



# Identifying Mature and Old Forests

**IN WESTERN WASHINGTON**

by Robert Van Pelt



WASHINGTON STATE DEPARTMENT OF  
**Natural Resources**  
Doug Sutherland - Commissioner of Public Lands

# Acknowledgements

The need for this guide became apparent after the 2004 Legislature directed DNR to conduct an inventory of old-growth forest stands on state lands as defined by a panel of scientists. The product of that effort, *Definition and Inventory of Old Growth Forests on DNR-Managed State Lands* (2005), made it clear that it was important for field personnel to be able to identify with confidence mature and old-growth forests throughout western Washington.

It is essential to acknowledge the people I worked with on the Old Growth Definition Committee: Dr. Jerry F. Franklin, Dr. Thomas Spies, Dr. Paula Swedeen, Dr. Rex Crawford, Sabra Hull, Steve Curry, and Walt Obermeyer, all of whom contributed to the concepts which form the basis of this guide.

Many people reviewed the text during its various iterations, which greatly contributed to improvements in both readability and scientific content:

Richard Bigley  
Angus Brodie  
Chris Earle  
Jerry Franklin  
Keala Hagman

Sabra Hull  
Arthur Jacobson  
Andrew Larson  
Corina Logan  
Tami Miketa

Kyra Nourse  
Walt Obermeyer  
Jeff Ricklefs

Many thanks to the University of Washington College of Forest Resources for their contribution to the printing effort.

The layout and design of this guide was ably and beautifully conducted by Nancy Charbonneau and Jane Chavey of the DNR Communications Group.

Photos, maps, and drawings by author except where indicated otherwise.

---

## Washington State Department of Natural Resources

This guide was produced under contract as part of the ongoing research and application of new information to inform both land management and resource protection goals of the department. The Washington State Department of Natural Resources manages 5 million acres of land - forests, farms, commercial properties and aquatic lands to provide perpetually for both revenue and conservation objectives for the people of Washington State.

*Identifying Older Forest in Western Washington*, will be a valuable tool for agency forestland managers and others interested in the complexities and ecological relationships that give rise to older forests. This guide will be used by the department to aid in the identification and protection of these unique forest structures.

---

### Suggested Citation:

Van Pelt, R. 2007. Identifying Mature and Old Forests in Western Washington. Washington State Department of Natural Resources, Olympia, WA. 104 p.

*This guide was developed  
to support management of  
forested state trust lands.*

Washington State  
Department of Natural Resources  
Land Management Division  
Ecosystem Services Section

June 2007

# **Identifying Mature and Old Forests**

**IN WESTERN WASHINGTON**

by Robert Van Pelt



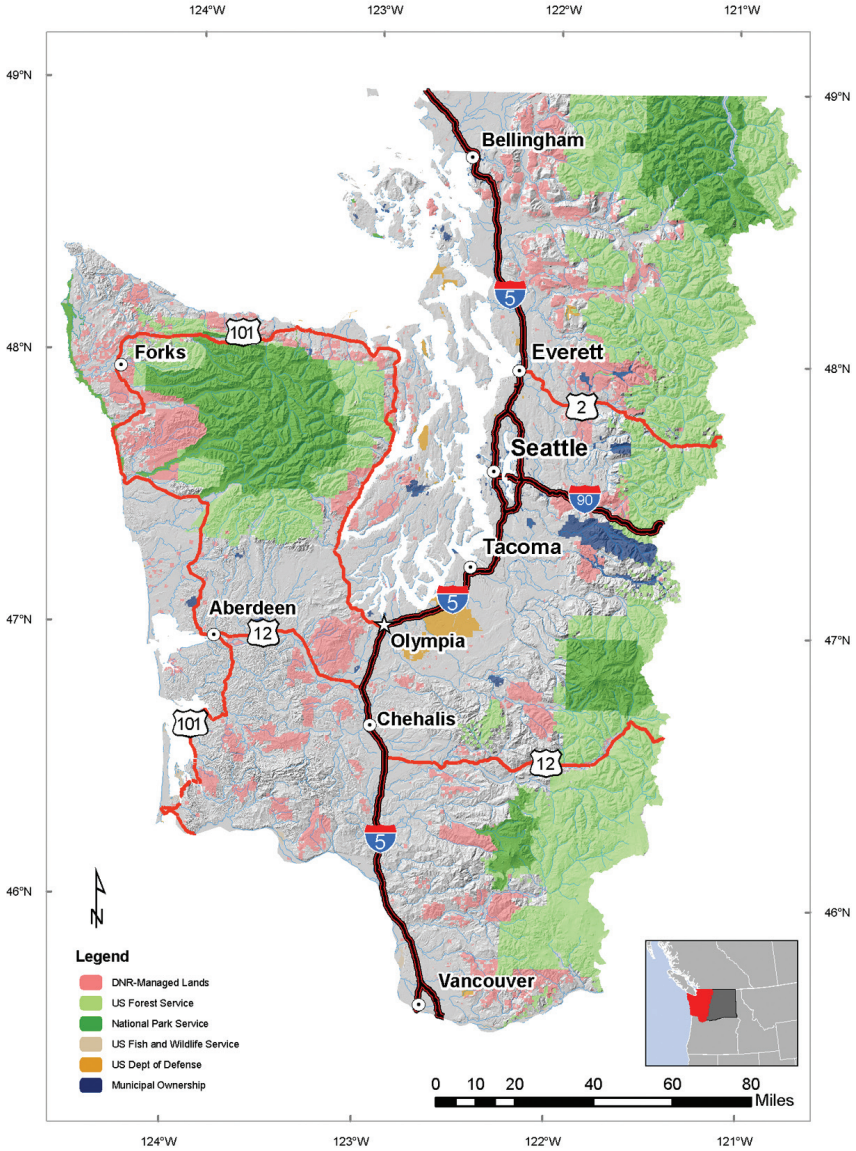
WASHINGTON STATE DEPARTMENT OF  
**Natural Resources**  
Doug Sutherland - Commissioner of Public Lands



# Table of Contents

5	Introduction
6	Guide Organization
9	Environmental Setting of Western Washington
12	Key to Vegetation Zones in Western Washington
16	Fire in Western Washington Prior to Euro-American Settlement
22	Wind Disturbances
24	Important Information on Shade Tolerance
27	Stand Development in Natural Douglas fir Forests
27	Disturbance and legacy creation
32	Cohort establishment
34	Canopy closure
35	Biomass accumulation/Competitive exclusion
36	Maturation I
37	Maturation II
39	Vertical diversification
41	Horizontal diversification
42	Pioneer cohort loss
44	Other scenarios
46	Key to Stand Development Stages in Western Washington
49	Douglas fir
51	Bark characteristics
54	Lower crown characteristics
58	Crown form and tree vigor
64	Rating system for aging legacy trees
65	Longevity and death
67	Sitka spruce
68	Early growth patterns
72	Patterns in mature trees
73	Longevity and death
77	Noble fir
83	Western hemlock
88	Hemlock dwarf mistletoe
89	Longevity and death
93	Western redcedar
97	Pacific silver fir
101	Conclusion
101	English equivalents
102	Citations
103	Appendix-Stand development stage crosswalk

# Locator map of Western Washington with major public ownerships



### Introduction

Western Washington is part of the most heavily forested portion of the United States. Within this small region, a great diversity of environments can be found, ranging from the coastal rain forests of the Olympic Peninsula to the gravelly plains of the Puget lowlands and the glacier-clad peaks of the Cascade Mountains. Across this landscape, complex patterns of precipitation have resulted in a diversity of fire regimes. Despite this diversity, relatively few species of trees, primarily represented by long-lived conifers, are found within these forests.

Such varied environmental conditions can affect the physiology and appearance of the trees that occupy the region. The purpose of this guide is to help the reader interpret the ecology, disturbance history, and age of a given stand using features of the environment, including the physical characteristics of the trees themselves.



This guide is intended to provide much of the necessary information needed to reconstruct stand history and discern stand development stages for the major forest types found in western Washington. The great size achieved by many trees coupled with the heart rots common in western Washington makes the use of increment borers impractical in many forests. Assessing the age of a forest without specific knowledge of the ages of the trees contained within is an exercise in gathering and deciphering the relevant pieces of data. A working ecological understanding of the major tree species, the environments where they grow, and the dominant disturbance regimes at play in a given stand is required when making determinations of stand age.

The scope of this guide will be limited to western Washington; a separate guide will cover eastern Washington.

### **Guide Organization**

In order to identify mature and old forests, the great diversity of environments present in western Washington must be acknowledged. In addition, to discern age patterns in forests, one must understand a number of ecological concepts. Finally, the characteristics of the dominant species, important in the identification of mature and old forests, must be clearly understood.

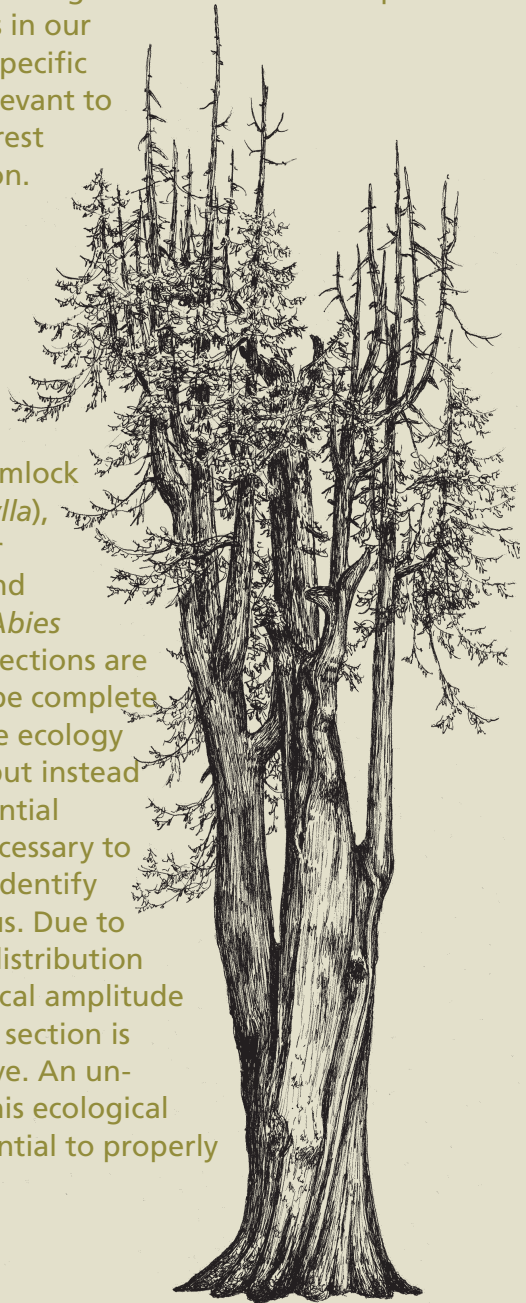
This guide presents the general forces that drive the composition, structure, and the nature of western Washington forests. Physiographic and environmental gradients, fire and wind disturbance patterns, and the ecological characteristics of shade tolerance are discussed. An idealized model of forest stand development is presented in detail, applicable to most forests in western Washington. Variations of the model are also examined.



## Introduction

The latter part of this guide addresses the important individual species in our forests, and the specific characteristics relevant to discussions on forest age and succession.

This includes sections on Douglas fir (*Pseudotsuga menziesii*), Sitka spruce (*Picea sitchensis*), noble fir (*Abies procera*), western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), and Pacific silver fir (*Abies amabilis*). These sections are not intended to be complete discussions on the ecology of each species, but instead focus on the essential characteristics necessary to understand and identify successional status. Due to the widespread distribution and wide ecological amplitude of Douglas fir, its section is the most extensive. An understanding of this ecological amplitude is essential to properly



## Introduction

understand and discern stand development where Douglas fir occurs.

Several tree species are not specifically treated in this guide, including red alder (*Alnus rubra*), grand fir (*Abies grandis*), bigleaf maple (*Acer macrophyllum*), black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), mountain hemlock (*Tsuga mertensiana*), yellow cedar (*Cupressus nootkatensis*), and subalpine fir (*Abies lasiocarpa*). These species are mentioned in the text when appropriate, but a specific section on each was deemed unnecessary. While red alder is abundant at lower elevations in western Washington, and pure stands are not uncommon, it is rare to find specimens older than 100 years of age. Its usefulness in a guide on identifying mature and old forests is therefore limited.