bad enough that no honest reporting could have disguised it. The public does recognize that some problems are difficult to solve and perhaps beyond the capacity even of the best leaders. And, though the reservoir of confidence in institutions remains high, it is more vulnerable to major crisis than ever before in this century.

Any book containing the range of material to be found here would be worthy of some note. This volume, however, integrates the material with imagination and insight. It is a richly drawn general portrait of American attitudes, and it contains much information of practical interest to the leaders of American institutions as well as of general interest to the public.

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Acidic Deposition in Forests

Effects of Accumulation of Air Pollutants in Forest Ecosystems. B. ULRICH and J. PANKRATH, Eds. Reidel, Boston, 1983 (distributor, Kluwer Boston, Hingham, Mass.). xviii, 389 pp., illus. $58.50. From a workshop, Göttingen, Germany, May 1982.

On the basis of available evidence concerning known and potential effects of air pollutants, ozone and heavy metals are judged to be the most important wide-area pollutants deposited in forests in the temperate latitudes. In nature, forest ecosystems may be exposed to more than one contaminant concurrently or sequentially. Interactive influences of multiple pollutants may be extremely important.

Acidic and acidifying materials resulting from a variety of human activities, particularly combustion of fossil fuels, are regional contaminants similar to ozone and heavy metals. Our history of research with acidic deposition is much shorter than that with the latter pollutants, however, and our understanding of its effects on forest ecosystems is much less complete.

This volume is useful, for it presents the perspectives of European scientists on the effects of deposition of acidic materials and, to a much lesser extent, heavy metals, on forest ecosystems. The book consists of 30 papers presented at a workshop, 28 of which are authored by Europeans (two are by Canadians). Twenty papers are by West Germans, nine of them by authors from the University of Göttingen. Bernhard Ulrich is the author or coauthor of four of the papers.

In an introductory paper, Ulrich presents a thorough discussion of his hypothesis that the wet and dry deposition and accumulation of anthropogenically produced acidic and acidifying substances from the atmosphere in forest ecosystems ultimately result in soil acidification, increased soil leaching, and aluminum or trace metal toxicity to tree roots or other elements of the soil biota. Ulrich proposes that soil is acidified beyond natural tendencies owing to disruption by air contaminants of decomposition processes and ion cycles within forest ecosystems. He proposes that cation leaching is increased owing to excess nitrate and sulfate ions in the soil as a result of atmospheric input. He proposes that the potential for aluminum-induced root or mycorrhizal toxicity is high when the ratio of calcium to aluminum in the soil drops below 1 in soils with a *p*H of less than 4.

The volume is divided into five sections, on the deposition and storage of atmospheric inputs, hydrogen ion dynamics and nutrient cycling, and the effects of atmospheric inputs on soil chemistry, soil biota, and forest trees. In large measure, most papers provide additional perspective or evidence bearing on the Ulrich hypothesis. The papers in section 1 provide quantitative data on the deposition of acidic materials and heavy metals to selected German forests (four papers) and a Swedish forest (one paper). In section 2, a paper by Nillson concludes that evidence of acidification of Swedish forest soils by atmospheric deposition is not available. In section 3, a paper by Matzner provides elemental flux rates for four German forest ecosystems. A paper by Morrison provides important lysimeter evidence of leaching of nutrient cations and trace metals. Papers by Abrahamsen and Skeffington do not support the hypothesis concerning aluminum toxicity. In section 5, several authors (Keller, Wentzel, Flühler, Athari and Kramer, Rehfuess *et al.*, Bauch) correctly stress the importance of the asymptomatic response of forest trees to air pollution stress and emphasize the importance of examining air quality impacts on tree growth rates. Tomlinson attempts to relate North American red spruce morbidity and mortality to Ulrich's hypothesis.

In summary, the view that acid deposition may enhance soil leaching in certain forest ecosystems has been strengthened by this volume, as has the view that there is not sufficient evidence to support the hypothesis that widespread soil acidification and aluminum toxicity in forest ecosystems result from atmospheric deposition. The book provides valuable clarification of and perspective on the Ulrich hypothesis.

The book suffers from lack of editorial consistency. The papers, literature citations, and reference lists are very variable in format. The printing is of only moderate quality, and there are numerous typographical errors. The book will be of interest to air pollution specialists and research scientists.

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Thermometry

Temperature. T. J. QUINN. Academic Press, New York, 1983. x, 416 pp., illus. $58. Monographs in Physical Measurement.

T. J. Quinn is eminently qualified to write a book intended "to give a comprehensive account of the principles of thermometry over the range 0.5 K to about 3000 K." In the opinion of this reader, Quinn has succeeded rather well in this endeavor.

The book contains chapters on the definition of temperature, temperature scales, primary and secondary thermometry, fixed points, resistance thermometry, thermocouple thermometers, radiation thermometry, and liquid-in-glass thermometers. Many chapters contain brief historical summaries that provide a useful perspective without being distracting. The physical principles used for thermometry are discussed in considerable detail, and the reader is carefully directed to the literature for the remainder. Significant advances in the past 20 years in the application of these principles are fully described. An appendix includes the text of the present international temperature scale, skeleton tables for thermocouples, and interpolation equations for industrial platinum resistors and thermocouples. A useful index completes the book.

The book offers a modern perspective on the degree of accuracy of temperature scales and the physical principles used to obtain the scales. Temperature scales are in a continuous process of evaluation and evolve gradually to greater accuracy. The reader of this book will have a firm understanding of the basis for the next temperature scale, contemplated for the late 1980's. Since the book emphasizes the physical basis of thermome-