

THE SCIENTIFIC AND POLICY ISSUES  
OF ACID DEPOSITION

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A Thesis

Submitted for an Honors Degree

in Environmental Studies

Brown University

May 1981

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Man has altered his natural world for centuries. He has diverted waters, cut forests, and exhausted the soil. Yet he has never altered the environment in the way he now threatens to. The invention of the fuel generated engine is perhaps one of the most significant events in man's relationship to his natural world. Fuel combustion was so enthusiastically hailed in Europe and the United States that it readily replaced wind and water generated energy. At the time, few probably stopped long enough to consider what the effects of the emissions might be. Today, we continue to pollute with the knowledge that the emissions are having a severe impact on our environment. While aloft, emissions from coal and oil burning sources often photo-oxidize into acids. Some emissions are transported as particulates and combine with moisture to form acids on object surfaces. Still other emissions combine with moisture in the air to create acidic "fogs." It is believe that many of the chemical forms of pollutants are washed out as acids during rainstorms. We now know that the deposition of these acids is threatening aquatic life, forests, and crops while eroding buildings and perhaps permanently depleting our soils.

In a few areas, the acidity of rainfall, of the soil, and of freshwater bodies has been measured and isopleth lines drawn to approximate acidity of rainfall in surrounding areas.<sup>1</sup> Yet scientists are reluctant to comment upon specific sources of acid-forming pollutants. This is largely because it is difficult to monitor the transport patterns and to determine the makeup of pollutants. Prevailing winds may separate the sources

of the pollution from its deposition by hundreds of miles. Most scientists agree that precipitation acidity has increased since measurements were first taken, and that emissions from burning oil and coal have increased with industrialization. The environmental processes that contribute to the problem begin with fuel combustion and carry on through emission, transport, and deposition. Sulfur dioxide ( $\text{SO}_2$ ) and nitric oxides ( $\text{NO}_x$ ), emitted from stationary sources, comprise the bulk of pollutants that are transported and cause acid deposition. The height of the emissions release, the geographic location of the source, and the seasonal variation of the transport process will determine the contribution that the precursors make to acid deposition.

"Acid rain" is an increasingly familiar term used to describe deposition. This environmental phenomenon has only recently received attention from the media in the United States. In Scandinavian countries, where the problem is quite severe, scientific research and an enlightened public have brought worldwide attention to this international issue. There, prevailing winds and weather systems have carried acid forming pollutants from industrialized areas to the sensitive northern regions. The scientists that appear at American lecture podiums and in interviews today suggest that a similar pattern has been occurring in the northeastern United States for many years.<sup>2</sup> Evidence from rainfall studies now show that acid rain has spread north into Canada and as far south as Florida.<sup>3</sup>