PREFACE

In the early 1980s, the problem of acidification was acknowledged on a governmental level in the Netherlands as posing a major environmental threat. The concern for damage to forests and ecosystems, and materials and monuments, as well as for acidification of soils and moorland pools stimulated research and policy development. Acid deposition was used as a characterisation of the atmospheric input leading to these effects. As such, wet and dry deposition of acids, and dry deposition of acid precursors as sulphur dioxide and nitrogen oxides, were considered. At the same time, the important role of ammonia in the acidification of soils and moorland pools was acknowledged. Ammonia, the most important acid neutralising component in the atmosphere, was shown to be nitrified to an important extent in soil into nitric acid, thereby contributing to acidification. This led to the concept of potential acid deposition, in which the deposition of actual acid (H^+) was added to that of potential acid (ammonia + ammonium). Moreover, the role of atmospheric nitrogen input was recognised as a disturbing factor for natural ecosystems and forests growing on poor soils.

In Europe critical loads have been widely accepted as a basis for control strategies for regional air pollution. The use of critical loads for ecosystem studies and abatement strategies requires relevant deposition data to describe the atmospheric input to the ecosystem. The knowledge of deposition processes and the possibility of making relevant and accurate deposition estimates are important issues in the work of long-range transport modelling in Europe. Large-scale dispersion and deposition of air pollution emitted in different countries above Europe needs to be assessed correctly to serve as a relevant basis for abatement strategies. On the local scale, the large variations in deposition to landscape, and in sensitivity between landscape elements, make it essential to compare the actual deposition with the site-specific critical load to determine the exceedance value. This is even more important for those areas where high sensitivity is linked to high inputs.

The Dutch Priority Programme on Acidification Research, which was started in 1985, aimed at the following fields of research:
- the relationship between occurrence and effects of acidification on plants in their natural environments (air, soil), in particular the effects on forests, heather and crops;

- ammonia emissions and the deposition of SOx, NOy and NHx, along with emission abatement techniques;
- derivation of critical loads and levels for forest and heathland ecosystems, and estimation of the effectiveness of abatement measures in decreasing the effects.

In this book the research efforts in this programme directed at atmospheric deposition are summarised. These efforts relate to the approach to generalising deposition estimates using models and measurements to meet the local and large-scale demands. Although most research efforts described are of Dutch origin, it has been our endeavour to put the research into a broader perspective by summarising the state of knowledge on the processes affecting atmospheric deposition in Europe. This has resulted in detailed deposition maps for the Netherlands and Europe. Highlighted are the evaluation and applicability of the programme's results. Although the work described in this book is related to components relevant in the issue of acidification, the methods can be used for other components related to other environmental issues as well.

This book was written to collect the results of a large quantity of research in, for example, the Netherlands, which has already been published as parts of books and as articles in international journals. It is intended for anyone involved in research related to atmospheric deposition; i.e. not only those who measure or model atmospheric deposition or ecologists interested in exposure from atmospheric deposition, but also policy-makers and students.

It was Thomas Way who wrote in 1855[1]:

'.. the quantity at any time present in the air must merely have relation to the distance of time at which it was last swept from it by rain, and takes no account of that which the soil has in the meanwhile appropriated. To be perfect, these experiments should be made simultaneously on the ammonia in the air and in the rain, and that absorbed by a given extent of surface-soil. This is a labour that we can hardly expect from any one experimenter; and considering the great varieties of soil, the result would even then be but an approximation to the truth.'

Although we will attempt in this book to provide estimates of the atmospheric input to different types of vegetation and soil, we are forced to conclude that despite 140 years of research the results presented here are even now only an approximation of the truth.

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[1] J.T. Way (1855), *J. Roy. Agr. Soc.*,**16**,265-266

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To the memory of
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