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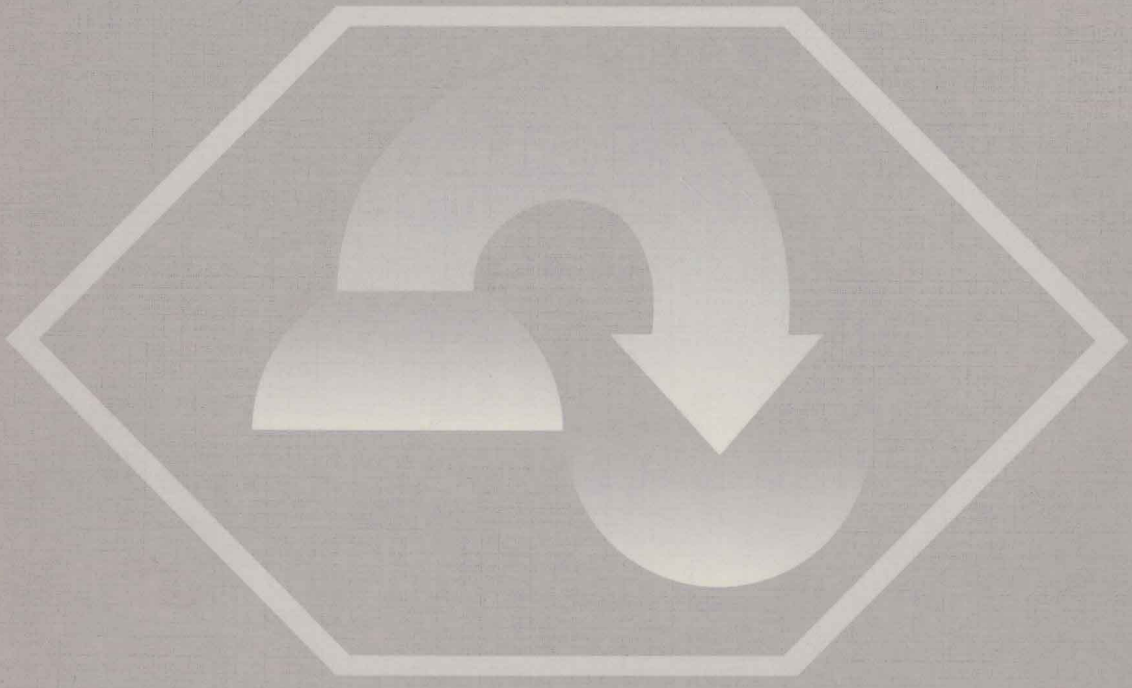
ACID RAIN RESEARCH: DO WE HAVE ENOUGH ANSWERS?

Edited by:
G.J. Heij
J.W. Erisman



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ACID RAIN RESEARCH: DO WE HAVE ENOUGH ANSWERS?

FOREWORD

This book represents the Proceedings of the International Specialty Conference, "*Acid Rain Research; do we have enough answers*", held for about 120 scientists from 15 countries 10 - 12 October 1994 in 's-Hertogenbosch in the Netherlands. The conference proved a valuable conclusion to the co-ordinated research on acidification in the Netherlands, lasting from the beginning of 1985 to the end of 1994. Directly following the conference, an international team of experts in the field reviewed the research of the third and last phase of the Dutch Priority Programme on Acidification. The main results of the first two phases including a scientific review were published in the Elsevier series on Studies in Environmental Sciences, no. 46 (Heij and Schneider, 1991), while the results of the third phase of the programme, including the review team's report, will also be published in the same series.

The Specialty Conference focused on:
Atmospheric deposition
Effects of acid deposition on forest ecosystems in the Netherlands
Future of acidification research.

Atmospheric deposition has been a major research issue in several national and international research programmes. The aim of the Dutch Priority Programme on Acidification in this field was to assess acid, nitrogen and base-cation deposition loads to forest and heathland, and to compare these loads with critical deposition values to determine exceedances. As the critical loads concept is applied to ecosystems, deposition fluxes must also be assessed at the ecosystem level. During the conference, special attention was given to the following subjects: *trace gases*, chaired by David Fowler (Institute of Terrestrial Ecology, UK); *ammonia*, chaired by Willem Asman (National Environmental Research Institute, Denmark) and *particle deposition*, chaired by Jan Willem Erisman (National Institute of Public Health and Environmental Protection, the Netherlands). Other topics, such as wet deposition, fog and cloud-water deposition, important for obtaining an overall assessment of deposition loads to ecosystems and soils, were discussed in a session on *generalisation* chaired by Bruce Hicks (National Oceanic and Atmospheric Administration, USA).

At the end of a long-term research programme the question usually arising is: Do we have enough answers, or are we generating new problems to keep our research going .....? Final results and conclusions of the Dutch research on forest stands and forest soils were presented and discussed in that light in a session chaired by BertJan Heij (National Institute of Public Health and Environmental Proteciton, the Netherlands). The session on "*Future of acidification research*" on the last day of the conference brought up the question of whether present day knowledge and research trends have attracted sufficient support for decision-making purposes. This session was chaired by Ellis Cowling (College of Forest Resources, North Carolina State University, USA). Future acidification research has to be combined with research on other environmental topics, such as climate change, landuse changes or ecosystem dynamics, incorporating all relevant stress factors. A special session on these topics was chaired by Tomas Paces (Czech Geological Survey, Czech Republic).

Each chairman summarized the main conclusions of his session. These conclusions, and an answer to the question: Do we have enough answers? are listed in the chapter titled Conclusions. The proceedings of the Conference start with the opening statements by André van Alphen and are followed by the papers presented during the different sessions along with about 30 posters for explanation to the visiting scientists. Posters were divided into the following topics: critical loads / exceedances, wet deposition / throughfall, dry deposition / concentrations and a miscellaneous session.

ACKNOWLEDGEMENTS

The editors would like to express their gratitude for the outstanding effort of all the chairmen and, in particular, the organizing chairman, Toni Schneider. Ottelien van Steenis not only carried out the organisation of the Conference but also operated the Registration and Information desk, with the excellent help of Marianne Vonk. Last but not least, Ottelien also took care of all the preparatory work for the Proceedings. Ottelien and Marianne are therefore greately acknowledged for their contributions. We hope that although the Conference focused on the three topics: atmospheric input, summary of Dutch Acidification research results and the future of acidification research, the excellent calibre of work and new initiatives on acidification research as a whole, reflected in the proceedings, will be of value to both research scientists and policy makers.

CONCLUSIONS

Deposition

1. Trace gases

- Fluxes of the acidifying compounds NO_2, NH_3, SO_2 and aerosols to forests and short vegetation have not only been measured directly, overcoming important uncertainties in methods and interpretation, but also have been monitored over long periods.
  This work provides the basis for greatly improved accuracy of input estimates of pollutants to forests and the landscape in The Netherlands and across Europe.

2. Ammonia / ammonium

- The highest uncertainty in estimates of NH_3 deposition is caused by uncertainties in temporal and spatial variations in NH_3 emissions.
- The conversion rate of NH_3 to NH_4^+ aerosol is not known accurately. It is likely that it shows temporal and spatial variations, that e.g. depend on the concentration of acidic compounds in the atmosphere. This information should be known as it determines where NH_x will be deposited, because the dry deposition velocity of NH_3 is much larger than the dry deposition velocity of NH_4^+ aerosol. For that reason reduction of emissions of acidic compounds in the air only could lead to a change in the dry deposition pattern of NH_3.
- The concentration of NH_3 at the surface of vegetation and seawater determines partly the flux of NH_3 to or from the surface. It should be taken into consideration in transport modelling. NH_3 emissions from agricultural crops could be potentially important in the growing season.

3. Particle deposition

- Dry deposition of particles to forests has often been underestimated until now. Furthermore, the role of particles in regulating water layer (chemistry) on vegetation and thus influencing gaseous dry deposition is important.

4. Generalization

- Deposition should be determined at a scale that enables the estimation of risk for ecosystem damage. Furthermore, most important factors determining deposition (edge effects, slopes, topography, roughness transition zones, etc.) should be taken into account in estimating input to sensitive ecosystems. For model development it is necessary to obtain key parameters by field experiments and validate the models by further field measurements.

Effects of acid deposition

1. No direct relationship exists between tree health and acid deposition.
2. Atmospheric deposition of N and S compounds on forests leads to:

- changes in vegetation composition into the direction of nitrogen-loving species and monocultures;
- high concentration of Al and NO_3 in soil solution and groundwater and to loss of biodiversity in non forest ecosystems.

3. Ozone has a significant adverse impact on plants. Not only crops, but also forest trees can be affected. The impact on natural vegetation is largely unknown as yet. In The Netherlands the contribution of NO_x to the total nitrogen deposition is currently less than 20%. But its adverse impact through formation of ozone must not be neglected.
4. The impact of atmospheric deposition on forest trees should be evaluated in terms of risk rather than in terms of visible effects.

The future

1. Global climate change and land use change will influence acidification processes;
2. A shift is necessary from effect oriented to system oriented research;
3. Ecologists, studying acidification effects, have to include climate factors;
4. Scientific uncertainties have to be reported explicitly.
5. Long term monitoring programmes are necessary to evaluate effects of acidification and of policy actions.
6. "Local" processes are largely unknown (especially for N). Knowledge on "local" processes will improve knowledge on causal relations.

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OPENING SESSION

ACID RAIN RESEARCH CONFERENCE, October 10–12, 1994

Opening remarks by André van Alphen

Deputy director Air and Energy, Ministry of Housing, Spatial Planning and Environment, P.O. Box 30945, 2500 GX, The Hague, The Netherlands

Ladies and Gentlemen,

Addressing this conference, while deputizing for Joris Al, the Chairman of the Steering Committee on Acidification Research, is a rather confusing experience. Of course I feel privileged to do so, but I realise that Joris Al, who chaired the entire third phase of the Dutch acidification research programme, is far more experienced in this matter than I. However, I have sufficient knowledge of the subject to know that there is another, more factual, reason for these mixed feelings. This Symposium marks the completion of a ten-year acidification research programme in the Netherlands, at a moment when the call for hard and conclusive scientific evidence coincides with the most drastic cut in research budgets ever. That is why I really feel confused.
In the next ten minutes I intend to focus on three elements of the problem:

- -the desire for hard evidence;
- -the end of a research programme of long standing;
- -future acidification research.

To start with the first, I must say that the sub-title of the conference "Do we have enough answers?" is a perfect description of the policymakers' dilemma:

> we know a lot about acidification, but is it all the knowledge we need for policy purposes and would more knowledge lead to policy measures that are not only easier but also better?

When looking into that question there are two points which have to be stressed. Firstly, results from scientific research can never be a substitute for policy decisions. Both scientists and policymakers may regard this as a truism, but it is still worthwhile repeating it now and then. Secondly, one should not forget that environmental problems like acidification, with a great lapse of time between the onset of the effects and evidence of damage, can only be dealt with on the basis of a risk approach. Action should be taken on the basis of the risk that acidification results in harmful effects which, if we postpone action until damage is apparent, will probably be irreversible.
Since the start of acidification abatement the approach has been to start by gradually reducing emissions while intensifying research into acidification to consolidate the scientific basis for action.
Of course the intention was to ensure that the timing of more drastic measures coincided with the development of further scientific substantiation of the acidification issue.
In real life however, scientific knowledge develops more capriciously: not only does our