

# A Brief Natural History of Oregon's Forests

## The Forests of Oregon

*The curious world which we inhabit is more wonderful than it is convenient; more beautiful than it is useful; it is more to be admired than to be used.*

—Henry David Thoreau<sup>1</sup>

Oregon is known for its wonderful, beautiful, admirable forests. And, while all forests are unique, here's why some of Oregon's forests are especially so. As naturalist Daniel Mathews notes:

*The area made rainy by the Cascades, Olympics and other Pacific coastal ranges is the Conifer Capital of the World. This is the only large temperate-zone area where conifers utterly overwhelm their broadleaf competitors. It grows conifers bigger than anywhere else, and the resulting tonnage of biomass and square-footage of leaf area, per acre, are the world's highest, even greater than tropical rain forests.<sup>2</sup>*

Oregon's inland conifer forests are much drier than those near the coast and the trees are less supremely massive than in westside forests, yet eastside forests are still unique and their trees majestic.

Approximately half of Oregon is — or was — forested. Ecologists usually classify forests by the type of tree(s) that currently dominate the forest, or by the tree(s) that would be most prevalent given enough time and if spared human and natural disturbance. To classify broader ecoregions, ecologists also study the geology, soils and climate. Forest vegetation types do not fall precisely into generally accepted ecoregions, but then few things in nature are easily ordered.

## Major Oregon Forest Ecoregions

Natural scientists categorize terrestrial Earth on a scale that ranges from the very broad to the increasingly detailed. The broadest scale or so-called “Level I” category divides the continents in the Western Hemisphere into twenty-four huge ecoregions.

Oregon contains portions of three, of which this book focuses on two: the “Northwestern Forested Mountains” and “Maritime West Coast Forest.” (The third Level I ecoregion in Oregon is the “North American Deserts.”) The “Northwestern Forested Mountains” includes most of Oregon's forests, with the exception of the Coast Range. Because it is more maritime than mountainous, the Willamette Valley is included in the “Maritime West Coast Forest” along with the Coast Range.

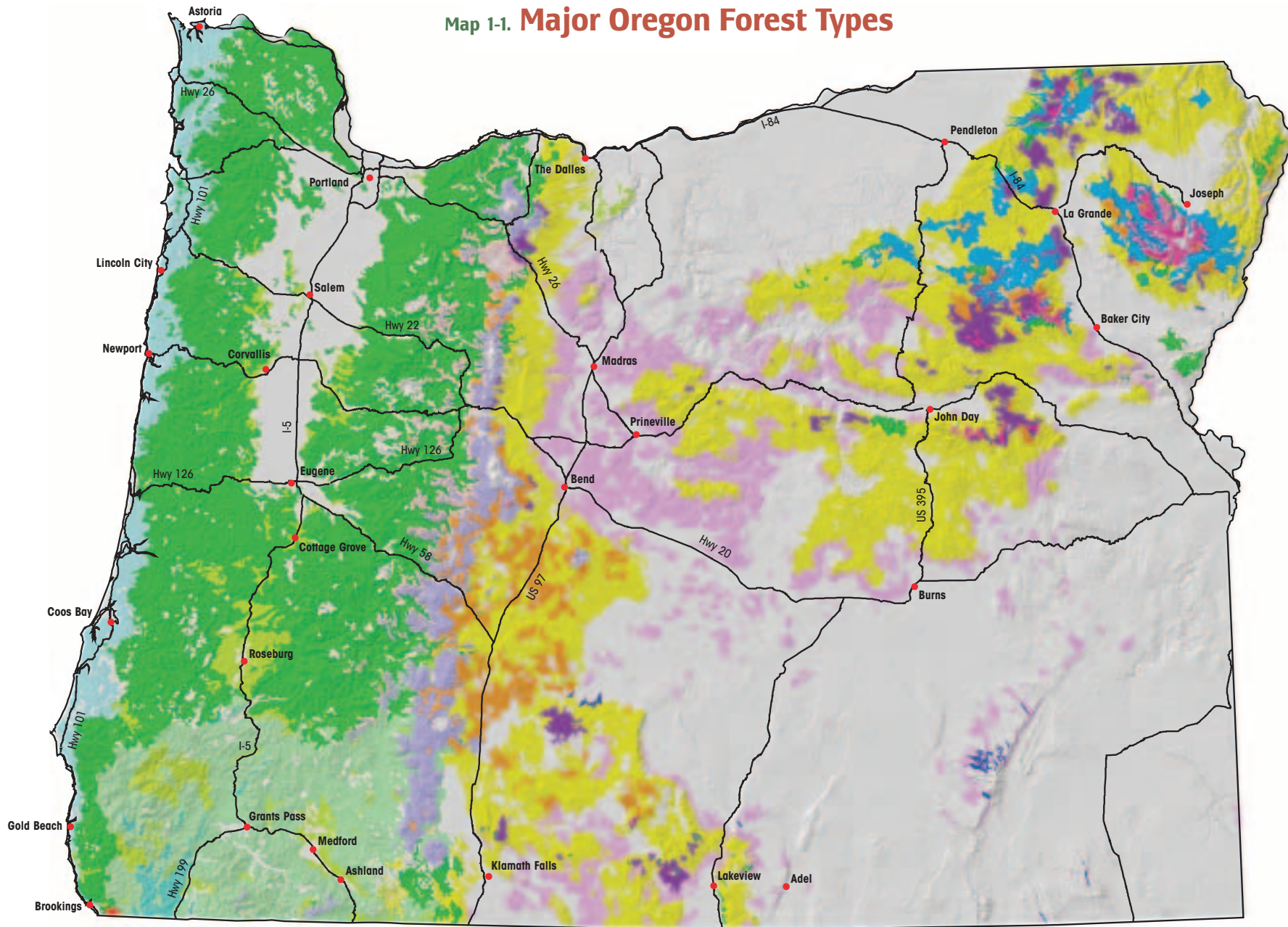
The “Level II” category further divides our hemisphere into 82 very large ecoregions. Oregon forests occupy part of just two Level II ecoregions that are subparts of Oregon's Level I ecoregions. The “Marine West Coast Forest” includes the Oregon Coast Range and the Willamette Valley, while the “Western Cordillera” includes the remainder of Oregon's primarily forested landscapes. (To complete the description, the rest of Oregon, which is generally tree-free, occupies the “Western Interior Basins and Ranges” Level II ecoregion.)

Oregon is then further divided into nine separate “Level III” ecoregions. (The entire Western Hemisphere has approximately 311 Level III ecoregions.) These are “large areas with similar physical conditions and biological features,”<sup>3</sup> and are based on the interplay of geology, landforms, soils, land use, vegetation, climate, wildlife and hydrology. Five of Oregon's Level III ecoregions are primarily forested and the subject of this book. The vast majority of Oregon's forests (moving west to east) lie within the “Coast Range,” “Klamath Mountains,” “Cascades,” “East Cascades Slopes and Foothills” and “Blue Mountains” Level III ecoregions. The Wilderness proposals described in this book are organized by Level III ecoregion.

Oregon also has four generally non-forested Level III ecoregions. Three — the “Columbia Plateau,” “Snake River Plain” and “Northern Basin and Range” ecoregions — are primarily sagebrush steppe and related ecosystems (also known as the Sagebrush Sea), although they do contain significant amounts of aspen forest, juniper woodland, and relic pine groves and fir forests.<sup>4</sup> These small bits of forested wildlands that are surrounded by hundreds of thousands of acres of Sagebrush Sea are not addressed in this book. Similarly, while both forested and non-forested wildlands occur in the Blue Mountains Ecoregion, only the predominantly forested areas are considered in this book.<sup>5</sup>

The fourth generally non-forested Oregon Level III ecoregion is the Willamette Valley. The Oregon Biodiversity Project notes that the valley is:

Map 1-1. Major Oregon Forest Types



Dominant Tree Species				
Douglas-fir	Mountain Hemlock	Quaking Aspen	Siskiyou Mixed	True Fir
Jeffrey Pine	Oregon White Oak	Redwood	Sitka Spruce	Western Juniper
Lodgepole Pine	Ponderosa Pine	Silver Fir	Subalpine Fir	Western Larch



**Table 1-1. Major Oregon Forest Types<sup>8</sup>**

Dominant Tree Species on Map 1-1	Forest Types	Dominant Tree Species on Map 1-1	Forest Types
<b>Douglas-fir</b>	Douglas-fir/Broadleaf Deciduous	<b>Quaking Aspen</b>	Quaking Aspen
	Douglas-fir/Oregon White Oak	<b>Redwood</b>	Redwood
	Douglas-fir/Ponderosa/Incense Cedar	<b>Silver Fir</b>	Silver Fir/Western Hemlock/Noble Fir
	Douglas-fir/Ponderosa/True Fir	<b>Siskiyou Mixed</b>	Siskiyou Mixed Conifer (High Elevation) Siskiyou Mixed Conifer Siskiyou Mixed Evergreen
	Douglas-fir/Western Hemlock	<b>Sitka Spruce</b>	Sitka Spruce
<b>Jeffrey Pine</b>	Pine/Western Larch	<b>Subalpine Fir</b>	Subalpine Fir/ Engelmann Spruce Parklands
		<b>True Firs</b>	True Fir/Douglas-fir True Fir/Lodgepole True Fir/Lodgepole/ Western Larch/ Douglas-fir
<b>Lodgepole Pine</b>	Lodgepole	<b>Western Juniper</b>	Juniper/Big Sage Juniper/Bitterbrush Juniper/Grasslands Juniper/Low Sage Juniper/Mountain Big Sage Juniper/Ponderosa
	Lodgepole/True Fir	<b>Western Larch</b>	Western Larch/Douglas-fir/ True Fir Western Larch/Douglas-fir/ Ponderosa/Lodgepole
<b>Mountain Hemlock</b>	Lodgepole/Western Larch		
	Subalpine Lodgepole		
<b>Oregon White Oak</b>	Mountain Hemlock		
	Mountain Hemlock/Parklands		
<b>Ponderosa Pine</b>	Mountain Hemlock/Red Fir		
	Mountain Hemlock/ Red Fir/Lodgepole		
<b>Oregon White Oak</b>	Oregon White Oak/Douglas-fir		
	Oregon White Oak/ Pacific Madrone		
<b>Ponderosa Pine</b>	Oregon White Oak/Ponderosa		
	Ponderosa		
<b>Ponderosa Pine</b>	Ponderosa/Douglas-fir/True Fir		
	Ponderosa/Douglas-fir/ Western Larch/Lodgepole		
<b>Ponderosa Pine</b>	Ponderosa/Grasslands		
	Ponderosa/Lodgepole		
<b>Ponderosa Pine</b>	Ponderosa/White Oak		
	Ponderosa on Pumice		
<b>Ponderosa Pine</b>	Ponderosa/Scrub		

Old-growth incense-cedar (*Libocedrus decurrens*) on the Umpqua National Forest. ►



*...among the state's most altered ecoregions. Development for agriculture, urbanization, fire suppression, construction of dams and impoundments, drainage of marshes and wetlands, commercial forestry, livestock grazing, and the introduction of exotic plants and animals have all dramatically reshaped the valley's ecosystem.<sup>6</sup>*

The Willamette Valley also has an expanding population of 2.3 million people and no forested — nor probably any other kind of — wilderness of large size remains in the Willamette Valley Ecoregion.<sup>7</sup>

The introduction to each (Level III) ecoregion presented here includes a description of the area's Level IV ecoregions.

There are Level V ecoregions, but we won't be going there, particularly since such delineations are still being developed. Suffice to say that every piece of nature has biologically and ecologically unique characteristics. The same cannot be said of strip malls.

## Major Oregon Forest Types

Scientists have defined forty-four forest and woodland types in Oregon between the Pacific Ocean and the Snake River. "Woodlands" have fewer trees than forestlands, but more trees than "grasslands." Precipitation, soil type, elevation and other factors determine an area's vegetation, which further determines the forest type. While each forest type is named after its dominant tree species, one will often find that the range of that species is much broader and occurs in several other forest types. The introduction to each ecoregion chapter in this book describes the region's major forest types (see Table 1-1). However, for readability, the forty-four types have also been simplified to seventeen types as depicted on Map 1-1 on page 2.

In addition to the forty-four forest types, scientists have identified twenty-six other non-forest vegetation types. Many, but not all, are interspersed with the forest types and are described in the introductions to the ecoregion chapters as follows: Agriculture, Alpine Barren Fell Fields, Barren Playa, Big Sage/Scrub, Big Sagebrush, Bitterbrush Scrub, Built-Up Area, Cleared Grasslands, Cottonwood/Willow Riparian, Cutover/Burned, Grasslands/Bunchgrass, Inland Dunes, Low Sagebrush, Manzanita/Buckbrush Chaparral, Marsh/Wet Meadow, Montane Shrublands, Mountain Big Sage, Open Lava, Sage on Lava, Other Sagebrush, Pasture/Riparian Bottomlands, Rimrock Shrublands, Saltmarsh, Scrub and Shorelands.



## FEATURED SPECIES

## Whitebark Pine

"I love all trees, but I am in love with pines."

—Aldo Leopold<sup>9</sup>

The whitebark pine (*Pinus albicaulis*)<sup>10</sup> is often the last tree to give way to the harshly cold conditions above timberline. Most whitebark pine are now protected in designated Wilderness, national parks, or in areas so high in elevation that they have mostly been spared from human disturbance.

From the interior coastal ranges of British Columbia, across the Canadian Rockies to the Wyoming Basin, down the Cascade Crest and the Sierra Nevada, whitebarks often consort with subalpine fir, mountain hemlock, lodgepole pine and Engelmann spruce. Individual trees have been found to live over 1,000 years. Ecologists call the whitebark pine a "keystone species" as it determines the ability of a large number of other species to exist in whatever biological community it occurs.

The very large (for a pine) and nutritious pea-sized seed is coveted by the Clark's nutcracker, which plays a critical role in the dispersal of the wingless seed. At least 110 species of wildlife, including bears, eat the seed, as can humans.

Although it is protected throughout much of its range, whitebark pine faces a bleak future in Oregon and throughout the rest of its range unless critical steps are taken soon. The species suffers from three major deadly threats: lack of fire, an excess of mountain pine beetles and an exotic fungal disease.

Due to active fire suppression, the fire frequency in whitebark pine stands is perhaps one-tenth of what it was naturally. Unless frequent fire is rapidly restored, whitebarks will continue to be replaced by shade-tolerant conifers that also serve as reservoirs of mountain pine beetles, a native killer of whitebarks. Periodic fire is essential to the propagation of whitebark pines because it creates optimal conditions for seedlings.

An exotic blister rust (*Cronartium ribicola*) was introduced to North America in the early twentieth century and has since ravaged whitebark and other five-needle pines species. The blister rust causes cankers on the bark that kills the tree by girdling it. Thus far, rust-induced mortality in Oregon has been light to moderate. Ghost-like snags can be seen on Mount Hood. Up to 20 percent of the whitebark pines in Crater Lake National Park are infected, and a 46 percent decline in the park's mature whitebark pine is predicted by 2050. In some places outside of Oregon, whitebark pine stands have suffered 90 percent mortality.

Some scientists expect the blister rust will eventually spread to the entire range of the species within one to several decades. The telltale signs of the fungus are red-brown foliage on the dying upper branches and cankers on branches and boles. Some specimens are naturally resistant or, by sheer luck, avoid infection. To complicate matters, the rust also affects all other native five-needle pines and finds an alternative host on *Ribes* species (currants and gooseberries), often found in association with whitebark pine.

GEORGE WUERTHNER



Whitebark pine (*Pinus albicaulis*) on the Fremont National Forest.

In a few cases, killing competing tree species may encourage whitebark pine growth, but this is not economically feasible. In some places rust-resistant seedlings grown from local stock are being planted. However, planting is best done indirectly by letting Clark's nutcrackers distribute the seed. The birds instinctively know better (even if they don't know so) than humans (even if they think so) as to where the trees should be planted.

After a fire, five to seven decades must pass before a whitebark pine starts producing

cones. The more whitebark pines there are, the more rust-resistant specimens there will be to carry on.

Some forest managers favor chainsaws over fire, usually more for social than scientific reasons. They anticipate objections from tourists who don't like to see charred and smoky Wilderness areas and parks, and who have an overriding aversion to and fear of fire that has been instilled in them by Smokey Bear for the past fifty years. Fire, however, is a vital and necessary component of the alpine ecosystem. The end of fire suppression and concurrent reintroduction of fire in these areas must begin immediately to save whitebark pines.

To aid conservation and restoration of whitebarks, the Whitebark Pine Ecosystem Foundation has been established and could use your support.<sup>11</sup>



## Major Oregon Forest Owners

Contrary to myth and common perception, less than one-half of Oregon is forest-land. The federal government — more importantly, *the public* — owns more than half of that land (state, county and other public ownership brings the total to nearly 60 percent). From the standpoint of timber-production, private lands are inherently more productive than public lands. They generally are lower elevation (with a longer growing season), have more productive soils and are dedicated solely to producing timber.

## Old, Mature and Young Forests

*It is impossible to state precisely what is at stake biologically and ecologically, because as (former Forest Service Chief and scientist) Jack Thomas succinctly pointed out, these forests are not only more complex than we think, they are more complex than we can think. But there is little question that “(m)uch of the biological diversity of the Pacific Northwest is associated with late-successional and old-growth forests.”*

—Seven noted Pacific Northwest forest scientists<sup>13</sup>

Before determining the current and historic extent of old-growth forests in Oregon, agreement must be reached on exactly what constitutes an “old-growth” forest. The problem is that the ecological, social and political complexities of old-growth forests defy simple definition.

The definition of old growth can vary with the perspective (or axe) one has (to grind). As a Supreme Court justice once said, “I shall not today attempt further to define (pornography), but I know it when I see it.”<sup>14</sup> In the same sense, one knows an old-growth forest when one sees it.

It’s easy to see the difference between a real forest and a timber plantation. A real forest has multiple species of trees, usually of different ages, heights and diameters, a biologically diverse understory and a full complement of fish and wildlife species. A timber plantation is usually a monoculture of a single species, all the same size, all planted the same distance apart and all to be clearcut again within a half to a full human lifetime.

An industrialist seeking to maximize financial profit may consider old growth anything older than economic “rotation” age — the age at which it is first profitable to cut a tree down and send it to a mill. But the tree is not “old” by any biological definition and would continue to grow for centuries if left uncut.

A forester seeking to maximize wood volume considers old growth anything older than the silvicultural “rotation” age (also called the “culmination of mean annual increment”), or that point at which the tree’s annual growth rate reaches its maximum

**Table 1-2. Forestland Ownership in Oregon**<sup>12</sup>

Land Owner	Acreage	Total Acreage
<b>Federal</b>		<b>18,157,000</b>
Forest Service	15,135,000	
Bureau of Land Management	2,368,000	
National Park Service	166,000	
Fish and Wildlife Service	13,000	
<b>State</b>		<b>1,022,000</b>
Department of Forestry	645,000	
Common School Fund (forested)	133,000	
Parks and Recreation Department	60,000	
Department of Fish and Wildlife	39,000	
Department of Transportation (rights-of-way)	7,000	
Board of Higher Education	15,000	
County and Municipal (various)	123,000	
<b>Non-Public</b>		<b>10,872,000</b>
Indian Land	480,000	
Non-Industrial (generally small woodlots)	4,438,000	
Industrial (generally large corporations)	5,954,000	
<b>Total Oregon Forest Land</b>		<b>30,051,000</b>
<b>Total Oregon Land</b>		<b>61,441,280</b>

and begins to decline. (For Douglas-fir, this is traditionally thought to be approximately 80 years, but may actually be 150 to 200 years of age.) The tree continues to grow — in fact, it will grow until it dies — but not as quickly as the forester’s theoretical replacement tree.

Scientists, for the most part, have agreed on other quantitative definitions of old growth, which are usually determined by forest type. An old-growth forest must have a certain minimum of large trees of a certain size, per given area. Besides standing live trees, the forest will also have standing dead trees (snags) and downed trees in various states of decomposition. Age and the growing site determine the size of a tree. A good growing site will produce a forest that develops older forest characteristics sooner than a

## FEATURED SPECIES

## Quaking Aspen

The quaking aspen (*Populus tremuloides*) is the most widely distributed tree in North America. It is found at sea level in the north end of its range and at 11,500 feet elevation at the southern end. The species ranges from Alaska to Newfoundland and from Virginia to Northern Mexico. In Oregon, the brilliant spring green and magnificent gold fall foliage of quaking aspen can be seen in the Cascades, East Cascades Slopes and Foothills and Blue Mountains ecoregions. Only a few aspen stands occur in the Coast Range and Klamath Mountains. More can be found in the high ranges of the Oregon Desert such as Steens Mountain and Hart Mountain.

The slightest breeze will make quaking aspen leaves dance. The leaves' bright green tops contrast sharply with their dull green undersides against the backdrop of their white bark and the blue sky. Viewing quaking aspen turning gold on a crisp and clear autumn day is a powerful reminder that all is not wrong in the world.

Aspen forests are biologically rich and provide cover, nesting and feeding habitat for a wide range of birds. Deer and elk heavily graze aspen twigs and foliage, as they do the associated understory. A quaking aspen grove may have 3,000 pounds of understory growth per acre, compared to 200 pounds per acre in a conifer forest. Aspen grow in wet areas and are a favorite of beavers. Rabbits eat the bark and grouse feed on aspen's winter buds. Humans like to carve their initials and ideograms in the bark. Those carved by lonely late nineteenth and early twentieth century sheepherders can still be found and are often sexual in nature.

While individual trees (which are actually stems of a much larger, underground organism) are relatively short-lived, a stand of aspens is not. Aspens typically grow twenty to seventy feet high and live 70 to 90 years. However, an aspen grove can survive indefinitely even if it burns occasionally. Within six weeks of a burn, aspen shoots will rise through the forest floor from the clonal rootstock below and have a distinct advantage over any conifer seeds from cones.

If you see several clumps of aspen trees, each with a distinctive color, know that each cluster consists of clones (genetically identical) from the same original tree that sprouted from a seed 8,000 to 10,000 years ago. In one case, some 47,000 trees have been found to come from one original ancestor.

Any amount of grazing by domestic livestock is harmful to aspen, as the bovines trash the understory and nip off all the replacement shoots from the root system.

SANDY LONSDALE



Quaking aspen (*Populus tremuloides*) (foreground) and ponderosa pine (*Pinus ponderosa*) (background) on the Ochoco National Forest.

In the American West, the original 9.6 million acres of quaking aspen is down to just 3.9 million acres. In Oregon's Malheur National Forest, aspen have been reduced by 80 percent from historic levels from livestock grazing. While domestic livestock are unquestionably a large part of the problem, another culprit is Smokey Bear.

Aspen sprout profusely after a fire. The first year after a burn may result in 150,000 sprouts per acre. A few years later, the aspen will be a few feet tall with a density of 40,000 to 50,000 sprouts per acre.

The absence of fire — as is now the case throughout most of the West due to federal fire-fighting policies — allows shade-tolerant conifers to slowly invade aspen stands. The conifers then out-compete new aspen shoots by using the aspen's biology against them. Live and healthy adult aspens send a growth-inhibiting hormone down their trunks and into their roots to discourage excessive shoot production, thereby inhibiting the growth of young aspens. When adult aspens die, this hormonal impediment to new shoots ceases. If conifers have overtaken the forest floor by the time the adult aspens die out, the new aspen shoots cannot get established and the aspen stand may eventually be replaced by conifers.



poor growing site. The quality of a growing site is determined by rainfall, soil depth, elevation, aspect, latitude and other factors.

Generally, in western Oregon the onset of old-growth characteristics begins at 150 years of age. Historically, old-growth stands were typically between 250 to 650 years old, though some were over 1000 years old. Individual trees can live longer. If undisturbed by humans for long enough, they are often killed by stand-replacing events: fire, wind, insect, disease or other natural events.

There is a general scientific consensus that — historically, across the landscape and over time — as much as 80 percent of western Oregon forests were over 80 years old, and about two thirds were older than 200 years, or “old growth.” The age of trees and percentage of old growth varied, but that was the average. Researchers estimate that today, only 13 to 18 percent of the forested area of western Oregon is old growth, a reduction of over 75 percent. In eastern Oregon, the amount of old growth that existed before European-American invasion averaged about 90 percent for the low elevation ponderosa pine forests, while today it is approximately 20 percent. The rate of old growth loss in Oregon slowed somewhat at the end of the twentieth century, but it still continues.

While the public debate in the Northwest has centered on old-growth forests, “mature forests” (natural forests that are between 80 and 150 years of age) are just as important in the larger and longer scheme of things. Mature (also called “late successional”) forests are not old growth, but they are approaching that stage. These forests are home to many of the same species as old growth, though in different proportions.

Therefore it is important to save not only old-growth forests, but mature forests as well, including those that are fragmented by roads and logging. By saving more habitat we can increase the probability of the continued existence of species and ecosystems. As a group of eminent scientists noted, “The more saved now, the greater the buffering against such losses.... Protecting all that remains buys some insurance.”<sup>15</sup>

Mature forests have great ecological and watershed values and are the forest stands that will eventually augment and replace current standing old-growth forests. The cycle repeats as the old growth stands are replaced by natural young forests, which will then become mature forests on their way to becoming old-growth forests again. The National Research Council has noted that:

*Forest Management in the Pacific Northwest should include the conservation and protection of most or all of the remaining late-successional and old-growth forests.... The remaining late-successional and old-growth forests could form the cores of regional forests managed for truly and indefinitely sustainable production of timber, fish, clean water, recreation, and numerous other amenities of forested ecosystems.*<sup>16</sup>

Young Sitka spruce (*Picea stichensis*) growing out of a very old and long dead Stika spruce on the Siuslaw National Forest. ►

ELIZABETH FERRY, ENVIRONMENTAL IMAGES





## FEATURED SPECIES

## Western Larch

Not all conifers are evergreens. The ten species of larch (*Larix* spp.), located mostly in the colder climates in the Northern Hemisphere, are conifers (they have cones), but also lose their needles each fall. Three larch species are found in North America: the alpine larch found primarily at high elevations in western Canada; the eastern larch found in boggy areas of the northern forests of eastern North America; and the western larch found in the American West. Commonly called tamarack in the east, this name is sometimes used out west, too. The only other North American “deciduous conifer” is the bald cypress (*Taxodium distichum*), found in the American southeast.

Oregon's larch is the western larch (*Larix occidentalis*). This tallest larch species can reach 150 feet in height, four feet in diameter at the base and 500 years of age. Some specimens reach 200 feet, six feet at the base and live up to 1,000 years. Their great height often makes them an easy target for lightning.

The western larch is easily identified at a distance. During the spring and summer, the bright, almost iridescent, green color of the needles sets it apart from the duller green of the forest's other conifers. Starting in October, the needles turn yellow; by the end of the month they are a brilliant yellow-gold. During the winter, the trees remain distinctive, standing tall and straight without needles.

From a distance, the branches often look feathery, in that the branches are covered with a uniform row of light-green needle clumps. In hand, the needles are very soft and are one to two inches long. There are 14 or more needles per bud. The western larch's small cones are woody and brown.

The bark at the tree's base is quite thick, up to six inches in an old growth specimen. The bark is a furled reddish orange and jigsaw-shaped somewhat like that of ponderosa pine. The thickness of the bark, and the fact that the first limbs often begin up to 50 feet from the ground on large tree, make the western larch the most fire resistant tree in the Pacific Northwest.

Occasionally fire does win the battle with the larch. The dying larch responds by producing huge numbers of seeds that can be dispersed — by the wind — up to 400 feet away. The large-winged seeds are very small; it takes about 143,000 seeds to make a pound. After a fire, western larch often re-establishes itself at the same rate as lodgepole pine, another fast growing species. As the canopy closes, western larch is eventually replaced by other, more shade-tolerant, species in the stand until fire again gives the fire-tolerant larch the advantage.

In Oregon, larch can be found between 3,000 and 7,000 feet in elevation along the east side of the Cascade Range south to the Metolius watershed, but are most abundant in the mountain ranges of the Blue Mountains Ecoregion (Ochoco, Strawberry, Aldrich, Greenhorn, Elkhorn, Wallowa and Blues). Outside Oregon, the western larch ranges through southeastern British Columbia, southwestern Alberta, central and eastern Washington, northwestern Oregon, northern Idaho and western Montana. It prefers the generally moist locations of north slopes and valley bottoms.

SANDY LONSDALE



Western larch (*Larix occidentalis*) on the Wallowa-Whitman National Forest. The larch has a contrary nature as a deciduous conifer. After turning color in the fall, the needles fall off.

The utility of the western larch is not limited to its beauty. Rotting cavities within larch trunks provide homes to several songbird species, woodpeckers, owls and flying squirrels. Occasionally osprey, bald eagle and even Canada geese make their large platform nests in western larch trees. Both blue and spruce grouse eat the buds and leaves. Black bears favor larch trees for escape because the textured bark and large size make for easy climbing (if one is a bear).

Glactan, the natural sugar gum in the wood, resembles a slightly bitter honey and can be made into baking powder (in case you're running low and can't get to a store).

The native quinine conk (*Fomes officinalis*) that grows perpendicular on tree trunks can be deadly to western larch, but has medicinal value to humans. In earlier times, conk growing high above the forest floor was harvested by rifle shot and sold to European pharmaceutical firms.

The larch casebearer (*Coleophora laricella*), a native of Europe, was introduced to the range of the western larch and is now a serious pest that defoliates the victim trees. In Europe, the casebearer is naturally controlled by parasites, as it is in eastern North America. But importing the parasites to the West has not been effective as a control measure. Fortunately, the western larch is accustomed to losing its needles and will grow a second crop if defoliated in the spring. However, repeated defoliation stresses the trees and does not bode well for the larch's ability to compete in the forest environment in the future.

For much of the last half-century, government and industry has routinely “salvage” logged forests after major natural disturbances such as wild fire, windthrow, insect infestations or disease outbreaks. This has caused scientists to note the importance and rarity of natural young (0-80 years old) forests, as well as older forests.

*Indeed, naturally developed early-successional forest habitats, with their rich array of snags and logs and nonarborescent vegetation, are probably the scarcest habitat in the current regional [Pacific Northwest] landscape.<sup>17</sup>*

The continued siege by federal forest managers and timber companies against young, mature and old-growth forests in Oregon, and the increasing rarity of all three forest types, certainly strengthens the case for more forest wilderness.

## Selected Fish and Wildlife in Oregon's Forests

*Idaho is full of elk. Ohio isn't. The reason is obvious.*

—Howie Wolke (Wyoming guide, wilderness defender and co-founder of Earth First!)

EVERETT COLLECTION



Northern flying squirrels (*Glaucomys sabrinus*) do not actually fly, but do glide between trees using a flap of skin that extends between their front and rear legs. They mostly eat underground fungi and are mostly eaten by northern spotted owls.

Approximately 579 wildlife species are regularly found in Oregon, including 31 amphibians, 31 reptiles, 370 birds and 137 mammals. Many of these species are in trouble. In Oregon, 139 vertebrate species (most species are invertebrates) are categorized as “endangered,” “threatened” or “sensitive.” This means that their populations are neither stable nor increasing — as a matter of scientific, if not legal, determination. As of 1996, this list included 36 fish, 19 amphibian, 8 reptile, 54 bird and 22 mammal species. Not included are the grizzly bear and other species that have been extirpated from Oregon.

Excessive exploitation (hunting, fishing and trapping), disease and other factors

contributed to the decline of several species. However, in almost every case, the overwhelmingly critical factor contributing to species’ decline is the loss of habitat caused by development, agriculture, logging, grazing and mining. If the full complement of Oregon’s native fish and wildlife are to have a future, we must leave room for nature.

Conservation biologists have developed the concept of “focal species” to help gauge and manage ecosystem health. Focal species are “organisms used in planning and managing nature reserves because their requirements for survival represent factors important to maintaining ecologically healthy conditions.”<sup>18</sup> Several types of focal species exist.

► **Keystone Species** “enrich ecosystem function in a unique and significant manner through their activities,” with an “effect... disproportionate to their numerical abundance.”<sup>19</sup> For example, when beaver disappear from an area, the ecosystem structure changes, resulting in a loss of diversity.

► **Umbrella Species** “generally cover large areas in their daily or seasonable movements.”<sup>20</sup> Large mammalian carnivores, because they are wide-ranging and ecological generalists, often serve as umbrella species, although large herbivores and raptors can also serve this role. Protecting enough habitat for these species often provides habitat sufficient for numerous other species. Grizzly bear, wolf and elk are good examples of umbrella species in Oregon.

► **Flagship Species** “are charismatic creatures.”<sup>21</sup> Globally, giant pandas, harp seals, whales and sea turtles fill this role. These species attract public attention for the conservation objective they are associated with. Fortunately, the northern spotted owl is warm-blooded, has feathers and is telegenic, making it an ideal flagship species for old-growth forests. (Though Pacific salmon are cold-blooded, slimy and difficult to photograph, they too have charisma.) In Oregon, grizzly bear and wolf can be additional flagship species if ever they are returned to their former habitat in the state. Flagship species are also sometimes called “lightning rod species” because they can attract intense opposition to conservation goals.

► **Indicator Species** “are tightly linked to specific biological elements, processes or qualities; are sensitive to ecological changes; and are useful in monitoring habitat quality.”<sup>22</sup> In Oregon, there is no better indicator of westside forest ecosystem health than the northern spotted owl. An indicator species can indicate something as narrow as stream temperature or as broad as wilderness quality.

Each of the four types of focal species has a different, but critical function.

*A keystone species is defined by ecological value. An umbrella species is a basis for management decisions, particularly about size, shape, and spatial distribution of*



*protected areas. A flagship species is charismatic and used in public relations and fundraising. Finally, an indicator species is useful in assessing and monitoring quality of habitat.*<sup>23</sup>

One species can represent more than one type of focal species. The spotted owl, as noted above, is both a flagship and an indicator species. The grizzly bear — temporarily absent from Oregon — can be all four.

Below are a selection of brief accounts of wildlife species that do, could again or may still inhabit Oregon's wild forests. Additional natural history of certain species can be found in the individual descriptions of proposed Wilderness areas.

## Carnivorous Mammals

*Carnivora.* These are flesh eaters.

Oregon's forests are short on carnivores due to habitat destruction, trapping for sport and profit, as well as simple human meanness and fear. Regardless of size or species, most Oregon carnivores are not prospering, save for the wily coyote, which is in no trouble at all, and the cougar, whose numbers have been growing steadily.

The gray wolf and the grizzly bear are presently missing from Oregon, although the wolf is beginning to make a comeback.

There are four medium-sized flesh eaters in serious decline throughout Oregon's forests and elsewhere: lynx, marten, fisher and wolverine.

Carnivores, at or near the top of the food chain, serve important regulatory functions in ecosystems and as indicators of an ecosystem's overall health.

To date, species that fly or swim have received more conservation, legal and political attention than those that roam the land. The Pacific Northwest Forest Plan, for example, was designed primarily to protect marbled murrelets, northern spotted owls and Pacific salmon. While the habitat requirements of birds and fish often overlap those for carnivores, taking specific steps to provide habitat needs for mid- and top-level carnivores will likely also protect the needs of small carnivores and their prey species.

If lynx, wolverine, fisher and marten are to survive in Oregon (and if the wolf and the grizzly bear are to return) we need to protect our remaining wilderness — including that which is already designated Wilderness, and especially that which is not.

**Lynx** *Lynx canadensis* was thought to have been extirpated from Oregon, but it turns out that the species is just very rare and, until now, hard to detect. Over the last several decades there has been a string of credible lynx sightings from south of Crater Lake all the way to the Wallowa Mountains. Adding to the sightings, the lynx's



The large paws of the lynx (*Lynx Canadensis*) allow them to hunt atop heavy snow. The blood is not lynx blood.

presence in Oregon was recently proved by analysis of hair samples.

Listed as a threatened species under the Endangered Species Act, lynx are almost perfectly calibrated to snowshoe hare populations, especially in the boreal regions of its range. As hare numbers rise and fall, so do lynx populations. In the southern portion of its range, lynx eat a variety of other prey species, including small mammals and birds. Red squirrels are an alternative food source for lynx throughout much of its range. In Oregon, red squirrels are found only in the Blue Mountains. Douglas squirrels, first cousins to the red, are found in the rest of Oregon's forested ecoregions.

Times are particularly difficult for lynx both when squirrel numbers decline (due to a scarcity of conifer cones) and

the hares are also at the bottom of their natural cycle (due to reduced food supply).

In Oregon, lynx prefer forest habitats that are similar to northern boreal forests. They live in high elevation areas where the snow is deep in winter. Their oversized paws are natural snowshoes, giving them a competitive advantage over other predators like the bobcat when pursuing prey atop the snow. Lynx paws are comparable in size and shape to those of a cougar, though the latter weighs three to five times more. Bobcats and coyotes may compete with lynx in some (lower elevation) areas, limiting lynx populations. This may be especially so in places where snowmobiles provide perfectly groomed pathways through deep snow, aiding bobcats and coyotes to pursue prey where they would not otherwise go. If wolves are returned to Oregon, research indicates that coyote numbers would probably decrease, affording some respite to lynx.

Lynx need large areas of contiguous habitat. They won't persist in small isolated refuges, which might otherwise be suitable habitat.

Recently disturbed forest stands (preferably by wildfire rather than logging) are highly productive for snowshoe hares, but these open habitats are transient, as they develop quickly into early succession forests. Late-seral (old) forests, on the other hand, are moderately productive for hares and support stable populations for long periods. Lynx find refuge in these older forests.

Controversy is now brewing over how lynx habitat should be defined in the

southern extent of its range. Wildlife and forest management agencies — preferring not to consider lynx needs when developing timber sales, roads and winter recreation — have arbitrarily categorized millions of acres of Oregon’s national forests so that they are no longer considered lynx habitat.

EVENING BULL



The American marten (*Martes americana*) needs mature closed-canopy forests.

## Marten

*We know little firsthand of the marten in Oregon, but we suspect that populations here likely will not increase greatly if short-rotation timber harvest and single-species replanting continue as recommended forest-management practices. Other practices, more of the past than of the present — such as burning or otherwise removing slash, snags and downed logs, and large clearcuttings — likely are detrimental to marten populations.*

—B. J. Verts and Leslie N. Carraway, in *Land Mammals of Oregon*<sup>24</sup>

We do know that from 1834 to 1837 the Hudson’s Bay Company, through its headquarters near present day Vancouver, Washington, bought 334,362 American marten (*Martes americana*) pelts. For comparison with a better-known fur, during the same three years the company bought 307,186 beaver pelts.

Research shows that martens live longer, more productive lives and suffer less natural and trapping mortality in undisturbed old forests, compared to logged forests.

They can live in a variety of older forest types. In Oregon, martens are most abundant in the southern Cascade Range but also live in the Blue and Willowa mountains. A few are also found in the Coast Range. Once believed extinct, the

Humboldt subspecies (*M. a. humboldtensis*) may have been recently rediscovered just south of the Oregon border and may range into the Kalmiopsis country.

Martens are opportunistic feeders, eating not only small birds and mammals, but also carrion.

**Fisher** In Oregon, the fisher (*Martes pennanti*) once ranged through all forested ecoregions of the state. It now appears to be limited to a portion of the Klamath Mountains and the Cascades Ecoregion.

Classified in the same family of carnivores as river otter and mink, the fisher is larger than both of these and the marten. It is renowned for its unique ability to kill porcupines. Contrary to lore, the fisher does not flip the porcupine over and then attack its quill-free underbelly. (In 1979, I saw Senator Mark Hatfield get down on his hands and knees in his capitol office to demonstrate the technique.) Rather it bites the porcupine’s quill-free face until it dies, which can last a half-hour before the real eating begins.

The fisher in its west coast range has been found to be warranted for protection under the Endangered Species Act. Only three small populations of fishers remain in the Sierra Nevada, northern California and the Oregon Cascades. The species is extirpated from the rest of Oregon, including the Blue Mountains.

The only native fisher population in Oregon is in the Klamath Mountains. The current Oregon Cascades population is the result of a successful reintroduction of individuals from British Columbia and Minnesota. To please the timber industry, the Oregon Department of Fish and Wildlife reintroduced fishers, hoping to control the porcupine populations that were decimating tree seedlings in timber plantations.

BRUCE HAYWARD



Very rare in Oregon, the fisher (*Martes pennanti*) has been the victim of trapping and habitat loss. It needs dense, mature forests with a deciduous component.



While porcupines can adapt to such severely simplified ecosystems, fishers require a variety of densely forested habitats at low and middle elevations. Fishers require large blocks of intact old forests with snags and continuous closed canopies, especially along riparian areas. Fishers need the cavities of large trees for dens. Swamps and other forest wetlands are important fisher habitat. Timber plantations have none of these. An estimated 60 to 85 percent of the fisher's original habitat has been destroyed across its range.

Despite the name, fishers don't eat fish, but they do eat small mammals and birds, carrion, fruit and truffles.

## Wolverine

*The wolverine occurs in a broad range of wilderness habitats. Coastal forest, inland forest of coastal composition, boreal forest, and even tundra areas are occupied depending on elevation and latitude. Within these types, ecotonal areas, especially those near marshes, seem to be significant components of habitats used by wolverines. Open areas seem to be avoided, skirted or crossed rapidly. Nevertheless, the critical component seems to be the absence of human activity or development.*

—B. J. Verts and Leslie N. Carraway, in *Land Mammals of Oregon*<sup>25</sup>

Wolverines (*Gulo gulo*) are legendary for their savage disposition, although this reputation is probably derived from observing the behavior of individuals caught in cages or traps where they display unparalleled defensive aggression compared to other trapped species. (Wouldn't you?)

Wolverines are large, powerful animals, and sometimes weigh over 50 pounds. They often escape from traps, break into structures or food stores and can even kill large deer and elk. An adept climber and swimmer, the wolverine is about the size of a bear cub. While primarily a meat eater, it will also take berries in season. Wolverines kill some of their own meat and also eat carrion. The extirpation of wolves in Oregon has meant less carrion lying around for wolverines (and other carrion eaters) and that has probably affected the species.

Wolverines can be found in boreal (northern) forests that receive deep winter snow. Recent wolverine sightings in the southern Oregon Cascades and southern Blue Mountains — and mostly in designated Wilderness and de facto wilderness — are exciting news. Wolverines were thought to have been extirpated from Oregon until 1965 when a large male was killed on Three Fingered Jack (Mount Jefferson Wilderness). Since then, tracks, sightings and trappings have been reported on Steens Mountain (Wilderness), Broken Top (Three Sisters Wilderness), Mount Thielsen (Wilderness), Mount McLoughlin (Sky Lakes Wilderness) and Mount Bailey (proposed North Umpqua Wilderness).

GERALD AND BUFF CORSE



Wolverines (*Gulo gulo*) do not get along well with people or development.

**Cougar** In Oregon, cougar or mountain lion are the most common names for *Puma concolor*. Since the species originally had the widest range of any mammal in the Western Hemisphere, it also picked up some other names, including puma, catamount, panther and painter.

Oregon's largest cat is doing well. Before hunting cougars with hounds was eliminated in 1994 by a vote of the people, the population was growing 4 to 5 percent annually. After the hounds were held at bay, the annual cougar population growth spurted to 8 to 12 percent, but has since returned to about 5 percent.

Cougars average 120 pounds with extremely large males having been reported at as much as 264 pounds.

Three of the 15 recognized cougar subspecies occur in Oregon. The smaller *P. c. californica* is found in the Siskiyou Mountains and southern interior valleys of southwestern Oregon. The lighter colored *P. c. missoulensis* makes its home in the Willowa Mountains and Hells Canyon, while the darker *P. c. oregonensis* is found throughout the rest of Oregon.

The cougar has a wide distribution and a wild spirit that symbolizes wilderness. In Oregon, cougars range widely in a variety of habitats, but are most often found in forested areas, especially in winter. The most productive cougar habitat in western Oregon is of the Douglas-fir/trailing blackberry type with an old growth component. In northeastern Oregon, the best habitat appears to be open mixed-conifer, including pine-bunchgrass canyons. Home ranges can be from 60 to 100 square miles.

Cougars don't like clearcuts, roads and humans and generally try to avoid all three. Cougars don't prefer other cougars much either, as they spend most of their lives



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alone, save for mating and when mothers are rearing their young.

Deer and elk are primary prey for the cougar, but the big cat also eats porcupine, snowshoe hare, small mammals and grass. A cougar will kill a deer or elk every seven to ten days. Domestic livestock can also cure a cougar's hunger, but such predation is relatively rare, even though livestock are pervasive in cougar country.

While hungry cougars have been seen on the edge of urban areas, your chances of seeing one are only a little better than being struck by lightning. Your chance of being killed and eaten by a cougar is not much greater than your chance of winning the lottery without buying a ticket.

**Wolf** The gray wolf was officially extirpated from Oregon in 1946 when the last state bounty was paid on a dead wolf. However, since then there has been tantalizing evidence of *Canis lupus*' return to the state. Carcasses confirmed to be wolves were found in Baker County in 1974 and Douglas County in 1978. Were these remnants of the native Oregon population, or renegades that crossed the border from elsewhere?

Some speculate that wolves have persisted all along at unnoticeably low levels in the southern Cascades.

Three wolves have been confirmed in the state during the last few years. The first was captured near the Middle Fork John Day River and returned to Idaho. A vehicle on Interstate 84 hit and killed a second wolf in Baker County. Both of these wolves came from an experimental population in Idaho and had collars to prove it. A third, found dead without any collar, was shot near Ukiah. (Though some yahoo likely had a beef with this wolf for threatening domestic livestock, an analysis of the wolf's stomach contents found no beef.) There have been 40 additional gray wolf sightings since 2001, including a reliable one as far west as Klamath County, although some of the animals reported were probably not wolves.

"Official" Oregon has never been charitable to wolves. A reason for organizing the first state government in 1843 was to institute a \$3 bounty (\$52.95 in 2001 dollars) on wolves and other predators.<sup>26</sup> Before that, from 1834 to 1837, the Hudson's Bay Company bought 19,544 wolf pelts from trappers. Fortunately, times have changed. Killing an endangered wolf in Oregon today is a federal offense punishable by a maximum of a \$100,000 fine and one year in jail.

Until recently, the position of the Oregon Department of Fish and "Wildlife" policy on wolves (the department used to be called "Fish and Game," which reflected the agency's bias against non-game species, including predators) was that the federal government should give any wolf found in Oregon a free ride (back) to Idaho. ODFW was not only kowtowing to a minority of hunters who detest sharing their prey with wolves, but worse, the agency was pandering to the concerns of private livestock interests who oppose the wolf's return. It is no wonder this agency has little public support.

◀ Few are lucky enough to encounter a cougar (*Puma concolor*) in the wild.



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The gray wolf (*Canis lupus*) was once common in Oregon, then was extirpated and now is moving back into the state from Idaho.

The largest canid in the world, the gray wolf once ranged across the continent from the central plateau of Mexico to the lower Arctic and from coast to coast. Usually gray, the wolf can also be yellowish or light brownish with black. Two subspecies historically ranged in Oregon. The smaller, darker *C. l. fuscus* was found in the western three-fifths of the state while the lighter, larger *C. l. irremotus* was found elsewhere.

Over the last 150 years the wolf population in the continental United States has been reduced from hundreds of thousands of individuals to about 1,000 (mostly in Minnesota). Wolves have since been reintroduced in Idaho and Yellowstone National Park in 1994. An individual wolf can disperse nearly 500 miles in search of a new home and mate.

So their return to the Pacific Northwest and elsewhere is almost inevitable. Wolves are beginning to reappear in Washington's Cascade and Selkirk ranges. It is only a matter of time until the wolf becomes a full-time resident of Oregon again.

The Oregon Cattlemen's Association (OCA) opposes the return of wolves to Oregon. Their predecessors worked hard to kill off Oregon's wolves last century, and they worry about the potential threat of wolf predation on their livestock that range on the public lands.

These cowboys are acting more like Little Red Riding Hood than John Wayne. It doesn't matter to the OCA that Defenders of Wildlife will pay 100 percent of the value of livestock confirmed to be killed by wolves and 50 percent for probable wolf kills. Under this program, Defenders has paid out more than \$206,000 to 180 ranchers since 1987. However, more important to the larger debate on wolf restoration is a comparison of wolf predation to other causes of livestock loss. In Montana, for every eight to ten livestock taken by wolves, approximately 1,000 livestock are killed by domestic dogs (*Canis familiaris*). In 1996, more than 97 percent of livestock deaths nationwide were attributed to digestive problems, respiratory difficulties, calving complications, weather and other causes. Less than three percent were attributed to predation by all classes of predators.

Oregon's Klamath, Siskiyou, Cascade and Blue mountains all have good wolf habitat because they have good prey populations of deer and elk. Where there is prey there should be predators. One of the reasons for the exploding coyote (*Canis latrans*) population in Oregon and across the West, despite the cattle industry's best efforts to wipe them out, is that nature's coyote control, the gray wolf, has been missing from the top of the food chain. Oregon has more wolf habitat than Montana and it is mostly on public lands. It's time to fill it up with these beautiful animals again. Defenders of Wildlife reports:

*Predators and predation play a dynamic and essential role in maintaining the health of ecosystems. By preying mostly on the young and elderly, the sick and injured and the weak and unfit, wolves help keep prey population healthy and vigorous.... In fact, ... a classic study... showed that the reproductive rate of deer herds remains stable and may even rise in the presence of wolves. More fawns survive as wolves remove older animals, thus reducing competition for food and other resources.<sup>27</sup>*

Polls indicate that 70 percent of Oregonians would welcome the wolf back for both ecological and cultural reasons. If the Oregon Department of Fish and Wildlife is worried about decreased deer and elk tag revenue from wolf restoration (unlikely), it should consider offering people who purchase deer and elk hunting tags the opportunity to waive their tags in favor of these new fanged Oregonians. They might be pleasantly surprised by the support for such a program.

**Black Bear** Currently, Oregon's only native bear is the black bear (*Ursus americanus*). Take note: black bears can be black or brown and are occasionally white or bluish. Much smaller than grizzly bears, female adult black bears average 175 pounds and males about 275 pounds. On all four feet, they are about three feet high. Standing upright, black bears measure five feet. With short powerful legs, they can reach bursts of speeds of 35 mph. Black bears can live up to 20 years in the wild. Their natural enemies include other bears, cougars and humans.

Black bears are forest-dwellers. Oregon has two recognized subspecies. *U. a. altifrontalis* is larger, occurs west of the Cascade Range and has a four to one chance of actually being black. The smaller *U. a. cinnamomum* is common east of the Cascades and has 55 percent chance of being brown. It is possible that a third subspecies, *U. a. californiensis*, occurred in the southern portion of the Cascade Range, but historical data is inconclusive. Black bear numbers are increasing in Oregon with an estimated population of 25,000.

Largely herbivorous, black bears eat the new growth of grasses and forbs (wildflowers) in spring. In summer, they eat mostly berries and fruits. In fall, their diet



Black bears (*Ursus americanus*) prefer dense conifer-deciduous forests, but will munch on the cambium layer of little trees in timber plantations (since there is little else around). Consequently, the timber industry advocates severely reducing their numbers.

tree. And the large, living tree must first have been allowed to grow into an old tree, at least 150 to 200 years. In northeast Oregon, top-entry bear den trees average 57 feet in height (the tree was once taller) and over 43 inches in diameter at the base. Grand fir, western larch and western redcedar provide the best dens. While subject to heart rot, western white and lodgepole pines, Douglas- and subalpine fir and Engelmann spruce seldom form hollow chambers needed by bears.

## Grizzly Bear

*There seems to be a tacit assumption that if grizzlies survive in Canada and Alaska, that it's good enough. It is not good enough for me.... Relegating grizzlies to Alaska is about like relegating happiness to heaven; one may never get there.*

—Aldo Leopold<sup>28</sup>

At the time of Lewis and Clark, as many as 100,000 grizzly bears (*Ursus arctos*) could be found in what are now the lower 48 United States. Today, about one percent

consists primarily of acorns, nuts and berries, as well as insects and fish. Black bears will never pass up carrion (dead animals), but only about 10 percent of their diet is animal protein. In winter, the only thing they eat during dormancy is the soles of their own footpads. (Really!) The hairless pads shed and have been found in bear scat near dens. Until the new pads harden with use, emerging bears with tender feet are limited in their movements.

While black bears eat well in young forests, wet meadows and even clearcuts, they do require dens in winter, often provided at the base or within the trunks of large hollow trees. A large hollow tree must first have been a large, living

of their original population remains in the lower 48 states in about two percent of their historical range.

Grizzlies once ranged from Alaska and the Canadian north to the Great Plains to the Pacific Ocean and central Mexico. Today, the species' range is limited to the far northlands: northeastern Washington, the northern most part of Idaho, western Montana and northwestern Wyoming.

The last grizzly bear was killed in Oregon on September 14, 1931, on Chesnimnus Creek in Wallowa County. Oregon has plenty of black bears (*U. americanus*), but no grizzly bears, also known as “brown bears,” even though they are sometimes black. The best ways to distinguish the species are by size (the grizzly is usually much larger) and shape (the grizzly has characteristic humped shoulders and a dished [concave] face). Verts and Carraway in *Land Mammals of Oregon* note that:

*(G)rizzly bears seemingly were widespread in Oregon before European settlement; they occurred in the Cascade Range; the Siskiyou, Blue, Steens and Wallowa mountains; the Klamath, Rogue, Umpqua and Willamette valleys; and some of the high desert country south and east of Bend.* <sup>29</sup>

The United States Geological Survey lists 29 natural features in Oregon named “Grizzly.” They include ten summits (peaks and mountains), three ridges, three valleys, nine streams and four flats in thirteen Oregon counties from Wallowa to Lake and from Curry to Clatsop. Verts and Carraway describe the habitat needs of the grizzly bear.

*The grizzly bear is a species of the rugged, largely inaccessible spacious wilderness areas where either by law or by remoteness its populations are protected from overexploitation by humans. Within such areas, the requirements for food, dens, and cover may be met by a variety of vegetative and physiographic types. A variety of forest types, alpine and subalpine communities, early seral communities in riparian or burned-over areas, grasslands, and shrublands appropriately intermixed and interconnected with travel lanes serve as habitat for these wide-ranging mammals. Succulent, high-protein, and high-energy foods; dry dens not subject to being disturbed by humans; and sufficient vegetation to serve as a shield from human view seem to be habitat requisites for grizzly bears. Thus, precisely how communities provide these elements (which plant and animal species are involved) does not seem as critical as the elements themselves.*<sup>30</sup>

Grizzly bears are opportunistic feeders and eat varied plant and animal matter. Because they hibernate, they must put on lots of fat, which means eating lots of flesh. New evidence suggests that the grizzly bear cannot successfully return to Oregon until



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The last grizzly bear (*Ursus arctos*) in Oregon was shot in 1931. It is possible that they are returning to the state from Idaho.

**Table 1-3. Causes of Death in National Parks in Grizzly Country**<sup>32</sup>

<b>Yellowstone National Park Deaths (1839-1994)</b>		<b>Glacier National Park Deaths (1913-1998)</b>	
Drowning	101	Drowning	48
Falls	24	Heart Attack	31
Climbing	21	Vehicle Accidents	26
Airplane Crashes	20	Falls	24
Burns from Hot Springs	19	<b>Bear Attacks</b>	<b>10</b>
Suicides	15	Natural Death	9
Hypothermia	9	Avalanches	8
Horse Drawn Wagons	9	Falling Object	7
Indian Battles	7	Missing/Presumed Dead	7
Horses	7	Airplane Accident	6
Accidental Shootings	7		
Carbon Monoxide Poisoning	7		
Missing/Presumed Dead	5		
Murder	5		
Avalanches	5		
Falling Trees	5		
Lightning	5		
<b>Bear Attacks</b>	<b>4</b>		

salmon runs are adequately restored. Scientists have analyzed museum specimens and determined that most of what Northwest grizzly bears ate was salmon.<sup>31</sup>

Thus, as part of an astounding biological cycle, the grizzly bear and salmon link the Pacific Ocean and the magnificent old-growth forests of the Pacific Northwest. Washington State University researchers say that as a result of bears eating salmon, 400 pounds of phosphorus and nitrogen are deposited in adjacent forests each year. As bear scat, these elements are in a more usable form as nutrients for trees than even manufactured fertilizers. The nutrients-to-salmon-to-bear (and other species)-to-forest connection can account for up to 20 percent of tree growth. These old-growth forests depend not just on climate, genetics, soils and time, but also on nutrients transported and deposited by healthy fish and wildlife populations.

So the answer to the age-old question of “does an ursine defecate in the forest?” has been answered unequivocally. (The infamous companion question about the religion of the Pope is not addressed by these studies.)

Like most natural processes, this one is entirely circular. When trees that have benefited from wildlife-deposited nutrients fall into streams they return nutrients to riparian and oceanic systems downstream that support an aquatic food chain that features salmon at the top. Interestingly, Hawaiian natives made dugout canoes from old-growth trees that originated in North American Pacific Coast forests and washed up on the islands’ shores, after floating down rivers and out to sea.

This natural ecosystem can again accommodate grizzlies, but can human society accommodate the bears? Grizzlies do kill people. Although more people die from mosquito-borne disease, it is somehow not the same. In grizzly country, humans are species *numero dos* and that makes many people uncomfortable. Perhaps it is because a grizzly bear can weigh up to 800 pounds, stand eight feet tall and run 35 to 40 miles per hour. Still, while an individual grizzly can easily overwhelm a human, humankind is utterly overwhelming bearkind.

Humans and grizzly bears can co-exist. Whether we choose that future depends on whether society believes that humans are all-important or that humans are only the most important part of an all-important biosphere. To put the grizzly-human balance in perspective, consider the causes of human death in both Yellowstone and Glacier National Parks, the two locales in the continental United States where grizzlies and humans most often meet (Table 1-3).

In 1979, a grizzly bear was sighted in Oregon. It was heading east up Steep Creek into the proposed Homestead Addition to the Hells Canyon Wilderness. The bear was apparently coming from the proposed Lake Fork unit of the proposed Wallowa Mountains Wilderness across the road. Oregon is not complete without the grizzly bear. The wildest wilderness exists where our largest ursine colleague can find a home.

## Herbivorous Mammals

Not all mammals eat mammals. Oregon's forests contain majestic and interesting herbivorous mammals as well. But even these, on their worst days — but as nature intended — can end up as dinner for carnivorous mammals.

### Beaver<sup>33</sup>

*The destruction of salmon habitat in the rivers of the Pacific Northwest started with this near annihilation of beaver in the last half of the nineteenth century.*

—Jim Lichatowich, in *Salmon Without Rivers*<sup>34</sup>

Yes, Oregon's official state mammal is a rodent. But this largest rodent on the continent, which can weigh 55 pounds, is by no means a riparian rat. The beaver (*Castor canadensis*) enriches its ecosystem far in disproportion to its numbers. Because the beaver modifies its environment to make a living and creates habitat for numerous other species, it is what biologists call a keystone species.

Perhaps 200 million beavers once inhabited North America. Beavers were everywhere there was water. However, after centuries of severe over-trapping and the resulting decline in the fur market, the beaver is only now beginning to recover and make a partial comeback.

Beavers live to dam moving water and don't care if the water moves through irrigation ditches or highway culverts. Beavers can be a nuisance to human notions about order and territory but, on the whole, any annoyance or damage beavers cause to human development is far outweighed by the great ecological benefits they provide. According to Oregon's *Living Landscape*, beaver benefits include:

- Raised water tables and related sediment settling, which contributes to the creation of meadows behind beaver dams and to the enhancement of fisheries downstream
- Control of streambank and channel erosion by trapping silt eroding from adjacent lands
- Creation of large carbon-absorbing reservoirs that greatly boost the amount of nitrogen available to plants
- Regeneration of riparian vegetation, which increases food and shelter for numerous invertebrates, other mammals, waterfowl and songbirds
- Enhancement of fish habitat behind dams by increasing water depth
- Reduction of stream velocity and overall improvement of water quality as riparian vegetation intercepts contamination from agricultural runoff

Beaver (*Castor americana*) are a "keystone" species that creates habitat upon which many other species depend. ►





- Recharging of groundwater reservoirs and stabilization of stream flows throughout the summer and during droughts
- The protection of downstream croplands and urban areas from floods by the beaver's enhancement of upstream water storage (through the creation of meadows and wetlands)<sup>35</sup>

Four subspecies of beaver can be found in Oregon: the small, dark *C. c. idoneus* in northwestern Oregon; the large chestnut brown *C. c. leucodontus* in the northern two-thirds of Oregon east of the Cascades; the small, dull and pale *C. c. baileyi* in the Harney Basin; and the bright, chestnut brown *C. c. shastensis* in south central and southwestern Oregon.

**Elk** There are two subspecies of elk (*Cervus elaphus*) in Oregon. The typically larger and darker Roosevelt elk (*C. e. roosevelti*) is found west of the Cascade crest. Males have larger antlers with a narrower spread than do the Rocky Mountain elk (*C. e. nelsoni*) that are found east of the Cascade crest. Individual variation within the two subspecies makes identification difficult, so geography is the best way to differentiate the two.

Best known as forest-dwelling animals, the Rocky Mountain subspecies, for reasons not clear, are also reinhabiting the Oregon Desert portion of the Sagebrush Sea. Across Oregon, elk are most abundant in the Blue and Wallowa mountains (Rocky Mountain) and in the north Oregon Coast Range (Roosevelt).

Also called wapiti, the elk is Oregon's largest native ungulate, save for the very occasional stray moose, and can weigh in at over 1,100 pounds. Bull antler size is related to nutrition, as is female reproductive success. Rocky Mountain cows (females) are likely to bear a calf every year, while Roosevelt cows usually give birth every other year. From late August through mid-November, mature bulls gather harems for autumn mating. It's good work if you can get it, but dominant bulls are so busy servicing the harem and fending off challengers that they often suffer from a lack of sleep and nutrition. Calves are born the following spring.

During the summer, elk try to build up fat reserves for winter by eating lots of grasses and wildflowers. They can often be found in moist meadows and streambanks, which provide food and cool places to escape the heat. If you come across a dug-out mud hole in a meadow, it's probably an elk wallow used to both cool the occupant and create a urine- and feces-soaked mud defense against insects. It makes one appreciate modern bug spray.

In the winter, elk browse on woody vegetation such as oak, aspen, alder, yew and willow. During very cold times — especially in eastern Oregon, but also in the Coast Range — elk require the thermal cover provided by older forests.

In Oregon, elk hunting was banned from 1908-32 in an attempt to rebuild herds

GARY BRAASCH



Roosevelt elk (*Cervus elaphus roosevelti*) are found west of the Cascade Crest.

that had been decimated by commercial hunting (some for the meat, mostly for the hides, antlers and upper canine teeth) and competition from livestock grazing.

In the publicly owned mountains of eastern Oregon, domestic livestock compete with elk for summer forage. Obviously, any forage that is appropriated by domestic livestock is not available for native wildlife. Livestock typically spend their winters back at privately owned ranches in the mountain valleys where the elk also wander to avoid deep snow.

Hearing elk is as exciting as seeing them. Bulls bugle a deep bellowing whistle for obvious reasons in the fall, but cows also vocalize in spring while calving.

**Rocky Mountain Bighorn Sheep.** Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) are now at 5 percent of their pre-European invasion numbers. Over 90 percent of all remaining Rocky Mountain bighorns spend part of their life on the national forest system. In Oregon, Rocky Mountain bighorns are found primarily in the Wallowa-Whitman and Umatilla National Forests. The original native population was extirpated from Oregon by 1945. Unrestricted hunting, diseases transmitted from domestic sheep and other conflicts with domestic livestock contributed to the demise of wild sheep in Oregon.

Rocky Mountain bighorns have since been reintroduced in limited areas in Oregon. Ten herds of bighorns are now found in the proposed Hells Canyon, Wallowa Mountains and Grande Ronde Wilderness areas in the Grande Ronde, Burnt and Imnaha Basins, which also include the existing Hells Canyon, Eagle Cap and Wenaha-Tucannon Wilderness areas.



Rocky Mountain bighorn sheep (*Ovis americana americana*) are often fatally susceptible to diseases from domestic sheep.

In 1971, twenty Rocky Mountain bighorns were transplanted from Jasper Park, Alberta to Hells Canyon, but they eventually disappeared. Another twenty were released the same year on the Lostine River in the Eagle Cap Wilderness. Fortunately, that population thrived and became the source of successful transplants elsewhere in Northeastern Oregon (including Hells Canyon) and other states. Today, Oregon has an estimated 700 Rocky Mountain bighorn sheep.

The Rocky Mountain subspecies usually has heavier horns and is a little larger, stockier and darker in color than the California subspecies (*O. c. californiana*). The general geographic boundary between the two subspecies ranges is the John Day-Burnt River Divide.

The California subspecies, while found mostly in the Oregon Desert, also occurs on Strawberry Mountain and in some other forested areas. Conversely, Rocky Mountain bighorns are found at Sheep Mountain at the south end of Hells Canyon in the Oregon Desert.

The Oregon Department of Fish and Wildlife has identified numerous additional potential transplant sites for both subspecies, mostly in designated Wilderness or proposed Wilderness areas. These sites provide both winter and summer range, generally contain the sheep's preferred precipitous terrain and have few trees or other vegetation that obstructs long-distance vision. In some places, unless the trees burn periodically, conifer encroachment will degrade bighorn habitat.

In Oregon, the single most effective limitation on increased populations of Rocky Mountain bighorn sheep is the U.S. Forest Service, particularly in the Wallowa-Whitman National Forest. There — and elsewhere — the Forest Service insists on

continuing domestic sheep grazing that, although at best a marginal enterprise on these public lands, is deadly to wild sheep. Where domestic and wild sheep interact, wild sheep often die in large numbers. Domestic sheep are carriers of, but are not affected by, a strain of pneumonia (*Pasteurella* spp.) that is lethal to bighorn sheep. All ages of wild sheep are affected and lamb mortality rates are adversely affected for three to five years after each outbreak of the disease.

Responding to litigation and public concern, the Forest Service has reluctantly ended domestic sheep grazing in most parts of the Oregon side of the Hells Canyon National Recreation Area (NRA). Nonetheless, the Hells Canyon wild sheep recently suffered a large die-off, which was directly linked to a domestic sheep allotment on the edge of the NRA in the Seven Devils Mountains on the Payette National Forest in Idaho.

The Wallowa-Whitman National Forest still hosts 33,885 sheep-months of grazing on various parts of the forest, which prohibits the re-introduction of wild bighorn sheep in these areas. The government takes in less than \$10,000 a year in grazing revenue, while spending several-fold more than that to facilitate such grazing. Meanwhile, in 2001, one hunter bid and paid \$67,500 for the opportunity to hunt for an Oregon bighorn sheep (either subspecies). The proceeds from hunting license auctions fund bighorn sheep research and management.

## A Maybe Mammal

### Bigfoot

"I hope there's an animal somewhere that nobody has ever seen. And I hope nobody ever sees it."

—Wendell Berry (quoting his daughter in his poem, "To the Unseeable Animal")<sup>36</sup>



Although it has been given a scientific name (*Gigantopithecus americana*) Bigfoot or Sasquatch probably doesn't exist. However, it might.

Is Bigfoot legend or reality, or both a legend and reality? No one really knows if Bigfoot exists or not. It is always more difficult to prove a negative. If Bigfoot does exist, is it more ape-like or human? Also called Sasquatch, is *Gigantopithecus canadensis* a carnivore, herbivore or an omnivore?

The U.S. Army Corps of Engineers has speculated that Bigfoot exists.<sup>37</sup> A Washington State University anthropology professor has studied enough evidence to convince himself that Bigfoot is a living descendant of *Gigantopithecus*, known from Pliocene and Pleistocene fossil records in Southeast Asia.<sup>38</sup>

Thus, tantalizing evidence of this creature exists.



However, because Bigfoot has always been more than a matter of science, but also of myth, legend and dreams, the question of its existence has tended to attract as many dreamers, schemers, crackpots and pranksters (including some who have recently admitted to hoaxes long cited as evidence by believers) than serious scientists. If Bigfoot does indeed exist and has thus far escaped our detection, then there is no doubt that Bigfoot is the ultimate wilderness species.

In *Where Bigfoot Walks*, Pacific Northwest naturalist and author Robert Michael Pyle opens his excellent exploration of the science, myth and hope behind Bigfoot by saying:

*Something definitely is afoot in the forests of the Pacific Northwest. Either an officially undescribed species of hominoid primate dwells there, or an act of self- and group-deception of astonishing proportions is taking place. In any case the phenomenon of Bigfoot exists. Whether the animals themselves are becoming scarcer or whether they even walk as corporeal creatures at all, their reputation and cult are only growing. More and more people, including credible and skeptical citizens and scientists, as well as the gullible, the wishful and the whacko, believe that giant hairy monsters are present in our midst. What does it mean? Who is this beast described by the great ecologist G. Evelyn Hutchinson as “our shadowy, perplexing and perhaps non-existent cousin”? 39*

## Birds

Many birds have co-evolved with particular forest habitats so individual species often become the proverbial “canary in a coal mine,” each warning of the decline of their individual forest types.

**Brown Creeper** Behold the brown creeper (*Certhia americana*). It is the only bird on the continent that relies on both the trunk and bark of a tree for foraging and nesting. It is a small bird, with a down-curving bill to reach insects hiding deep in the bark. Streaked with white on its otherwise brown back, the species is one of the most camouflaged forest birds.

Brown creepers are found in most forested regions of the continent. Nine subspecies are recognized, three or four of which are found in Oregon. Generally, wherever there are large, old forests, there are brown creepers.

Brown creepers usually nest under the loose bark of large standing dead trees. The life of a dead standing tree (snag) can be quite long, but the bark usually loosens and sloughs off relatively quickly. Thus, a forest must contain many large, old live trees to produce a sufficient number of large, old dead trees in varying stages of decay to yield

GREG CLARK



The brown creeper (*Certhia americana*) specializes in exploiting the short period in the life of a snag where the bark is beginning to fall off, but hasn't quite.

enough bark-sloughing snags for brown creepers.

Brown creepers eat animals with at least six-legs and these are abundant in old forests.

Want to see a brown creeper creeping up the side of a tree? The next time you are in an old forest during the spring or summer, listen for the call that sounds like “trees, trees, beau-ti-ful trees!”

**Goshawk** When thinking of hawks, one usually conjures images of majestic birds soaring high above open coastlines, estuaries, lakes, meadows, mountaintops and tundra. There are, however, three “forest” hawks that specialize in more confined surroundings: goshawk, Cooper’s hawk and sharp-shinned hawk. Because of its size and

aggressiveness, the goshawk is the most magnificent of the three.

Goshawks (*Accipiter gentilis*) evolved with short, very powerful wings and protective eye tufts that allow them, amazingly, to fly unscathed (mostly) and rapidly through the forest in search of small mammals, songbirds and grouse.

Approximately the size of a common raven, individual goshawks increase in size as their range goes north. The color of the adult plumage is generally silver-gray on the bird’s upper parts and barred pale grayish-white on their under parts. Look for the distinctive eye-stripes that flare behind their eyes.

Scientists generally recognize three subspecies of goshawks: the Queen Charlotte (*A. g. laingi*), the northern (*A. g. atricapillus*) and the Apache (*A. g. apache*). The Apache lives far south of Oregon while the Queen Charlotte now lives north of our state. In Oregon, northern goshawks (*A. g. atricapillus*) need mature and old-growth forests between 1,900-6,100 feet in elevation like those found in portions of the Cascades, Blue and Klamath mountains. The highest concentrations of northern goshawks are found in the drier forests east of the Cascade crest. Northern goshawks may also be on Steens Mountain, a sky island in the Sagebrush Sea.

Goshawks do not occur in the Oregon Coast Range. However, some scientists suspect that the goshawk subspecies that did (and can again) inhabit the Coast Range is the Queen Charlotte goshawk that is adapted to wetter marine forests.



Northern goshawk (*Accipiter gentilis*) nestlings. This species prefers big trees and open understory.

Seeing a goshawk is a rare treat because of its reclusiveness and specialized habitat requirements. A pair of goshawks builds and maintains three to nine nests each year, but only defends one nest each year. The others are free for use by northern spotted owls, great gray owls, great-horned owls, short-eared owls, Cooper's hawks, red-tailed hawks, squirrels and many other species.

A goshawk's reproductive home range has three critical components: a foraging area, a nesting area and a post-fledging family area. Foraging areas are 4,900 to 5,900 acres, comprised of a forest mosaic that includes large trees, snags and downed logs with interspersed openings. Under natural fire conditions, the forest floor is generally open, allowing goshawks to see their prey with relative ease. Fire exclusion allows the understory to fill with shrubs to the detriment of goshawks.

One of the reasons goshawk forage areas are so large is that the birds remove so much prey from localized areas that prey from adjacent areas must recolonize them. This is also a reason for the goshawks' multiple nests.

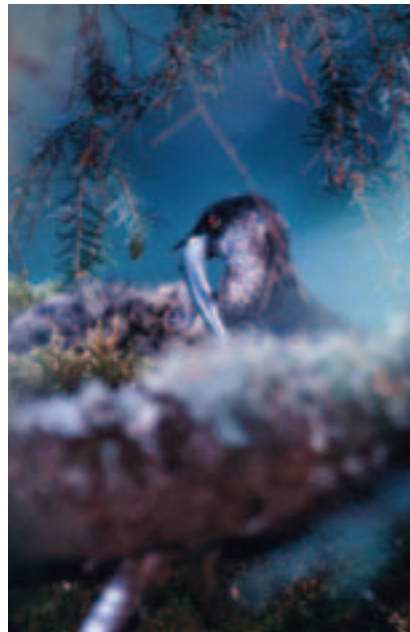
Goshawks usually nest in very large Douglas-fir, true fir, lodgepole pine, ponderosa pine, western larch or quaking aspen, in mature forest stands that have a high canopy closure. The loss of both big nesting trees and of closed canopy, open-floored forests for foraging have greatly reduced goshawk numbers. Halting and reversing the loss of these forest types halt and reverse the declines in goshawk populations.

**Marbled Murrelet** In 1985, an Oregon State University wildlife graduate student was hiking on the east side of Marys Peak in the Coast Range when she heard what sounded like a seabird. Being 30 miles inland, S. Kim Nelson was perplexed, but

eventually identified the bird as a marbled murrelet (*Brachyramphus marmoratus*), a sea bird that is primarily found within a few miles of shore during the breeding season and up to six miles out to sea in winter.

At that time, however, no marbled murrelet nest had ever been found in Oregon and only one had been identified in northern California. That the species nested so far inland in interior forests had never been confirmed. Nelson went on to do her master's degree research on cavity nesting birds in the Oregon Coast Range, finding many more marbled murrelet nests in Oregon's marine forests and has since become one of the leading experts on marbled murrelets.

The marbled murrelet is an amazing little dove-sized bird. It can speed through the air at up to 98 miles per hour. It can dive for small fish 160-feet under ocean swells and nest in old-growth trees 150-feet above the ground, as far as 36 (and possibly 80) miles inland from the ocean. Marbled murrelets do not actually build a nest but use a large moss-covered limb — usually of an old-growth tree — as a nesting platform, where one egg is laid in the moss. Eggs and chicks are vulnerable to edge-dwelling generalists such as crows and ravens. Mom and Dad murrelet each take dawn-to-dawn shifts on the nest while their mate makes up to eight round trips to the nest per day delivering fresh fish from the ocean to the chick. When the young fledge, they fly to the sea unescorted.



A seabird, the marbled murrelet (*Brachyramphus marmoratus*) can nest up to 50 miles inland from the ocean, but only in big old trees.

Marbled murrelets exhibit strong site fidelity to a particular stand of trees. Nest success is higher in larger intact old-growth stands than smaller and/or fragmented forests.

The first marbled murrelet nest was discovered in 1974, in California's Big Basin Redwoods State Park. None were found in Oregon until 1990, the first near Five Rivers in Benton County. The species is uncommon to rare along the entire Oregon coast, but has the greatest concentration between Cascade Head (north of Lincoln City) and the California border. This concentration coincides with the relative abundance (compared to clearcut private lands) of nearby onshore publicly-owned mature and old-growth forests in the Siuslaw and Siskiyou National Forests.





Between 6,600 to 20,000 marbled murrelets call Oregon home. Population declines are currently estimated at four to seven percent annually (do the math). Murrelets are typically counted at sea, so these numbers do not represent the nesting population. While only 10 percent of their original nesting habitat remains, life on the ocean is often no picnic these days for marbled murrelets either. At sea they are vulnerable to oil spills, often to gillnet fisheries, and to the vagaries of El Niño messing with their food supply. Because it's a long-lived species and it is displaced by logging, there may be many "homeless" (non-nesting) marbled murrelets.

The species was listed as threatened under the Endangered Species Act in 1991. While the Northwest Forest Plan's late successional reserves will eventually provide adequate habitat once the clearcuts in the reserves grow back to something approximating real forests, the marbled murrelet's status will remain tenuous for the next half to full century. To fully return the species to its former range, private lands must be restored to provide suitable habitat.

### Northern Spotted Owl

*I rejoice that there are owls. Let them do the idiotic and maniacal hooting for men. It is a sound admirably suited to swamps and twilight woods which no day illustrates, suggesting a vast and undeveloped nature which men have not recognized. They represent the stark twilight and unsatisfied thoughts which we all have.*

—Henry D. Thoreau<sup>40</sup>

It has been said that if the northern spotted owl didn't exist, conservationists would have had to invent it. Far from an invention, *Strix occidentalis* is a real bird that has had an incredible impact on old growth logging in the Pacific Northwest. Three subspecies are generally recognized: the Northern (*S. o. caurina*), California (*S. o. occidentalis*) and the Mexican (*S. o. lucida*).

For the last three decades, this inconspicuous species has conspicuously dominated the debate over the Pacific Northwest's last old-growth forests. Fortunately, the northern spotted owl is a charismatic (a.k.a. "telegenic") species. It is also a guileless bird with no innate fear of humans that can be enticed to pose for the cameras with either a human or recorded rendition of the male territorial call. (It also helps to dangle a small mammal, screaming loudly, on a string.) Spotted owls will even follow humans through the woods.

Northern spotted owls are very strongly associated with wet (but not too wet; they don't like Sitka spruce) old-growth forests from southwestern British Columbia through northwestern California. In Oregon, low- and mid-elevation coniferous forests of Douglas-fir, grand fir, ponderosa pine and incense cedar are preferred habitat, but the species also ranges into Shasta red fir and Pacific silver fir zones. The subspecies is

◀ The northern spotted owl (*Strix occidentalis caurina*) is the most famous resident of old-growth Douglas-fir forests.

not found in high-elevation forests. It is most abundant in mature and old-growth forests on either side of the Cascade crest and in the Klamath Mountains and Coast Range ecoregions. Where northern spotted owls are found in young forests, they are undoubtedly associated with residual old trees that survived disturbance, be it logging or natural events. The owls nest in cavities, on broken tops or natural platforms in big trees or snags.

Median home ranges are typically 3,000 to 4,500 acres per breeding pair. Ninety percent of their diet is small forest mammals such as flying squirrels in northwest Oregon and voles and woodrats in southwest Oregon, with the occasional insect, frog or snake.

The northern spotted owl was protected under the Endangered Species Act in 1991 (making the cover of *Time*) and was the driving factor in the creation and implementation of President Clinton's Northwest Forest Plan. The plan is equal parts political and biological (actually an improvement over past plans). But its formula for saving the species is predicated on the debatable premise that continued current logging of mature and old-growth forest habitat is permissible because of the anticipated existence of more old-growth habitat a century from now. Yet while less logging of mature and old-growth forests has occurred than originally envisioned by the plan since its implementation, owl numbers are still declining precipitously.

The northern spotted owl, with its dark eyes and creamy white mottling on the breast, is distinctive, but can be confused visually with a barred owl (although its bars aren't "spots"). The barred owl (*Strix varia*) was historically limited to the east coast of North America where it was similarly dependent upon old-growth forests. In the twentieth century, due to increased forest openings caused by logging and development, the species rapidly expanded west across Canada, then south, reaching northeast Oregon by 1974. The barred owl is now a permanent resident of every forest region in Oregon and appears to be more tolerant of logging activity than the spotted owl.

Barred and spotted owls have interbred (the offspring are not fertile). Despite the havoc barred owls are causing, the primary factor in the decline of spotted owls continues to be the destruction of old-growth and mature forests.

**Pileated Woodpecker** The pileated woodpecker (*Dryocopus pileatus*) is in all likelihood the largest woodpecker left on the continent, since the similarly colored ivory-billed woodpecker (*Campephilus principalis*) is probably extinct. Some birders continue to search desperately for ivory-bills in a swamp near the lower Mississippi River. There have been sporadic reports of sightings in Cuba, but essentially all the old forest upon which the ivory-billed woodpecker depended has now been eliminated.

The continued existence of the pileated woodpecker (the subspecies found in Oregon is *D. p. picinus*) depends upon the willingness of humans to allow sufficiently

EVELYN BULL



The pileated woodpecker (*Dryocopus pileatus*) requires trees at least 70 years of age for nesting.

large snags (standing dead trees) and downed trees to remain in forests. We must also allow very large old trees to die naturally and become large snags and/or downed trees.

The large dull black and white woodpecker with a red crest is usually heard before it is seen. You're likely to hear it pecking on a snag seeking its insect food or hear its distinctive and lengthy (up-to-eight-note) "wok" sounds. Alternatively, you may hear the bird drumming on a hard snag in 11-30 beat bursts, usually to mark territory. Even if you don't spot one, you are likely to notice their excavation of rectangular holes in large snags. Over four-fifths of a pileated woodpecker's diet is ants and termites — both insects that live in downed and standing dead

trees. (Dead trees almost always support more life than live ones.)

A keystone species, the pileated woodpecker excavates a new nest every spring. Their old nests are used by a variety of other species, as are the dozens of roosts each pair of woodpeckers excavates each year.

Pileated woodpeckers inhabit mature and old-growth conifer forests of the Blue Mountains, Cascades, East Cascade Slopes and Foothills, Klamath and Coast Range ecoregions. They are rarely found in pure ponderosa pine forests. They sometimes occur in deciduous forests at the bottom of the Willamette, Rogue and Umpqua valleys. Logging and forest fragmentation lead to a less dense canopy overall, leaving pileated woodpeckers more vulnerable to predation.

**White-headed Woodpecker** The white-headed woodpecker (*Picoides albolarvatus*) is to old growth ponderosa pine what the northern spotted owl is to old-growth Douglas-fir. The habitat of these medium-sized woodpeckers consists of



pure stands of big old yellow-bellied ponderosa pines, or where ponderosas otherwise dominates a mixed conifer forest. Although heavily dependent on ponderosa pine seeds in winter, white-headed woodpeckers will also eat sugar pine seeds and small insects. The species usually excavates nest cavities in snags, but also uses stumps, leaning logs and the dead tops of live trees.

White-headed with a glossy black body, the males of the species have a red patch on the nape and juveniles are a dull black with the nape patch tending toward orange.

In Oregon, the white-headed woodpecker is a permanent, although uncommon, resident of the Ochoco, Blue, Wallowa and the eastside Cascade mountains where

suitable habitat can be found. White-headed woodpeckers occasionally occur in the upper reaches of the Umpqua River and Siskiyou Mountains. Stronger populations are centered in the Winema and Deschutes National Forests.

The more old-growth ponderosa pine there is, the more white-headed woodpeckers there are. Unfortunately, ponderosa forests have become one of the most endangered forest types in the West. Ponderosa pine forests have been dramatically reduced by logging, and fire suppression has curtailed the low-intensity ground fires that burn out the young trees under the big old pines. The result of fire suppression is that fir forests grow up underneath and eventually replace the pine forests. Competition from this



In Oregon, the white-headed woodpecker (*Picoides albolarvatus*) has a strong affinity for ponderosa pine.

understory also reduces pine seed production. Livestock grazing also removes grass that carries these beneficial fires. As an increasing shrub and tree layer replaces the open forest floor, predation by small mammals of white-headed woodpecker nests increases.



Coho salmon (*Oncorhynchus kisutch*) eggs and alevins (more than just an egg, but not quite a fry) need clean and gravelly stream bottoms.

## Fish

The very best habitat for native fish exists in undisturbed roadless areas. Habitat destruction has led to a long and dramatic decline of native fish species in Oregon. In addition, fish managers have a long history of introducing exotic species valued for sport fishing, introductions which have proven harmful to native species.

**Bull Trout** Before the European-American invasion, abundant populations of bull trout (*Salvelinus confluentus*) existed in the Klamath, Willamette, Deschutes, John Day, Umatilla, Walla Walla, Grande Ronde, Imnaha, Pine Creek, Powder and Malheur River basins of Oregon. The species presently ranges from northern British Columbia to northern California and east to western Montana. In the clear, unpolluted refuges in Upper Klamath Lake (where clean water from creeks and underwater springs enter the lake), bull trout can weigh over 20 pounds.

Today, healthy bull trout populations occupy only 3.8 percent of their historical range. Fully 76 percent of the remaining habitat occurs in large — greater than 5,000 acres — roadless areas, Wilderness, Wilderness Study Areas and national parks. If one factors in small roadless areas (1,000 to 5000 acres), the number of bull trout in roadless areas is undoubtedly higher.

Bull trout are the aquatic canary in the (forest) coal mine. The species has exacting standards for habitat and water quality. As watersheds are degraded, bull trout decline.

Biologists recognize three distinct population segments of bull trout in Oregon.

1. Upper Columbia Basin (John Day River and Columbia tributaries upstream to the mouth of and including the Snake River);
2. Lower Columbia Basin (Willamette, Deschutes and Hood River basins); and
3. Klamath Basin.

SANDY LONSDALE



Bull Trout (*Salvelinus confluentus*) require cold, clear water and are an excellent indicator of watershed health.

Bull trout have three major life histories. *Resident* bull trout permanently reside in their natal streams. *Fluvial* runs migrate from the smaller tributaries where they spawn and rear as juveniles to larger streams where adults forage and live for the majority of their lives. *Adfluvial* runs are similar to fluvial runs except that adult rearing occurs in lakes or reservoirs.

Bull trout require shaded and stable streams with overhanging banks and large amounts of woody debris; plenty of gravel and riffles with little sediment; and corridors of clean, cold and free-flowing water through which the fish can migrate.

The limiting factors identified for bull trout populations are:

- (1) genetics (too few fish in a population leads to inbreeding);
- (2) overfishing (catching more than can be sustained by the population);
- (3) passage barriers (dams, etc.);
- (4) exotic species (of trout and other aquatic organisms);
- (5) habitat loss and degradation (channelization, dewatering, removal of streamside vegetation and debris, etc.);
- (6) global climate change (especially at the edge of the species range); and
- (7) ecosystem change (wholesale decimation of watersheds).

Bull trout evolved to co-exist with a suite of native salmonid and aquatic species, but did not co-evolve with introduced non-native salmonids such as lake trout, brown

trout and brook trout that often out-compete bull trout in degraded stream conditions.

Adult bull trout prey upon chinook salmon fry. Since both species are at risk of extinction, it is essential to restore chinook runs for their own benefit, as well as for bull trout.

Roads, logging, grazing, mining, dams and cropland agriculture are all major contributors to the decline of bull trout. Additional factors are residential and urban pollution, as well as past management practices such as intentional chemical poisoning of bull trout by fish agencies to make room for more popular non-native game species.

Fishing regulations have been modified to conserve bull trout over non-natives to help improve the species' prospects in the short-term. For the long-term, habitat conservation and restoration is the key. The conservation of roadless areas is critical to the survival of bull trout.

**Pacific Salmon** Each of the seven Pacific salmon species that inhabits, once inhabited or could again inhabit Oregon's rivers and streams has a unique life history. Of course, their central common and fascinating trait is that of anadromy. All salmon are born in fresh water, migrate to saltwater to feed and live much of their lives, and return to fresh water to spawn the next generation. Their common life cycle aside, each salmon species is distinct in appearance, size, distribution, abundance, age of maturity, juvenile rearing and migration and spawning habitat.

There are seven salmonid species native to the Pacific Northwest. Two additional salmonid species are found in the northwestern Pacific (commonly called amago and masu) and one species is native to the Atlantic. The seven northeastern Pacific salmon species are:

Pink Salmon - *Oncorhynchus gorbuscha*  
 Coho Salmon - *Oncorhynchus kisutch*  
 Chinook Salmon - *Oncorhynchus tshawytscha*  
 Chum Salmon - *Oncorhynchus keta*  
 Sockeye Salmon - *Oncorhynchus nerka*  
 Steelhead Trout - *Oncorhynchus mykiss*  
 Cutthroat Trout - *Oncorhynchus clarkii*

All but pink salmon spawn in Oregon waters.

Several species can inhabit the same watershed, using different areas at different times. Sockeye spawn only in association with a lake. Fall chinook favor a river's lower main channel for spawning, as do chum and pink salmon. Summer chinook spawn further up the watershed, with spring chinook spawning the farthest upstream.

Salmon are the ultimate keystone species. From bears to killer whales, forty-one





mammal species feed on salmon during some part of the species' life cycle. So do 89 species of birds, including bald eagles. Even five reptile and two amphibian species feed on salmon, for a total of 137 species. This does not include insects, like caddis fly larvae that feed on salmon carcasses and later become food for both trout and salmon. (And we certainly cannot forget the importance of salmon to the survival of the Northwest's native people!)

Pacific salmon co-evolved with Pacific Northwest forests. As fisheries biologist Jim Lichatowich writes:

*Between 5,000 and 4,000 years ago, the climate began to shift toward the cool, moist maritime conditions that persist today. This change in the environment enabled forests to grow. Early in the cooling period, Douglas-fir, which favors drier conditions, dominated; then western hemlock and western red cedar took hold, especially in the wetter areas. Eventually, what we now call old-growth forests emerged, creating stable, well-shaded streams and high-quality salmon habitat. The extensive root systems of the large trees held the streams to defined channels and prevented erosion, while the thick foliage filtered out the sun's heat, helping to maintain cool water temperatures. When the large trees died and fell across stream channels, they created pools and added structure and diversity to riverine habitats. The logs accumulated and eventually backed up water, creating productive side channels and sloughs. The thousands of trees falling across streams also functioned as small check dams, holding back sediment and stabilizing streambeds, thus enabling streams to run clear. As a result, these rivers carried far less sediment than the unshaded rivers had. Old-growth forests created complex and stable stream habitats and it's possible that salmon populations first reached levels of eighteenth- and nineteenth-century abundance around 5,000 years ago.<sup>41</sup>*

Most salmon stocks in the Pacific Northwest are now in danger of extinction. Many are listed under the Endangered Species Act. Those that are not listed should be.

Currently, twenty-six distinct salmon populations are listed under the Endangered Species Act. At the time of this writing, a legal dispute about wild and hatchery fish and the role of hatchery fish under the Endangered Species Act has become a distraction to conservation efforts that further jeopardizes the continued existence of wild salmon. Detractors would have you believe that, since hatcheries produce salmon, wild fish are unnecessary. However, while similar genetically, hatchery and wild fish are quite different. To avoid going into extreme technical detail, consider this analogy: dogs and wolves are very similar genetically and can even interbreed. However, domestic dogs are not comparable to wild wolves.

Hatchery fish are more susceptible to predators and are less healthy, having been raised on processed, pelletized junk food rather than natural food. Hatchery managers

tend to use the first returning fish as brood stock for the following year's production, resulting in successive runs returning before river conditions are really ready for natural spawning migration.

Salmon face many trials and tribulations downstream from the forested areas where they emerge as fry and later return to spawn before dying. Lichatowich notes:

*While native people made good use of the region's watersheds, their impact on salmon habitat was probably negligible. In contrast, the newly arrived pioneers and entrepreneurs fully exploited all the watersheds' economic resources through trapping, mining, logging, grazing and irrigation. As a result, the salmon's habitat came into direct contact with the industrial economy throughout the entire length of the chain of habitats that make up its ecosystem — logging and mining in the headwaters, agriculture in the rivers' lower elevations, cities and industry in the broad alluvial plains and estuaries and finally pollution and large-scale fishing in the ocean. A major part of the salmon's problem, then and now, is that there is not just one threat to their existence but a continuous series of threats at nearly every point in their range, throughout their entire lifecycle. At every point of contact with the industrial economy, from the headwaters to the sea, the salmon have long engaged in a losing struggle for habitat.<sup>42</sup>*

Salmon will be lost unless all of the so-called "four 'H's" are addressed: habitat, hatcheries, harvest and hydropower. This includes Wilderness designation of salmon sanctuaries as a vital part of what must be done to restore healthy salmon runs with sustainable harvestable surpluses.

## Enigmatic Microfauna

Not all species can be charismatic megafauna. Wilderness is also home to infamous and little known species in Oregon. Many of these creatures play an important part in the web of forest life. Without them, forest ecosystems are incomplete.

**Mollusks** In 1994, Senator Bob Packwood — no fan of President Clinton's Northwest Forest Plan — faced a tough election challenge. In an attempt to woo undecided voters, his campaign manager tested a variety of messages. Among these was the fact that the Northwest Forest Plan protected the Malone jumping slug. The mollusk doesn't really "jump" but falls, however, if you don't know your malacology, you may believe it jumped on you. The media never bit, so the public never swallowed.

Well over 150 species of terrestrial snails and slugs are found in the Pacific Northwest's moist forests. Undoubtedly, many new species — perhaps half again as many — will be discovered as soon as someone takes the time to look.



WILLIAM LEONARD



The Malone jumping slug (*Hemphilla malonei*) is only found in older forests.

Mollusks in Pacific Northwest forests can number 4.5 million per acre and, merely by eating, are responsible for recycling up to 90 percent of the biomass in a forest. Because they tend to have very exacting ecological needs and because they are rather small and very slow, Northwest forest mollusks don't disperse well. Imagine being an inch long with one foot and trying to cross a 40-acre clearcut to get to "greener pastures."

As a group, mollusks are some of the Northwest's most endangered species. They are very sensitive to forest fragmentation, grazing, fire, fertilizers, herbicides, pesticides, turbidity and water impoundments. In water bodies, mollusks are indicators of stream health. Many species have adapted specifically to oligotrophic (nutrient-poor, oxygen-rich) mountain streams and springs. These mollusk species are the primary herbivores in freshwater aquatic systems. They also serve as food for fish, crayfish, raccoons, herons and other wildlife. In pristine freshwater streams there are usually more species of insects than mollusks. However, mollusks often comprise up to 90 percent of a stream's invertebrates by weight.

There are over 100,000 different taxa (kinds) of mollusks — from barely moving slugs to fast-moving squids. Gastropods (slugs and snails) and bi-valves (clams and mussels) are all members of the Phylum Mollusca.

For the record, the annoying slugs that decimate Pacific Northwest gardens and flowerbeds are introduced exotic species. However, while this garden pest has not wreaked havoc on Northwest forests, the recent discovery of the New Zealand mud snail in three Oregon locations is a serious development for native ecosystems, especially for salmon and trout streams.

Despite their lack of charisma, mollusks received a disproportionately large amount of attention in the Northwest Forest Plan. That is because the Forest Service requested one of the world's foremost malacologists, Dr. Terry Frest, provide information on mollusks for the plan. Although the agency had carefully avoided asking the question, Frest nonetheless provided a long list of the region's mollusks and noted which species — in his professional opinion — qualified as threatened or endangered under the Endangered Species Act.

Oregon Natural Resources Council thereafter used the Frest report to petition for protection of several hundred species of mollusks under the ESA. The government rejected the petition but covered its official posterior by promising to survey for mollusks before offering timber sales.

An inch-long snail, the rare blue-grey tail-dropper (*Prophysaon coeruleus*) "cannot cross your fingernail in five minutes, but could stop a timber sale," says Jim Rogers of Friends of Elk River. It has been affectionately renamed the "blue-grey sale-stopper."

Alas, the federal forest agencies and the timber industry, exploiting their chances under the more mollusk malevolent Bush Administration, have skipped the surveys and decimated species that depend on old-growth forest. Wilderness designation affords permanent protection for both enigmatic microfauna and charismatic megafauna, as well as not subject to the whims of changing administrations.

STU GARRETT



A stronghold for the pumice grape fern (*Botrychium pumicola*) is the proposed Newberry Volcano Wilderness.



Baker City gets its drinking water from the Elkhorn Mountains in the proposed North Fork John Day-Elkhorns Wilderness.

## It's the Water<sup>43</sup>

Do you know where your tap water comes from?

Two thirds of Oregonians get their water from surface sources and most Oregon tap water originates on federal lands, primarily national forests. Rain and snowmelt from forests are collected, treated (sometimes only minimally because the initial quality is excellent) and delivered to businesses, schools and household taps.

Intact forests are natural reservoirs that absorb, store, filter and gradually release water to forest streams. Logging and road building in forest watersheds degrades their natural hydrology. Water that once percolated slowly through stable soils runs off more quickly, carrying with it soil and other sediments. Logged watersheds have both earlier peak flows and greater storm volumes than do pristine watersheds that maintain more consistent flows through the hot summer months.

Logging reduces water quantity in other ways as well. An intact old-growth conifer forest “harvests” water from fog, as droplets condense from the moist air onto the needles, then drop to the ground. The surface area of the needles of a single old-growth Douglas-fir tree, if spread flat, would cover a football field. This “fog drip” contributes up to one third of all precipitation in Portland’s Bull Run municipal watershed and, in many Northwest watersheds, may be the only source of summer precipitation.

Of course, when the trees are logged, fog drip no longer occurs. Moreover, without

shade from the standing forest, the sun evaporates even more water from the soil. This decreases the amount of water “migrating” into the streams and rivers during the dry summer months when the demand for municipal and irrigation water is greatest. The combination of high summer demand (related to increased population and per capita consumption) and reduced supply (related to roading and logging) may ultimately force us to drink from dirty rivers full of agricultural chemicals, dioxin and sewage.

Clackamas area water planners, for example, could be driven to tap the polluted lower Willamette River (home to toxic three-eyed fish), while timber interests continue to deforest and dewater the Clackamas River watershed.

Roads can affect the hydrology of watersheds as much or more than logging. Municipal watersheds have already been damaged by past roading and logging. Further logging operations (with or without more roads) bring more flood and water quality risks. Yet the continuing controversy over the mismanagement of Oregon’s forests has rarely centered on drinking water. Federal forest management plans are focused more on addressing fish and wildlife issues than on protecting people’s water supplies. However, securing safe and plentiful drinking water should not be a coincidental afterthought of other forest management priorities. Occasionally, water quality and quantity for domestic, commercial and industrial use does become a political issue.

In Oregon, the greater Portland area relies primarily on water from the Bull Run River, a tributary of the Sandy River, which is a tributary of the Columbia River that empties into the Pacific Ocean. At the turn of the last century, Portland was growing and had polluted its water supply in its West Hills. Faced with the prospect of having to drink out of the polluted Willamette River, Portland instead chose to make the pristine Bull Run Watershed its water source because it was far away, federally owned and not subject to human development. In 1904, Congress passed the Bull Run Trespass Act to keep the public out and prevent most activities that could be harmful to the watershed.

After World War II, the Forest Service went on a timber binge (it hasn’t quite ended yet), ignoring the law and seriously roading and logging a good portion of the Bull Run Reserve. In the 1970s, the agency was successfully sued to stop the logging. In 1978 Congress responded with a law that legalized logging in the Bull Run watershed. An increasingly outraged (and, more importantly, an organized) citizenry finally prevailed upon Congress in 1996 to essentially prohibit logging in the Bull Run watershed Management Unit. In an attempt to further protect Portland’s water supply, the unit was expanded in 2001 to include the Little Sandy Watershed, upstream of Aschoff Creek.

The Forest Service has officially recognized several other municipal watersheds on national forest lands in Oregon, including Dallas, Corvallis, Medford, Ashland, Cottage Grove, Bend, The Dalles, Baker City, La Grande and Walla Walla (a Washington city, but most of its watershed is in Oregon). While most of these watersheds are clearly



marked on forest recreation maps, that recognition does not necessarily mean protection from logging, roading, grazing, mining, excessive human recreation and other abuses. Other municipalities, like Eugene, Salem, Idanha, Mill City, Stayton, Jefferson, Sweet Home, Lebanon, Oregon City, West Linn, Lake Oswego, Albany, Beaverton, Gresham, Estacada, Long Creek and Sandy also take their water from streams that rise on federal forests. In fact, more than half of the inventoried (large) roadless areas discussed in this book are located in municipal drinking watersheds.

The better the water's initial quality, the less treatment is needed to make it potable. Two Oregon watersheds — greater Portland's Bull Run and Baker City's Elkhorns Front — are so pure that they don't require filtration before use and need only minimal treatment.

Many current federal forest plans carelessly target municipal watersheds for logging, which has numerous detrimental effects. Logging in the "rain-on-snow" zone (that elevation band where it does often snow, but it also usually rains which rapidly melts the snow) results in flooding and sedimentation of the water. It can also result in lower summer and autumn flows, when water is most needed.

Turbid (sediment-laden) waters create multiple problems for many municipal water supplies. Water treatment becomes more difficult and more chlorine is usually added. For some systems, frequent backwashing of filters is required, which increases expense and the risk of operator error with subsequent contamination by waterborne

ELIZABETH FERYL ENVIRONMENTAL IMAGES



Heavy logging has soiled Fish Creek, a tributary to the Clackamas River on the Mount Hood National Forest.

disease. Muddy water forces some municipal water systems to shut down completely.

Other communities are now looking to Portland's Bull Run protections as an example of how to safeguard a water supply. The cities of Salem and Sandy have recognized that their watersheds, damaged by an ugly legacy of clearcuts that produce muddy water, are further threatened by new logging. Both city councils have passed resolutions and requested the withdrawal of federal timber sale proposals. Citizen support for permanent legislative protections — such as Wilderness designations — is building dramatically around the state to protect water supplies.

Some of Oregon's municipal watersheds do not lie within public forestlands or have private or municipal inholdings within the boundaries of the public lands. Where undeveloped, these watersheds could be better managed under federal ownership. Municipal ownership is generally a bad idea, because many water departments have chosen to log the forests in their watershed for short-term revenues to help keep water rates low while spoiling the water supplies they were supposed to protect. The best way to protect a municipal watershed is through federal ownership with an informed and active municipality which can watchdog the watershed's management.

The primary reason that roadless forestlands lack roads is that it has been too expensive to build any. Slopes in these areas are steeper and more unstable than those in surrounding forests. Consequently, roading and logging these last wildlands would have a disproportionately greater impact on municipal watersheds than all comparable

ELIZABETH FERYL ENVIRONMENTAL IMAGES



The vast majority of Oregonians get most of their drinking water not from groundwater, but from surface sources.



development that has occurred to date.

Oregon's 1.7 million acres of domestic watersheds include many areas of both protected Wilderness and unprotected wilderness. If these wildlands receive permanent protection, they will continue to serve their essential role in providing some of the best and most plentiful water on earth. It's time for Oregonians to stand up for the forests that produce our clean drinking water — a move that will also benefit the fish and wildlife that call these watersheds home.

## The Carbon Connection

Perhaps the greatest threat facing the planet is that of global climate change, accelerated by human activities that are loading the atmosphere with excessive amounts of greenhouse gases (most commonly carbon dioxide).

We now understand the impacts of increased temperatures due to elevated greenhouse gases in the atmosphere to be enormous and these will worsen if we don't phase out our use of fossil fuel. These impacts include: a rise in global sea level great enough to wipe out numerous island nations (and flood much of our own coastal areas where most Americans live); melting polar ice caps from underneath polar bears and penguins; the loss of coral reefs in tropical waters; increased frequency and intensity of inclement weather (including hurricanes); increased spread of what were once "tropical" diseases; and large-scale disruption of ecosystem function and agricultural production.

In the Pacific Northwest, temperatures increased 1 to 3° F over most of the region during the twentieth century. Unless we significantly change our behaviors, summer and winter temperatures are anticipated to rise 7 to 8° F and 8 to 11°F, respectively, by the end of the twenty-first century.

The annual Columbia River Basin snowpack, for example, is projected to decrease and melt earlier, possibly resulting in increased winter flooding and reduced summer and fall river flows. By the 2090s, projected snowpack on March 1 will be only slightly greater than what we presently have on June 1. Increasing temperatures will mean added stresses on salmon runs, increased coastal erosion due to rising sea-level, increased forest fires and resulting changes to forest composition, including notable migrations of forest species both elevationally and latitudinally (assuming the trees can adjust their range faster than the climate changes).

Today, while most atmospheric carbon increase results from humans burning carbon-heavy fuels (oil, gas and coal) that had long been ensconced under our feet in the lithosphere, nine percent of annual U.S. emissions are attributable to logging. Logging transfers biospheric carbon (stored as living or newly dead organic matter) to

Old-growth forests store massive amounts of carbon taken from the air. Excess carbon dioxide and other greenhouse gases cause global warming. To end human-induced climate change, we must phase out our use of fossil fuels, preserve all remaining native forests and re-establish real forests (not timber plantations). ►





the atmosphere. After traveling through the atmosphere, large amounts of previously lithospheric carbon (fossil fuel) are sequestered in the hydrosphere (i.e., the ocean). Increased oceanic carbon levels are a contributing factor of coral reef decline.

Until the exponential proliferation of fossil fuel use in recent decades, human-caused excess atmospheric carbon was due about equally to fossil fuel burning and the destruction of forests — especially of old-growth forests that contain massive amounts of stored carbon. “Reforestation” does not balance the carbon equation. A better term than reforestation would be “weeforestation” because with replanting, massive old-growth forests are replaced with diminutive young plantations, which can sequester far less carbon. Well before reaching old growth conditions, these young trees are cut again, releasing any carbon stored over their short lives.

The Kyoto Protocol — which the second Bush Administration renounced as too radical — would only slow (not stabilize, let alone reverse) increasing atmospheric carbon levels. To return to safe levels of atmospheric CO<sub>2</sub>, we need to end our use of fossil fuels, truly reforest our wildlands and protect remaining virgin forest from further logging. We also need to reduce human population to sustainable levels.

Protection of roadless areas and old-growth forests in the Pacific Northwest is particularly important because of these forests’ relatively high carbon loads (as compared to other forests). Logging of old-growth forests has resulted in 117 times the release of carbon into the atmosphere than from average land use conversions:

*A mere 0.017% of the earth's land surface, old-growth forest conversion [in western Oregon and western Washington] appears to account for a noteworthy 2% of the total [Carbon] released [into the atmosphere] because of land use changes in the last 100 years.<sup>44</sup>*

Biomass equals carbon, so large tracts of large old trees provide more carbon sequestration. Leaving forests intact and not logging them prevents the conversion of biospheric carbon to atmospheric carbon. Letting forestlands grow to be real forests again can increase biospheric carbon and thus reduce harmful levels of atmospheric carbon. Let’s not forget the coincidental benefits of watershed protection, biodiversity conservation and human recreation (pronounced “re-creation”) that intact forests provide. Intact forests are both more resilient and more resistant to the effects of global climate change. ◆

## Notes

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- <sup>2</sup> Mathews, Daniel. 1999. CASCADE-OLYMPIC NATURAL HISTORY GUIDE: A TRAILSIDE REFERENCE. 2nd ed. Raven Editions. Portland, OR: 11.
- <sup>3</sup> Oregon Biodiversity Project. 1998. OREGON’S LIVING LANDSCAPE: STRATEGIES AND OPPORTUNITIES TO CONSERVE BIODIVERSITY. Defenders of Wildlife. Portland, OR: 1.
- <sup>4</sup> This region was previously classified as Basin and Range, Columbia Basin, Owyhee Uplands and Lava Plains ecoregions.
- <sup>5</sup> For more information on the (generally) “tree-free” wildlands of Oregon, see Andy Kerr. 2000. OREGON DESERT GUIDE: 70 HIKES. The Mountaineers. Seattle, WA.
- <sup>6</sup> Oregon Biodiversity Project. 1998. OREGON’S LIVING LANDSCAPE: STRATEGIES AND OPPORTUNITIES TO CONSERVE BIODIVERSITY. Defenders of Wildlife. Portland, OR: 190.
- <sup>7</sup> A few thousand acres of the Cowlitz/Chehalis Foothills Level IV Ecoregion (Puget Lowland Level III Ecoregion) exist along the left bank of the Columbia River downstream from Portland. It is not further considered in this book.
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- <sup>10</sup> The Forest Service, Rocky Mountain Research Station, Intermountain Fire Sciences Laboratory publishes an informative newsletter, “Nutcrackernotes” on whitebark pine research and management, available at <http://nrmcs.usgs.gov/nut-notes/>.
- <sup>11</sup> Whitebark Pine Ecosystem Foundation, P.O. Box 16503, Missoula, MT 59808 ([www.whitebarkfound.org](http://www.whitebarkfound.org)).
- <sup>12</sup> Oregon Department of Forestry ([www.odf.state.or.us](http://www.odf.state.or.us)); Torgerson, Tim (ed.). 1999. OREGON BLUE BOOK 1999-2000. Office of the Secretary of State. Salem, OR.
- <sup>13</sup> Perry, David A., Reed F. Noss, Timothy D. Schowalter, Terrence J. Frest, Bruce McCune, David R. Montgomery, James R. Karr. 2001. Letter to Regional Interagency Executive Committee to implement Northwest Forest Plan (Sept. 4, 2001) (citing in part National Research Council. 2000. ENVIRONMENTAL ISSUES IN PACIFIC NORTHWEST FOREST MANAGEMENT. National Academy Press. Washington, DC: 5).
- <sup>14</sup> *Jacobellis v. Ohio* 378 U.S. 184 (1964) (Justice Potter Stewart concurring opinion).
- <sup>15</sup> Perry, David A., Reed F. Noss, Timothy D. Schowalter, Terrence J. Frest, Bruce McCune, David R. Montgomery, James R. Karr. 2001. Letter to Regional Interagency Executive Committee to implement Northwest Forest Plan (Sept. 4, 2001).
- <sup>16</sup> National Research Council. 2000. ENVIRONMENTAL ISSUES IN PACIFIC NORTHWEST FOREST MANAGEMENT. National Academy Press. Washington, DC: 5-6.
- <sup>17</sup> Lindenmayer, David B. and Jerry F. Franklin. 2002. CONSERVING FOREST BIODIVERSITY: A COMPREHENSIVE MULTISCALE APPROACH. Island Press. Washington, DC: 69.
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- <sup>19</sup> Ibid.
- <sup>20</sup> Ibid.
- <sup>21</sup> Ibid.
- <sup>22</sup> Ibid.
- <sup>23</sup> Ibid at 82-83.
- <sup>24</sup> Verts, B. J. and Leslie N. Carraway. 1998. LAND MAMMALS OF OREGON. University of California Press. Berkeley, CA: 411.
- <sup>25</sup> Verts, B. J. and Leslie N. Carraway. 1998. LAND MAMMALS OF OREGON. University of California Press. Berkeley, CA: 427.
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- <sup>29</sup> Verts, B. J. and Leslie N. Carraway. 1998. LAND MAMMALS OF OREGON. University of California Press. Berkeley, CA: 379.
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- <sup>31</sup> Olsen, Ken. *Unbearable conditions: could grizzlies be fat and happy without salmon runs?* Spokesman-Review (Nov. 29, 1998).
- <sup>32</sup> Ibid.
- <sup>33</sup> The section on Beaver is adapted with permission from Andy Kerr. 2000. OREGON DESERT GUIDE: 70 HIKES. The Mountaineers. Seattle, WA: 56-57.
- <sup>34</sup> Lichatowich, Jim. 1999. SALMON WITHOUT RIVERS: A HISTORY OF THE PACIFIC SALMON CRISIS. Island Press. Washington, DC: 55
- <sup>35</sup> Oregon Biodiversity Project. 1998. OREGON'S LIVING LANDSCAPE: STRATEGIES AND OPPORTUNITIES TO CONSERVE BIODIVERSITY. Defenders of Wildlife. Portland, OR: 157.
- <sup>36</sup> Impastato, David (ed.). 1997. UPHOLDING MYSTERY: AN ANTHOLOGY OF CONTEMPORARY CHRISTIAN POETRY. Oxford University Press. Oxford, England: 135.
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- <sup>42</sup> Ibid at 46.
- <sup>43</sup> This section coauthored with Regna Merritt, Executive Director, Oregon Natural Resources Council, and long-time water quality advocate.
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