8800 t in 1985 (MAGS, 1972). Similar predictions have also been made in the USA (Heggestadt and Heck, 1971). A doubling of SO_2 emissions from oil and particularly coal-fired power plants is expected between 1960 and 1980 (Wood, 1968; Lewis et al., 1974).

When it is considered that total control of air pollutants is technically and especially economically impossible, it is important that, in the future, emissions are controlled within a technical and economic framework to such an extent that ambient pollutant concentrations near the ground present no hazard to man or his environment (BImSchG, 1974).

In order to evaluate and set such limits for allowable pollutant concentrations, knowledge of the quantitative relationships between ambient pollutant concentrations and the object affected is necessary. Since several effective components occur at the same time, studies on the effects of pollutants in combination are essential.

Compared with man, animals, or materials, plants respond very sensitively to widely distributed pollutants, such as sulfur dioxide, hydrogen fluoride (HF) and hydrogen chloride. Extensive loss to agriculture and lasting changes in natural ecosystems are the result. Studies on the effects of air pollution on vegetation, therefore, provide an important basis, particularly for preventive measures in air pollution control.

Such studies require a characterization of the pollutant situation that is based on effects of pollutants. Also necessary is an evaluation, based on economical and ecological criteria, of these effects on the intended use of particular plant species. Responses of plants to pollutants are not only primarily dependent on pollutant concentration and exposure time, but also on the amount of pollutant absorbed by the plant per unit of time (Guderian, 1970). The rate of uptake varies just as