Forests of Eastern Oregon: An Overview

Sally Campbell, Dave Azuma, and Dale Weyermann





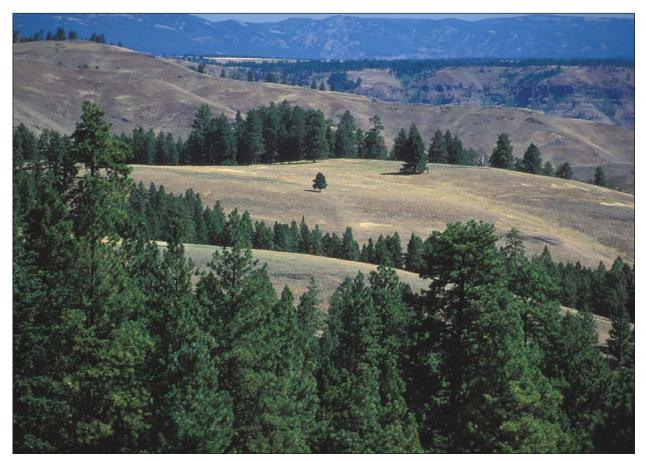




Pacific Northwest Research Station

General Tecnical Report PNW-GTR-578 April 2003





Joseph area, eastern Oregon. Photo by Tom Iraci

Authors

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Cover: Aspen, Umatilla National Forest. Photo by Tom Iraci



Sally Campbell, Dave Azuma, and Dale Weyermann

U.S. Department of Agriculture Forest Service Pacific Northwest Research Station Portland, OR April 2003

State Forester's Welcome

Dear Reader:

The Oregon Department of Forestry and the USDA Forest Service invite you to read this overview of eastern Oregon forests, which provides highlights from recent forest inventories. This publication has been made possible by the USDA Forest Service Forest Inventory and Analysis (FIA) Program, with support from the Oregon Department of Forestry.

This report was developed from data gathered by the FIA in eastern Oregon's forests in 1998 and 1999, and has been supplemented by inventories from Oregon's national forests between 1993 and 1996. This report and other analyses of FIA inventory data will be extremely useful as we evaluate fire management strategies, opportunities for improving rural economies, and other elements of forest management in eastern Oregon. We greatly appreciate FIA's willingness to work with the researchers, analysts, policymakers, and the general public to collect, analyze, and distribute information about Oregon's forests.

Developing current and historical information across all ownerships and forest types is critical to the Oregon Board of Forestry, which has embarked on an effort to define forest sustainability and assess the sustainability of Oregon's forests. Inventory data will be used to monitor changes in forest conditions, project future forest conditions, and develop benchmarks against which we can assess Oregon's progress in achieving forest sustainability.

As we reevaluate our forest management strategies in eastern Oregon with an eye to improving the social, economic, and environmental contributions from these forests, it is critical that we have available an up-to-date and consistent knowledge base. Current information using common measurements and standards by which to evaluate sustainable forest management locally, statewide, and nationally is indispensable. Recent and ongoing inventories and analyses help provide that knowledge base and will be extremely useful to policymakers and for educating Oregonians and others about Oregon's forest resources.

I encourage you to review the information in this report and keep it in mind as the Oregon Board of Forestry, the USDA Forest Service, and others craft and implement policies to assure a continuous and high level of goods and services from eastern Oregon's forests.

James E. Brown

James E. Brown State Forester

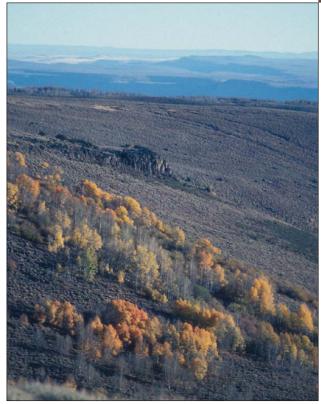
Highlights

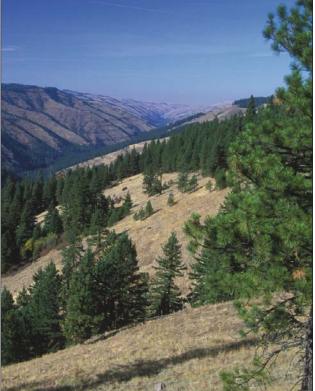
This publication provides highlights of forest inventories and surveys from 1993 to 2001.

- About 35 percent of eastern Oregon is forested.
- The amount of forest land in eastern Oregon has increased overall by about 650,000 acres since the earliest inventory in the 1930s.
 - Timberland decreased by about 2.9 million acres
 - Western juniper forest land increased by about 1.8 million acres
 - Other forest land increased by 1.7 million acres
- Thirty-one tree species were tallied in forest inventories during the 1990s, with ponderosa pine the predominant species in all ecological provinces in eastern Oregon.
- Excluding juniper forest land, about 69 percent of eastern Oregon forest land is managed by the Forest Service, 2 percent by the Bureau of Land Management (BLM), 1 percent by the Oregon Department of Forestry, and 1 percent by other public agencies; the remaining 27 percent is privately owned.
- Forests are younger on private and other public lands, with only 17 percent over 100 years old, and older on national forests, with 55 percent over 100 years.
- Volume of wood in eastern Oregon forests is about 26.2 billion cubic feet, of which an average of about 312 million cubic feet (1.4 billion board feet) per year was harvested between 1987 and 1999.
- Between 1987 and 1999, the volume of mortality and removals exceeded the volume of growth for all ownerships.
- Down woody debris generally increases with forest age but shows no trend related to ownership across eastern Oregon.
- Native insects and diseases are present on the majority of forest land in eastern Oregon with higher levels of dwarf mistletoe, bark beetles, and root disease on national forests than on private and other public land.
- Over half of the inventory plots on nonfederal lands have at least one introduced plant species, and over 4 percent have at least one noxious weed.
- The greatest diversity of lichens (indicators of air pollution, climate, and forest age and structure) is found in the Blue Mountains Province and the lowest in the Intermountain Province.
- No ozone injury has been detected on sensitive forest species in eastern Oregon since ozone monitoring began in 1998.

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Whitman Overlook. Photo by Paul Dunham

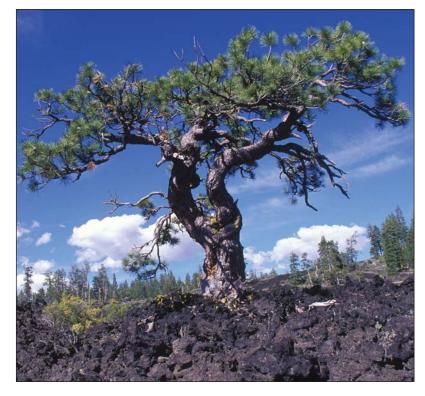
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Steens Mountain area. Photo by Tom Iraci

Abstract

Campbell, Sally; Azuma, Dave; Weyermann, Dale. 2003. Forests of eastern Oregon: an overview. Gen. Tech. Rep. PNW-GTR-578. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 31 p.

This publication provides highlights of forest inventories and surveys from 1993 to 2001. About 35 percent of eastern Oregon is forested. The amount of forest land in eastern Oregon has increased by about 650,000 acres from the 1930s, with increases in juniper forest land accounting for most of the change. Thirty-one tree species were tallied in forest inventories during the 1990s, with ponderosa pine the predominant species in all ecological provinces in eastern Oregon. The Forest Service, Bureau of Land Management, and other federal agencies manage about 71 percent of eastern Oregon forests; about 27 percent is privately owned; and the remaining 2 percent is managed by the Oregon Department of Forestry and other nonfederal public agencies. The volume of wood in eastern Oregon forests is about 26.2 billion cubic feet, of which about 312 million cubic feet per year were harvested between 1987 and 1999. In the same time period, annual mortality and removals exceeded annual growth for all ownerships. Down wood is an important forest component and shows increases with forest age. Insect defoliators, bark beetles, root diseases, and dwarf mistletoes are present on over 72 percent of forest land in eastern Oregon. Year-to-year defoliation or mortality trends can be detected with aerial surveys. Introduced plant species are present on over 50 percent of private and other public forest land. Diversity of lichens (indicators of air pollution, climate, and forest age and structure) is greatest in the Blue Mountains Province and lowest in the Intermountain Province. No ozone injury has been detected on sensitive forest trees and plant species in eastern Oregon.



Ponderosa pine, Newberry National Volcanic Monument. *Photo by Tom Iraci*

Errata for PNW-GTR-578

The following changes have been made in this document.

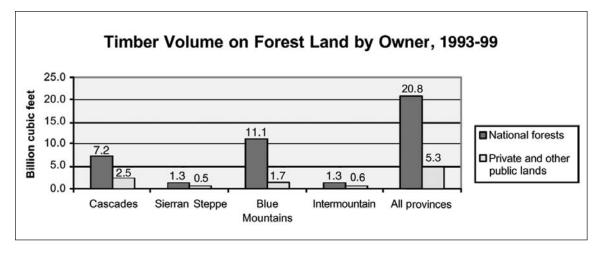
Publication: Forests of Eastern Oregon: An Overview, PNW-GTR-578, April 2003 **Authors:** Sally Campbell, Dave Azuma, Dale Weyermann

Highlights (3rd page), 6th bullet: Change volume figure in sentence from 25.7 to 26.2 billion cubic feet.

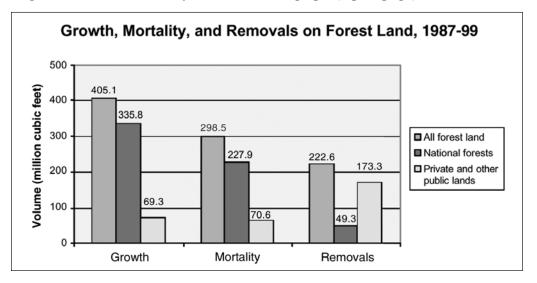
Abstract (5th page), 6th sentence: Change volume figure from 25.7 to 26.2 billion cubic feet.

Page 18: Change the following sentence from:

"The forests of eastern Oregon have about 25.7 billion cubic feet of timber..." to: "The forests of eastern Oregon have about 26.2 billion cubic feet of timber..."

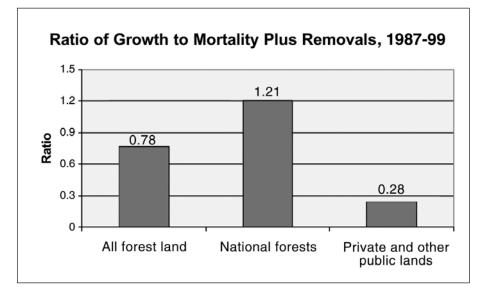


Page 19: Timber Volume on Forest Land by Owner graph:



Page 21: Growth, Mortality, and Removals graph (top of page)

Page 21: Ratio of Growth to Mortality Plus Removals graph (bottom of page)





HIS REPORT DESCRIBES THE FORESTS OF EASTERN OREGON TODAY. We present several

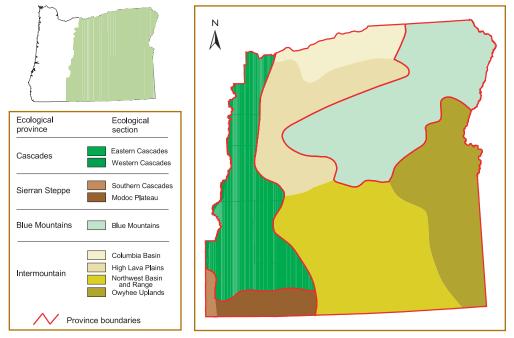
L aspects of eastern Oregon forest land: Where it is, how old it is, who owns or manages it, how much wood volume is present, what tree species are present, and where it is being affected by insects, diseases, and air pollutants.

The information is organized by ecological provinces¹ that delineate relatively homogeneous landscapes by topography, hydrology, and climate. The four provinces in eastern Oregon, and the ecological sections that fall within them, are listed below.

- Cascades (Cascades mixed forest, coniferous forest, alpine meadow). This province includes portions of the Eastern Cascades and Western Cascades sections.
- Sierran Steppe (Sierran steppe, mixed forest, coniferous forest). This province includes portions of the Southern Cascades and Modoc Plateau sections.
- Blue Mountains (Middle Rocky Mountain steppe, coniferous forest, alpine meadow). This province includes the Blue Mountains section.
- Intermountain (Intermountain semidesert and desert). This province includes portions of the Columbia Basin, High Lava Plains, Northwest Basin and Range, and Owyhee Uplands sections.

¹ Bailey, R.G. 1980. Ecoregions of the United States. Misc. Publ. 1391. Washington, DC: U.S. Department of Agriculture, Forest Service.





Source: Bailey 1980. See footnote 1.



Collecting inventory data. Photo by Paul Dunham

Most of the information in this report is from the 1998-99 Forest Inventory and Analysis (FIA) inventory on state, private, and other public (such as National Park Service and Bureau of Land Management [BLM]) lands and the 1993-96 inventory on national forests. We also include information from the 1988 juniper aerial survey, 1998–2001 forest health monitoring plots (now a part of the FIA plot network), and Forest Insect and Disease aerial surveys between 1987 and 2001. With the exception of the aerial surveys where forest condition is observed and recorded from the air, all other data were collected by field crews visiting permanent ground plots and, unless otherwise noted, results reporting on tree or plot conditions are from the FIA and national forest ground inventories.

Two terms are commonly used to describe forested land: "forest land" and "timberland."

- Forest land (14.9 million acres in 1999 in eastern Oregon²) is a more encompassing term that includes all land that is at least 10 percent covered by trees of any size, greater than 1 acre in area, and at least 120 feet wide.
- **Timberland** (10.4 million acres in 1999 in eastern Oregon; see footnote 2) is a portion of the forest land (described above) that produces (or is capable of producing) more than 20 cubic feet per acre of industrial wood products each year under natural conditions, is not withdrawn from timber use, and is not developed for nonforest uses.

Examples of areas included in forest land but excluded from timberland are national and state parks, nature preserves, wilderness areas, and urban forests (such as cemeteries and city parks). Also, because of agency policies such as those arising from the environmental assessments or for riparian reserves, all federal lands meeting the above definition of timberland may not be equally available for timber production.

 $^{^2}$ The 14.9 million acres of forest land and 10.4 million acres of timberland include 2.2 million acres and 40,000 acres of juniper forest land and timberland, respectively, from the 1988 juniper aerial survey.



FOR CENTURIES BEFORE EUROPEAN SETTLEMENT of the Pacific Northwest, the primary agents of forest change in eastern Oregon were fire, wind, flooding, insects, and disease. Fire patterns ranged from frequent, mild, ground fires at low elevations to occasional intense, stand-replacing fires at high elevations. Native people also deliberately modified the vegetation of eastern Oregon, primarily through the use of fire. Fires were set to improve production of food and medicinal plants; to maintain open forests for traveling and hunting; to improve browsing conditions for deer, elk, and, by the early 1800s, horses; and to reduce fire risk around campsites.³ ⁴

Thousands of emigrants passed through eastern Oregon on the numerous Oregon Trail routes to the Willamette Valley from the 1840s through the 1860s, with some settling in the river valleys of eastern Oregon. In the more forested areas of the Blue Mountains and eastern Cascades, grazing, ranching, and mining began, followed by extensive timber harvest enabled by railroads that could transport the milled lumber to more distant markets (see footnote 3). Beginning in the early 1900s, it was public policy that fires be vigorously suppressed owing to a perceived threat to forest management (see footnote 4). Fire suppression continued through much of the 20th century, taking away an important natural means for removing fuels and thinning stands, leaving sites dense with tree cover, particularly at lower elevations. Fire suppression



Ponderosa pine forest in the early 1900s.

Significant forestry events in eastern Oregon

1860s: First eastern Oregon sawmills mainly provided for local needs such as lumber for mining flumes and sluices. **1887–1890:** One of the worst droughts in

eastern Oregon hastened widespread pine mortality from bark beetles.

1905: The USDA Forest Service was cre-

ated in order to conserve forest resources and stabilize markets.

1907: Northeastern forest insect control project started at the request of the forest supervisor of the Imnaha (Wallowa) National Forest to control bark beetle mortality on lodgepole and ponderosa pine near Joseph, Oregon.

1911: Oregon Department of Forestry was established, with F.A. Elliott appointed the first state forester.

1934: The first forest inventory in eastern Oregon was mandated by the McSweeney-McNary Act of 1928.

1964: The Wilderness Act originally designated 9.1 million acres of wilderness on national forest land across the United States. Now nearly 100 million acres of wilderness, countrywide, is managed by the Forest Service, BLM, and Fish and Wildlife Service. Oregon currently has 40 wilderness

Continues on page 4.

³ Robbins, W.G.; Wolf, D.W. 1994. Landscape and the intermontane northwest: an environmental history. Gen. Tech. Rep. PNW-GTR-319. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 32 p.

⁴ Agee, J.K. 1993. Fire ecology of Pacific Northwest forests. Washington, DC: Island Press. 493 p.

areas, 21 of these falling partially or wholly in eastern Oregon and covering nearly 1.34 million acres.

1970: The National Environmental Policy Act requires analysis of environmental and economic impacts of significant actions (such as timber harvest) on federal lands.

1971: Oregon State Forest Practices Act the Nation's first Forest Practices Act set minimum standards for state and private forest lands for reforestation, road construction and maintenance, timber harvesting, chemical application, and slash disposal. Federal forest managers agreed to meet or exceed these standards.

1973: The Endangered Species Act requires federal departments and agencies to conserve endangered and threatened species and their habitat.

1973: Oregon Land Conservation and Development Act—a land use planning law to limit further loss of Oregon's most productive forest and farm land.

1974: Forest and Rangeland Renewable Resources Planning Act (RPA) requires the Forest Service to comprehensively assess the renewable resources on all forest and rangelands for purposes of sustained yield and multiple uses.

1976: The National Forest Management Act requires the Forest Service to prepare management plans for each national forest to provide for multiple use and sustained yield. Federal Lands Policy and Management Act in the same year authorized BLM to inventory and manage its public land for similar purposes.

1978: The Forest and Rangeland Renewable Resource Research Act further expanded the McSweeney-McNary Forest Research Act of 1928 and RPA of 1974 to include nontimber resources in forest and rangeland inventory and analysis.

1993: Interior Columbia Basin Ecosystem Management Project—an assessment by the Forest Service and Bureau of Land Management (BLM) of the resources, impacts, and potential forest management strategies for eastern Oregon and Washington with results to be applied to forest plans. and the selective harvest of older, large pines, larch, and Douglas-fir transformed many open, parklike stands into dense, overcrowded stands. Grazing and loss of beaver dams and pool-stabilizing logs altered riparian areas. Grazing also affected fire intensity and frequency by removing fine grass fuels; as a result, understory species and density increased. High-elevation forests with longer natural fire frequencies were less affected by fire suppression than were those at low elevations (see footnote 4).⁵ ⁶

Owing to these changes in disturbance patterns and resulting vegetation, many eastern Oregon forests, in the last 50 years, have experienced greater mortality from bark beetles, greater infection rates of root diseases, and more severe and frequent attacks by defoliating insects such as Douglas-fir tussock moth and western spruce budworm (see footnote 6).⁷ And although the number of forest fires has decreased (owing to continued fire suppression), severity and size of those that occur have been much greater in the drier ponderosa pine and Douglas-fir forests (see footnote 4).

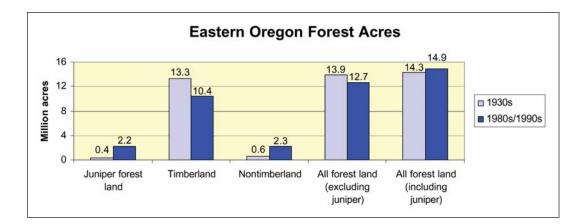
In the last few decades, natural resource managers have altered many forest management practices to reverse these changes in eastern Oregon forests. Thinning, prescribed fire, grazing restrictions, and control of insect defoliators are some of the tools they are using to restore forests to a more desirable condition.

⁵ Campbell, S.; Liegel, L., tech. coords. 1996. Disturbance and forest health in Oregon and Washington. Gen. Tech. Rep. PNW-GTR-381. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station and Pacific Northwest Region; Oregon Department of Forestry; Washington Department of Natural Resources. 105 p.

 ⁶ Lehmkuhl, J.F.; Hessburg, P.F.; Everett, R.L. [et al.]. 1994. Historical and current forest landscapes of eastern Oregon and Washington. Part I:Vegetation pattern and insect and disease hazards. Gen. Tech. Rep. PNW-GTR-328. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 88 p.
⁷ Hessburg, P.F.; Mitchell, R.G.; Filip, G.M. 1994. Historical and current roles

⁷ Hessburg, P.F.; Mitchell, R.G.; Filip, G.M. 1994. Historical and current roles of insects and pathogens in eastern Oregon and Washington forested landscapes. Gen. Tech. Rep. PNW-GTR-327. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 72 p.

Forest inventories by the Forest Service were authorized in 1928 by the McSweeney-McNary Forest Research Act. The first inventory in eastern Oregon was undertaken between 1934 and 1937. Inventories from that first one to the present show an increase in juniper and nontimberland acres of 1.8 and 1.1 million acres, respectively, and a decrease in timberland acres of about 2.9 million acres.



How Much of Eastern Oregon Is Forest and Where Is It?

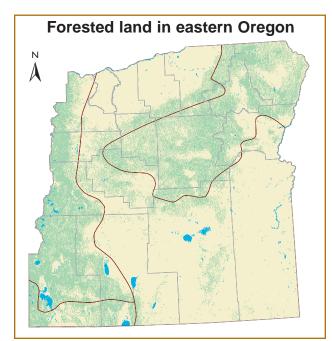
O^F EASTERN OREGON'S 42.3 MILLION acres, 14.9 million (35 percent) are forested. The majority of the area is grassland and shrubland. The eastern slopes of the Cascade Range and the Blue Mountains are the two primary areas of forest. The larger cities and towns, such as Bend and La Grande, are found in these two areas as well.

The Cascades Province,⁸ extending north to south on the eastern flank of the Cascade mountain range, makes up 16 percent of eastern Oregon. It has the highest percentage of forest land of the provinces in eastern Oregon (77 percent). Wide ranges in elevation (<100 to over 10,000 feet) and precipitation (20 to 120 inches) are typical of this province.

⁸ The eastern Oregon 1990s inventory included a small piece (314,000 acres) of the western Cascades Province (see Campbell et al. 2002 for a description of this province). Data from this piece are included here.



Mount Bachelor, Cascades Province. Photo by Tom Iraci



Water
Province boundaries
County boundaries

Forested land Nonforested land

Source: Multiresolution Land Characterization Consortium (MRLC), U.S. Geological Survey Map produced by classification of Landsat 5 satellite imagery (acquired 1992).

The northern portion of the province drains to the east into the Deschutes River and the southern portion into the Klamath River. The Newberry Volcanic National Monument and the town of Bend sit on the central eastern edge of the province, with smaller towns such as Dufur to the north and Chemult to the south. Portions of a number of wilderness areas, such as Badger Creek, Mount Jefferson, and Three Sisters, can be found in this province at the higher elevations along the Cascades Range.

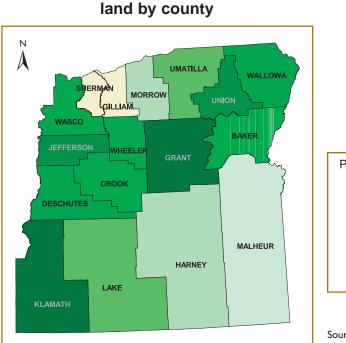
The Sierran Steppe Province covers 5 percent of eastern Oregon (with the majority of the province in California); 51 percent of the province within eastern Oregon is forested. The northernmost portions of the Modoc Plateau and Southern Cascades sections are found within this province and include the towns of Klamath Falls and Lakeview.

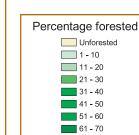
Ecological Province	Forest land ^a	Nonforest land ^b
	Million acres (percentage of province)	
Cascades	5.2 (76.6)	1.6 (23.4)
Sierran Steppe	1.0 (50.8)	1.0 (49.1)
Blue Mountains	5.9 (64.8)	3.2 (35.2)
Intermountain	2.8 (11.3)	21.7 (88.7)
Total	14.9 (35.2)	27.5 (64.8)

^{*a*} Based on 1998-99 Forest Inventory and Analysis and 1993-96 National Forest System inventory plot data and the 1988 juniper aerial survey.

^b Based on USDA Forest Service gap analysis program data.

Percentage of forested





71 - 77

Source: 1998-99 Forest Inventory and Analysis and 1993-96 National Forest System inventory data.

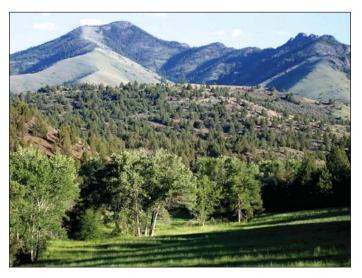
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The Blue Mountains Province makes up about 21 percent of eastern Oregon. It is almost 65 percent forest land. This portion of northeastern Oregon is a plateau that includes the Ochoco Mountains in the southwest and the Wallowa Mountains to the east. The Hells Canyon National Recreation Area and Eagle Cap Wilderness are found in this province. Elevation ranges from 1,000 to 10,000 feet. Precipitation in the valleys (9 to 18 inches) is considerably less than in the mountains (17 to 100 inches). Towns in the Blue Mountains province include La Grande, Enterprise, Elgin, Baker, and John Day.

The Intermountain Province covers about 58 percent of eastern Oregon but has the least amount of forest land (per our definition) in eastern Oregon—about 11 percent—because much of it is desert, shrub-grass land, or woodland. Elevation ranges from 200 feet near the Columbia River up to 10,000 feet for some mountain peaks. Precipitation is low through most of the province— 4 to 20 inches. Ranching and farming (dryland and irrigated) are common. This province includes



Whitman Overlook, Blue Mountains Province. Photo by Paul Dunham



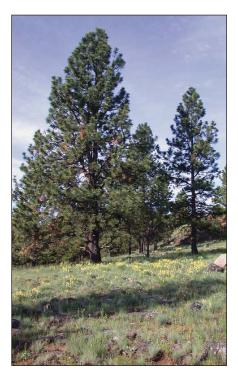
Steens Mountains, Intermountain Province. Photo by Tom Iraci

the Columbia Basin ecological section north of the Blue Mountains and the High Lava Plains, the Owyhee Uplands, and Northwest Basin and Range south of the Blue Mountains. The Columbia Basin area ranges from 200 feet near the Columbia River to over 4,500 feet in low mountains; communities include Hermiston, Pendleton, and Boardman. The High Lava Plains is a high desert area (2,000 to 5,000 feet elevation) with a history of volcanic activity (the most recent in Oregon) and the towns of Heppner, Fossil, Antelope, Madras, Prineville, and Redmond. The Northwest Basin and Range area consists of level valleys and basins, such as the Alvord Desert, and sharply rising plateaus and mountain ranges such as the Steens and Hart Mountains (over 9,700 and 7,600 feet, respectively). The Steens Mountain Wilderness Area, managed by the BLM, can be found in this area. Ranching communities here include Burns, Christmas Valley, and French Glen.



ANY SPECIES OF TREES GROW IN EASTERN OREGON. Forest inventories measure trees on each inventory plot and record detailed information on live trees including species, age, diameter, height, and damage by insects and disease. Thirty-one species of trees, 9 hardwood and 22 softwood (conifer), were tallied in eastern Oregon inventories (see tree list on page 29).⁹ The Cascades Province is the most diverse, with 31 species tallied in the 1990s inventory; the Intermountain and Sierran Steppe were the least diverse with 17 and 19 species tallied, respectively (note: the number of species for the portion of a province—such as the Sierran Steppe—that is in eastern Oregon may not be representative of the entire province).

Several species are abundant in every ecological province in eastern Oregon: ponderosa pine, lodgepole pine, Douglas-fir, western juniper, white or grand fir, and quaking aspen. At the lowest elevations, western juniper grows along forest edges in a savannalike zone between ponderosa pine forests and dry sagebrush-grass areas. Ponderosa pine can



Ponderosa pine. Photo by Tom Iraci

be found either in pure stands where it has been maintained by fire or in mixes with other species such as true firs (*Abies* spp.) and Douglas-fir. Douglas-fir is generally found in mixed stands intermediate in elevation; common associates include western larch, western hemlock, true firs, western redcedar, and various pines. Lodgepole pine inhabits middle to high elevations; it grows across a broad range of environments from wet to droughty sites, developing after disturbances such as insect epidemics, fire, or logging; it is extensive on central Oregon pumice flats. Other species (besides lodgepole pine) found in higher elevation forests in the eastern Cascades and Blue Mountains include sub-alpine fir, mountain hemlock, Engelmann spruce, and whitebark pine. Several species have more specific growing requirements and may be found in only one or two areas (e.g., Oregon white oak in the northern Cascades and southwest of Klamath Falls in the Sierran Steppe Province) or in specific habitats (e.g., quaking aspen in riparian areas).

⁹ Because forest inventories sample only a portion of forest land, some species that are present may not be tallied.