APPENDIX A: Oregon ecoregion descriptions

Coast Range Ecoregion

The Coast Range Ecoregion includes the entire Oregon coastline and the northern and central Oregon Coast Range Mountains. It also extends north though the state of Washington to southwestern British Columbia on Vancouver Island, and south into California. Elevations in the Oregon Coast Range Ecoregion range from sea level to 4,000 feet, and the marine climate creates the most moderate and wettest habitats in the state. Average annual precipitation of 60 to 180 inches supports spectacular stands of temperate rainforests. Vegetation is characterized by forests of Sitka spruce, western hemlock, Douglas-fir and red alder.

The Oregon coast has other unique ecological features. Sand deposits from coastal streams and rivers (primarily the Umpqua and Columbia rivers) have created major coastal dune systems, the largest located at the Oregon Dunes National Recreation Area. On the north coast, steep headlands and cliffs are separated by stretches of flat coastal plain and large estuaries. The south coast includes the warmest areas, with rugged headlands and very mild winters, supporting local endemic species such as the coast redwood and Port-Orford-cedar.

Almost 40 percent of the region is in public ownership, primarily in national forest and state forest lands. Population is dispersed in many small towns, most located within a few miles of the ocean. Forest products, tourism and fisheries are the mainstays of the local economy. The Coast Range Ecoregion includes all of Oregon's coastal resources, including all of the intertidal, marine and estuarine cells. These resources are currently not well represented in Oregon's system of protected natural areas. The publication of the Territorial Sea Plan (Oregon Ocean Policy Advisory Council 1994) has created an excellent opportunity to improve protection of Oregon's marine and intertidal resources.

Coast Range forests

Forests are predominant in this ecoregion. Indeed, Coast Range forests are key to Oregon's national identity. Douglas-fir and western hemlock are the most important trees, covering most of the forests in the ecoregion. The coastal fog belt is dominated by Sitka spruce, occupying 10 percent of the region. The rare, southwestern Oregon Port-Orford-cedar forests are found on 1.6 percent of the region.

Over 95 percent of the ecoregion is forested, and over 60 percent of the forests are privately owned. Large timber companies own the majority of Coast Range forests. These forest lands provide a significant amount of Oregon's timber, and in this ecoregion still drive the economy. Because of the high productivity and economic value of the Coast Range forests, threats of forest conversion are generally low. According to Oregon Department of Forestry's analysis of forest conversion from *Forests, Farms and People* (Azuma *et al.* 1999), Coast Range forest conversions are largely restricted to the narrow coastal strip. The population of the Coast Range has remained about the same over the last 10 years. However, the pattern of growth has changed dramatically. Towns in southwestern Oregon such as

Brookings, Coos Bay, and Reedsport, which have relied on timber production from public lands, have either shown little growth or have lost population. Towns along the northern Oregon coast which rely on recreation, such as Seaside, Cannon Beach, Lincoln City and Newport, have grown substantially. In these fast-growing, ocean-side towns, private forests are being converted to residential homes. In these areas, the forests that are being lost are almost entirely dominated by Sitka spruce.

Willamette Valley Ecoregion

The Willamette Valley Ecoregion spans the area between the Coast Range and the western Cascades in northwestern Oregon, and includes Oregon's largest river valley. From Oregon it extends north to include the Vancouver, Washington bottomlands. The valley is characterized by broad, alluvial flats and low basalt hills. Soils include deep alluvial silts from river deposits and dense heavy clays from pluvial deposits in the valley bottom's numerous oxbow lakes and ponds.

The abundant rainfall and fertile soils have made the valley Oregon's most important agricultural region since the first settlers arrived. As a result, the Willamette Valley is Oregon's most altered ecoregion. Originally, the valley was a mosaic of gallery riparian forests and wetlands, open white oak savannas and prairie, with valley margins of oak, ponderosa pine and Douglas-fir woodlands. American Indians maintained the prairies, oak savannas and woodlands by regularly burning most of the valley. With settlement, the prairies have been largely farmed and the open oak savannas and oak-conifer woodlands have been logged or have overgrown into closed-canopy forests.

The Willamette Valley's location on the Pacific Flyway makes it a crucial area for migrating and wintering waterfowl. Geese and shorebirds benefit from flooded agricultural lands, and the Willamette River and its many tributaries support salmon and steelhead runs, mostly of hatchery origin due to the large number of dams in the system. The valley's few remaining fragments of native prairie support many special plant species and endemic invertebrates, while the remaining wetlands provide habitat to the Oregon chub, the western pond turtle and many other sensitive animal species.

The Willamette Valley is home to most Oregonians, with more than 70 percent of the state's population, the majority of its industry, and almost half of its farmland. It is also the fastest growing ecoregion, with the human population expected to double in the next 25 years. As a result of this growth ? and the importance of the region to Oregon's people, wildlife and endangered species ? the Willamette Valley has been the focus of numerous studies. Two recent reports describe some of these investigations into the impacts of changes in the valley on people, the river, wildlife, and habitats. The Willamette Restoration Initiative (2001) published an overview of their strategies and analyses called *Restoring the River of Life* and the Defenders of Wildlife published a report entitled *No Place for Nature: The Limits of Oregon's Land Use Program in Protecting Fish and Wildlife Habitat in the Willamette Valley* (Wiley 2001).

Willamette Valley forests

As with all the other habitats in the Willamette Valley, its forests, woodlands and savannas have been dramatically changed over the last 150 years. In fact, the most significant shifts from forest to developed uses in western Oregon have occurred on private land in or near the Willamette Valley, particularly in areas close to Portland (Azuma *et al.* 1999). In particular, the riparian gallery forests that characterized the Willamette River bottomlands and the huge expanses of Oregon white oak savanna are almost entirely gone. The complex open woodlands in the valley foothills were dominated by white oak with ponderosa pine and Douglas-fir in the north, and by a diverse mix of hardwoods and conifers, including incense cedar, ponderosa pine, Douglas-fir, Oregon white oak, California black oak and madrone.

Klamath Mountains Ecoregion

The Klamath Mountains Ecoregion covers most of southwestern Oregon and northwestern California, and includes the Siskiyou Mountains, California's Marble Mountains and Trinity Alps, and the interior valleys and foothills between these mountain ranges. Elevations range from 100 feet to over 7,500 feet. Valley bottoms in the interior generally range between 450 feet elevation in the north around Roseburg to almost 2,000 feet at Ashland near the California border.

This ecoregion has the oldest landscapes in Oregon and is one of the few areas of the state not largely shaped by volcanism. It is also by far the most geologically diverse, having large areas of metamorphic and sedimentary rocks such as serpentine, limestone and gabbro, as well as granites and basalt. Topography ranges from steep, dissected mountains and canyons to gentle foothills and flat valley bottoms. This ecoregion also has major climatic extremes. Far western portions receive more than 100 inches of rain per year, with relatively mild temperatures year-round. The southern interior valleys are much drier, with locations receiving less than 20 inches of rain per year and summer high temperatures averaging more than 90º F.

The combination of exceptional climatic, geologic, and topographic variation supports the most diverse habitats in Oregon. In addition, the Klamath Mountain Ecoregion is a floristic crossroads, including flora and fauna of the Sierra Nevada Mountains, the Sacramento Valley and Coast Range Mountains of California; the Cascade Mountains of Oregon and Washington; and the Great Basin to the east.

Because of its geologic age, stable climate, and many unusual habitats, the ecoregion is also a major center of species endemism for vascular plants. Of the 4,000 native plant species or subspecies occurring in Oregon, about half are found in this ecoregion, with about a quarter of these known only here. The region is also known for its diversity of conifers, with 30 different species. (In Oregon, the West Cascades Ecoregion has the second largest number of conifer species, with 18 species).

Prior to European settlement, most of the landscape was forested, with Douglas-fir, pine, and oak most prevalent, but with a very diverse array of forest plant communities found in the area. Other significant communities include native grasslands and chaparral which dominated the presettlement valley bottoms, and Port-Orford-cedar forests, which have been devastated by logging and disease. All of the natural habitats have changed since aggressive fire suppression policies became effective in the early 20th century. The region has a high frequency of dry, summer lighting storms, leading to a natural fire frequency of less than 40 years, and closer to 20 years in the valleys and eastern portions of the region. By now, over 50 years of fire suppression have dramatically altered the ecology of the forests, savannas and shrublands in this region. Most significant are the expansion of white fir and other fire sensitive forest species, along with declines in Port Orford cedar, incense cedar, native pines, and other fire dependent conifers. In many areas, forest understories have changed from open, grass and forb dominated to dense, tall shrublands.

The human population of the ecoregion is concentrated in the valleys along the Interstate 5 corridor. Forest products, agriculture and tourism are the foundations of the local economy. The region is currently growing at a rate second only to the Willamette Valley.

Klamath Mountain forests

Most of the Klamath Mountain Ecoregion is forested, dominated by three major vegetation types: Douglas-fir forests, oak woodlands and ponderosa pine woodlands. The diversity of forest habitats in the Klamath Mountains is nationally acclaimed, especially that of the conifer forests. This is the only region in Oregon with endemic tree species: Brewer spruce and Baker cypress are found only in the ecoregion (in Oregon and California). Also common are Port-Orford-cedar, Jeffrey pine, tan oak, grey pine (previously called digger pine), canyon live oak, California black oak, sugar pine, and Shasta red fir. In addition, the region also is the southern limit for many northern species, such as Alaska-cedar, Pacific silver fir and subalpine fir.

Cascades Ecoregion

The West Cascades Ecoregion extends from southern British Columbia south almost to the California border. This mountainous, heavily forested ecoregion is bounded on the west by the farms and woodlands of the Puget Trough and the Willamette Valley, and the drier forests and valleys of the Klamath Mountains. To the east, it spills over the crest of the Cascade Mountains to the drier ponderosa pine forests of the East Cascades Ecoregion.

The crest of the Cascade Range is dominated by a series of volcanic peaks. In Oregon Mount Hood is the highest at 11,245 feet, and a dozen others top 8,000 feet. The western slopes of the range feature long ridges with steep sides and wide, glaciated valleys. Most of the rivers draining the northern two-thirds of the ecoregion flow into the Willamette Valley and then to the Columbia River system; the southern third drains to the Pacific Ocean through the Umpqua and Rogue river systems. The climate varies with elevation and, to a lesser extent, latitude. Higher elevations receive heavy winter snows. The drier southern half has a fire

regime similar to the Klamath Mountains, with frequent lightning-caused fires. In the northern half, the natural fire regime has historically produced less frequent but more severe fires.

This ecoregion is almost entirely forested, and the flora and fauna are similar to that of the Coast Range Ecoregion. Alpine areas feature a variety of habitats ranging from dwarf shrubs, grasses and forbs, to wetlands and barren expanses of rocks and ice.

Forests have long been the foundation of the local economy in the west Cascades, and decades of logging put the region at the center of controversies surrounding the northern spotted owl, logging of old-growth forests, and management of federal lands. Most of the ecoregion's population is found in small towns in the river valleys where increasing recreation use supplements the traditional timber-based economy.

West Cascades forests

Douglas-fir/western hemlock forests prevail over large areas up to elevations of about 3,300 feet. However, most of the previously harvested forests of the lowlands and lower slopes now support mixed conifer-deciduous forests, with young Douglas-fir and western hemlock forests found in a mosaic with hardwood species such as bigleaf maple and red alder. Pacific silver fir-mountain hemlock forests occur at mid-elevations. Pacific silver fir, often referred to as a subalpine species, is common between 2,600 and 4,200 feet. Mountain hemlock is most common between 2,200 and 6,000 feet. In the higher areas, mountain hemlock or occasionally Alaska-cedar, subalpine fir, or whitebark pine woodlands open into alpine parklands with patches of forest interspersed with shrub and meadow communities.

Eastern Cascades Slopes and Foothills Ecoregion

The East Cascades Ecoregion is a transition zone that extends from below the crest of the Cascade Range east to where the ponderosa pine zone meets the sagebrush-juniper steppe. This ecoregion also extends north into Washington and south into California. In Oregon, this ecoregion is variable, including extensive lodgepole forests on deep Mazama ash, montane and foothill ponderosa pine forests, Klamath Basin lakes and wetlands, and many other diverse montane forests.

The eastern slopes of the Cascades are drier than the western slopes, with annual rainfall ranging from 14 to26 inches per year. This ecoregion is less steep and cut by fewer streams than the west side of the mountain range. It is also predominantly covered by conifer forests growing on volcanic soils. The northern two-thirds of the East Cascades is drained by the Deschutes River system, which includes a series of large lakes and reservoirs near its headwaters. The southern third is drained by the Klamath River, which flows south and west into California.

The Klamath Basin, which extends into the Modoc Plateau in California, is a broad, relatively flat mid-elevation valley that historically supported a vast expanse of lakes and marshes. Oregon's largest lake, Upper Klamath Lake, is the biggest remnant of this wetland system. Most of the basin's wetlands have been drained and converted to agriculture.

The mountains on the northern and eastern edges of the Klamath Basin lack a commonly accepted name, but include a series of peaks and ridges extending from Paulina Peak near Bend southward through the headwaters of the Williamson, Sprague and Chewaucan rivers to the Warner Mountains east of Lakeview. These mountains are generally forested, but the valleys and flats between them include large marshes, irrigated meadows and pastures, and arid juniper and sagebrush steppes. These habitats are a critical component of the Pacific Flyway, supporting vast numbers of shorebirds and waterfowl, the densest wintering concentration of bald eagles in the world, and many other wildlife species.

Also of significance is the ecologically diverse corridor within the Columbia River Gorge on the northern end of this region ? the only area in eastern Oregon where the Oregon white oak can be found. This Columbia Gorge transition zone, along with the extensive ponderosa pine forests and woodlands, and the vast wetlands of the Klamath and upper Deschutes Basin are typical of this region.

The ecoregion's human population is concentrated in Hood River, The Dalles, Bend, and Klamath Falls. Forest products, agriculture, recreation and tourism are the biggest contributors to local economies.

East Cascades Slopes and Foothills forests

The East Cascade Slopes and Foothills Ecoregion is characterized by ponderosa pine, and include the largest remaining pine forests in Oregon. This ecoregion also includes a large area in northern Klamath and southern Deschutes counties that have very deep ash deposits, dropped when Mt. Mazama exploded to create Crater Lake. This large area contains Oregon's only climax lodgepole pine forests, providing home to many unique forest communities. This ecoregion also has the northernmost extension of the Warner Mountains, with Oregon's only examples of Washo pine, and some of Oregon's best western white pine forests. Along with the forests in the Blue and Klamath Mountains, changes in the natural fire regime have had significant impacts on the east Cascades. Through Governor Kitzhaber's Eastside Forest Health Task Force, the U.S. Forest Service and the Oregon Department of Forestry are working hard to restore fire to these forest ecosystems.

Blue Mountains Ecoregion

The Blue Mountains Ecoregion occupies nearly all of northeastern Oregon and extends into small portions of southern Washington and western Idaho. It encompasses three major mountain ranges: the Ochoco, Blue and Wallowa mountains. Landscapes include deep, rocky-walled canyons, glacially cut gorges, dissected plateaus, broad alluvial river valleys, and numerous mountain lakes, forests and meadows. Due to sharp differences in elevation, the climate varies over broad temperature and precipitation ranges. Overall, this ecoregion is characterized by short, dry summers and long, cold winters.

The flora is intermediate between the eastern Cascades and the western Rocky Mountains of Idaho and Montana. Species composition changes with altitude. Sagebrush and grassland steppes dominate the entire eastern length of the region along with significant areas in the south. The stands of western juniper on the western and southern reaches represent the

largest and most diverse representation of this species in the world, found in over 30 plant communities. Ponderosa pine woodlands are characteristic at mid-elevations while mixed coniferous forests dominate at higher altitudes. Barely half the ecoregion is forested, and vast sections at all elevations are treeless due to dry conditions and the harsh climate. Extensive grasslands occur in and north of the Wallowa Mountains.

Most of the region is thinly populated, with small towns in the major valleys, and rural residents scattered throughout the smaller valleys among the mountains. Rapid population growth and increasing recreational uses east of Bend and around Prineville and Redmond have increased development pressures dramatically in the juniper woodlands and sagebrush steppes of this area. Timber, ranching, agriculture and tourism provide the foundations for the local economy in most areas.

The diversity in elevation, soils and climate yields diverse habitats and many endemic plant species. The Wallowa Mountains alone have more than 10 plants species found nowhere else. Bighorn sheep, elk and large mammal populations here are among the largest in the state. The variety of habitats ? including low-, mid- and high-elevation grasslands, shrublands, and forests ? results in this ecoregion having more habitat diversity than all but the Klamath Mountains Ecoregion.

Blue Mountains forests

Although they do not contain quite the amazing forest diversity of the Klamath Mountains, Blue Mountain forests are the second most diverse in the state. The Wallowa, Elkhorn and Strawberry mountains have forests typical of the Rocky Mountains: stands of limber pine, Engelmann spruce, whitebark pine, lodgepole pine, and subalpine fir are common, along with the ubiquitous Douglas-fir, ponderosa pine and grand fir forests. These mountains have Oregon's only large western larch forests, and the Blue Mountains also contain some of the largest and best quality cottonwood riparian forests remaining in Oregon (e.g. in the Wallowa Valley and throughout Hells Canyon).

Forests in the Blue Mountains face considerable threats. An introduced pathogen, the white pine blister rust, is destroying whitebark pine forests and woodlands throughout the west, and is just beginning to impact this part of Oregon. Years of fire suppression have also made the extensive ponderosa pine forests vulnerable to insect outbreaks and destruction by overly intense wildfires that come with excess fuel build-up. This forest health issue was the focus of the recent U.S. government assessment of all the lands in the interior Columbia River Basin (Citation).

Columbia Plateau Ecoregion

The Oregon portion of the Columbia Plateau Ecoregion (sometimes referred to as the Umatilla Plateau) extends from the eastern slopes of the Cascades Mountains south and east along the Columbia River to the Blue Mountains. This ecoregion also extends northward throughout most of eastern Washington, and includes a small portion of west central Idaho. The region includes the Columbia Basin proper, and the Palouse.

The Columbia River, with its historic floods and large deposits of loess (wind-borne silt and sand) from the end of the last ice age, has greatly influenced the region. Most of the Oregon portion of the ecoregion is a lava plateau broken by basalt canyons carved out by the Deschutes, John Day, and Umatilla rivers and other streams that flow into the Columbia River. The climate is arid, with cold winters and hot summers. Most of the ecoregion receives less than 15 inches of precipitation per year (some areas as little as eight inches), much of that in the form of snow.

The majority of the ecoregion's natural vegetation is native bunchgrass prairie, often called palouse prairie because of the deep, loess soils and plentiful bunchgrass. The majority of the ecoregion in Washington was originally sagebrush steppe. Sandy deposits along the Columbia River support open dunes, bitterbrush steppe and western juniper. A few species of ground squirrels and plants (milkvetches among others) adapted to these habitats. The rivers are generally characterized by intermountain riparian vegetation, with black cottonwood, willows, chokecherry and aspen covering the riverbanks. Less common are riparian habitats dominated by black hawthorn and white alder.

Early travelers along the Oregon Trail found vast natural grasslands broken by brushy draws and tree- and rimrock-bordered streams with numerous springs. Because of the deep loess soils, mild climate (due to low elevations), and the presence of adequate water (either from wells or from the Columbia, Snake and Umatilla rivers), much of this region provided model farmland. The human population is concentrated in the northeastern portion of the ecoregion, where Pendleton, Hermiston and other smaller communities serve as commercial centers for the agricultural economy.

The Columbia Plateau Ecoregion is second only to the Willamette Valley in the percentage of landscape converted to non-native habitats and human uses. Protected areas and public lands are very limited in this region ? the only vegetation types that have not declined dramatically are found on lands that cannot be farmed: the steep canyon grasslands and scablands.

Northern Basin and Range Ecoregion

The Northern Basin and Range Ecoregion is the large sagebrush zone of southeastern Oregon and northern Nevada. In this AON, it also includes Oregon's portions of the Snake River Plain Ecoregion and the Central Basin and Range Ecoregion. It includes southeastern Oregon's high desert and extends south into Nevada to Reno, and to extreme northeastern California. This ecoregion's name reflects its topography and geology, with numerous flat basins separated by isolated, generally north-south mountain ranges. Many of the mountains are fault blocks, with gradual slopes on one side and precipitous basalt rims on the other. In Oregon, elevations range from 4,100 feet in the lowest basin to more than 9,700 feet on Steens Mountain. Soils are generally rocky and thin, low in organic matter and high in minerals.

An important influence in the ecoregion is the geology, which is mostly of volcanic origin. Over large portions of the landscape, soils have been derived from underlying layers of basalt and rhyolite, or occasionally from sedimentary layers that have been exposed by erosion. Of more interest than these are soils derived from volcanic ash and welded tuffs, which are found in distinct sites such as Leslie Gulch and Succor Creek near the Idaho border, or the

extensive recent lava flows such as Jordan Craters, Saddle Butte, Diamond Craters, or Christmas Valley Lava Fields. The weathering of the exposed volcanic ash has resulted in unique soils with a high clay content and an unusual chemical composition. The adaptational challenge these peculiar soils present for plants has given rise to a relatively rich flora of endemic species. The welded tuffs in these areas have also produced remarkable rock formations that rival more well-known erosion-based formations in the national parks of Utah's Colorado Plateau country.

The climate is arid, with extreme ranges of daily and seasonal temperatures: the Alvord Desert (Oregon's driest location) receives less than seven inches of rain annually. Runoff from precipitation and mountain snowpacks often flows into flat, alkaline playas, where it forms seasonal shallow lakes and marshes.

Also known as the sagebrush desert or high desert, the Northern Basin and Range Ecoregion contains many diverse habitats. The most significant of these are the sagebrush steppe types, salt desert scrub, riparian and wetland types, and mountain-mahogany and aspen woodlands. The large wildlife refuges here support substantial populations of pronghorn antelope, white pelicans, sandhill cranes, and waterfowl, and are well known for their wildlife diversity.

Most of the ecoregion is uninhabited. The only towns with more than a few hundred residents are Ontario, with a population of about 9,400, and Burns and Lakeview, with populations of about 3,000 each. Livestock, agriculture and tourism are the foundations of the regional economy. Lumber production, formerly a major source of employment in the Burns and Lakeview areas, has declined with lower harvests on nearby national forests.

Diverse sagebrush steppe communities dominate most of the ecoregion, including Wyoming big sagebrush, basin big sagebrush, mountain big sagebrush, silver sagebrush, black sagebrush, low sagebrush and rigid sagebrush communities. Mountain-mahogany woodlands are very well developed, and the riparian habitats are very important to fish and wildlife, as they are in most arid regions of the West.