

Preface

Our atmosphere bears an increasing load of pollutants: carbon dioxide, ozone, oxides of nitrogen and sulfur, particulates, and heavy metals. These pollutants are deposited on leaf and soil surfaces, enter leaves through stomatal openings, and affect climate. The physiological responses of trees to these pollutants and to climate change are complex and only partially understood. Ecosystem processes such as nutrient cycling are also affected yet only beginning to be elucidated. Several decades of research have yielded important advances in understanding forest responses to single factors and certain combinations of factors. Complex, time-varying responses to multiple factors and their interactions are yet poorly understood. We remain incapable of extrapolating results from experiments and observations in space and time, with sufficient confidence to anticipate how forest vegetation in different regions will respond to air pollution and climate change in the 21st century.

Understanding past and current vegetation responses to air pollution and climate change is the critical first step toward improving our ability to anticipate future vegetation responses, and if necessary, initiate adaptive management responses and mitigation activities. Land managers require a solid scientific foundation for developing a strategy to adapt to anticipated 21st century air quality and climate. Policy makers need information about the location and magnitude of vegetation responses to various levels of air pollutants so that concentrations and exposure standards can be established with consideration of the effects on forest vegetation and the many services provided by healthy forest ecosystems.

The chapters in this book present a snapshot of the state of knowledge of air pollution effects at the beginning of the 21st century. From their different disciplines, a distinguished collection of authors document their understanding of how leaves, trees, and forests respond to air pollutants and climate change. Scenarios of global change and air pollution are described. Authors describe responses of forests to climate variability, tropospheric ozone, rising atmospheric CO₂, the combination of CO₂ and ozone, and deposition of acidic compounds and heavy metals. The responses to ozone receive particular attention because of increasing concern about its damaging effects and increasing concentrations in rural areas. Scaling issues are addressed—from leaves to trees, from juvenile trees to mature trees, from short-term responses to long-term responses, and from small-scale experiments and observations to large-scale forest ecosystems.

This book is one major product of a conference sponsored by the International Union of Forestry Research Organizations, the USDA Forest Service Global Change Northern Stations Program, the Arthur Ross Foundation,

NCASI, the Canadian Forest Service, and Michigan Technological University. The conference, held in May 2000 in Houghton, Michigan, USA, was appropriately titled "Air Pollution, Global Change, and Forests in the New Millennium". The editors, David Karnosky, Kevin Percy, Art Chappelka, Caroline Simpson, and Janet Pikkarainen performed a great service by organizing the conference and editing this book. All of the authors, editors, and peer reviewers deserve congratulations for taking this important step in the journey toward sustaining healthy forests in a changing atmospheric environment.

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