Identifying Old Trees and Forests

IN EASTERN WASHINGTON

by Robert Van Pelt

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

Acknowledgements

This guide is a companion to *Identifying Mature and Old Forests in Western Washington* (Van Pelt, 2007). It was conceived in response to the work of the Old Growth Definition Committee. The committee was convened at the request of the Washington State Legislature to map and inventory old growth forests on state trust lands managed by DNR. In the course of the committee's work, the need became apparent for field guidance to assist field personnel in identifying individual old trees and forests.

It is essential to acknowledge the people I worked with on the Old Growth Definition Committee: Dr. Jerry F. Franklin, Dr. Miles Hemstrom, Joe Buchanan, Rex Crawford, Steve Curry, Sabra Hull, 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
Ron Brightman
Joe Buchanan
Angie Cahill
Chris Earle
Jerry Franklin
Keala Hagman
Miles Hemstrom
Sabra Hull
Arthur Jacobson
Andrew Larson
Jim Lutz
Tami Miketa
Bob Redling
Jeff Ricklefs

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 Washington's Department of Natural Resources. DNR 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.

Identifiying Old Trees and Forests in Eastern 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. 2008. Identifying Old Trees and Forests in Eastern Washington. Washington State Department of Natural Resources, Olympia, WA. 166 p.

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

Washington State
Department of Natural Resources

Land Management Divison
Ecosystem Services Section

September 2008

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Scope and Purpose

This guide is intended to help the reader interpret the ecology, disturbance history, and ages of eastern Washington forests through an examination of environmental conditions and physical characteristics at the stand and individual tree level. The process of recognizing older stands in eastern Washington involves more than simply determining age. The great size achieved by many trees coupled with the heart rot common in old trees in eastern Washington often precludes the use of increment borers. Assessing the age of forested stands and the individual trees contained within is an exercise in gathering and deciphering relevant information, requiring an understanding of the ecology of the major tree species, the environments they grow in, and the dominant disturbance patterns.

Eastern Washington is in many ways a microcosm of western North America. A great diversity of environments can be found within this relatively small area, ranging from rain forests near the Cascade Crest to dry, oak–pine forests of Klickitat County, to barren sand dunes in the Columbia Basin.

Across this landscape, complex patterns of tree species distribution, precipitation, human activity, and fire regimes have resulted in a great diversity of forest types. Such varied environmental conditions affect both tree physiology and appearance. Surprisingly, relatively few species of trees occur—most are long-lived conifer species.

Despite sharing many tree species, the forests of eastern and western Washington differ greatly in stand development and individual tree characteristics. In western Washington, an examination of forest stand-level features usually provides sufficient clues to decipher stand age. In contrast, forest disturbances in eastern Washington often do not kill all trees, and individuals are able to persist from one disturbance to the next. In such cases, the age of individual trees becomes more meaningful than overall stand age. While the stand concept is useful in many areas of eastern Washington, such as in the wet forests along the Cascades or those at high elevations, complex disturbance patterns in the drier forest types of eastern Washington make the task of defining a stand more difficult. In many of these dry or moderately moist forests an individual tree approach is required.

The scope of this guide is limited to eastern Washington—a separate guide has been prepared for western Washington—*Identifying Mature and Old Forests in Western Washington (Van Pelt 2007).*

Guide Organization

The task of identifying mature and old forests and trees in eastern Washington is threefold, requiring an understanding of the diversity of forest environments present, the ecological processes affecting how stands and trees change over time, and the characteristics used to deter-

mine age patterns of the dominant tree species. These concepts are discussed in two major sections within this guide.

The first section, **Ecological and Environmental Context,** describes the physiographic and environmental gradients found in eastern Washington. Detailed descriptions of the forested vegetation zones are provided, along with keys used to determine their presence. A discussion of disturbance follows, including fire frequency, severity, and how fire severity patterns have been altered by Euro-American settlement. Insect outbreaks and mistletoe infections are also discussed, as they often provide important clues to stand development. An understanding of stand developmental stages is necessary to determine the age of stands that have developed under high-severity fire regimes. An idealized model of stand development is presented, complete with keys. Lastly, the role of shade tolerance in discerning species interactions and age patterns is presented. In forests that develop under more moderate disturbance regimes, the concept of a stand is difficult to define. Instead, age determination is achieved by an examination of individual trees.

The latter part of this guide, **Individual Species or Species Group Treatments,** addresses the primary tree species found in eastern Washington and their specific characteristics relevant to discussions on forest age and succession. Four species are considered the most important within mid- to lower elevation forests: ponderosa pine (*Pinus ponderosa*), western larch (*Larix occidenta lis*), Douglas fir (*Pseudotsuga menziesii*), and grand fir (*Abies grandis*). A discussion of higher elevation forest patterns follows, including descriptions of Engelmann spruce (*Picea engelmannii*) and Rocky Mountain subal-

pine fir (*Abies bifolia*[1]). A final section discusses several tree species generally considered more important in western Washington—western hemlock (*Tsuga heterophylla*), western redcedar (*Thuja plicata*), Pacific silver fir (*Abies amabilis*), and mountain hemlock (*Tsuga mertensiana*)—and the differences they exhibit when found in eastern Washington. Each of these sections is intended to focus on the essential characteristics necessary for understanding and identifying successional status of the species, rather than a comprehensive review of their ecology. The sections on ponderosa pine, western larch, and Douglas fir are the most extensive due to these species' widespread distribution, ***ecological amplitude,*** economic importance, and the key role they play in helping to determine the age of forests in which they occur.

The two long-lived upper treeline species—those that occur at the fringe of the highest elevation that trees can grow—alpine larch (*Larix lyallii*) and whitebark pine (*Pinus albicaulis*), are not treated separately in this volume. These species include some of the oldest recorded individual trees in Washington, but live in such extreme treeline habitats that forests or woodlands that are even a few meters tall are often a century or two old. Active forest management does not occur in such severe habitats. Several other common tree species, including western white pine (*Pinus monticola*), lodgepole pine (*Pinus contorta* var. *latifolia*), noble fir (*Abies procera*), yellow cedar (*Cupressus nootkatensis*), Oregon white oak (*Quercus garryana*), quaking aspen (*Populus*

[1]*A. bifolia and A. lasiocarpa* are closely allied sibling species known to introgress through central British Columbia and northern Washington. *A. bifolia x lasiocarpa* may have morphologic features resembling either species. Pure populations of *A. lasiocarpa* are found in coastal areas of Alaska and British Columbia – see *www.conifers.org* for a more detailed discussion.

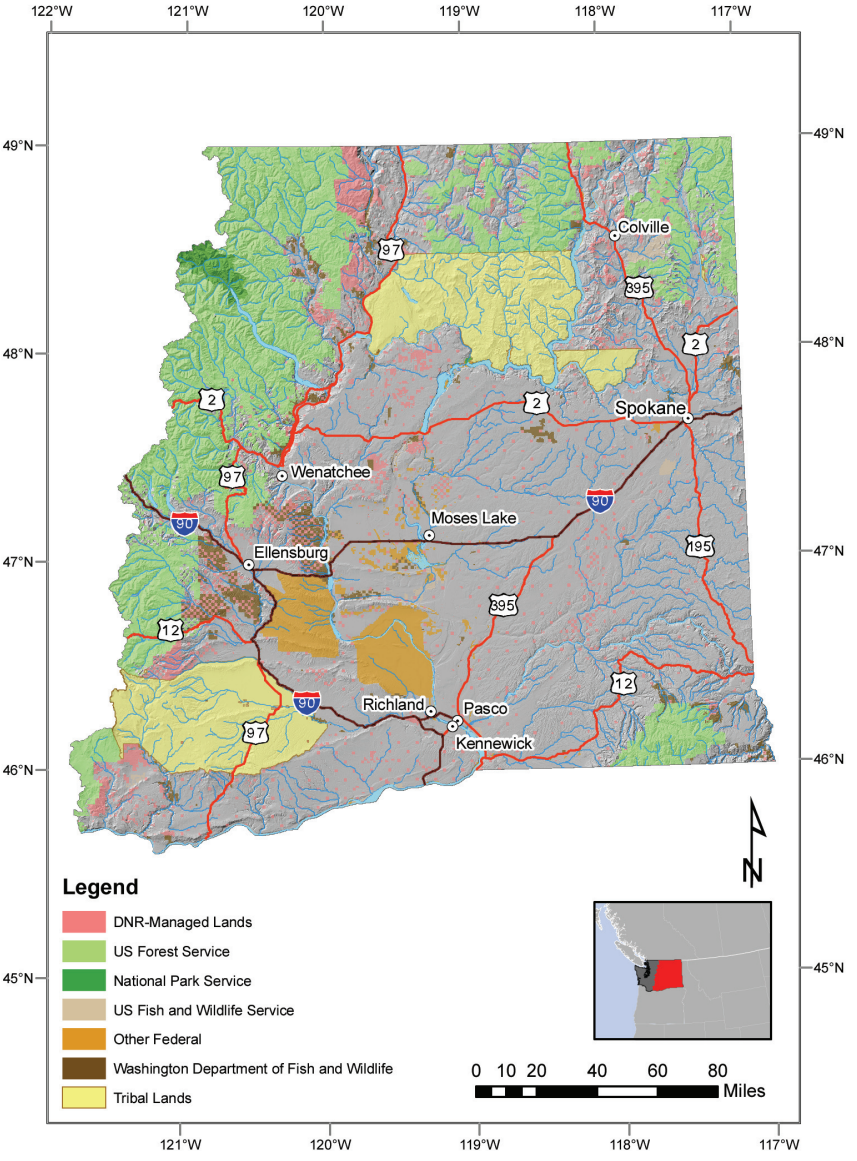
tremuloides), black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), and alder species (*Alnus*) were not given their own sections. These species are mentioned in the text where appropriate, but a specific section on each was deemed unnecessary – other species or stand characteristics are sufficient to determine tree or stand age. While alders and cottonwoods are abundant along virtually all watercourses, their short life-spans limit their usefulness in a guide to identifying mature and old forests.

How to Use This Guide

This guide provides the necessary tools to arrive at a reasonable age estimate for a selected tree, grove of trees, or forest stand using a three-step process:

1. Identify the forested vegetation zone.
2. Identify the level of fire-severity to determine if a tree-level or stand-level approach is needed.
3. Determine an approximate age by using either the stand development sequence key or the individual species keys. The remainder of this book provides an explanation of these concepts and includes the necessary keys to accomplish these tasks.

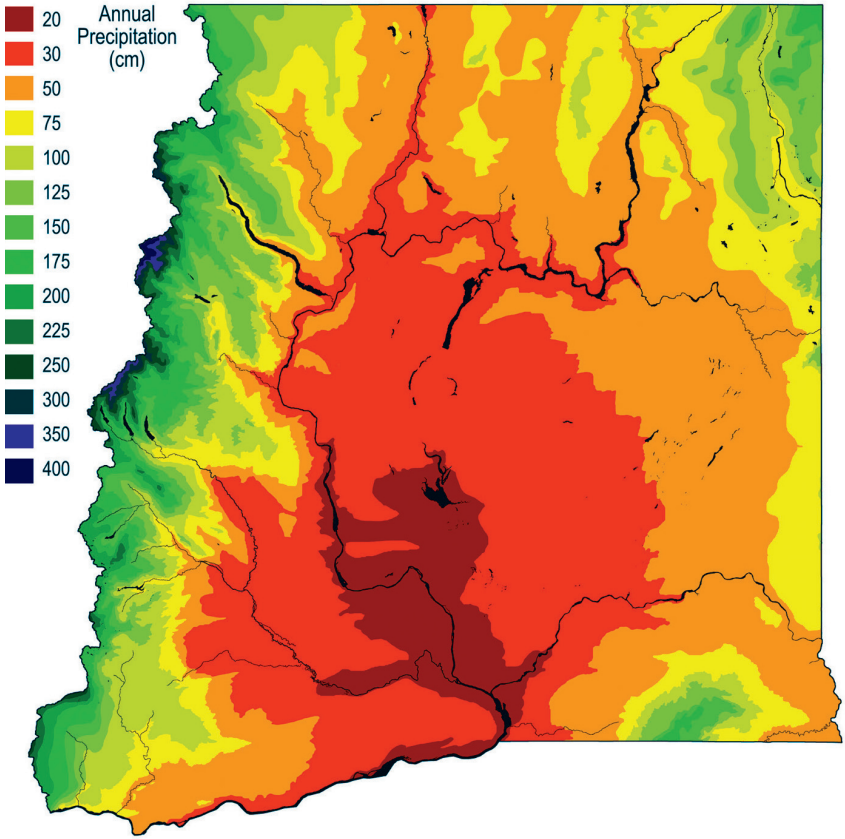
Locator map of Eastern Washington with major public ownerships. Map provided by Ned Wright.



Environmental Setting of Eastern Washington

Although it is the smallest of the western states (184,824 km^2 – 71,361 mi^2), Washington is among the most diverse, encompassing nearly all of the major biological habitats found in the West. Annual precipitation ranges from 20 cm (8 in) in the deserts of the Columbia Basin to 600 cm (236 in) along the western flanks of Mount Olympus on the Olympic Peninsula. The Cascade Mountains divide the state into two regions: western Washington—wet and with a strong maritime climatic influence, and eastern Washington—drier and with continental climatic influences. Eastern Washington, the focus of this guide, measures 118,000 km^2 (45,560 mi^2).

Figure 1. Annual precipitation for eastern Washington.



Eastern Washington lies between two major climatic regimes: a large Mediterranean climate zone centered on California, and the interior continental climate that characterizes much of central North America. Mediterranean climates are coastal in nature, characterized by warm, mild winters and hot, dry summers. In contrast, continental climates are characterized by frigid winters and hot summers. The Columbia Basin, which forms the center of eastern Washington, is protected from these two major climatic regimes by the Cascade Mountains to the west and by the Rocky Mountains to the north and east. While Washington is neither as hot nor as dry as California, the seasonal patterns are similar. Only 5–15 percent of the annual precipitation occurs during the summer months of July to September throughout the entire region, including the more continental areas of far northeastern Washington. Southwesterly oceanic storms are the primary source of precipitation for the region during the other nine months of the year. The presence of the Rocky Mountains, combined with a maritime influence, serves to moderate the continental winter blasts, resulting in a climate far less harsh than areas at the same latitude further east.

Eastern Washington contains a great diversity of habitats, from rain forests to alpine meadows and deserts. The westernmost portion of the region near the Cascade Crest, for example, receives abundant rain and snow where annual precipitation in limited areas exceeds 400 cm (157 in) (Figure 1). While most of the dominant forest types of western Washington may be found in eastern Washington, many are limited to these very wet areas. The bulk of the forested landscapes of eastern Washington consist of mixed conifer forests similar to those found in northern Idaho, western Montana, and southeastern British Columbia—a region defined as the ***Inland Empire.***

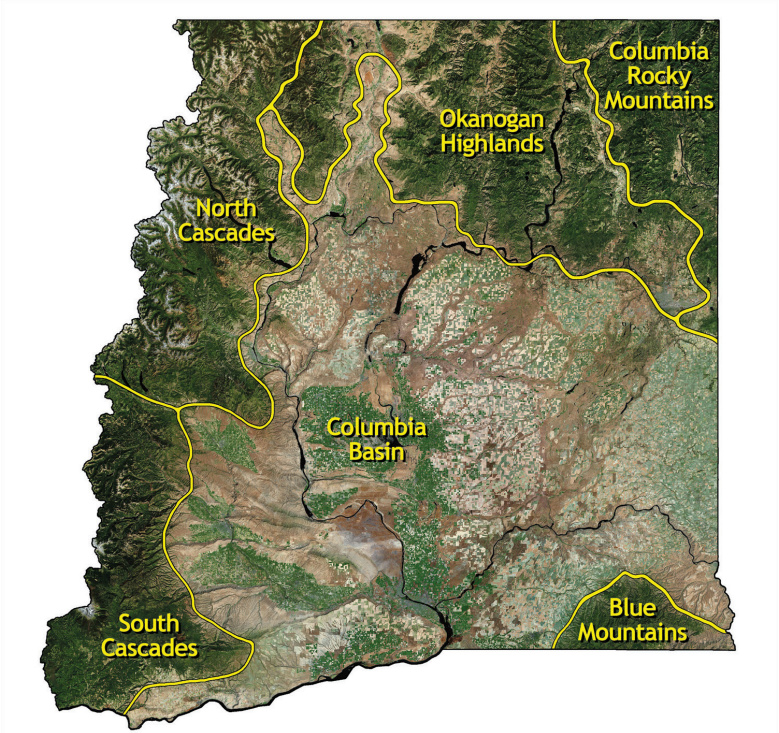
The term Inland Empire, coined by a Spokane newspaper in the nineteenth century, was originally used as a marketing phrase to spur colonization. Forests within the region were historically dominated by western white pine and western larch. Prior to 1910, forestry in the richest and wettest portions of this region, centered on the panhandle of northern Idaho, was focused on western white pine. The combination of heavy exploitation by humans, a fairly weak ability to fight off bark beetle attacks, and high susceptibility to an introduced disease—white pine blister rust (*Cronartium ribicola*)—has made white pine more of a memory from the distant past.

While a single species may dominate in limited areas or during a certain successional state, the forests within eastern Washington are usually a mix of several species. Ponderosa pine, western larch, Douglas fir, grand fir, western white pine, lodgepole pine, Engelmann spruce, subalpine fir, and quaking aspen all can be found growing together in forests throughout the region. Elevation, slope, aspect, topographic position, and disturbance history are the primary determinants in species composition for a given location.

Physiographic regions are often used to divide areas by interrelated geology, physiography, soils, climate, and vegetation. Eastern Washington can be divided into six physiographic regions, each with distinct, definable characteristics (Figure 2).

The **North Cascades** are characterized by steep, glaciated mountains and complex geology. Peaks are commonly more than 2,400 m (7,874 ft). Four surpass 2,800 m

Figure 2. Physiographic regions of eastern Washington. Background image courtesy of NASA.



(9,186 ft), with Bonanza Peak the highest at 2,899 m (9,511 ft). Annual precipitation varies, but is generally high, ranging from a low of 50 cm (20 in) along the Columbia Basin province to more than 400 cm (157 in) near the Cascade Crest.

The **South Cascades** are characterized by high, glaciated ridges that extend eastward from the Cascade Crest. Most of the region is forested, with the exception of Mount Adams (3,742 m – 12,276 ft) and a few peaks in the Goat Rocks (up to 2,494 m – 8,184 ft). The southeastern portion is dominated by the Horse Heaven Hills, a low-gradient plateau dissected by deep canyons. As in the North Cascades, precipitation is highest in the west and decreases sharply to the east.

The **Okanogan Highlands** form a mountainous region of complex geology that was covered by the Cordilleran ice sheet during the Quaternary (ice melting took place 13,000–10,000 years ago). The rolling topography is not as dramatic as either of the Cascade regions. Similar areas are found in southern British Columbia. The climate is dry, as much of the moisture from the Pacific is wrung from the clouds as they pass over the Cascades.

The **Columbia Rocky Mountains** are part of a much larger physiographic region that extends well into British Columbia, northern Idaho, and northwestern Montana. The Selkirk Mountains comprise most of the Washington portion and, like the adjacent Okanogan Highlands, were covered by the Cordilleran ice sheet. The Columbia Rocky Mountains are intermediate in character between the Okanogan Highlands to the east and the remainder of this region outside of Washington, where the mountains are much larger, with broad, low valleys in between.

The **Blue Mountains** are formed from uplifted Columbia basalt deposits, deeply carved by rivers. Most of this region, which has Rocky Mountain affinities, lies to the south in Oregon.

The **Columbia Basin** occupies most of eastern Washington and is dominated by hot, dry environments that support very little forested area. Trees are limited to higher elevations (especially in the northeastern section), and north-facing slopes along the Columbia, Snake, and Spokane Rivers. Small populations of western juniper (*Juniperus occidentalis*) and Rocky Mountain juniper (*Juniperus scopulorum*) are scattered on sand dunes and along cliffs of the Columbia River.