A PRESENTATION OF THE NORWEGIAN PROJECT
'ACID PRECIPITATION – EFFECTS ON FOREST AND FISH'

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Abstract. The joint research project, ‘Acid Precipitation – Effects on Forest and Fish’ (the SNSF-project) of the Agricultural Research Council of Norway and the Norwegian Council for Scientific and Industrial Research was started in 1972. The objectives of the project are to: (1) establish as precisely as possible the effects of acid precipitation on forest and freshwater fish; and (2) investigate the effects of air pollutants on soil, vegetation, and water, required to satisfy point 1.

Research activities on the project are organized and carried out mainly at four institutes. Within and between these institutes groups are formed carrying out investigations in fields including atmospheric transport and chemistry, dry deposition and leaching of foliage, forest growth, soil biology and soil chemistry, hydrological relationships of peatland, hydrobiology with special stress on fish, and hydrochemistry including snow chemistry.

1. Introduction

Air pollution is an international problem of the greatest dimensions. The continuous expansion of production and consumption in modern society is accompanied by the steadily increasing emission of air pollutants of different types. It is generally recognized that air pollutants can be transported in substantial amounts over distances of 1000 to 2000 km. This phenomenon has been studied with special attention being focused on acid S compounds, which are the main cause of acid precipitation.

The Norwegian research program entitled ‘Acid Precipitation – Effects on Forest and Fish’ (or the SNSF-Project) was undertaken to study such problems. The present paper discusses the evolution of that project and some of the research areas in which it is now involved.

2. The SNSF-Project

The long-range transport of air pollution in Europe has caused many problems. Through the Organization for Economic Cooperation and Development (OECD)-Project, ‘Long Range Transport of Air Pollutants,’ considerable progress has been made in establishing the connection between emissions of air pollutants, weather conditions and concentrations in precipitation areas in Europe. Southern Norway is especially exposed to increased precipitation from winds between the southeast and southwest. These air streams almost inevitably have passed over important emission regions within the industrialized belt across Europe. The precipitation that is caused by the mountain ranges in southern Norway will, therefore, often contain high concentrations of pollutants from remote sources. The severity of the air pollution problem, particularly acid precipitation, becomes obvious when we recognize that 80% of the
productive forest land in Norway is dominated by acid podzolic soil, and that thousands of lakes are located on acid granite bedrock.

Long-range transported air pollutants are recognized as the most acute environmental problem in Norway today; the problem is of sufficient importance to justify extensive studies. Therefore, in 1972 the nationwide joint research project, 'Acid Precipitation – Effects on Forest and Fish' was initiated as a result of action taken by the Government and two Norwegian Research Councils. This modern research effort is organized strictly as a project-oriented, cross-institutional, self-governing entity. More than 10 Norwegian research institutes participate in this project, involving nearly 50 scientists and a large supporting technical staff. The Norwegian government has recently increased its budget allocation for this project by a significant amount, thereby indicating the importance and reality of the acid precipitation problem to Norway. The government has clearly shown its intention and willingness to do something about the problem.

The main objective of the SNSF-Project is two-pronged:

(1) To establish as precisely as possible the effects of acid precipitation on forest and freshwater fish, and

(2) To investigate the effects of air pollutants on soil, vegetation and water, to the extent required for paragraph 1.

The data from this research project will be used as a scientific contribution to the forthcoming international negotiations aiming at control of the overall emission of air pollutants.

3. SNSF Research Programs

3.1 AIR POLLUTION DEPOSITION

Air pollution occurs primarily in the central mountain region of southern Norway. Close cooperation with the OECD-Project, in which the Norwegian Institute of Air Research acts as the Central Coordinating Unit, gives the SNSF-Project the possibility to utilize forecasts of polluted air streams, their origin and time of arrival. This allows our research teams the time necessary to reach various field stations prior to the arrival of the precipitation that carries air pollutants. All of Norway is used as our field of operation.

Two examples of such pollution are: (1) During 5 to 13 January, 1974, the southernmost part of Norway received precipitation as snow containing 850 kg sulphate per km², of which approximately 90% was H₂SO₄. The precipitation arrived on southeasterly winds with contributions both from eastern and western Europe; and

(2) during an eight-day period in January 1974, the southwestern parts of the country received over 20 000 km² precipitation from Great Britain amounting to 4000 t of sulphate corresponding to 100% H₂SO₄.

In addition to the deposition by precipitation, air pollutants may also be absorbed and adsorbed by vegetation and by the ground. This dry deposition accounts for the