The first edition of Air Pollution and Plant Life was published nearly two decades ago (1984), when Michael Treshow was the sole editor. Now, Nigel Bell has joined Treshow to update and expand this popular book. Treshow was the sole editor. Now, Nigel Bell has joined published nearly two decades ago (1984), when Michael Treshow was the sole editor. Now, Nigel Bell has joined with Treshow to update and expand this popular book, and both the breadth and depth of coverage are impressive. There are 24 chapters, up from 18 in the previous edition, and over 30 individual authors, who all bring to this book a wealth of expertise in the various disciplines that now comprise air pollution science. To give you an idea of how much this book has been revised, only two authors, Treshow and Runeckles, were retained from the first edition. Aimed at final year undergraduates, graduate students, and those seeking a comprehensive introduction to the field, the book will be useful to those teaching courses in air pollution, agriculture, ecology, physiology, and environmental policy. It will also serve as an excellent reference for those already engaged in air pollution research.

The book begins with an historical overview of air pollution research by Bell and Treshow that puts the rest of the chapters into perspective, followed by two chapters on the formation, dispersal, deposition and uptake of pollutants (Chapters 3 and 4). Although the chapter by Colville on atmospheric formation processes covered the basics, I was somewhat disappointed because it went more for breadth than depth, as the author stated was his goal, but I think the opposite path should have been taken. As a result, beginning students will be somewhat bewildered by the terminology, and from a pedagogical point of view, by the lack of diagrams showing photo-oxidant formation and destruction. Fowler’s excellent chapter on deposition and uptake by vegetation is an easier read and emphasizes the importance of plant surfaces in affecting pollutant fluxes. However, beginning students might be confused as to how to actually calculate deposition velocities unless they have already had some training in this area.

The next seven chapters are concerned with the most important gaseous pollutants, including ozone, oxides of nitrogen, sulphur dioxide, fluoride and organic compounds. A welcome addition to this list of pollutants is Farmer’s chapter on the impacts of particulates on plants, for which most of the literature has concerned only human health effects. The two chapters on ozone adequately cover this vast research area, which in recent years has occupied most of the attention of air pollution investigators. In chapter 6, Ashmore covers a wide range of topics related to plant and community responses to ozone, and emphasizes the importance of knowing the fluxes to the leaf if we are to adequately model plant responses to ozone. However, I would like to have seen this chapter appear before Long and Naidu’s analysis of ozone responses at the leaf and biochemical level (Chapter 5), as I prefer to see the big picture first. Long and Naidu’s chapter is a succinct and excellent analysis of the physiological and biochemical responses by which plants respond to ozone, but I have a quibble or two. They state that plants would rarely see much ozone at dawn, yet at high elevation ozone concentrations often peak in the night and can be quite high at dawn when stomata begin to open. In addition, they did not mention in their chapter of anomalous stomatal responses to ambient levels of ozone, such as stomatal opening after exposure to ozone, or what is now referred to as ‘stomatal sluggishness’ (see Chapters 18 and 19 in this book). These responses may be more prevalent in the field than previously appreciated, and, therefore, important from a modeling standpoint. I would also like to have seen a section on the use of molecular techniques, as significant new discoveries are being made through the use of genetically engineered plants. There is also some inconsistent chemical notation in the book: for example, hydroxyl radicals are denoted OH* in Chapter 2, but *OH in Chapter 5, and superoxide is ‘O2−’ in Chapter 5, but ‘O2*’ in Chapter 7. A little editing would easily clear this up.

Mansfield’s chapter on nitrogen oxides reminds us that these gases may at times act as nutrients, and at other times as pollutants, and that new physiological and biochemical developments in how plants assimilate and metabolize nitrogen should prove useful in discriminating between these two options. This chapter is followed by Legge and Krupa’s discussion of the impacts of sulphur dioxide on plants. This is a nice update on a subject that has waned in interest recently. Sulphur dioxide is a major problem in developing countries that burn low quality coal (see also Chapter 21 by Marshall on pollution in developing countries), and still a problem in developed countries such as Canada which extract petroleum from sands. My only complaint with this chapter is that the photos of injury were of such poor quality as to be of little pedagogical value. Although price is, no doubt, a factor for why no
color plates are present, the book would have been greatly improved by their inclusion. If the costs of color prints are indeed prohibitive, perhaps the editors could refer readers to dedicated websites that show injury.

The chapter by Bates on non-vascular plant responses to air pollution extends the subject beyond lichens to include bryophytes. It concentrates mainly on SO₂ effects, because that is where the majority of work has been done, but does review effects of other gaseous pollutants on these non-vascular organisms. I would like to have seen more discussion (perhaps even an entire chapter) on the use of both vascular and non-vascular plants and lichens as bioindicators for monitoring air pollution in remote areas.

I was especially glad that a comprehensive set of chapters on acidic deposition in both terrestrial and aquatic systems was included. Often, gaseous pollution and acidic deposition are relegated to separate books, and the editors are to be commended for not continuing that trend. I felt though, that there were some important omissions in this section. There was little discussion of the changing nature of acidic deposition, especially in the United States, where decreases in SO₂ emissions have resulted in a shift in dominance from sulphuric to nitric acid, with its attendant physiological consequences. The chapter by Bobbink and Lamers on nitrogen deposition takes a case history approach to illustrate the impacts of adding nitrogen to natural systems, but the examples they used were limited to European heath or grassland ecosystems, and nitrogen saturation and its consequences for forests were barely touched upon. Ashenden’s short chapter on wet deposition deftly covers this vast subject, but he misses a few key references, while Harriman et al. discuss the impacts of acidic deposition on aquatic plants, a subject not normally covered in such texts. Innes and Skelly raise serious doubts about the validity of claims for the deterioration in tree health across vast forested areas in both North America and Europe, and they debunk the concept of forest decline, i.e., Waldsterben. I applaud the editors for including what some might consider to be a controversial viewpoint, but which is in fact supported by most air pollution scientists. Along these lines, I would like to have seen them address DeHayes’ theory of calcium depletion caused by nitrogen-induced changes in frost hardiness of northern red spruce.

Air pollutants do not occur in isolation, yet the study of pollutant mixtures has received relatively little attention, perhaps due to the complexity and cost of such studies. Nevertheless, Fangmeier and his colleagues in their chapter make a brave attempt to review the sparse literature in this area. Four other chapters look at pollutant interaction concepts, including Runeckles’ chapter on pollutant–climate change interactions, and three excellently written chapters on pollutant–environmental interactions. As in any edited volume, there is bound to some redundancy. The chapter by Mills and that by Davison and Barnes overlap to some extent (i.e. both discuss interactive effects of drought and cold) and perhaps the editors should have been a bit more attentive here. Davison and Barnes also reiterate some of the arguments of Innes and Skelly on forest decline, but they go further and suggest that acidic deposition may indeed predispose some trees to decline, particularly northern red spruce. The one chapter with little or no overlap with others is Flückiger et al.’s on biotic interactions. Although this area is less well understood than most, they make a strong case for pollutants as predisposing agents with respect to fungi, bacteria, insects and other stressors.

Near the end of the book Ashmore reviews the difficulties in setting air quality guidelines and regulatory policies, including whether to use exposure or flux based indices, and the concept of critical loads for long term protection of ecosystems. This subject is often missing from books on air pollution, and is a welcome addition to the new edition.

In conclusion, this is the best edited book on the subject of air pollution effects on plants that I have read in a long time. At a purchase price of just US$49.95 paperback, it should be easily accessible to both students and non-students alike and on the bookshelf of anyone with an interest in air pollution and plants.

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