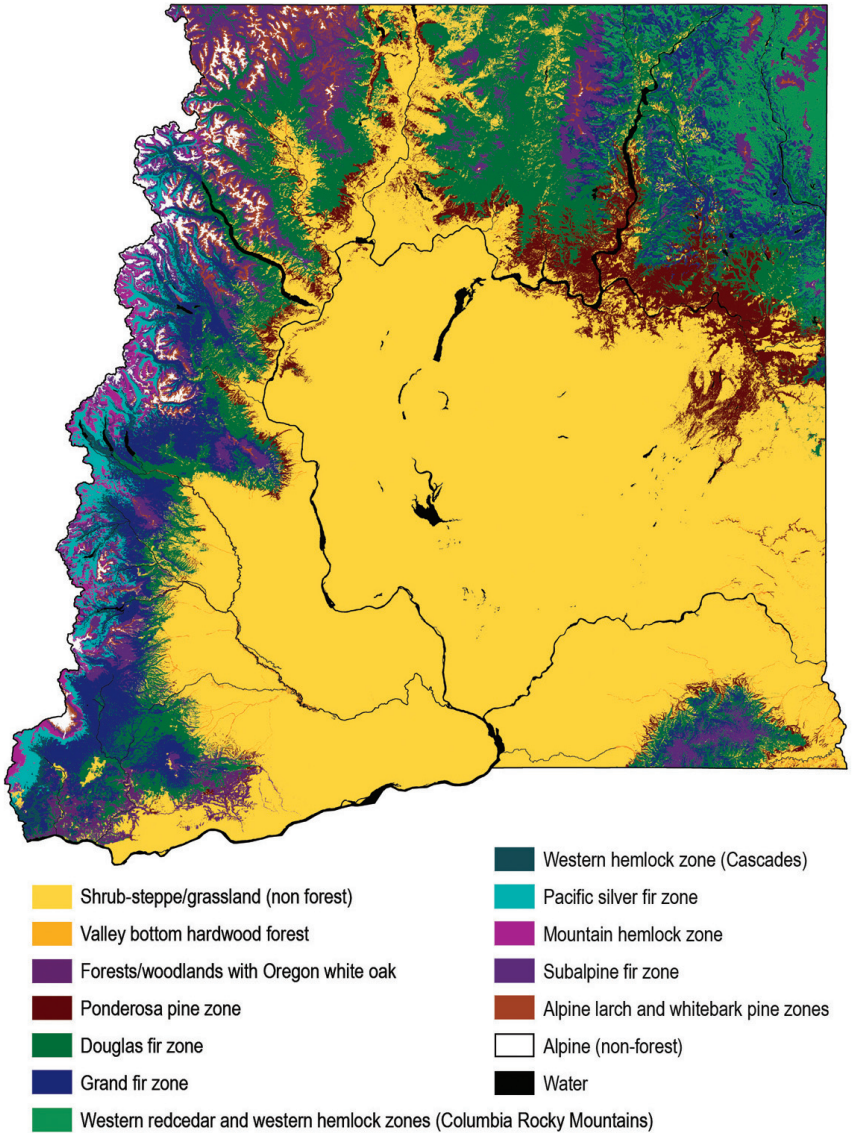


Forested Vegetation Zones Eastern Washington

Figure 3. Vegetation zones of eastern Washington.



Ecological and Environmental Context

The sharp contrast between the steep mountainous topography of the Cascade Range and the gentle terrain of the Columbia Basin has dramatic effects on precipitation and temperature gradients. Accordingly, tree species have become stratified by their competitive abilities and tolerance to both drought and cold. In *The Natural Vegetation of Oregon and Washington*, Franklin and Dyrness (1973) separate the region into vegetation zones based on the dominant tree species. Subsequent efforts by the Washington State Department of Natural Resources, U.S. Forest Service, and other agencies have further expanded and subdivided the vegetation zones into plant associations. Plant associations are groupings of plant species that reoccur on the landscape with particular environmental tolerances. They can be useful tools for predicting environmental conditions, site productivity, and response to forest management. In the simplest terms, the forested portion of eastern Washington can be divided into 12 vegetation

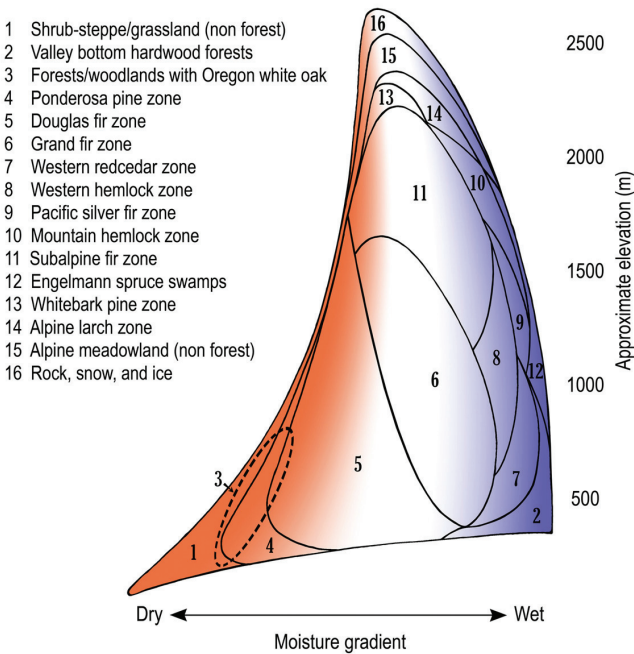


Figure 4. Environmental gradients of eastern Washington vegetation zones. Each of the shapes in the figure represents the environmental space occupied by a given vegetation zone. The species for which the zone is named (e.g. Douglas fir or ponderosa pine) may, in many cases, be able to grow beyond the boundaries of its zone. With the exception of the shrub-steppe/grassland zone, which occupies the bulk of eastern Washington, the size of each polygon is proportional to the area occupied by that forest zone.

Forested Vegetation Zones in Eastern Washington

zones (Figure 3). Each reflects different temperature and precipitation regimes, within which tree species are stratified by elevation (a surrogate for temperature) and precipitation gradients (Figure 4).

Tree-dominated vegetation communities in eastern Washington range from sparse savannas and woodlands to dense forests. Upper and lower treelines, some south-facing slopes, and areas of thin soils are naturally sparse. Within this guide, **forests** are defined as all habitats in which mature tree crowns cover at least one third of the land area; **woodlands** are habitats in which mature tree crowns cover less than one third of the land area. Vegetation zones are defined by their potential **climax tree species**—the species that may (or could) occur there given sufficient time and lack of disturbance. In many cases, the namesake climax species is absent or present only in small numbers as a result of the current successional state, or the history of disturbance. Generally speaking, the climax species is the most shade-tolerant tree species that can regenerate under a forest canopy. A zone is named for this species only when other more shade-tolerant species are



Figure 5. Timberline environment in the North Cascades. Alpine larch (with fall color) and whitebark pine (on rocks in upper right) are our two highest-dwelling tree species. The alpine larch and whitebark zones consist of sparse woodlands found at elevations higher than the forested subalpine fir zone (visible on the left).

not present. A given species may occur in multiple zones. For example, ponderosa pine is one of the least shade-tolerant conifer species. While ponderosa pine has a zone named for it, the tree also can be dominant or important in other zones, such as in the Douglas fir, grand fir, subalpine fir, Columbia Rocky Mountain western redcedar, or perhaps other zones.

Fires and other stand-replacing disturbances can confound the values in a vegetation key. The key below considers all forested habitats within eastern Washington, including woodlands and very young forests. In these cases, replace the percent cover with the phrase *present and reproducing successfully*. For example,

Key² to forested vegetation zones in eastern Washington

1	Alpine larch ≥ 10% cover	Alpine larch zone
	Alpine larch < 10% cover	2
<hr/>		
2	Whitebark pine ≥ 10% cover	Whitebark pine zone
	Whitebark pine < 10% cover	3
<hr/>		
3	Mountain hemlock ≥ 10% overstory cover or 2% understory cover	Mountain hemlock zone
	Mountain hemlock < 10% overstory cover or 2% understory cover	4
<hr/>		
4	Pacific silver fir ≥ 10% overstory cover or 2% understory cover	Pacific silver fir zone
	Pacific silver fir < 10% overstory cover or 2% understory cover	5
<hr/>		
5	Western hemlock and/or western redcedar present	6
	Western hemlock and/or western redcedar absent	8
<hr/>		
6	Location in the Cascade Mountains	Cascade western hemlock zone
	Location in Columbia Rocky Mountain province.	7
<hr/>		
7	Western hemlock present	Columbia Rocky Mountain western hemlock zone
	Western hemlock absent.	Columbia Rocky Mountain western redcedar zone
<hr/>		
8	Subalpine fir ≥ 10% overstory cover or 2% understory cover.	Subalpine fir zone
<hr/>		
9	Grand fir ≥ 10% overstory cover or 2% understory cover	Grand fir zone
	Grand fir < 10% overstory cover or 2% understory cover	10

Forested Vegetation Zones in Eastern Washington

in a treeline woodland situation, replace *Whitebark pine* with at least 10 percent cover with *Whitebark pine* present and reproducing successfully. Unless indicated, cover values refer only to the main tree canopy.

All of the upper treeline forests in eastern Washington are in either the **alpine larch** or the **whitebark pine zones**. These treeline communities often consist of sparse woodlands that extend above the lower, denser subalpine fir zone described in Figure 5. Alpine larch has the ability to remain arborescent in situations where other tree species have either dropped out or become *krummholtz*, a German word for the dwarf, stunted trees often seen in treeline environments.

10	Oregon white oak present	11
	Oregon white oak absent	15
<hr/>		
11	Douglas fir and/or ponderosa pine present.	12
	Douglas fir and/or ponderosa pine absent	Oregon white oak zone
<hr/>		
12	Douglas fir ≥ 10% overstory cover or 2% understory cover	13
	Douglas fir < 10% overstory cover or 2% understory cover	14
<hr/>		
13	Regenerating trees dominated by Douglas fir.	Douglas fir zone
	Regenerating trees dominated by Oregon white oak.	Oregon white oak zone
<hr/>		
14	Regenerating trees dominated by ponderosa pine.	Ponderosa pine zone
	Regenerating trees dominated by Oregon white oak.	Oregon white oak zone
<hr/>		
15	Douglas fir present	Douglas fir zone
	Douglas fir absent	16
<hr/>		
16	Lodgepole pine dominant	17
	Ponderosa pine dominant	Ponderosa pine zone
<hr/>		
17	Subalpine fir present	Subalpine fir zone*
	Douglas fir present	Douglas fir zone*

²Each dichotomous key used in this guide consists of a series of paired descriptions, or couplets, describing a given forest stand. Beginning with the first couplet, read each description to determine which most appropriately describes the stand in question. At the end of each description you will find either a number, indicating the next couplet to examine, or a name, indicating the conclusion.

* If at this stage of the key you are still unsuccessful, relax percentage values, and try again or treat as a woodland or early successional stand and try again. A determination of vegetation zone in either case may require expanding the search radius or an examination of adjacent stands.



Figure 6 left. Engelmann spruce is often the dominant tree within the subalpine fir zone.

The zone, however, is named for the more shade tolerant subalpine fir. Though the distribution of spruce and fir in eastern Washington are similar, Engelmann spruce may also be found at low elevations along stream corridors and cold air drainages.

Figure 7 below. Mountain hemlock zone in the North Cascades. The distribution of the snow-loving mountain hemlock does not stray far from the Cascade Crest, where dry air reduces its competitive abilities.

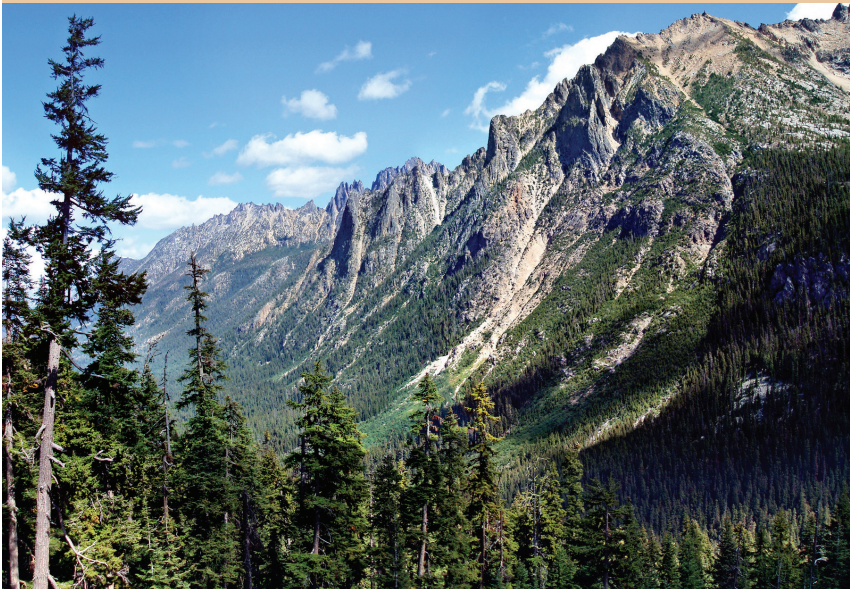




Figure 8. Pacific silver fir zone in the South Cascades.

Vegetation zones are compressed near the Cascade Crest, with many Eastside and Westside species growing together. Pacific silver fir reproduces well in the cool, dark, moist understory environment, but will often languish and die in the dry air found in the upper canopy.

The highest forested zone in the region is the **subalpine fir zone**. The most extensive of the subalpine forest communities, the zone is named for the most shade-tolerant species. However, other species, most commonly Engelmann spruce, are often present in greater numbers (Figure 6).

The **mountain hemlock zone** encompasses many very wet and snowy high-elevation forests near the Cascade Crest. Only a small section of this zone occurs in eastern Washington, as the arid environment quickly becomes too hostile for mountain hemlock (Figure 7). Similarly, the **Pacific silver fir** and **western hemlock zones**, common in western Washington, occur in limited areas near the Cascade Crest. Tree species diversity in eastern Washington is highest within these three zones, with sometimes a dozen or more species found growing side by side (Figure 8).



Figure 9. Columbia Rocky Mountain region. Up to 10 conifer species share dominance within the western redcedar and western hemlock vegetation zones found in the mountains of northeast Washington.

Although precipitation in the northeastern corner of the state is sufficient to support both western redcedar and western hemlock forests as well as a high diversity of tree species (Figure 9), the **Columbia Rocky Mountain western redcedar** and **Columbia Rocky Mountain western hemlock zones** differ in many ways from their Cascade counterparts.



Figure 10. Grand fir zone. Many of the best developed examples of western larch (pictured) and ponderosa pine forests are found within the grand fir zone. Historically kept at low numbers by frequent fire, dense stands of grand fir are now common as a result of a century of fire suppression.

The **grand fir zone** is the primary mixed conifer forest belt of eastern Washington (Figure 10). Some of the highest forest productivities in eastern Washington and many of the largest pines, larches, and Douglas firs are found within this zone. As grand fir is a drought-sensitive species, this zone is largely limited to the South Cascades and Columbia Rocky Mountain regions (Figure 2).



Figure 11. Douglas fir zone. Ponderosa pine occurs throughout the Douglas fir zone. On occasion, it is co-dominant with other species (as shown here), but may also form nearly pure stands.

The **Douglas fir zone** is the most extensive forested zone in eastern Washington, consisting of drier areas with annual precipitation between 50 and 80 cm (20 and 31 in) (Figure 11). Generally too dry for grand fir, the primary conifer species present are ponderosa pine and Douglas fir (but limited areas of western larch and lodgepole pine also may be found).

The **ponderosa pine zone** occupies the driest forested environments at the lower fringes of the forested landscape where even Douglas fir cannot survive (Figure 12). The true ponderosa pine zone is not very extensive, even though ponderosa pine is one of the most widespread tree species in eastern Washington.

Oregon white oak becomes a dominant tree or shrub, often growing with ponderosa pine and/or Douglas fir near lower treeline within the South Cascades region, adjacent to the Columbia River (Figure 13). Strictly speaking, pure stands of Oregon white oak contain no conifers and represent a small fraction of the area

Forested Vegetation Zones in Eastern Washington



Figure 12 left. Ponderosa pine zone. Ponderosa pine is the only conifer that can tolerate the hot, dry conditions at the lower fringes of the forested environment of eastern Washington.

Figure 13 below. Oregon white oak communities. Oregon white oak forms a lower timberline community in the South Cascades along the Klickitat River Canyon. Photo by Andrew Kratz.



Ecological and Environmental Context

mapped as forest/woodlands within the **Oregon white oak zone** in Figure 3. However, these less-than-pure mixed oak stands are distinct enough to warrant inclusion here. Most of the eastern portion of the area depicted is in the ponderosa pine zone, while most of the western portion is in the Douglas fir zone.

In many western states, pure or dominant stands of lodgepole pine are common. In eastern Washington, it is most abundant in the western portion of the Okanogan Highlands, but is present in all forested regions. Nearly always successional to other species in the forests of eastern Washington (Figure 14), lodgepole pine develops extremely dense stands of small trees that are highly susceptible to stand-replacing fire events. For this reason, lodgepole pine does not have its own zone, even though it may appear as the only species capable of growing in certain areas.



Figure 14. Dense stands of lodgepole pine are often encountered at middle to high elevations throughout eastern Washington. These stands are most commonly found where cold air collects in valley bottoms or on poorly drained soils. Lodgepole pine stands are characteristically dense and uniform, with little height differentiation. Such conditions are predisposed to stand-replacing fire events, after which the pine will often recolonize the burned landscape.

Forested Vegetation Zones in Eastern Washington

Table 1 summarizes all of the forested vegetation zones of eastern Washington, the primary tree species that occur in each zone, and whether each species represents a minor (m) or major (M) component of the vegetation.

		Vegetation zones														
		Alpine larch	Whitebark pine	Subalpine fir	Mountain hemlock	Pacific silver fir	Cascade western hemlock	Columbia Rocky Mountain western hemlock	Columbia Rocky Mountain western hemlock	Grand fir	Douglas fir	Ponderosa pine	Oregon white oak			
Fire Severity		H?	H?	H	H	H	H	H	H	M	M	H	L	M	L	M
	Pacific silver fir			m	M	M										
	Subalpine fir		m	M	m											
	Grand fir			m			m	m	M	M						
	Noble fir				m	m										
	Yellow cedar			m	m	m										
	Alpine larch	M														
	Western larch						m	m	M	M	M					
	Engelmann spruce		m	M	m	m	m	m	m							
	Whitebark pine		M	m												
	Lodgepole pine		m	M	m	m					m	m				
	Western white pine			m	m	m	m	M	M		m					
	Ponderosa pine			m					M	M	M	M				
	Douglas fir			m	m	m	M	M	M	M	M					
	Western redcedar				m	m	m	M	M		m					
	Western hemlock				m	M	M	M								
	Mountain hemlock				M	m										
	Alders			m	m	m	m	m	m	m	m	m	m			
	Black cottonwood			m	m	m	m	m	m	m	m	m	m			
	Quaking aspen			m	m	m	m	m	m	m	m	m	m			
	Oregon white oak											m	m			M

Table 1. Fire severity and tree species distributions in eastern Washington vegetation zones. Three classes of fire severity are listed: High (H), Mixed (M), or Low (L). More than one fire severity class may be present in a given vegetation zone — in such cases, the dominant class is listed first. Tree species are listed by vegetation zone. A blank indicates the species does not occur; a gray box with a small m indicates the species is a minor component; and a black box with a capital M indicates the species is a major component. The species listed below may not be present at all times — presence will vary with successional stage and disturbance patterns.



Figure 15. The 70,000 hectare (about 173,000 acre) Tripod Fire of 2006 left many areas without a single living tree.