

PREFACE AND INTRODUCTORY REMARKS

The seminar "Management of Nutrition in Forests Under Stress" was sponsored by Division of IUFRO, the Federal Ministry of Science and Technology (Bonn, West Germany), the U.S. Department of Agriculture/Forest Service (Washington, D.C., USA), Living Lakes, Inc. (Washington, D.C., USA) and hosted by the Institute of Soil Science and Forest Nutrition at the Albert-Ludwigs-University at Freiburg (West Germany).

The symposium is part of a series of meetings that started in 1984 with the IUFRO Symposium on "Site and Productivity of Fast Growing Plantations" in South Africa and was followed by the IUFRO Seminar "Management of Water and Nutrient Relations to increase Forest Growth" carried out at Canberra, Australia in the fall of 1987.

For a long time it has been recognized that forests are under stress in many parts of the world. This is true for natural as well as for managed forest ecosystems. As an example we take the recent forest decline phenomenon in West Germany; for this issue was also the immediate reason for the Freiburg Symposium. In West Germany, as elsewhere, many-fold natural site conditions related to a great variety of various parameters such as geology, soil, climate and weather conditions are associated with well-known stress factors like drought, winter damage, water logging and biotic diseases. Besides these natural stress factors, anthropogenic impacts also influence the vitality of forests adversely. With respect to direct effects, the SO₂ fumigation damage is a well-known case. This damage type has been studied for more than 150 yr in regions with high SO₂ concentrations. However, the recent forest damage in West Germany is dominated by moderate to low concentrations of SO₂ and other pollutants like O₃, NO_x and NH₃. Even though these substances may act synergistically on forest ecosystems it is now clear that direct effects are not the primary cause of the so called "new type" forest damage.

We will not discuss the long series of hypotheses which originated through the intensive research in this field from Al toxicity to N saturation. With respect to the theme of our Symposium we simply want to draw the conclusion that supply and turnover of nutrients in forest ecosystems is influenced in many ways indicating that nutrition is playing an important site and stand specific role in causing various damage types. Hence, it is not surprising that the new type forest damage is more or less frequently associated with nutritional disturbances.

At this point it must be emphasized that man-made effects on the nutrient supply of forest soils and on the nutritional status of the trees, respectively, have taken place for centuries in many forest areas. Land use history and forest management practices appear to have a much stronger influence on the actual nutritional status of forest trees and stands than the deposition of air pollutants. Some of these relations are already known since the beginning of scientific forest research. Some are now better understood from the results of recent ecosystem studies. The rising knowledge on the status and reaction of forest ecosystems has always produced recommendations to forest practice.

With respect to improvement of the nutrient supply of forest sites and stands, we observed several waves that influenced the silvicultural management of the German forests since the early 1900s. In the first decades of this century applications of mineral fertilizers started.

Based on the estimate that forest trees and stands have a rather low nutrient requirement the applied doses were mostly too low and did not produce convincing results. From the 1930s to the 1950s a liming wave rushed through the German forests in order to mobilize the nutrients stored in the raw humus layers. After the Second World War, N fertilization was the "hit" for more than a decade. It corrected the deficit of organic N that was evident over large areas mainly due to the repeated removal of litter, a common practice in former times. Also combinations with phosphate and K fertilizers were used. The observed rise of current wood increment was generally very promising. In spite of these positive effects forest fertilization activities were reduced considerably in the 1970s. There are several reasons for this change in silvicultural practice, among them campaigns like "keep chemistry out of forests." Indeed N fertilization is not required that much anymore because of the increased anthropogenic deposition of NO_x and NH_3 that have improved the N status at many forest sites remarkably and led, in combination with other factors, to a considerable increase in overall forest growth.

In the 1980s "Waldsterben" was detected bringing about a new wave of activities in the forests. The advocates of the soil acidification and Al toxicity hypothesis postulated and achieved broad scale liming operations, now called "compensation liming" to buffer the "acid rain." Detailed surveys of the nutritional status of forests by foliar (and soil) analysis and the encouraging results of comprehensive diagnostic fertilization networks led to successful applications of mineral fertilizers, especially Mg and K salts. Just recently, international ecosystem and watershed research projects were started to estimate the environmental benefits and risks involved with the use of lime and fertilizers in modern forestry.

Coming back to the worldwide scope of our Symposium, it is now evident that nutritional problems play an increasingly important role, particularly in plantation forestry but also in the management of natural woodland. There is no doubt that many forests are under nutritional stress related to a large variety of factors that in any case are site and/or stand specific and should be treated alike.

Forest science and forest practice are sitting in one boat moving forward in the stream of rising knowledge and experience. Meetings like ours may help a bit to steer the vessel on the right course. Papers enclosed in this special issue of "Water, Air, and Soil Pollution" indicate the present status of this and related problems.

The proceedings contain six thematic papers, 26 selected voluntary papers and 24 poster presentations. They are organized under the following main headings:

- Environmental pollution and forest nutrition;
- Natural stresses and forest nutrition;
- Effects of liming and fertilization in the forest ecosystem, and
- Strategies for increasing health and productivity of forests.

These contributions represent overviews and syntheses of current knowledge, highlights of present research on nutrition in forests under stress and they identify opportunities for improved management practice-particularly related to the revitalization and/or restabilization of damaged forest ecosystems.

We would therefore like to take the opportunity of this preface to thank the organizers, participants and sponsors that made this meeting a truly international and successful event.

The success of the Symposium and associated field tours was due in large part to the spirit of friendship, willing cooperation and active participation shown by the 170 forest scientists from almost 30 countries from all the world's continents. This response is a tribute to both the Symposium Committee and the Institute of Soil Science and Forest Nutrition at the Albert-Ludwigs-University in Freiburg that hosted the Symposium. We hope that these proceedings will stimulate greater international commitment to integrated research on the "Management of Nutrition in Forests Under Stress" and especially the proper application of research results for ecological, economic and social benefit.

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H.W. Zöttl
(Symposium Chairman)

R.F. Hüttl
(Symposium Coordinator)