

Chapter 1

Development of the *Forest Nursery Manual*: A Synthesis of Current Practices and Research

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Abstract

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Abstract

The *Forest Nursery Manual*—a joint effort between the Department of Forest Science, Oregon State University, and the U.S.D.A. Forest Service, Division of State and Private Forestry—presents state-of-the-art information about current bareroot-nursery practices and research in the Northwest (northwestern United States and province of British Columbia, Canada). The *Manual* emphasizes all stages of seedling production, from nursery-site selection through outplanting. To gather information, 21 Northwest bareroot nurseries and eight seed-processing plants were surveyed with two in-depth questionnaires. Survey results were interpreted and incorporated into chapters written by leading scientists and nursery managers. Over 250 people previewed the *Manual* at the Bareroot Nursery Technology Workshop, held at Oregon State University in October 1982. The growing size and sophistication of the Northwest bareroot-nursery industry underscore the pressing need for this up-to-date manual.

1.1 Objective and Rationale

The Forest Nursery Manual is the result of a coordinated effort between the Department of Forest Science, Oregon State University (OSU), and the U.S.D.A. Forest Service, Division of State and Private Forestry. Current forest-nursery practices and research are reviewed and synthesized into a state-of-the-art presentation on bareroot nursery technology in the Northwest (northwestern United States and province of British Columbia, Canada).

In 1979 a task force was appointed by the Dean of the OSU School of Forestry and the State Forester of Oregon to study and report on the status of forest-nursery management in the Northwest. In addition to recommending the establishment of a Nursery Technology Cooperative at OSU, the task force also recognized the need for a detailed review of bareroot nursery technology.

At about the same time, nursery specialists of the U.S.D.A. Forest Service identified the need for a bareroot nursery manual. The Forest Service publication *How to Grow Tree Seedlings in*

Containers in Greenhouses (see Appendix 1, this chapter)¹ has been well received worldwide. On that basis, a decision was made to initiate plans for a similar manual on bareroot nurseries.

Although many nursery handbooks have been published over the years (see Appendix 1), no up-to-date manual discusses current bareroot-nursery practices in depth. *Regenerating Oregon's Forests*, a recent publication, has a chapter on seedlings; the Forest Nursery Handbook, developed for bareroot nurseries in British Columbia, focuses largely on cultural practices. Other recent nursery publications (such as *Nursery Management: Administration and Culture*) deal primarily with ornamental nursery practices. None of these has comprehensively addressed operations, problems, and needs of forest-tree nurseries producing large numbers of bareroot seedlings for commercial use.

Bareroot nurseries are a sizable industry in the Northwest, annually producing about 278 million seedlings. New nurseries are being started and existing nurseries expanded to meet the increased seedling-production needs projected for the next decade. In addition, foresters are becoming more and more aware of the importance of high-quality seedlings to reforestation success. New nursery practices such as seedling vigor testing and the advent of new seedling stock types (e.g., plug+1 transplants; see chapter 16, this volume) are not covered in current nursery texts. For all these reasons, an up-to-date bareroot nursery manual is essential.

1.2 The OSU Nursery Survey

1.2.1 Survey participants

To meet our objectives of summarizing current bareroot-nursery practices, we conducted a survey (the OSU Nursery Survey) of 21 Northwest bareroot nurseries, 16 in the United States and 5 in Canada² (Fig. 1). To be selected, nurseries had to (1) produce more than 6 million seedlings per year and (2) be located in, or supply seedlings to, the Northwest. The 16 U.S. nurseries produced 229 million seedlings in 1980—approximately 95% of the bareroot seedlings grown in the northwest U.S. (Fig. 2). The five Canadian nurseries, located in British Columbia, produced 49 million seedlings—approximately 89% of the bareroot seedlings grown in the province.

The 21 nurseries ranged in elevation from 30 m (100 ft) to 1,282 m (4,206 ft). The oldest nursery, the U.S.D.A. Forest Service Wind River Nursery, was established in 1909 and the

¹All nursery handbooks mentioned are fully cited in Appendix 1, Bareroot Nursery Handbooks, at the end of this chapter.

²The Canadian portion of the Survey was conducted by David Simpson, B.C. Ministry of Forests.

newest, the Tye Tree Nursery, in 1979. Douglas-fir [*Pseudotsuga menziesii* (Mirb.) Franco] is the most common species produced in the surveyed nurseries, and 2-year-old (2+0) seedlings are the most common stock type (Fig. 2).

Because not all seed collection and processing are done by nurseries, eight Northwest seed-processing plants also were surveyed (Fig. 3). These data are reported and discussed in chapter 4, this volume.

1.2.2 The questionnaires

With the help of chapter authors, we developed two in-depth questionnaires for the OSU Nursery Survey; copies are found in Appendices A and B at the end of this volume. Questionnaire # 1, a series of tables, requested specific numeri-

cal information on topics such as fertilization, root culturing, and equipment; because of its detailed nature, this questionnaire was mailed to nurseries prior to our visits, which were made in fall 1981. Questionnaire #2, in short-answer form, was administered during those visits and was completed in about 4 hours at each nursery.

Data collected from the Survey were later distributed to the authors for interpretation and use in their individual chapters.

1.3 Preparing the *Manual*

Leading scientists with a practical knowledge of on-the-ground operations were invited to write chapters for the *Manual*. To present a balanced point of view, we chose authors from public agencies and institutions as well as private industry and also solicited chapters on selected topics in nursery management from practicing nursery managers in the Northwest.

As editors, we interacted regularly with authors during all stages in the writing process. First, we provided each author with a list of topics establishing the subject area to be covered in his or her chapter. Each author then developed a working outline and tentative title. Rough drafts were technically reviewed by us and by other scientists and nursery personnel; final drafts were technically edited at the Forest Research Laboratory, OSU, where the *Manual* was designed and produced.

Participants of the Bareroot Nursery Technology Workshop, held at OSU, previewed the *Manual* in preliminary form on October 26-28, 1982. Attendance of over 250 people at the

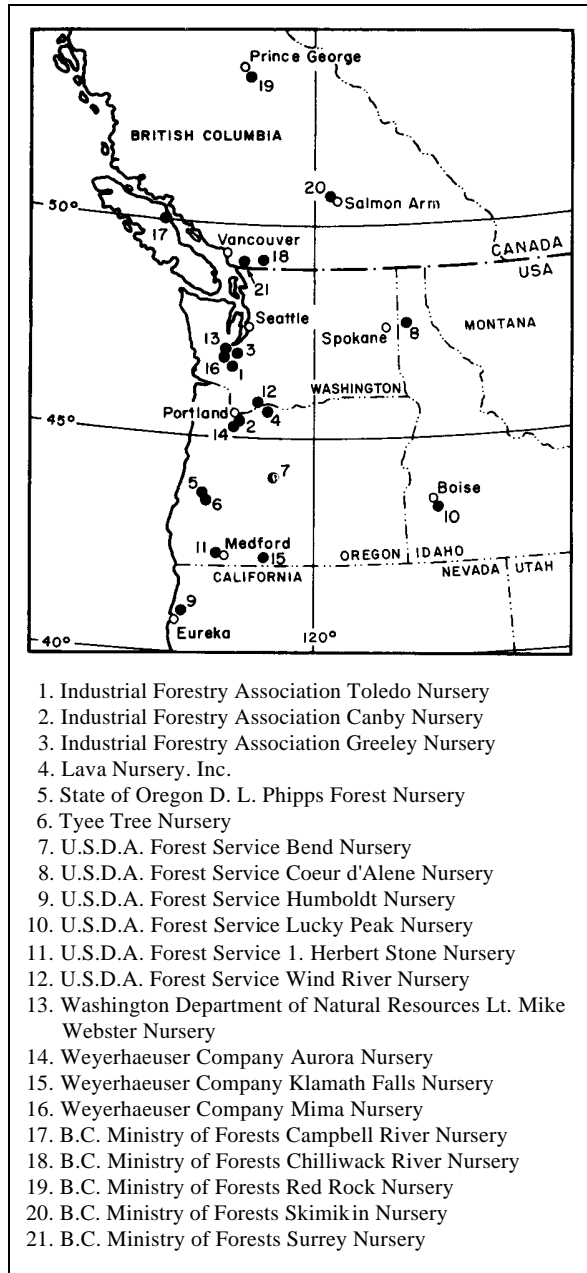


Figure 1. Listing and location of the 21 Northwest bareroot nurseries participating in the OSU Nursery Survey.

Total 1980 Production: 278 million seedlings	
16 U.S. nurseries: 229 million	
5 Canadian nurseries: 49 million	
Species produced	% of total
Douglas-fir [<i>Pseudotsuga menziesii</i> (Mirb.) Franco]	61
Ponderosa pine (<i>Pinus ponderosa</i> Dougl. ex Laws.)	10
Lodgepole pine (<i>Pinus contorta</i> Dougl. ex Loud.)	6
Spruces (<i>Picea</i> spp.)	14
True firs (<i>Abies</i> spp.)	7
Other	2
	<hr/> 100
Stock types produced	% of total
1+0	1
2+0	79
3+0	1
Bareroot transplant	17
Plug+1 transplant	2
	<hr/> 100

Figure 2. Total 1980 production of bareroot seedlings in the 21 nurseries participating in the OSU Nursery Survey, by seedling species and stock type.

B.C. Ministry of Forests, Duncan Seed Centre. Duncan, British Columbia
Brown Seed Company, Vancouver, Washington
Crown Zellerbach Nursery, Aurora, Oregon
Esses Tree Seed Company, Inc., Montesano, Washington
Pacific Forest Seeds, Medford, Oregon
Rex Timber, Inc., a subsidiary of Georgia-Pacific Corporation, Eugene, Oregon
Simpson Timber Company, Albany, Oregon
Weyerhaeuser Company Seed Plant, Rochester, Washington

Figure 3. The eight Northwest seed-processing plants responding to the seed section of the OSU Nursery Survey.

workshop reinforced our belief in the pressing need for state-of-the-art information on nursery practices. Stimulating discussions between authors and other participants resulted in important additions to many chapters: in particular, chapter 28, Designing Nursery Experiments, was proposed and subsequently added to the Manual.

The Forest Nursery Manual is organized into seven sections emphasizing the major stages of seedling production—from

selecting a nursery site and starting seedlings through growing, harvesting, and outplanting. Where possible and appropriate, cross-referencing directs readers to other chapters that might provide additional useful information. The final section, Upgrading Nursery Practices, is intended to stimulate thinking toward improving nursery management. A comprehensive glossary and tables of common nursery conversion factors are also included as appendices.

Appendix 1—Bareroot Nursery Handbooks

- Abrahamson, L. P., and D. H. Bickelhaupt (eds.). 1980. **Proceedings, North American forest tree nursery soils workshop.** State Univ. New York, Coll. Environ. Sci. and Forestry, Syracuse. 333 p.
- Aldhous, J. R. 1972. **Nursery practice.** Her Majesty's Stationery Office, London. Forestry Comm. Bull. 43. 184 p.
- Armson, K. A., and V. Sadreika. 1979. **Forest tree nursery soil management and related practices.** Ministry of Natural Resources, Ontario. 179 p.
- Bluhm, W. L., and J. L. Green. 1979. **Growing nursery stock—is it for me?** Oregon State Univ. Ext. Serv., Corvallis. Ext. Manual 5. 56 p.
- Cleary, B. D., R. D. Greaves, and R. K. Hermann (eds.). 1978. **Regenerating Oregon's forests.** Oregon State Univ. Ext. Serv., Corvallis. 286 p.
- Davidson, H., and R. Mecklenburg. 1981. **Nursery management: administration and culture.** Prentice-Hall, Inc., Englewood Cliffs, New Jersey. 4 50 p.
- Kummel, J. F., C. A. Rindt, and T. T. Munger. 1944. **Forest planting in the Douglas-fir region.** U.S.D.A Forest Serv., Washington, D.C. 154 p.
- Schubert, G. H., and R. S. Adams. 1971. **Reforestation practices for conifers In California.** Dep. of Conservation, Div. of Forestry. State of California, Sacramento. 3 59 p.
- Stoeckeler, J. H., and G. W. Jones. 1957. **Forest nursery practice in the Lake States.** U.S.D.A. Forest Serv., Washington, D.C. Agric. Handb. 1 10. 124 p.
- Stoeckeler, J. H., and P. E. Slabaugh. 1965. **Conifer nursery practice In the Prairie-Plains.** U.S.D.A. Forest Serv., Washington, D.C. Agric. Handb. 279. 93 p.
- Tillotson, C. R. 1917. **Nursery practice on the national forests.** U.S.D.A. Forest Serv., Washington, D.C. Bull. 479. 86 p.
- Tinus, R. W., and S. E. McDonald. 1979. **How to grow tree seedlings in containers in greenhouses.** U.S.D.A. Forest Serv., Rocky Mountain Forest and Range Exp. Sta., Fort Collins, Colorado. Gen. Tech. Rep. RM-60. 2 56 p.
- Tourney, J. W., and C. F. Korstian. 1942. **Seeding and planting in the practice of forestry.** 3rd ed. John Wiley and Sons, Inc., New York. 520 p.
- van den Driessche, R. 1969. **Forest nursery handbook.** B. C. Forest Service, Victoria. Res. Note 48. 44 p.
- Wakeley, P. C. 1954. **Planting southern pines.** U.S.D.A. Forest Serv., Southern Forest Exp. Sta., New Orleans, Louisiana. Agric. Monograph 18. 233 p.
- Williams, R. D., and S. H. Hanks. 1976. **Hardwood nurseryman's guide.** U.S.D.A. Forest Serv., Washington, D.C. Agric. Handb. 473. 78 p.