



FOREST FERTILIZATION:

SUSTAINING AND IMPROVING
NUTRITION AND GROWTH
OF WESTERN FORESTS

Edited by

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The following chapters were written and prepared by U.S. government employees on official time, and are therefore in the public domain: "Nutrient Management of Subalpine *Abies* Forests" by Robert F. Powers and Robert L. Edmonds; "Fertilization Response of Subalpine *Abies* Forests in California" by Robert F. Powers; "Fertilization Response by Interior Forests: When, Where, and How Much" by P.G. Mika, J.A. Moore, R.P. Brockley, and R.F. Powers; "Effects of Fertilization on Wood Quality and Tree Value" by J.M. Cahill and D.G. Briggs; "Considering Fertilization in Forest Management Planning" by Douglas Daoust; "Fertilizers and Other Means to Maintain Long-term Productivity of Western Forests" by R.E. Miller, J.R. Boyle, A.E. Harvey, T.M. Ballard, L.M. Palazzi, and R.F. Powers; "Fertilization in Western Washington and Oregon: A Checklist for Projects on National Forest Lands" by Thomas J. Beckman; and "Considering Nutrient Management in Future Western Forestry" by D.S. DeBell, R.E. Miller, T.A. Terry, and H.W. Anderson.

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FOREWORD

Stanley P. Gessel

This conference was organized to review and discuss methods to sustain and improve the productivity of our northwestern coniferous forests through nutrient management. The initial conference on this subject sponsored by the College was held in 1979 at Alderbrook Inn. I was privileged to attend that conference and since then a number of others in different parts of the world. They have all been useful in advancing the science and practice of forest tree nutrition. I expect this one to open new research vistas and extend the application of research results in the quest for better forest management. Carrying this out will not be an easy task in view of the many arguments about almost any aspect of forestry these days. However, I believe all factions accept the importance of sustained forest productivity even though each may have a different concept of what it means and what role the forest manager can play. This conference takes the approach that forest productivity can be improved and sustained by proper forest management and that achieving this is a legitimate goal for both researchers and managers. Participants discussed some of the techniques to accomplish this goal as well as some of the pitfalls.

Personally, I approached this conference with mixed feelings. On the one hand, I view it as representing the culmination of over forty years of work in this field by myself and close associates, especially Dick Walker and some departed ones such as Bill Stoate and Ken Turnbull. This does make me a little sad, especially since the challenges, the opportunities, and the need for good information in the field is so great that I would rather be embarking on a career dedicated to acquiring more information to improve forestry than finishing one.

On the other hand, I am happy about what has been achieved by the forty years of research. We know the basic facts about the nutrition of our Northwest species, and we know how to improve the vigor, health, and growth of our forests through proper soils management and fertilization practices. What we now need is to break through the mysticism currently engulfing forestry and apply what we know so as to achieve better forest management. I think this conference has helped us move in that direction.

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Many individuals and organizations contributed to the success of this conference and the collection of papers in this volume. The conference was sponsored by the University of Washington College of Forest Resources, the Stand Management Cooperative, the U.S. Forest Service Pacific Northwest Research Station, and the Washington Department of Natural Resources.

The program was planned by a committee consisting of:

Mr. Harry Anderson	Washington Department of Natural Resources
Dr. James Boyle	Oregon State University
Mr. Robert Brockley	B.C. Ministry of Forests, Research Branch
Dr. Nick Chappell	University of Washington
Mr. Donald Connett	USDA Forest Service, Pacific Northwest Region
Dr. Stanley Gessel	University of Washington
Mr. Larry Larsen	Bureau of Land Management
Dr. Richard Miller	USDA Forest Service, Pacific Northwest Research Station
Dr. James Moore	University of Idaho
Dr. John Olson	Potlatch Corporation
Dr. Robert Powers	USDA Forest Service, Pacific Southwest Research Station
Dr. Thomas Terry	Weyerhaeuser Company
Dr. Gordon Weetman	University of British Columbia

This committee developed the program and recruited authors for the topics presented. The lead authors, in turn, worked with coauthors and consulted with others to make this a truly regional effort. The time and effort of all these contributors resulted in excellent presentations and posters. Papers were reviewed before acceptance for publication, and the input of the many reviewers (listed at the end of the proceedings) is much appreciated. The session moderators, Jim Boyle, Jim Moore, Don Connett, Tom Terry, Larry Larsen, and Nick Chappell, provided program linkage and kept the conference on schedule.

Ms. Beverly Gonyea and Ms. Betty Johanna of the University of Washington College of Forest Resources Continuing Education office were responsible for conference arrangements and management. Their efforts and those of the registration workers, projectionists, and other volunteers were critical for the smooth operation of the conference and are greatly appreciated.

Production of this volume was coordinated through the Institute of Forest Resources; Robert Beer, Veronica Gallardo, Margaret Lahde, Mary Smith, and Shirley Verzosa spent many hours working on this publication. Final editing and publication preparation were handled by Leila Charbonneau. The capable efforts of this skilled group are gratefully acknowledged.

H. N. Chappell
G. F. Weetman
R. E. Miller

Fertilization has become a silvicultural practice of major significance in western forests. Research beginning about 1950 in western Washington demonstrated that increases in tree and stand growth after fertilizer application were comparable to responses in other forest regions. This stimulated interest in further research and fostered initial operational fertilization. Since that early work, the scale of research has increased, with three regional projects providing information for coastal forests in Washington and Oregon (the Regional Forest Nutrition Research Project), coastal British Columbia (the B.C. Ministry of Forests EP703 trials), and interior forests (the Intermountain Forest Tree Nutrition Cooperative), as well as many other research endeavors in university, government, and industry research organizations. Fertilization operations—primarily for application of nitrogen to coastal Douglas-fir stands—have increased on both private and public timberlands.

In addition to considering timber production objectives in developing fertilization prescriptions, managers are faced with critical economic influences, environmental concerns, and regulatory constraints. Forest managers and planners must weigh the relative costs and benefits of their options, and allocate resources to those that most effectively and efficiently advance their multiple objectives. Uncertainty about response and environmental risks are inherently associated with decisions about treatments in complex situations, such as prescribing fertilizer treatments

The information base for forest fertilization has improved significantly over the past twenty years. The first regional conference on forest fertilization was held in Union, Washington, and the proceedings of that conference have served as a reference for many managers and researchers. Other fertilization meetings, including a provincewide workshop held in Vancouver, British Columbia, in 1988, have provided current information to forest managers and planners dealing with fertilization prescriptions.

The goal of the 1991 conference was to summarize and synthesize research results and operational experience, updating information presented at the first regional conference. This volume represents the efforts of many authors to achieve that goal, and provides a comprehensive compilation of information relevant to forest fertilization in the West. It should be useful to anyone involved with forest fertilization and tree nutrition as a means to sustain and improve growth of managed stands.