Introduction

Healthy Trees!

This book focuses on the dark side of forest-nursery production. However, our emphasis on pests and problems is really just a step toward the common goal of producing healthy trees for regenerating the forests of the Northwest. Healthy trees don't grow in nurseries by accident. In fact, the same conditions that make nursery production of seedlings successful—high densities, favorable temperature and moisture, and intensive agricultural crop-management techniques—are also ideal for many of the fungi and insects that attack seedlings. Healthy trees result when pest management is integrated with the other aspects of nursery culture throughout the crop cycle. This book is about growing healthy trees by integrating nursery pest-management principles with the day-to-day operation of the enterprise.

The quality of forest-nursery stock has risen dramatically over the last 20 years. The payoff from better stock is seen in the young forests of the Northwest. With success has come higher expectations—field survival of 90 percent or better was only a dream a few years ago, and now it is the norm for most sites. A large portion of the credit goes to the managers and growers of the forest nurseries of the region. They have learned with each crop and now consistently apply those lessons. It is worth listing some of the key features of the current success, lest a new generation forget some of the practices we often take for granted.

Forest nurseries of the Pacific Northwest consistently grow high-quality seedlings that have high field survival rates on forest sites.

1. **Careful handling of seedlings.** Constant attention to lifting, storage, and handling assures that seedlings reach the field in optimal physiological condition.

2. **Better seed.** Emphasis on the collection of clean seed and the careful handling and storage of seed have improved germination vigor and greatly reduced losses from seed decay and damping-off. High-vigor seed also produces more-robust seedlings, which are better able to recover from biotic and abiotic damage.

3. **Improved nursery soils.** Better seed is sown in better ground. The worst nurseries and the worst portions of others have been abandoned and new sites have been selected. Cultural and soil characteristics are now just as important as short-term economic considerations in selecting nursery sites—or perhaps even more. Soil management to maintain and improve the tilth and fertility of nursery soils is now everyone's priority. Pest management can be successful only where soil conditions give the seedlings at least a fighting chance.

4. **Improved pesticides and application procedures.** Most insect and nematode problems and several diseases are now effectively managed with chemicals. Growers are more aware of the need for early

detection and of the advantages of preventing problems from appearing in the first place.

5. Attention to detail. Nurseries are managed more professionally than ever before, and managers have a widespread understanding that the success of the whole enterprise depends on proper timing and execution of each step of the process.

Progress has been dramatic. While there is room for improvement, the emphasis of this book is on what we know rather than on what we have yet to learn.

Why this book? Why now?

There are other publications on nursery pest management. These are helpful to many managers and growers. References to other sources of information follow each chapter. Our book focuses on problems of bareroot nurseries of the Pacific Northwest. The tree species, the climate, and the cultural practices of this region are different from those in other tree-growing areas, even British Columbia. Consequently, the diseases and insect pests and the strategies to manage them are different. We hope that the regional focus of this work allows it to be specific in its identifications and recommendations.

And why now? In recent years there has been an unprecedented effort from universities, the forest services of the United States and Canada, the states of Oregon, Washington, Idaho, and California, and the nurseries themselves to understand the causes of nursery problems and ways to reduce their effects. This effort has been brought on by the ever-increasing value of seed and seedlings, and by the need for the appropriate seedlings to be available on time for reforestation of cut-over sites. The information is scattered, and in some cases is not even written down. Now is the time to summarize what we have learned and make it generally available. And there is nothing like writing a book to highlight the remaining gaps in our understanding. This book, therefore, is also the springboard for future improvements in pest-management research and development.

Where to find more help

In many cases you will need more information to apply or confirm what you learn here. Any of the following sources will be helpful in providing more, or updated, information:

- Philip Hamm, Everett Hansen, or the Plant Clinic
  Department of Botany and Plant Pathology
  Oregon State University
  Corvallis OR
  (503) 737-3451

- Sally Campbell
  Forest Pest Management,
  USDA Forest Service
  Portland, OR
  (503) 326-2727

- Tom Landis
  Cooperative Forestry
  USDA Forest Service
  Portland, OR
  (503) 326-2727

- Susan Frankel
  Forest Pest Management,
  USDA Forest Service
  San Francisco, CA
  (415) 705-2651

- Fred McElroy
  Peninsu-Lab
  Kingston, WA
  (800) 635-6866

- Bob James
  Forest Pest Management,
  USDA Forest Service
  Coeur d'Alene, ID
  (208) 765-7421

- Alan Kanaskie and Dave Overhulser
  State Department of Forestry
  Salem, OR
  (503) 378-2554

- Ken Russell
  Washington Department of Natural Resources
  Olympia, WA
  (206) 753-0671

- Jack Sutherland and John Dennis
  Canadian Forestry Service
  Victoria, BC
  (604) 388-0639