

# Manual and Land Cover Type Descriptions Oregon Gap Analysis 1998 Land Cover for Oregon

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# INTRODUCTION

Generally, the mapping of land cover is done by adopting or developing a land cover classification system, delineating areas of relative homogeneity (basic cartographic objects), then labeling these areas using categories defined by the classification system. More detailed attributes of the individual areas are added as more information becomes available, and a process of validating both polygon pattern and labels is applied for editing and revising the map. This is done in an iterative fashion, with the results from one step causing re-evaluation of results from another step.

In its coarse filter approach to conservation biology (e.g., Jenkins 1985, Noss 1987), gap analysis relies on maps of dominant natural land cover types as the most fundamental spatial component of the analysis (Scott *et al.* 1993) for terrestrial environments. For the purposes of GAP, most of the land surface of interest (natural) can be characterized by its dominant vegetation.

Vegetation patterns are an integrated reflection of the physical and chemical factors that shape the environment of a given land area (Whittaker 1965). They also are determinants for overall biological diversity patterns (Franklin 1993, Levin 1981, Noss 1990), and they can be used as a currency for habitat types in conservation evaluations (Specht 1975, Austin 1991). As such, dominant vegetation types need to be recognized over their entire ranges of distribution (Bourgeron *et al.* 1994) for beta-scale analysis (*sensu* Whittaker 1960, 1977). The central concept is that the physiognomic and floristic characteristics of vegetation (and, in the absence of vegetation, other physical structures) across the land surface can be used to define biologically meaningful biogeographic patterns. There may be considerable variation in the floristics of subcanopy vegetation layers (community association) that are not resolved when mapping at the level of dominant canopy vegetation types (alliance), and there is a need to address this part of the diversity of nature. As information accumulates from field studies on patterns of variation in under story layers, it can be attributed to the mapped units of alliances.

Land cover classifications must rely on specified attributes, such as the structural features of plants, their floristic composition, or environmental conditions, to consistently differentiate categories (Küchler and Zonneveld 1988). The criteria for a land cover classification system for GAP are: (a) an ability to distinguish areas of different actual dominant vegetation; (b) a utility for modeling vertebrate species habitats; (c) a suitability for use within and among biogeographic regions; (d) an applicability to Landsat Thematic Mapper (TM) imagery for both rendering a base map and from which to extract basic patterns (GAP relies on a wide array of information sources, TM offers a convenient meso-scale base map in addition to being one source of actual land cover information); (e) a framework that can interface with classification systems used by other organizations and nations to the greatest extent possible; and (f) a capability to fit, both categorically and spatially, with classifications of other themes such as agricultural and built environments.

For the National GAP Program, the system that fits best is referred to as the National Vegetation Classification System (NVCS) (Grossman *et al.* 1998). The origin of this system was referred to as the UNESCO/TNC system because it is based on the structural characteristics of vegetation derived by Mueller-Dombois and Ellenberg (1974), adopted by the United Nations Educational, Scientific,

and Cultural Organization (UNESCO 1973) and later modified for application to the United States by Driscoll *et al.* (1983, 1984). The Nature Conservancy (TNC) and the Natural Heritage Network (Grossman *et al.* 1998) have been improving upon this system in recent years with partial funding supplied by GAP. The basic assumptions and definitions for this system have been described by Jennings (1993).

The development of the 1998 OR-GAP vegetation coverage was done as an update to the pilot GAP analysis project and first generation land cover map in 1992. That map, *Oregon Current Vegetation*, Kagan and Caicco (1992) utilized a process of manual interpretation of hardcopy color composites of the 23 Landsat scenes that wholly or partly encompass the state. Vegetation polygons were drawn on mylar acetate overlays and later digitized. The digital layer was created using Arc/Info GIS software. In 1994, the Ecological Analysis Center of the Oregon Dept. of Fish and Wildlife began the development of this 1998 update, using Landsat TM digital data and conventional remote sensing analysis and classification techniques. By 1999, most of the staff of ODFW's Ecological Analysis Center had moved to a new start-up non-profit called the Northwest Habitat Institute (NWHI). Staff of NWHI developed most of this manual and the metadata for the 1998 OR-GAP vegetation cover.

ODFW chose not to use the NVCS system to revising its classification scheme and mapping protocol from the Kagan and Caicco (1992) initial mapping effort. Since the major purpose of our classification was to map vegetation at a regional scale using remotely sensed data for the classification, vegetation physiognomy was selected as the primary criteria. A second purpose for the classification was to establish relationships between major environmental controls and the identified vegetation units. For this reason, floristic composition was chosen as a second criteria in combination with physiognomy. While we were creating the classification, a panel of Pacific Northwest resource agencies came up with a proposed vegetation classification scheme (IREC 1994). Their scheme was similar to the NVCS and our approach in that it utilized both floristic composition and physiognomy as key classification criteria. The appeal of the IREC approach was that various mapping efforts would become generic in their utility by the basis of the common classification units. A second appeal to the IREC system is that label criteria is not restricted to species dominance and allows for more descriptive class types such as the Northeastern Oregon Mixed Conifer Forest.

To classify barren or non-vegetated lands we followed the classification approach described by the U.S. Geological Survey (Anderson *et al.* 1976). The Anderson classification system is commonly used in remote sensing applications and uses a hierarchy that partitions regional landscapes into broad major land use/land cover categories such as agriculture, urban, forest, etc. Second level distinction separates the broad level I class into specific categories. For example, the Anderson level I class Barren Land is classified into dunes, exposed rock, salt flats in level II. We classified barren, or non-vegetated lands to Anderson level II in this mapping project. Agricultural lands were kept at Anderson level I in the interest of time, project finances and the general focus of GAP, which is to inventory natural ecosystems.

## THE LAND COVER CLASSIFICATION SCHEME

Table 1. Landscape-level vegetation types and proportional area of land cover for Oregon.

<i>Map Code #</i>	<i>CLASS NAME</i>	<i>Proportional Area of Land Cover</i>
<b><u>FOREST AND WOODLAND COVER TYPES</u></b>		
32	<i>Sitka Spruce-W. Hemlock Maritime Forest</i>	397521
33	<i>Mountain Hemlock Montane Forest</i>	331700
34	<i>True Fir-Hemlock Montane Forest</i>	1510010
35	<i>Montane Mixed Conifer Forest</i>	83834
37	<i>Shasta Red Fir-Mountain Hemlock Forest</i>	54086
39	<i>Whitebark-Lodgepole Pine Montane Forest</i>	1323
40	<i>Ponderosa Pine Dominant Mixed Conifer Forest</i>	427295
41	<i>Northeast Ore. Mixed Conifer Forest</i>	3144370
42	<i>Jeffery Pine Forest and Woodland</i>	53781
43	<i>Serpentine Conifer Woodland</i>	51874
44	<i>Lodgepole Pine Forest and Woodland</i>	256444
45	<i>Subalpine Fir-Lodgepole Pine Montane Conifer</i>	714286
46	<i>Coastal Lodgepole Forest</i>	41869
49	<i>Douglas Fir-W. Hemlock-W. Red Cedar Forest</i>	6618660
50	<i>Douglas Fir-Port Orford Cedar Forest</i>	166450
51	<i>Douglas Fir-Mixed Deciduous Forest</i>	10894
52	<i>Douglas Fir-White Fir/Tanoak-Madrone Mixed Forest</i>	1126290
53	<i>Douglas Fir/White Oak Forest</i>	196692
54	<i>Ponderosa Pine Forest and Woodland</i>	4680430
56	<i>Douglas Fir Dominant-Mixed Conifer Forest</i>	2553290
57	<i>Ponderosa Pine/White Oak Forest and Woodland</i>	163112
58	<i>Ponderosa Pine-W. Juniper Woodland</i>	201553
59	<i>Ponderosa-Lodgepole Pine on Pumice</i>	1502790
61	<i>Western Juniper Woodland</i>	3784130
63	<i>Red Alder Forest</i>	124929
64	<i>Red Alder-Big Leaf Maple Forest</i>	4268
66	<i>Aspen Groves</i>	22287
67	<i>Mixed Conifer/Mixed Deciduous Forest</i>	1412120
68	<i>Cottonwood Riparian Gallery</i>	2574
72	<i>Siskiyou Mtns. Mixed Deciduous Forest</i>	200396
75	<i>Oregon White Oak Forest</i>	115579
77	<i>South Coast Mixed Deciduous Forest</i>	2894
110	<i>Subalpine Parkland</i>	76262

**SHRUBLAND AND GRASSLAND TYPES**

85	<i>Siskiyou Mtns Serpentine Shrubland</i>	32404
87	<i>Hawthorn-Willow Shrubland</i>	8132
89	<i>Manzanita Dominant Shrubland</i>	15440
90	<i>Mountain Mahogany Shrubland</i>	1378
91	<i>Sagebrush Steppe</i>	5244610
93	<i>Low-Dwarf Sagebrush</i>	435480
95	<i>Salt Desert Scrub Shrubland</i>	571920
96	<i>Big Sagebrush Shrubland</i>	12325200
97	<i>Bitterbrush-Big Sagebrush Shrubland</i>	152276
103	<i>Northeast Ore. Canyon Grassland</i>	404702
105	<i>Subalpine Grassland</i>	107232
106	<i>Forest-Grassland Mosaic</i>	382767
112	<i>Modified Grassland</i>	963640
113	<i>Coastal Strand</i>	1941
121	<i>Grass-shrub-sapling or Regenerating young forest</i>	1846210

**NON-NATIVE OR MINIMAL VEGETATIVE COVER**

122	<i>Alkali Playa</i>	128075
124	<i>Urban</i>	601668
125	<i>Agriculture</i>	6455430
126	<i>Exposed Tidal Flat</i>	23039
127	<i>Lava Flow</i>	157010
128	<i>Coastal Dunes</i>	48728
129	<i>Alpine Fell-Snowfields</i>	154748
130	<i>Open Water</i>	1709630

**RIPARIAN AND HERBACEOUS WETLAND TYPES**

114	<i>Wet Meadow</i>	2911
135	<i>Palustrine Forest</i>	26901
136	<i>Palustrine Shrubland</i>	7640
137	<i>Estuarine Emergent</i>	965
138	<i>Palustrine Emergent</i>	19950
200	<i>NWI Palustrine Forest</i>	921
201	<i>NWI Palustrine Shrubland</i>	1005180
202	<i>NWI Estuarine Emergent</i>	40822
203	<i>NWI Palustrine Emergent</i>	50431

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# METHODS

## Map Development

Each of the 23 Landsat TM scenes that were used in the classification of Oregon's vegetation underwent a two phase, multi-step process. The major steps involved with the two phases are briefly described below.

### Phase I: Image preparation, Radiometric Preview, and Image Analysis

- 1) Partitioning imagery into ecoregional similarity. Previous mapping efforts by the NWHI staff have demonstrated that whenever classification takes place over a large land area, (such as a TM scene), the problem of signature extension severely compromises classification effort. Ecoregional partitioning reduces spectral complexity displayed in a full TM scene and groups vegetation types into more probable associations.
- 2) Construct derivative bands. A normalized difference vegetation index (NDVI) and the first three principal component bands of a Tasseled Cap Transformation algorithm was incorporated with TM bands 1-5 and 7 to form a 10 band image. This image was the basis of all subsequent spectral analyses.
- 3) Conversion of TM imagery to TIFF format files. A three-band (bands 3, 4 and 5) image was subset from the 10-band image and converted to a TIFF, which was downloaded to a laptop computer for field reconnaissance purposes.
- 4) Conversion of vector format ancillary data. Coverages which assist the analyst during field verification, especially the road and stream networks were converted to a DXF format and brought into the laptop computer to display over the TIFF images.

### Phase II: Image Classification, Field Verification, and Accuracy Assessment

- 1) Unsupervised classification of the scene ecoregion. Initial classification procedure starts with a sufficiently large number of spectral clusters (generally between 100-150), to form mutually exclusive spectral signatures. These signatures are then run through a maximum likelihood classifier to produce the initial spectral cluster map.
- 2) Preliminary assignment of spectral class to vegetation class. Linking spectral clusters to vegetation information classes is first done through an on-screen examination of the clusters overlaid on the image. In many cases the information class is spectrally distinct enough that cluster labeling is very straightforward. However, there will always be a number of spectral clusters that are indeterminable at this stage, as well as, information classes that do not readily lend themselves to an identification (like palustrine forest). Which is the reason for the iterative process to determine spectral/information class relationships.
- 3) Field verification of spectral-vegetative condition. This process involves recording vegetation identity at known points within the image. This entailed linking our GPS unit to the TIFF version of the TM scene through Field Notes software and recording field training sites. A database was developed for each ecoregion using the Field Notes software that includes XY coordinates, the vegetation/land cover class, and environmental variables that may be useful to the analyst in future processing iterations. The database was brought into ARC/INFO as a point location file and displayed over the various thematic classifications. Other ancillary data, (the NWI (National Wetlands Inventory) and stream and road network data) were utilized extensively with the TIFF data to assist in cover type identification.
- 4) Refinement-reclassification of spectral class to vegetative condition. This step begins the process of winnowing the scene into identifiable and unidentifiable, or problem spectral classes. Once the analyst was confident of the relationship between spectral cluster and land cover class that class is masked out of succeeding classification iterations. Once the problem spectral classes were identified,

separate classifications were performed where each class partitioned into many spectral classes and, if possible, those classes are related to probable land cover types and masked out. Further refinement of spectral cluster/land cover type was accomplished through the use of ancillary data as Alogical operators@. For example, deep shadows in mountainous terrain typically are confused with water signatures, by using a digital elevation model the analyst can overlay that spectral class on all slopes less than 1% and quickly ascertain those areas which are to steep to pond water.

- 5) Field verification of Aproblem@ spectral-vegetation classes. If the analyst cannot confidently relate spectral cluster to land cover class, another field visit was often necessary to uncover the spectral cluster identity.
- 6) Editing the refined coverage. As a last step in the classification phase the analyst used on screen editing of those areas, which are too obscure to classify by conventional image processing techniques. Typically, these were the cloud, cloud shadow, or smoke obscured areas. Aerial photo interpretation of recent aerial photography became the interpretation basis for the classification within these obscured regions.
- 7) Accuracy assessment. Accuracy assessment techniques and procedures are not included as part of this document. Accuracy assessments were done for portions of the state, and a discussion of these are included elsewhere.

## Mapping Standards

### Landsat TM Imagery

Twenty-three Landsat TM scenes formed the basis for interpretation of the Oregon GAP project. All imagery contained less than 10% cloud cover and was acquired from May to October between 1991 and 1993. Cloudy and smoke-obscured regions within the imagery were interpreted using adjacent imagery, where possible, or using aerial photography as the information source. Imagery was registered to the Universal Transverse Mercator (UTM) map coordinate system, zones 10 and 11.

Table 2. Landsat TM Imagery and dates used for mapping project

Path/Row	Month/year	Path/Row	Month/year	Path/Row	Month/year
P42/R28	June / 1991	P44/R28	May / 1993	P46/R28	Aug / 1991
P42/R29	July / 1992	P44/R29	June / 1992	P46/R29	June / 1992
P42/R30	July / 1992	P44/R30	Oct / 1991	P46/R30	July / 1992
P42/R31	June / 1993	P44/R31	June / 1991	P46/R31	July / 1992
P43/R28	Sept / 1993	P45/R28	Oct / 1993	P47/R28	Sept / 1991
P43/R29	July / 1991	P45/R29	June / 1992	P47/R29	July / 1991
P43/R30	Aug / 1993	P45/R30	July / 1992		
P43/R31	Aug / 1991	P45/R31	Aug / 1991		

### Airborne Videography

ODFW had airborne videography recorded between August 25 and September 3, 1993. Approximately 4% of Oregon was sampled by flying north-south transects at approximately 30-km intervals (Figure 3.2.2). In areas of high vegetation diversity and variability, transects were flown at 15 km intervals. The video was acquired from an airplane flying approximately 600 m above the ground with a zoom camera activated every



nine seconds for five seconds. Hence, the video has coverage at two scales: approximately 1:1,800 and 1:150 when displayed on a 25-inch diagonal television.

The video acquisition system integrated a digital color video camera, a laptop computer, a Super VHS (S-VHS) VCR, a Trimble Pathfinder GPS (Global Positioning System), and a Horita time code generator/recorder/encoder to record real-time location data as well as the video imagery. The Horita time code generator/recorder/encoder recorded the GPS time onto the audio track of the videocassette and dubbed the time in a window directly on the imagery as well. Simultaneously, GPS time and the corresponding location were recorded once per second in a digital file on the laptop computer. At the 1:150 scale, there are more than 18,000 reference points that are GPS linked to ground coordinates. These GPS points are not differentially corrected. Therefore, the GPS acquired geodetic measurement could be 0 to 140 meters from the true location of each reference point (Graham 1993).

### **Special Feature Mapping**

Several collateral databases (NWI, riparian vegetation and the Oregon State Service Center urban growth boundary) were incorporated into the vegetation database to assist with distributional mapping of riparian wetland and urban cover types.

### **Wildlife Habitat Mapping**

Given that wildlife-habitat relationships are generally not available at the plant association or alliance levels, an additional lumping of alliances for the 286 NVCS alliances listed for Oregon and Washington was necessary. Species-habitat vegetation types were primarily identified based on vegetative characteristics. Criteria for the aggregation of alliances (Johnson and O=Neil 1997) were based on:

- Floristic similarity of the vegetation between types.
- Physiognomic and environmental similarity of alliances
- Mosaic-like alliances in a similar environment were lumped together if they were not regional in extent and occurred in close proximity to each other.
- Alliances that were largely the result of human modification were lumped based on physiognomy, and to a lesser degree, major environmental zones.

Using the aggregation criteria the 286 NVCS alliances were aggregated to 87 landscape level alliances. These 87 types were condensed into 27 upland terrestrial wildlife habitat types following the cluster analysis procedure (O=Neil *et al.* 1995) first produced for Oregon wildlife habitat types. OR-GAP modified these into 33 types, which were the basis for the Gap Analysis.

# RESULTS

## Landsat TM Imagery Mapping

The statewide vegetation map (Figure 4.1.1) displays distributional information on the 66 landscape level vegetation types. Despite the large number of landscape level vegetation types the 10 most commonly occurring types constitute 76.7 per cent of the total vegetation, (Table 3). Big sagebrush and its variant sagebrush steppe account for nearly a third of the total vegetation coverage, and this figure is probably conservative since a fair amount of the western juniper, and the northeastern Oregon canyon grassland and shrubland types could have been put into big sage or sagebrush steppe. On the other hand, a number of the types have less than one per cent of the proportional land area. Some of these types are rare by virtue of their unique relationship to localized environments (e.g. Siskiyou Mountains Serpentine shrublands). Other types particularly the riparian gallery forests and riparian types are more widespread than indicated in Table 2.2.1, but generally are smaller than map resolution.

Table 3. The 10 most commonly occurring landscape-level vegetation type occurring in Oregon and their percentage of total acreage.

Landscape-Level Type	Percentage of Total Acreage
Big Sagebrush Shrubland	19.6
Douglas Fir/Western Hemlock/W. Red Cedar Forest	10.4
Agriculture	10.1
Sagebrush Steppe Shrubland	8.3
Ponderosa Pine Forest and Woodland	7.3
Western Juniper Woodland	6.0
Northeastern Oregon Mixed Conifer Forest	5.1
Douglas Fir Dominant/Mixed Conifer Forest	4.0
Grass/Shrub/Sapling-Regenerating Forest	3.2
Open Water	2.7
Total	76.7

When you aggregate the cover types by vegetative form (i.e. forest, shrub, etc.), forest and woodland occupy 48% of total land area (Figure 4.1.2). Of the entire state 85.4% is classified as having predominantly natural vegetation. Agriculture, non-vegetated, water, and urban comprise the remainder. The proportion of vegetated to non-vegetated surface (85.4%?) is very similar to California's (79.8%), (Stoms *et al.* 1998).

# LAND COVER TYPE DESCRIPTIONS

## FOREST AND WOODLAND COVER TYPES

### *SITKA SPRUCE-WESTERN HEMLOCK MARITIME FOREST (32)*

**Geographic Distribution.** This conifer dominant forest extends the length of the Oregon coast but is narrowly restricted in its distribution. Frequently this cover type will be no more than a 2 mile wide from the coastal margin to its bordering cover type. This maritime forest is most widely distributed in the rolling hills and coastal plain of the northwest coast. Along the south coast this cover type is restricted to the windward sides of hills on the narrow coastal plain. Sitka spruce (*Picea sitchensis*) and to a lesser extent western hemlock (*Tsuga heterophylla*), along with various willows (*Salix* spp.) also form palustrine forests in the tidewater reaches of the northwest coast and in the islands of the Columbia River east of Astoria.

**Structure and Appearance.** Closed canopy, multi-story conifer forest typically with a dense understory of shrubs, forbs and ferns.

**Composition.** Sitka spruce and western hemlock dominate the overstory with Douglas fir (*Pseudotsuga menziesii*), and western red cedar (*Thuja plicata*), becoming more frequent as the type grades into inland forest covers.

Shrub cover is diverse and often dominates the understory. Evergreen huckleberry (*Vaccinium ovatum*), salal (*Gaultheria shallon*), vine maple (*Acer circinatum*), pacific rhododendron (*Rhododendron macrophyllum*), salmonberry (*Rubus spectabilis*), and elderberry (*Sambucus racemosa*) are common associates.

Herbaceous cover is diverse and typically contains several fern species. Swordfern (*Polystichum munitum*) is the most common fern with deerfern (*Blechnum spicant*), bracken (*Pteridium aquilinum*), and chainfern (*Woodwardia fimbriata*). Other common forbs are devils club (*Oplopanax horridum*), false lily-of-the-valley (*Maianthemum dilatatum*), inside-out-flower (*Vancouveria hexandra*), and Oregon oxalis (*Oxalis oregana*).

**Landscape Setting.** The Sitka spruce-western hemlock forest is bordered inland by the Douglas fir/western hemlock/western red cedar forests. This forest type is frequently battered by high winds from Pacific Ocean storms with overstory trees showing evidence of wind shear and the effects of salt spray along the coastal margin. This type will also extend inland for several miles on river floodplains.

**References.** Hemstrom and Logan 1986, Wiedemann *et al.* 1974, Ripley 1983.

## MOUNTAIN HEMLOCK SUBALPINE FOREST (33)

**Geographic Distribution.** Mountain hemlock (*Tsuga mertensiana*) ranges throughout the Cascades at higher elevations (generally above 4500 ft). In the southern Cascades and Siskiyou Mountain ranges the mountain hemlock cover type grades into the Shasta red fir (*Abies magnifica* var. *shastensis*)/mountain hemlock forest cover type. Mountain hemlock is also found in the Wallowa Mountains of northeastern Oregon. In both the Siskiyou and Wallowas, mountain hemlock is not as common, nor as extensive, as in the Cascades.

**Structure and Appearance.** At the lower elevation range of mountain hemlock this cover type is a forest that can have a multi-storied canopy, although it typically tends to single story. In these conifer dominant forests tree size is considerably smaller and regeneration difficult than lower elevation conifer cover types due to persistent snowpack and short growing season. Mountain hemlock, at its upper elevation range, grades into alpine parkland. Parkland settings are considered as a mosaic of treeless openings with clumps of closed canopy trees.

**Composition.** Mountain hemlock typically dominates the overstory in this upper elevation conifer forest. Pacific silver fir (*Abies amabilis*), lodgepole pine (*Pinus contorta*), western white pine (*Pinus monticola*), western hemlock (*Tsuga heterophylla*), and Douglas fir (*Pseudotsuga menziesii*) may be present in the overstory. In parkland mosaics mountain hemlock may appear in pure clumps, or mixed with subalpine fir (*Abies lasiocarpa*) or whitebark pine (*Pinus albicaulis*).

Shrubs and forb layer are typically sparse and species poor. Several of the *Vaccinium* genus are the most commonly found shrubs, big huckleberry, (*V. membranaceum*), grouse whortleberry (*V. scoparium*), and Alaska huckleberry (*V. alaskaense*). Dwarf bramble (*Rubus lasiococcus*), and prince=s pine (*Chimaphila umbellata*) also occurs commonly in this type.

Beargrass (*Xerophyllum tenax*) is the dominant herb in most places. Other associated herbs are: sidebells pyrola (*Pyrola picta*), beadlily (*Clintonia uniflora*), and sickletop pedicularis (*Pedicularis racemosa*).

**Landscape Setting.** In the Cascade Range mountain hemlock occupies the elevation zone between the true fir dominant montane forests, and the alpine parkland forest types. Mountain hemlock also occurs as high elevation savanna in pure clumps or mixed with whitebark pine in the volcanic soils of the southern Cascades.

**References.** Atzet *et al.* 1996, Hemstrom *et al.* 1987, Volland 1985, Crawford *et al.* 1999, Johnson and Simon 1987

## TRUE FIR/HEMLOCK MONTANE FOREST (34)

**Geographic Distribution.** Found throughout the northern and central Cascade Range at middle to higher elevations, especially west of the Cascade crest. The true fir/hemlock type reaches its southern limit in the upper Rogue River drainage, east of Prospect. This type is also found in disjunct populations in the Coast Range.

**Structure and Appearance.** Multi-story closed canopy forests. Trees can grow to large stature barring disturbance in these fertile, mid-elevation forests. Snags and large woody debris are commonly found. Understory vegetation is rich in species with a diversity of forms.

**Composition.** Canopy co-dominance of pacific silver fir (*Abies amabilis*), and/or noble fir (*A. procera*) along with both western and mountain hemlock characterize this conifer forest type. Other canopy trees found in this type include: Douglas fir (*Pseudotsuga menziesii*), western white pine (*Pinus monticola*), subalpine fir (*Abies lasiocarpa*), Alaska yellow cedar (*Chamaecyparis nootkatensis*) and grand fir (*Abies grandis*).

The shrub layer in this cover type is dense and diverse with a number of deciduous and evergreen shrubs commonly found. Shrubs associated with this cover type are: pacific rhododendron (*Rhododendron macrophyllum*), Cascade azalea (*R. albiflorum*), salal (*Gaultheria shallon*), fools huckleberry (*Menziesia ferruginea*), big huckleberry (*Vaccinium membranaceum*), Alaska huckleberry (*V. alaskaense*), dwarf Oregon grape (*Mahonia nervosa*), and vine maple (*Acer circinatum*).

The forb layer in these forests is also rich in species and abundance. Indicator species of wet and mesic sites include: skunk cabbage (*Lysichitum americanum*), devils club (*Oplopanax horridum*), beadle lily (*Clintonia uniflora*), foamflower (*Tiarella unifoliata*), wild ginger (*Asarum caudatum*), Oregon oxalis (*Oxalis oregana*), vanillaleaf (*Achlys triphylla*), bunchberry (*Cornus canadensis*) and beargrass (*Xerophyllum tenax*).

**Landscape Setting.** This cover type is adjacent to Douglas fir/western hemlock/western red cedar at its lower elevation range and subalpine forest types at its upper limits. These are cool site, fertile soil forests with winter snowpack and moist soils during the growing season. The long droughty summers of southern Oregon are likely the limiting factor in its southern distribution.

**References.** Hemstrom *et al.* (1982, 1987), Atzet and Wheeler 1984, Atzet *et al.* 1996, Halvorson *et al.* 1986, Crawford *et al.* 1999.

## SHASTA RED FIR-MOUNTAIN HEMLOCK MONTANE FOREST (36)

**Geographic Distribution.** Mid-to-upper elevation conifer forest found in the Siskiyou Mountains and southern Cascades, especially south of Crater Lake.

**Structure and Appearance.** Closed canopy, multi-story conifer forest typically with a dense understory of shrubs, forbs and ferns.

**Composition.** Overstory species include: Shasta red fir (*Abies magnifica* var. *shastensis*), mountain hemlock (*Tsuga mertensiana*), with white fir (*Abies concolor*), lodgepole pine (*Pinus contorta*),

Shrubs associated with this type are: dwarf bramble (*Rubus lasiococcus*), Oregon boxwood (*Pachistima myrsinites*), pinemat manzanita (*Arctostaphylos nevadensis*), saddler oak (*Quercus sadleriana*), and baldhip rose (*Rosa gymnocarpa*).

Herbs associated with this type are: false Solomon=s seal (*Smilacina racemosa*), rattlesnake plantain (*Goodyera oblongiflora*), woods strawberry (*Fragaria vesca*), white flowered hawkweed (*Hieracium albiflorum*).

**Structure and Appearance.** This forest type takes on a variety of forms, ranging from multi-story closed canopy forests to open canopy alpine parkland type forest.

**Landscape Setting.** This montane forest cover type is found at elevations mostly above 4,000 ft. with a tendency towards north aspects, especially when occurring at lower elevations.

**References.** Atzet and Wheeler, 1984, Atzet *et al.* 1996, Jimerson *et al.* 1996, Frenkel and Kiilsgaard 1984.

## WHITEBARK-LODGEPOLE PINE ALPINE FOREST (39)

**Geographic Distribution.** The whitebark-lodgepole pine type has a sporadic distribution in the high elevation zone of the eastern Cascades. The forest cover type is found mainly in the southern reaches of the eastern Cascades, especially around the Gearhart Mt. Wilderness Area.

**Structure and Appearance.** This conifer forest has generally open to moderately closed canopy (less than 60% crown closure). Stands are of moderate stature with sparse shrub and forb layers. Regeneration of conifer trees is minimal.

**Composition.** Whitebark pine (*Pinus albicaulis*) and lodgepole pine (*Pinus contorta*) dominate the overstory. Occasional white fir (*Abies concolor*) and western white pine (*Pinus monticola*) are found in the overstory.

Shrub layer is sparse with little diversity, occasional pinemat manzanita (*Arctostaphylos nevadensis*), and sticky currant (*Ribes viscosissimum*).

Forb layer is predominantly grasses, with Wheeler's bluegrass (*Poa nervosa*), western needlegrass (*Stipa occidentalis*), bottlebrush squirreltail (*Sitanion hystrix*), and long stolon sedge (*Carex pensylvanica*). Forbs are gay penstemon (*Penstemon laetus*), and tailcup lupine (*Lupinus caudatus*).

**Landscape Setting.** This type is not readily mapped because of its non-contiguous cover and its occurrence as a mosaic with alpine grassland and shrubland types.

**References.** Hopkins 1979.

## *PONDEROSA PINE DOMINANT- MIXED CONIFER FOREST (40)*

**Geographic Distribution.** The ponderosa pine dominant-mixed conifer forest is found primarily in the southern half of the eastern Cascades, ranging from the California border to Bend.

**Structure and Appearance.** This type is typically a two story conifer forest with the predominance of the overstory canopy (greater than 60%) being ponderosa pine (*Pinus ponderosa*). White fir (*Abies grandis* and *A. concolor*), is the other common overstory tree with occasional incense cedar (*Calocedrus decurrens*), and sugar pine (*Pinus lambertiana*). Understory regeneration can be dense, or sparse, based on intensity of cattle grazing, fire frequency, and ecological site conditions.

**Composition.** Overstory conifers are ponderosa pine, white fir, with lesser contribution from incense cedar and sugar pine. Understory trees are similar in composition to overstory although generally white fir predominates over ponderosa and lodgepole pine (*Pinus contorta*) is a common understory occupant.

The shrub and herb layers form a diverse and prominent ground cover component in this forest type especially when compared to adjacent cover types. Commonly associated shrubs include snowberry (*Symphoricarpos albus*), creeping snowberry (*S. mollis*), dwarf Oregongrape (*Mahonia nervosa*), wax currant (*Ribes cereum*), and serviceberry (*Amelanchier alnifolia*).

Indicator cover type herbs are: heartleaf arnica (*Arnica cordifolia*), long stolon sedge (*Carex pensylvanica*), squirreltail bottlebrush (*Sitanion hystrix*), starwort (*Stellaria jamesiana*), white hawkweed (*Hieracium albiflorum*), and broadleaf strawberry (*Fragaria virginiana*).

**Landscape Setting.** This mid elevation cover type occupies the zone between the drier low elevation types, primarily ponderosa-western juniper cover type, and higher elevation mixed conifer or sub-alpine types. This type, with its mesic site conditions, is transitional in its ecological setting bridging the gap between drier, low elevation types and the colder, wetter higher elevation types. This type also warrants distinction because of its lack of Douglas fir (*Pseudotsuga menziesii*) in its stands and the consistent presence, but lack of co-dominance by associated conifers.

**References.** Hopkins, 1979, Volland, 1988, Kovalchik, 1987.



## NORTHEASTERN OREGON MIXED CONIFER FOREST (41)

**Geographic Distribution.** Common mid-elevation forest cover type found throughout the various mountain ranges of northeastern Oregon. More common on north and east facing slopes.

**Structure and Appearance.** This cover type can take on a variety of structural and canopy appearances based on site history. In its unaltered form stands are typically two storied with an overstory of ponderosa pine (*Pinus ponderosa*) over smaller ponderosa, or grand fir (*Abies grandis*), western larch (*Larix occidentalis*), lodgepole pine (*P. contorta*), western white pine (*P. monticola*), Douglas fir (*Pseudotsuga menziesii*), or Engelmann spruce (*Picea engelmannii*) depending on local environment. Selective logging, grazing, and fire suppression effects have significantly changed the appearance of this forest type.

**Composition.** Overstory conifers can be ponderosa pine, grand fir, western white pine, lodgepole pine, western larch, Engelmann spruce, and Douglas fir. Forest regeneration after wildfires favors recruitment of western larch and lodgepole pine. Cool, moist sites within this type typically contain Engelmann spruce and grand fir. Understory trees reflect the same species of conifers and occasionally will have western yew (*Taxus brevifolia*).

Shrub layer is prominent and diverse. Common tall shrubs include bigleaf huckleberry (*Vaccinium membranaceum*), rocky mountain maple (*Acer glabrum*), ninebark (*Physocarpus malvaceus*), Scouler=s willow (*Salix scouleriana*) serviceberry (*Amelanchier alnifolia*). Mid and low shrubs include shiny-leaf spirea (*Spiraea betulifolia*), myrtle pachistima (*Pachistima myrsinites*), snowbrush (*Ceanothus velutinus*), grouse whortleberry (*Vaccinium scoparium*), bog blueberry (*V. uliginosum*), dwarf Oregon grape (*Mahonia nervosa*), and the prostrate manzanitas (*Arctostaphylos nevadensis* and *A. uva-ursi*).

Commonly encountered forbs in this cover type include: false Solomon=s seal (*Smilacina racemosa*), heartleaf arnica (*Arnica cordifolia*), rattlesnake plantain (*Goodyera oblongifolia*), white hawkweed (*Hieracium albiflorum*), Wilcox=s penstemon (*Penstemon wilcoxii*), bigleaf sandwort (*Arenaria macrophylla*), woods strawberry (*Fragaria vesca*), meadowrue (*Thalictrum occidentale*), sweet cicely (*Osmorhiza chilensis*), sidebells pyrola (*Pyrola picta*), and trail plant (*Adenocaulon bicolor*).

**Landscape Setting.** This type can extend to grassland or shrubland cover types on its low elevation end but usually it is transitional between ponderosa pine on its lower end and subalpine fir/lodgepole pine at higher elevations.

**References.** Hall 1973, Johnson and Simon 1987, Johnson and Clausnitzer 1989, Kagan and Caicco 1992, Chappell *et al.* 1999.

## JEFFREY PINE WOODLANDS (42)

**Geographic Distribution.** Jeffrey pine (*Pinus jeffreyi*), while common in the mountains of California, is at the northern extension of its range in Oregon and is found only in Josephine, Curry, Jackson Counties and small, scattered patches in the south fork of the Umpqua River drainage in Douglas County. Closely associated with ultramafic rocks this open woodland is a good indicator of parent material and is most readily found west of the Illinois River by Cave Junction. Ultramafic rock, serpentine and peridotite have such high concentrations of nickel, chromium and magnesium that soils derived from this substrate are toxic to most plants. Those plants which are tolerant to the heavy metal concentrations form a unique and diverse flora within southwestern Oregon.

**Structure and Appearance.** Jeffery pine woodlands are open canopy, (less than 30% crown closure in most stands), single story, conifer dominant cover type. Floristic composition is diverse, but sparse in appearance. This type tends to have a lot exposed bedrock and gravel scattered amongst the vegetation.

**Composition.** Jeffrey pine is the dominant overstory tree species in this cover type. Incense cedar (*Calocedrus decurrens*) is commonly found but rarely does it have sufficient cover to be considered co-dominant. In moist areas Port Orford cedar (*Chamaecyparis lawsoniana*) replaces incense cedar. Understory trees are Jeffrey pine, incense cedar, Douglas fir (*Pseudotsuga menziesii*) and California laurel (*Umbellularia californica*).

Shrubs are prominent and diverse in this type. Commonly associated shrubs are coffeeberry (*Rhamnus californica*), hoary manzanita (*Arctostaphylos canescens*), whiteleaf manzanita (*A. viscida*), squaw carpet (*Ceanothus prostratus*), dwarf ceanothus (*C. pumilus*), silk tassel (*Garrya buxifolia*), and the shrub form of tanoak (*Lithocarpus densiflora*).

Grasses and forbs are also prominent. Lemmon=s needlegrass (*Stipa lemmonii*), Idaho fescue (*Festuca idahoensis*), Roemer=s fescue (*F. roemen*) and California fescue (*F. californica*) are common. Commonly associated forbs are: rock fern (*Aspidotis densa*), Tolmie=s mariposa (*Calochortus tolmeii*), death camas (*Zigadenus venenosus*), yarrow (*Achillea millefolium*) and beargrass (*Xerophyllum tenax*).

**Landscape Setting.** Because of the unique relationship this cover type has with parent material its setting is largely a function of local geology. Jeffrey pine woodlands are interspersed with the other two ultramafic rock influenced cover types, serpentine conifer woodland and Siskiyou Mountains serpentine shrubland. Jeffrey pine woodlands often are found in low to mid elevation, southerly exposure settings.

**References.** Plant classification and ecology works that describe this cover type include: Atzet *et al.* 1996, Jimerson *et al.* 1995, Kruckeberg 1984, Frenkel and Kiilsgaard 1984, Atzet and Wheeler 1984, and Zobel and Hawk 1980.

## SERPENTINE CONIFER WOODLAND (43)

**Geographic Distribution.** Similar in distribution pattern and environmental relationship as the Jeffrey pine woodlands. This conifer woodland is most common in California and reaches its northern extent in southwestern Oregon.

**Structure and Appearance.** This cover type, responding to recent fire by serotinous cone regeneration, is relatively short lived and responds well to disturbances, or disturbed soils. Stands are open to dense, even-aged, and low in stature.

**Composition.** Knobcone (*Pinus attenuata*) and lodgepole pine (*P. contorta*) are the most commonly associated conifers in this type. Western white pine (*P. monticola*), sugar pine (*P. lambertiana*), Jeffrey pine (*P. jeffreyi*) incense cedar (*Calocedrus decurrens*), madrone (*Arbutus menziesii*), and occasionally, brewers spruce (*Picea breweriana*) form the regeneration and overstory layers in these short stature (most trees are less than 20 ft tall) stands.

Shrub layers typically have moderate to high cover. Huckleberry oak (*Quercus vaccinifolia*), tanoak (*Lithocarpus densiflora*), chinquapin (*Castanopsis chrysophylla*), creambrush oceanspray (*Holodiscus discolor*), and red huckleberry (*Vaccinium parvifolium*).

Forb layers are diverse and rich in species. Commonly found species being: beargrass (*Xerophyllum tenax*), western starflower (*Trientalis latifolia*), wild ginger (*Asarum hartwegii*), creeping Oregongrape (*Mahonia repens*), spreading dogbane (*Apocynum androsaemifolium*), spotted coralroot (*Corallorhiza maculata*), Tolmies mariposa lily (*Calochortus tolmiei*), fawn lily (*Erythronium grandiflorum*), and woodland tarweed (*Madia madioides*).

**Landscape Setting.** This type is primarily associated with the distribution of serpentine soils within southwestern Oregon. It most commonly occurs on higher elevation benches, slopes and ridges and is a pioneer forest community following fire or mining disturbance.

**References.** Frenkel and Kiilsgaard 1984, Jimerson *et al.* 1995, Atzet *et al.* 1996.

## LOGGEPOLE PINE FOREST AND WOODLAND (44)

**Geographic Distribution.** A common forest cover type found throughout the central and southern Cascades, east of the crest; and in smaller, scattered mosaics throughout the mountains of northeastern Oregon, and along the crest of the Cascades.

This cover type is most extensive in the same geographic area as the ponderosa-lodgepole pine on pumice type; but warrants distinction because it occurs on mid-slopes and ridges and is a forest type responding from wild fires, not soil conditions.

**Structure and Appearance.** Single layer, open to closed canopies, dominated by lodgepole pine (*Pinus contorta*). A typical post-fire successional path for this cover type is to have dense reproduction of short stature lodgepole. As the stand matures lodgepole cover thins to scattered overstory lodgepole with regeneration layers of other conifers. These other conifers, regionally important replacement trees would be: Douglas-fir (*Pseudotsuga menziesii*), grand fir (*Abies grandis*), white fir (*A. concolor*), incense cedar (*Calocedrus decurrens*), and western white pine (*Pinus monticola*) will eventually form the overstory and eliminate lodgepole from the stand entirely.

**Composition.** Lodgepole dominates the overstory in early to mid successional stands. Western larch (*Larix occidentalis*), another post-fire colonizing conifer, can be co-dominant in this cover type, especially in the northeastern Oregon mountains. Regeneration layers are composed of conifers listed in the structure and appearance section.

Shrubs are common and diverse in this cover type: common snowberry (*Symphoricarpos albus*), mountain snowberry (*S. mollis*), serviceberry (*Amelanchier alnifolia*), ninebark (*Physocarpus malvaceus*), shiny-leaf spirea (*Spiraea betulifolia*), bitterbrush, (*Purshia tridentata*), baldhip rose (*Rosa gymnocarpa*), myrtle pachistima (*Pachistima myrsinites*), and several huckleberries (*V. membranaceum*, *V. scoparium*, *V. uliginosum*, and *V. caespitosum*).

Grasses dominate some understories with few shrubs. Pine grass (*Calamagrostis rubescens*), Ross= sedge (*Carex rossii*), elk sedge (*Carex geyeri*), bluebunch wheatgrass (*Agropyron spicatum*), western needlegrass (*Stipa occidentalis*), Idaho fescue (*Festuca idahoensis*), prairie junegrass (*Koeleria macrantha*), and mountain brome (*Bromus carinatus*) are commonly found.

**Landscape Setting.** Since this forest cover type usually is the response following wild fires there is no environmental relationship that controls its distribution. This cover type appears as a mosaic within the larger, regionally important cover types.

**References.** Hopkins 1979, Johnson and Clausnitzer 1986, Johnson and Simon 1987, Crawford *et al.* 1999, Kagan and Caicco 1992.

## *SUBALPINE FIR-LODGEPOLE PINE MONTANE FOREST (45)*

**Geographic Distribution.** A common mid to high elevation conifer forest cover type in the mountains of northeastern Oregon, and along the crest of the Cascades.

**Structure and Appearance.** Short stature single story canopy forests. Crown closure ranges from open to closed. At its lower elevation range, this cover type grades into various montane forest types and maintains a continuous canopy. At its upper elevation range, (which can be the timberline), the type grades into subalpine parkland, or it takes on the clumpy appearance of a parkland cover type.

**Composition.** Subalpine fir (*Abies lasiocarpa*) and lodgepole pine (*Pinus contorta*) dominate the canopy overstory. Engelmann spruce (*Picea engelmannii*) can be a locally important overstory tree, especially in northeastern Oregon. Understory tree composition usually is dominated by subalpine fir.

Shrub cover in this type can be extensive and is typified by big huckleberry (*Vaccinium membranaceum*), and grouse huckleberry (*V. scoparium*). Other commonly associated shrubs include: gooseberry (*Ribes lacustre*), shiny-leaf spirea (*Spiraea betulifolia*), and prince=s pine (*Chimaphila umbellata*).

Forb cover is often low but diverse in species. Common indicator forbs would be strawberries, (*Fragaria vesca* and *F. virginiana*), roundleaf violet (*Viola oreganum*), heartleaf arnica (*Arnica cordifolia*), sidebells pyrola (*Pyrola secunda*), skunkleaf polemonium (*Polemonium pulcherrimum*), sweet cicely (*Osmorhiza chilensis*) and meadowrue (*Thalictrum occidentale*).

**Landscape Setting.** Occupies the upper elevation range of continuous forest cover for much of northeastern Oregon. As discussed in the structure and appearance section, this type grades into, or takes on the appearance of parkland cover types. Lodgepole pine is successional to subalpine fir, but remains a common component on harsher sites and ridgetops. Successional change is slow in this cover type with its short growing season and persistent snow cover.

**References.** Hall 1973, Johnson and Simon 1987, Johnson and Clausnitzer 1989, Kagan and Caicco 1992.

## COASTAL LODGEPOLE FOREST (46)

**Geographic Distribution.** Most commonly found along the south-central coastline near Florence, this type can be found throughout the length of the Oregon coast. It is uncommon to find this type more than a mile or so off the coastline and primarily located in deflation plain settings.

**Structure and Appearance.** Low stature, single story conifer stands, with moderate to closed canopies. Overstory is predominantly lodgepole pine (*Pinus contorta*) on newly colonized dunes and deflation plains. As the habitat matures Sitka spruce (*Picea sitchensis*) increases in abundance, becoming the successional forest. Sitka spruce will also co-dominate with lodgepole on wet places in the deflation plain. South of Coos Bay, Port Orford cedar (*Chamaecyparis lawsoniana*) can be found in this forest type in the wet deflation and dune places.

Understory vegetation is often a dense, impenetrable shrub layer in stable, late successional stands. Early succession stands, and places with active sand movement, have sparse understories.

**Composition.** Conifer overstories of lodgepole pine and locally abundant Sitka spruce. Shrub layer is dominated by salal (*Gaultheria shallon*), pacific rhododendron (*Rhododendron macrophyllum*), and evergreen huckleberry (*Vaccinium ovatum*). Forb layer is sparse to non-existent under the heavy shrub covers

**Landscape Setting.** Lodgepole pine is the early colonizer of dunes and deflation plains. This cover type can exist as a narrow strip bordering on the Sitka spruce-western hemlock type along the northern coast; or it can become fairly extensive on the dune sheets between Florence and Coos Bay.

**References.** Wiedemann *et al.* 1974, Ripley 1983.

## DOUGLAS FIR/WESTERN HEMLOCK/WESTERN RED CEDAR FOREST(49)

**Geographic Distribution.** The most common low to mid elevation forest found in western Oregon. Extends from the foothills of the western Cascades to approx. 4,500 ft and is ubiquitous throughout the Coast Range to the coastal margin forests. Its distribution becomes scattered in southwestern Oregon and the southern Cascades and is replaced by Douglas fir-mixed conifer mixed deciduous types.

**Structure and Appearance.** In its mature form this conifer forest type contains numerous large trees, multi-story tree canopies, numerous snags and downed logs. Sub-canopies are composed of shade tolerant conifer species and deciduous trees where there is discontinuous overstory canopy cover. Early seral and commercial forests have dense accumulations of smaller trees, (typically dominated by Douglas fir, *Pseudotsuga menziesii*) and single story canopies.

Shrub and herbaceous layers are dense and rich in species in mid-to-late successional forest stands

**Composition.** Douglas fir dominates most of the overstory in these stands, with western hemlock (*Tsuga heterophylla*), western red cedar (*Thuja plicata*) and grand fir (*Abies grandis*) present to locally co-dominant. Western hemlock and western red cedar form the bulk of the subordinate tree and regeneration layers. Pacific yew (*Taxus brevifolia*) is another conifer that shows up in the sub-canopy tree layers. Big leaf maple (*Acer macrophyllum*), and to a lesser extent, red alder (*Alnus rubra*) are common in riparian strips and stands that do not have continuous conifer overstories.

Large stature shrubs are common in the Cascades stands. Vine maple (*Acer circinatum*), pacific rhododendron (*Rhododendron macrophyllum*), and fools huckleberry (*Menziesia ferruginea*) and red huckleberry (*Vaccinium parvifolium*) are frequently found. Coast Range shrub layers are dominated by salal (*Gaultheria shallon*), evergreen huckleberry (*V. ovatum*), elderberry (*Sambucus racemosa*), and salmonberry (*Rubus spectabilis*).

Herbaceous layers are rich in species and abundance. Swordfern (*Polystichum munitum*) and other ferns, bracken (*Pteridium aquilinum*), deer fern (*Blechnum spicant*), and lady fern (*Athyrium filix-femina*) are commonly found and can dominate the herb layer. Other forbs associated with this cover type include: inside-out flower (*Vancouveria hexandra*), twinflower (*Linnea borealis*), Siberian springbeauty (*Claytonia sibirica*), vanillaleaf (*Achlys triphylla*), bedstraw (*Galium triflorum*), western iris (*Iris tenax*), and Oregon oxalis (*Oxalis oregana*).

**Landscape Setting.** In the interior valleys of western Oregon at low elevations this forest type grades into agriculture, or Douglas fir/deciduous types. Bordering this cover type at upper elevations are the true fir dominant montane forest types. This type extends west of the Coast Range onto the coastal plains where it borders the coastal margin forests.

**References.** Hemstrom *et al.* 1987, Hemstrom and Logan 1986, Franklin and Dyrness 1974, Atzet *et al.* 1996, Atzet and McCrimmon 1990, Chappell *et al.* 1999, Halverson *et al.* 1986

## DOUGLAS FIR-PORT ORFORD CEDAR FOREST (50)

**Geographic Distribution.** A low to mid elevation forest type found mainly in the Coast Range and Siskiyou Mountains of Curry County of southwestern Oregon. This type does not grow north of Coos Bay on the Oregon coast and Roseburg in the interior valleys. Common west of the Coast Range Crest, but is largely restricted to moist ultramafic soil environments inland. This cover type is mostly confined to moist habitats of moderate elevation and steep riparian situations.

**Structure and Appearance.** This conifer forest type is characterized by, multi-story tree canopies, co-dominated by Port Orford cedar (*Chamaecyparis lawsoniana*), and Douglas fir (*Pseudotsuga menziesii*). Sub-canopies are composed of conifers and evergreen deciduous trees where there is discontinuous overstory canopy cover.

**Composition.** Douglas fir and Port Orford cedar dominate canopy overstory in these stands. Western hemlock (*Tsuga heterophylla*) is common west of the Coast Range, and sugar pine (*Pinus lambertiana*) and grand fir (*Abies grandis*) present in the overstory of interior stands.

Understory conifers are Douglas fir, western hemlock, western yew (*Taxus brevifolia*) and Port Orford cedar. On ultramafic substrates, sugar pine and western white pine (*Pinus monticola*) are frequent associates. Evergreen deciduous trees are California laurel (*Umbellularia californica*), tanoak (*Lithocarpus densiflora*), and chinquapin (*Castanopsis chrysophylla*).

Large stature shrubs are common west of the Coast Range crest, vine maple (*Acer circinatum*), pacific rhododendron (*Rhododendron macrophyllum*), and red huckleberry (*Vaccinium parvifolium*), and evergreen huckleberry (*V. ovatum*). Interior stands shrub layers contain western azalea (*Rhododendron occidentale*), Sadler oak (*Quercus sadleriana*), and dwarf Oregonrape (*Mahonia nervosa*).

Herbaceous layers are rich in species and abundance. Swordfern (*Polystichum munitum*) and other ferns, bracken (*Pteridium aquilinum*), deer fern (*Blechnum spicant*), and lady fern (*Athyrium filix-femina*) are common. Other forbs include: vanillaleaf (*Achlys triphylla*), bedstraw (*Galium triflorum*), western iris (*Iris tenax*), Oregon oxalis (*Oxalis oregana*), redwoods violet (*Viola sempervirens*), western starflower (*Trientalis latifolia*), rattlesnake plantain (*Goodyera oblongifolia*), and white trillium (*Trillium ovatum*).

**Landscape Setting.** This cover type is under-represented in the mapping effort because it often exists as a coniferous riparian type that is not extensive enough to be mapped. It is largely transitional to the other Douglas fir conifer types found in the region.

**References.** Atzet and Wheeler 1983, Jimerson *et al.* 1995, Atzet *et al.* 1996, Frenkel and Kiilsgaard 1984, Hawk 1978, Hawk and Zobel 1980



## DOUGLAS FIR / MIXED DECIDUOUS FOREST (51)

**Geographic Distribution.** Low to mid-elevation conifer and mixed deciduous forest. Found primarily in the southwestern Oregon counties of Douglas, Coos, northern Curry, Josephine, and Jackson. Also extends north into southern Lane County. This type is most common on the eastern side of the Coast Range and in mesic microsites in the Siskiyou Mountains.

**Structure and Appearance.** This conifer/mixed deciduous forest type in its mature form is a large structure multi-canopy forest. Upper tree layer always contains Douglas fir (*Pseudotsuga menziesii*). Sub-canopies are mixes of shade tolerant conifers, with deciduous and evergreen deciduous trees in discontinuous conifer canopies. Shrub and herb layers are prominent and rich in species.

**Composition.** The overstory canopy is largely Douglas fir (*Pseudotsuga menziesii*). Sub-canopy trees include: tanoak (*Lithocarpus densiflora*), madrone (*Arbutus menziesii*), chinquapin (*Castanopsis chrysophylla*), and pacific dogwood (*Cornus nuttallii*) in the Siskiyou Mountains. Deciduous sub-canopies in the Coast Range will also include madrone, some chinquapin, and some Oregon white oak (*Quercus garryana*) but will mostly contain big leaf maple (*Acer macrophyllum*), and red alder (*Alnus rubra*).

Indicative shrubs of this cover type include: dwarf Oregongrape (*Mahonia nervosa*), pacific blackberry (*Rubus ursinus*), oceanspray (*Holodiscus discolor*), California hazelnut (*Corylus cornuta*), baldhip rose (*Rosa gymnocarpa*), pacific rhododendron (*Rhododendron macrophyllum*), salal (*Gaultheria shallon*), red huckleberry (*Vaccinium parvifolium*), creeping snowberry (*Symphoricarpos mollis*), and snow bramble (*Rubus nivalis*).

Commonly associated herbs include: cutleaf goldthread (*Coptis laciniata*), coolwort foamflower (*Tiarella trifoliata*), white trillium (*Trillium ovatum*), western starflower (*Trientalis latifolia*), swordfern (*Polystichum munitum*), trail plant (*Adenocaulon bicolor*), prince=s pine (*Chimaphila umbellata*), Scouler=s harebell (*Campanula scouleri*), vanillaleaf (*Achlys triphylla*), streamside violet (*Viola glabella*), Oregon fairybell (*Disporum hookeri*), and inside-out-flower (*Vancouveria hexandra*).

**Landscape Setting.** This cover type occurs at intermediate elevations with moderate amounts of precipitation. The abundant understory and sub-canopy layer distinguishes this type from other regional conifer/deciduous cover types.

**References.** Atzet *et al.* 1996, White 1996, Frenkel and Kiilsgaard 1984, Smith *et al.* 1987.

## DOUGLAS FIR-WHITE FIR/TANOAK-MADRONE MIXED FOREST (52)

**Geographic Distribution.** Low to mid-elevation mixed conifer and mixed deciduous forest. Found primarily in Jackson, Curry, and Josephine Counties of southwestern Oregon. This type is common in the Siskiyou and Klamath Mountains and to a lesser extent, the southern Cascades.

**Structure and Appearance.** This mixed conifer/mixed deciduous forest type in its mature form is a large structure multi-canopy forest. Upper tree layer always contains Douglas fir (*Pseudotsuga menziesii*), with co-dominant to lesser amounts of fir (*Abies grandis* or *Abies concolor*) and usually some representation of incense cedar (*Calocedrus decurrens*). Sub-canopies are mixes of shade tolerant conifers with evergreen deciduous and deciduous trees. Shrub and herb layers are well represented.

**Composition.** The proportion of overstory composition may vary by microsite and disturbance history, but there will always be some mix of Douglas fir, white fir, and incense cedar in the stand. Sugar pine (*Pinus lambertiana*) and western white pine (*P. monticola*) are infrequent overstory occupants. Sub-canopy trees include: tanoak (*Lithocarpus densiflora*), madrone (*Arbutus menziesii*), chinquapin (*Castanopsis chrysophylla*), and lesser amounts of pacific dogwood (*Cornus nuttallii*) and California laurel (*Umbellularia californica*).

Indicative shrubs of this cover type include: baldhip rose (*Rosa gymnocarpa*), dwarf Oregongrape (*Mahonia nervosa*), pacific blackberry (*Rubus ursinus*), oceanspray (*Holodiscus discolor*), California hazelnut (*Corylus cornuta*), and hairy honeysuckle (*Lonicera hispidula*).

Commonly associated herbs include: western starflower (*Trientalis latifolia*), rattlesnake plantain (*Goodyera oblongifolia*), trail plant (*Adenocaulon bicolor*), prince=s pine (*Chimaphila umbellata*), Scouler=s harebell (*Campanula scouleri*), vanillaleaf (*Achlys triphylla*), whipplevine (*Whipplea modesta*), and Oregon fairybell (*Disporum hookeri*).

**Landscape Setting.** Common California mid-elevation forest type that reaches its northern extent in southwestern Oregon. Logging, fires, and other stand disturbances promote the deciduous tree component. Shasta red fir types typically border the type at its upper elevation. Lower elevation by deciduous dominant cover types.

**References.** Atzet *et al.* 1996; Atzet and McCrimmon 1990; Jimerson *et al.* 1996

## DOUGLAS FIR-OREGON WHITE OAK FOREST (53)

**Geographic Distribution.** Foothills forest type found in the Willamette and western interior valleys of western Oregon. The type is also found in diminishing frequency in the Puget Trough of western Washington. This particular cover type description will pertain to the Willamette Valley communities.

**Structure and Appearance.** Mosaic cover type where patterns of dominance and co-dominance between Douglas fir (*Pseudotsuga menziesii*) and Oregon white oak (*Quercus garryana*) vary based on local environment and stand history. Understory vegetation conditions range widely as well. Ungrazed stands can have prominent shrub and herbaceous layers, while stands that are part of unmanaged pasture mosaics typically have understories where introduced annual grasses dominate.

**Composition.** Douglas fir and Oregon white oak are the dominant overstory trees. Grand fir (*Abies grandis*) and Pacific madrone (*Arbutus menziesii*) may be present, but limited in numbers. Sub-canopy tree layers can be dense in some stands and dominated by California hazelnut (*Corylus cornuta*), the invasive sweet cherry (*Prunus avium*), black hawthorn (*Crataegus douglasii*), and Indian plum (*Oemleria cerasiformis*).

Commonly associated shrubs for this type include poison oak (*Rhus diversiloba*), tall Oregongrape (*Mahonia aquifolium*), snowberry (*Symphoricarpos mollis*), trailing blackberry (*Rubus ursinus*), serviceberry (*Amelanchier alnifolia*), and baldhip rose (*Rosa gymnocarpa*).

The grass and forb layer typically includes cleavers (*Galium aparine*), blue wildrye (*Elymus glaucus*), western iris (*Iris tenax*), bracken (*Pteridium aquilinum*), hairy honeysuckle (*Lonicera hispidula*), and a variety of introduced grasses that seed in from adjacent pasturelands.

**Landscape Setting.** Hot, dry forests on the fringe between coniferous and valley bottom. Moisture is probably the most limiting characteristic. Douglas fir is invading these predominantly white Oak stands so stand composition typically grades from white oak dominance at lower treeline to co-dominance as the type merges with adjacent conifer forests. The hot, dry conditions of this cover type preclude seedling establishment of shade tolerant conifers, i.e. western hemlock (*Tsuga heterophylla*) and western red cedar (*Thuja plicata*). It is the lack of regeneration (and eventual stand succession), of shade tolerant species that distinguishes this cover type from the more mesic upslope conifer forest types.

**References.** Chappell *et al.* 1998

## PONDEROSA PINE FOREST AND WOODLAND (54)

**Geographic Distribution.** This conifer forest and woodland is a major cover type in mid to lower elevation zones along the flanks of the eastern Cascades and the mountain ranges of central and northeastern Oregon.

**Structure and Appearance.** In its mature form this forest type is typified by large structure, widely spaced ponderosa pine (*Pinus ponderosa*). The overstory is predominantly ponderosa with white fir (*Abies concolor*), grand fir (*A. grandis*), incense cedar (*Calocedrus decurrens*), and Douglas fir (*Pseudotsuga menziesii*) minor overstory trees based on location within the state.

Regeneration and understory tree layers are comparatively sparse in this cover type with regards to other regional forest cover types. A variety of forest related grasses and grass-like forbs are frequently found in this type.

**Composition.** Overstory tree along low elevation is exclusively ponderosa pine. At higher elevation margin and transition to mixed conifer types, overstory conifers can be white fir, grand fir, western larch (*Larix occidentalis*), incense cedar, Douglas fir, sub-alpine fir (*Abies lasiocarpa*), and Engelmann spruce (*Picea engelmannii*). Understory and regeneration layers reflect similar composition as overstory.

Shrubs are commonly found and reflect the same environmental trend as associated conifers; lower elevations have fewer shrubs and sparse appearance, increasing in diversity and abundance with elevation and improved soil moisture conditions. Indicative shrubs are bitterbrush (*Purshia tridentata*), big sagebrush (*Artemisia tridentata*), snowberry (*Symphoricarpos albus*), serviceberry (*Amelanchier alnifolia*), mountain mahogany (*Cercocarpus ledifolius*), greenleaf manzanita (*Arctostaphylos patula*), and squaw carpet (*Ceanothus prostratus*).

Grasses and grass-like vegetation are common and dominate the understory in many stands. Idaho fescue (*Festuca idahoensis*), prairie junegrass (*Koeleria macrantha*), bluebunch wheatgrass (*Agropyron spicatum*), Kentucky bluegrass (*Poa pratensis*), mountain brome (*Bromus carinatus*), elk sedge (*Carex geyeri*), Ross= sedge (*C. rossii*) and western needlegrass (*Stipa occidentalis*).

**Landscape Setting.** Ponderosa pine is the most tolerant of hot, dry environments of Oregon's conifers and forms the boundary zone between forest and rangeland cover types for much of Oregon. Its presence along the transition zone at lower elevations usually marks the adequacy of soil moisture to grow large stature vegetation. The exception to ponderosa pines types forming the forest/rangeland boundary is in central Oregon where western Juniper (*Juniperus occidentalis*) occupies the transition between sagebrush and ponderosa pine cover types.

Ponderosa pine can also tolerate cold conditions so it occupies a wide elevational range, but in the higher elevations it is restricted to southerly aspects. At these higher elevations ponderosa stands usually are not large enough to form mappable units. Similarly, ponderosa pine stands can be found in the low elevation, western Cascade forests but are not large enough to be mapped.

**References.** Volland, 1985, Johnson and Simon, 1987, Topik *et al.*, 1988, Hopkins, 1979, Atzet *et al.*, 1996.

## DOUGLAS FIR DOMINANT/MIXED CONIFER FOREST (56)

**Geographic Distribution.** Common mid elevation forest type in southwestern Oregon. This type also extends north to the Columbia River in a narrow band along the eastern side of the Cascades.

**Structure and Appearance.** Stand structure can be diverse in undisturbed late seral stands although single story forest canopies typify the type. Overstory tree layer ranges widely in canopy closure based on management practice, disturbance history, and microsite. Understory vegetation is usually diverse and rich in species.

**Composition.** This cover type contains a diverse array of conifers that complement the ever-present Douglas fir (*Pseudotsuga menziesii*). Fir (*Abies grandis* and/or *A. concolor*), incense cedar (*Calocedrus decurrens*), western white pine (*Pinus monticola*), and ponderosa pine (*P. ponderosa*) are found throughout the range. Sugar pine (*P. lambertiana*) occurs only in southwestern Oregon, and western red cedar (*Thuja plicata*), and Engelmann spruce (*Picea engelmannii*) only in the central and northern regions of the Cascades. Sub-canopy layer generally has the shade tolerant components of the overstory. Western yew (*Taxus brevifolia*) is a frequent sub-canopy component in southwestern Oregon.

Indicator shrubs in this cover type include: vine maple (*Acer circinatum*), Rocky mountain maple (*A. glabrum* var. *douglasii*), serviceberry (*Amelanchier alnifolia*), greenleaf manzanita (*Arctostaphylos patula*), pinemat manzanita (*A. nevadensis*), red huckleberry (*Vaccinium parvifolium*), Oregon grape (*Mahonia nervosa*), snowberry (*Symphoricarpos albus*), oceanspray (*Holodiscus discolor*), sticky currant (*Ribes viscosissimum*), and squaw currant (*R. cereum*).

Common herbs in this cover type include western yarrow (*Achillea millefolium*), silvery lupine (*Lupinus argenteus*), tailcup lupine (*L. caudatus*), strawberry (*Fragaria virginiana*), bull thistle (*Cirsium vulgare*), heartleaf arnica (*Arnica cordifolia*), peavine (*Lathyrus lanszwertii*), starry solomon-plume (*Smilacina stellata*), and white vein pyrola (*Pyrola picta*).

**Landscape Setting.** In southwestern Oregon this mid-elevation forest transitions between the deciduous dominant foothill forests and the true fir dominant montane conifers. Along the slopes of the eastern Cascades it is also transitional to the ponderosa pine and ponderosa/western juniper at its low end and montane forests at upper elevations.

**References.** Hopkins and Rawlings 1985, Atzet *et al.* 1996, Atzet and Wheeler 1983, Chappell *et al.* 1999, Kovalchik 1986, Volland 1985.

## *PONDEROSA PINE-OREGON WHITE OAK FOREST (57)*

**Geographic Distribution.** A low elevation forest found on the eastern flanks of Mount Hood and into the Columbia River Gorge. The type extends south to the Mutton Mountains of Wasco County. This type is also found in the foothills vegetation of southwestern Oregon, especially in the Rogue River Valley around White City.

**Structure and Appearance.** Open to closed canopy forest with small stature ponderosa pine (*Pinus ponderosa*), co-dominant with Oregon white oak (*Quercus garryana*). Ponderosa may be the canopy dominant but is considerably smaller than ponderosa grown in other environments. Except for an occasional Douglas fir (*Pseudotsuga menziesii*) around Mt. Hood and incense cedar (*Calocedrus decurrens*) in the Rogue River Valley other trees are absent from this type. Locally, white oak can be very dense. Shrub cover is typically sparse in this type, but rich in herbs and grasses.

**Composition.** Overstory tree species are ponderosa and white oak. Commonly associated shrubs with the type include: squaw carpet (*Ceanothus prostratus*), deerbrush (*C. integerrimus*), snowberry (*Symphoricarpos mollis*), serviceberry (*Amelanchier alnifolia*) and bitterbrush (*Purshia tridentata*).

Commonly associated forbs include western yarrow (*Achillea millefolium*), hawkweed (*Hieracium albiflorum*), smooth pruriest (Lithophragma glabra), American vetch (*Vicia americana*), tailcup lupine (*Lupinus caudatus*), arrowleaf balsamroot (*Balsamorhiza sagittata*), and nineleaf lomatium (*Lomatium triternatum*). Indicator grasses include: prairie junegrass (*Koeleria macrantha*), Idaho fescue (*Festuca idahoensis*), California brome (*Bromus carinatus*), cheatgrass (*B. tectorum*), bluebunch wheatgrass (*Agropyron spicatum*), elk sedge (*Carex geyeri*), and bulbous bluegrass (*Poa bulbosa*).

**Landscape Setting.** The ponderosa/white oak type is an indicator of warm, dry environments. This type usually forms the lower treeline zone and grades into unimproved pastures that were formerly grasslands. Grazing and selective logging pressure is high in these easily accessible environments. Frequent disturbance will decrease abundance of ponderosa and promote the spread of white oak.

**References.** Eyre 1980, Kagan and Caicco 1992, Topik *et al.* 1988, Williams, 1978.

## *PONDEROSA PINE/WESTERN JUNIPER WOODLAND (58)*

**Geographic Distribution.** Widespread conifer woodland forest type in eastern Oregon. This cover type is usually found in the foothills margin bordering upland conifer types and sagebrush dominant lowlands for most of the regions mountain ranges.

**Structure and Appearance.** Woodland conifer forest cover type. Two-story canopy with widely spaced overstory ponderosa pine (*Pinus ponderosa*) over the sub-canopies of western juniper (*Juniperus occidentalis*). Combined canopy layers generally ranges from 10-50 percent. The shrub layer, interspersed with annual and bunch grasses typically dominates understory vegetation.

**Composition.** Ponderosa pine and western juniper dominate the overstory in this cover type. Dominance of the tree layer between Ponderosa and juniper shifts by microsite and elevation. Improved site productivity favors dominance by Ponderosa. In lower elevations with warmer, drier microclimates, or sites with thin soils, dominance shifts to western juniper.

Indicator shrubs in this type include big sagebrush (*Artemisia tridentata*), low sagebrush (*A. arbuscula*), rabbitbrush (*Chrysothamnus nauseosus* and *C. viscidiflorus*), mountain mahogany (*Cercocarpus ledifolius*), and bitterbrush (*Purshia tridentata*).

Grasses dominate the herbaceous layer. Overgrazing in the cover type usually leads to the proliferation of cheatgrass (*Bromus tectorum*), bottlebrush squirreltail (*Sitanion hystrix*), or bulbous bluegrass (*Poa bulbosa*). Native bunchgrasses commonly found in this cover type include: Sandberg=s bluegrass (*Poa secunda*), Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Agropyron spicatum*), Great Basin wildrye (*Elymus cinereus*), and ricegrass (*Oryzopsis exigua*).

**Landscape Setting.** Similar to the western juniper woodland cover type, the ponderosa/juniper type occupies the transition between upland conifer forests and lowland sagebrush communities.

**References.** Shiftlet, 1994, Johnson and Clausnitzer 1992, Johnson and Simon, 1987, Dealy *et al.* 1981.

## *PONDEROSA-LODGEPOLE PINE ON PUMICE (59)*

**Geographic Distribution.** The most common forest and/or woodland cover type in the southern half of the eastern Cascades ecoregion. The long taproots of lodgepole (*Pinus contorta*) and ponderosa (*P. ponderosa*) make them especially well adapted to the droughty pumice soils of this region. Pumice soils are derived from the volcanic eruptions of prehistoric Mount Mazama and numerous cinder cones throughout the region. This forest type forms a nearly continuous cover from LaPine to the northern edge of the Klamath Marsh.

**Structure and Appearance.** Ponderosa and lodgepole dominate the overstory canopy and regeneration layers in these forests. In its mature, undisturbed form, these forests are distinctly two story canopies with large ponderosa over the shorter lodgepole. Due to extensive selective logging in this type most of the large ponderosa have been removed leaving large tracts of single story lodgepole forests. Regeneration and tree growth are slow in these infertile forests. These forests have an active fire history and have evolved with frequent fires.

Shrub and herb layers are poorly developed in this forest type.

**Composition.** Ponderosa and lodgepole are the most commonly encountered trees. In wet places and riparian strips, Engelmann spruce (*Picea engelmannii*), quaking aspen (*Populus tremuloides*), and white fir (*Abies concolor*) can be found.

The shrub layer in this cover type is poorly developed. The most commonly associated shrubs are bitterbrush (*Purshia tridentata*), greenleaf manzanita (*Arctostaphylos patula*), kinnikinnik (*A. uva-ursi*), and serviceberry (*Amelanchier alnifolia*).

The herb layer in most stands has sparse cover with few species. Several grasses, western needlegrass (*Stipa occidentalis*), squirreltail (*Sitanion hystrix*), Wheeler=s bluegrass (*Poa nervosa*), and Idaho fescue (*Festuca idahoensis*) are commonly found. Other forbs can be: wooly wyethia (*Wyethia mollis*), white hawkweed (*Hieracium albiflorum*), and Ross= sedge (*Carex rossii*).

**Landscape Setting.** The distribution of the ponderosa-lodgepole pine on pumice cover type closely corresponds to the distribution of deep tephra layers from the regions volcanic activity. As such, it doesn=t necessarily relate to environment or climatic conditions.

**References.** Volland 1988, Kovalchik 1987, Hopkins 1979.



## WESTERN JUNIPER WOODLAND (61)

**Geographic Distribution.** Western juniper (*Juniperus occidentalis*) is a common foothills vegetation type for many of the mountain ranges of eastern Oregon. Juniper reaches its greatest extent in the High Lava Plains Ecoregion centered on Bend, Oregon.

**Structure and Appearance.** This woodland type is typified by its open canopy (less than 30% crown closure), single story, short stature (6-20 feet tall) trees. Understory vegetation in these stands tends to be dominated by sagebrush species, although introduced annual grasses and native bunchgrasses can be important depending on site history and disturbance. As site productivity conditions improve, or as soil moisture availability increases, the pure stands of juniper give way to mixed stands of juniper and ponderosa pine (*Pinus ponderosa*).

**Composition.** In most stands western juniper dominates the tree layer. The most frequently encountered shrubs in this cover type are sagebrush species. Big sagebrush (*Artemisia tridentata*) is the most common with rigid sagebrush (*A. rigida*) and low sagebrush (*A. arbuscula*) also commonly found. Other shrubs associated with this type are mountain mahogany (*Cercocarpus ledifolius*), bitterbrush (*Purshia tridentata*), and rabbitbrush (*Chrysothamnus nauseosus* and *C. viscidiflorus*).

Grasses characterize the herbaceous layer. Cheatgrass (*Bromus tectorum*) and bottlebrush squirreltail (*Sitanion hystrix*) are typical and dominant on overgrazed or disturbed sites. Native bunchgrasses can usually be found. Idaho fescue (*Festuca idahoensis*), bluebunch wheatgrass (*Agropyron spicatum*), Thurber=s needlegrass (*Stipa thurberiana*), and Sandberg=s bluegrass (*Poa secunda*) are the most commonly encountered.

**Landscape Setting.** Western juniper occupies the transition zone between conifer dominant uplands and the shrub-steppe basins of eastern Oregon. In the driest mountain ranges of southeastern Oregon, i.e. the Trout Creek and Pueblo Mountains, juniper is found at all elevational ranges. Western juniper=s range is increasing in Oregon. Overgrazing and fire suppression are considered to be the primary factors for the spread of this type.

**References.** Crawford and Chappell 1999, Dealy *et al.* 1981, Monzingo 1986, Kagan and Caicco 1991.

*RED ALDER (63)*  
*& RED ALDER/BIG LEAF MAPLE FOREST (64)*

**Geographic Distribution.** Lowland riparian and low montane forest common in northwestern Oregon and found throughout the Coast Range mountains and the low elevation forests along the western margin of the Cascades. Big leaf maple (*Acer macrophyllum*) is most prevalent in the foothills region of the Cascades and the eastern side of the Coast Range. Maple is a minor deciduous component along the coastal margin.

**Structure and Appearance.** Moderate height (20-50 feet) closed canopy deciduous forest. Upland red alder (*Alnus rubra*) and alder/big leaf maple forests are early seral forests to the low elevation conifer forests of Douglas fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), and western red cedar (*Thuja plicata*). Red alder also is a common overstory tree along many streamside corridors within the Coast Range.

**Composition.** In early seral stages red alder and big leaf maple dominate the overstory. As the stand matures conifers overtop the deciduous trees and dominate the crown layer. In this advanced forest successional stage maintain a hold within the stand as sub-canopy trees in the large gaps among the overstory conifers.

Understory vegetation is prominent and diverse. Indicator shrubs are vine maple (*Acer circinatum*), salmonberry (*Rubus spectabilis*), thimbleberry (*R. parviflorus*), evergreen huckleberry (*Vaccinium ovatum*), and salal (*Gaultheria shallon*).

Herbaceous layer is rich in species and usually has one or more of the following moist site indicators: oxalis (*Oxalis oregana*), swordfern (*Polystichum munitum*), foamflower (*Tiarella trifoliata*), vanillaleaf (*Achlys triphylla*), beadlelily (*Clintonia uniflora*), skunk cabbage (*Lysichitum americanum*), coltsfoot (*Petasites frigidus*), and twinflower (*Linnaea borealis*).

**Landscape Setting.** Alder stands are important colonizers of sites following timber harvest and act to stabilize hill slopes and retard erosion. Alder and big leaf maple stands are indicative of warm, moist sites. Alder regeneration and establishment is always better on southerly exposures.

## *ALDER-COTTONWOOD (65)* & *COTTONWOOD RIPARIAN GALLERY FOREST (68)*

**Geographic Distribution.** Alder-cottonwood riparian forest is found along the margin of flowing streams in the foothills and mountains throughout much of Oregon. West of the Cascade crest the alder species is red alder (*Alnus rubra*); east of the crest it is typically white alder (*Alnus rhombifolia*). The type is especially prevalent along high gradient stream systems that flood frequently and deposit bed-load sand and gravel. The description of this type follows closely that of palustrine forest.

**Structure and Appearance.** Tall deciduous forest with partial-to-closed overstory canopy. Stands are often multi-layered. Cottonwood riparian stands are often mosaics of partial overstory canopy with dense understory reproduction to open areas dominated by willows (*Salix spp.*) to closed forests that may include conifers in the overstory.

**Composition.** Black cottonwood (*Populus trichocarpa*) is always present in the overstory. West of the Cascade crest red alder and big leaf maple (*Acer macrophyllum*) can be co-dominant with cottonwood. Conifers found in the western Oregon version of this type are Douglas fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), western red cedar (*Thuja plicata*), and Port Orford Cedar (*Chamaecyparis lawsoniana*) in southwestern Oregon.

Eastern Oregon deciduous overstory trees besides cottonwood include white alder, mountain alder (*Alnus incana*), pacific willow (*Salix lasiandra*), non-native black locust (*Robinia pseudo-acacia*), and quaking aspen (*Populus tremuloides*). Conifers associated with the eastern Oregon cottonwood gallery forests are ponderosa pine (*Pinus ponderosa*), Douglas fir, and in mountain settings Engelmann spruce (*Picea engelmannii*), and lodgepole pine (*Pinus contorta*).

Shrub and herb layers are prominent and diverse. Douglas spiraea (*Spiraea douglasii*), red osier dogwood (*Cornus sericea*), Nutka rose (*Rosa nutkana*), chokecherry (*Prunus virginiana*), and a variety of willow species (*Salix boothii*, *S. exigua*, *S. geyeriana*, *S. lemmonii*, and *S. bebbiana*). Forbs include speedwell (*Veronica americana*), cow parsnip (*Hieracleum lanatum*), skunk cabbage (*Lysichitum americanum*), pioneer violet (*Viola glabella*), stinging nettle (*Urtica dioica*), wide fruit sedge (*Carex eurycarpa*) and woolly sedge (*C. lanuginosa*).

**Landscape Setting.** Generally a narrow, linear cover type. Mostly bordering agriculture, the type also fingers into uplands and mountains along the larger watercourses.

**References.** Kovalchik 1986, Crawford *et al.* 1999, Kagan and Caicco 1992.

## ASPEN GROVES (66)

**Geographic Distribution.** Scattered throughout the coniferous forests of eastern Oregon in clonal clumps that are too small to map in most cases. Aspen (*Populus tremuloides*) groves are most extensive in the Steens Mountains of southeastern Oregon.

**Structure and Appearance.** Short stature (most aspen are less than 50 feet tall) deciduous trees that dominate the overstory. Lacking cattle grazing pressure aspen groves can be dense with numerous stems, most stands however are open with widely spaced aspen clumps with well-developed shrub and forb layers.

**Composition.** Aspen is the dominant tree in this cover type, although scattered conifers, or western juniper (*Juniperus occidentalis*) may be present.

Shrub layer is conspicuous and usually includes snowberry (*Symphoricarpos mollis*) and serviceberry (*Amelanchier alnifolia*). Other shrubs can be mountain big sagebrush (*Artemisia tridentata* var. *vaseyana*), bitterbrush (*Purshia tridentata*), and mountain mahogany (*Cercocarpus ledifolius*).

Forb layer is dominated by grasses, both native and introduced. Bluebunch wheatgrass (*Agropyron spicatum*), pinegrass (*Calamagrostis rubescens*), California brome (*Bromus carinatus*), blue wildrye (*Elymus glaucus*) and Idaho fescue (*Festuca idahoensis*), along with a variety of introduced grasses are common.

**Landscape Setting.** Aspen groves can be found in a variety of environmental settings in eastern Oregon. However, they mostly occupy mid to upper elevation ranges on the various mountain ranges.

**References.** Franklin and Dyrness 1973, Kagan and Caicco 1992, Kovalchik, 1987.

## CONIFER-DECIDUOUS FOREST (67)

**Geographic Distribution.** Low to mid elevation early successional forest found throughout the Coast Range and Cascade Mountains of western Oregon.

**Structure and Appearance.** Overstory canopy is composed of co-dominant conifer (generally Douglas fir (*Pseudotsuga menziesii*) and deciduous (generally red alder (*Alnus rubra*), and/or big leaf maple (*Acer macrophyllum*) trees. This type is classed as an old clear-cut, or young forest. Canopies are single story and closed. The deciduous component is a remnant of earlier clear-cut succession where red alder and big leaf maple can dominate the overstory. Over time conifers out compete the deciduous trees relegating them to a minor component in the mature conifer forests of western Oregon.

**Composition.** The most common overstory conifer in this type is Douglas fir as it is replanted in monotypic stands following timber harvest. Western hemlock (*Tsuga heterophylla*), western red cedar (*Thuja plicata*), grand fir (*Abies grandis*), and Sitka spruce (*Picea sitchensis*) will naturally reseed into the clear-cuts depending on geographic location within the types regional distribution. Deciduous trees are primarily red alder and big leaf maple.

Understory vegetation is negligible as the tightly crowded canopy casts deep and continuous shade upon the forest floor.

**Landscape Setting.** Common throughout the Coast Range and its coastal plain forests. Also common in the Douglas fir dominant- low elevation forests of the Cascades. Exists as a patchwork mosaic with younger clear-cuts and established forests.

## SISKIYOU MOUNTAINS MIXED DECIDUOUS (72)

**Geographic Distribution.** A common foothills forest type in the interior valleys of southwestern Oregon. Most readily found in the Rogue River valley between Grants Pass and Ashland. This type is also common in the Illinois River and other valley stream courses south to the California border. North of Grants Pass the type can be found in diminishing frequency in Douglas County to the Drain/Curtin divide.

**Structure and Appearance.** Dominant canopy layer is a low to mid stature (20-60 feet) deciduous and evergreen deciduous trees. Widely scattered emergent conifers, Douglas fir (*Pseudotsuga menziesii*) and incense cedar (*Calocedrus decurrens*) are common in stands that have not been selectively harvested, or have had recent fire activity.

**Composition.** Pacific madrone (*Arbutus menziesii*) and Oregon white oak (*Quercus garryana*) are generally co-dominant with less frequent representation from canyon live oak (*Q. chrysolepis*), black oak (*Q. kelloggii*), tan oak (*Lithocarpus densiflorus*), California laurel (*Umbellularia californica*), and chinquapin (*Castanopsis chrysophylla*).

Deciduous shrubs that are commonly associated with this cover type are poison oak (*Rhus diversiloba*), baldhip rose (*Rosa gymnocarpa*), common snowberry (*Symphoricarpos albus*), California hazelnut (*Corylus cornuta*), buckbrush (*Ceanothus cuneatus*), and hairy honeysuckle (*Lonicera hispidula*).

Commonly associated herbs include sweet cicely (*Osmorhiza chilensis*), bedstraw (*Galium aparine*), Sierra sanicle (*Sanicula graviolens*), blue wildrye (*Elymus glaucus*), bottlebrush squirreltail (*Sitanion hystrix*), and an assortment of naturalized annual grasses including the often dominant hedgehog dogtail (*Cynosorus echinatus*).

**Landscape Setting.** Siskiyou Mountains mixed deciduous forest is a transition forest type to associated regional upland conifer types. Its presence denotes warm, dry microclimates. Fire and grazing are frequent perturbations in this cover type.

**References.** Atzet and Wheeler 1983, Atzet *et al.* 1996, Jimerson *et al.* 1996, Hawk and Zobel 1983.

## OREGON WHITE OAK FOREST (75)

**Geographic Distribution.** Common throughout the western Oregon interior valleys of the Rogue, Umpqua and Willamette River valleys and the eastern end of the Columbia River Gorge. Oregon white oak (*Quercus garryana*) is a low elevation, warm site deciduous tree species. This cover type is rapidly disappearing throughout its range in Oregon due to urban expansion.

**Structure and Appearance.** Oregon white oak dominates the overstory in this deciduous forest that ranges from woodland to forest based on ecological site and site history. Understories in these forests typically contain tall deciduous shrubs and smaller stature deciduous trees. In southwestern Oregon the subcanopy is often California black oak (*Quercus kelloggii*), while in the Willamette Valley it is sweet cherry (*Prunus avium*).

**Composition.** The canopy layer is dominated by Oregon white oak. Other canopy trees can be Douglas fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*) in upland settings. On the valley floor, overstories can be mixed with Oregon ash (*Fraxinus latifolia*), cottonwood (*Populus trichocarpa*), and big leaf maple (*Acer macrophyllum*).

Shrub layer is prominent and diverse. Commonly encountered shrubs being: poison oak (*Rhus diversiloba*), baldhip rose (*Rosa gymnocarpa*), California hazelnut (*Corylus cornuta*), common snowberry (*Symphoricarpos albus*), oceanspray (*Holodiscus discolor*), Indian plum (*Oemleria cerasiformis*), and trailing blackberry (*Rubus ursinus*).

**Landscape Setting.** Through most of the interior western valley settings Oregon white oak is the transitional forest from the agriculture dominant valley floor to the conifer forest uplands. Oregon white oak is a vigorous sprouter after fires and this cover type benefited from frequent fires. Increased fire suppression in this last century has led to invasion of the Oregon white oak stands by upland conifers. Oregon white oak produces an abundance of acorns and is a highly desirable wildlife habitat.

**References.** Atzet *et al.* 1996, Kagan and Caicco 1992, Franklin and Dyrness 1973, Habeck 1961.

## *SOUTH COAST MIXED DECIDUOUS (77)*

**Geographic Distribution.** Low to middle elevation deciduous forest restricted to the western side of the Coast Range from Coos Bay south to the California border. This type is most prevalent in coastal northwestern California.

**Structure and Appearance.** Multi-story canopy composed of well-spaced large bole conifers (primarily Douglas fir (*Pseudotsuga menziesii*), over a densely stocked evergreen deciduous and deciduous sub-canopy. Understory is diverse and dominated by the shrub layer.

**Composition.** Overstory conifer is usually Douglas fir although western hemlock (*Tsuga heterophylla*), and Port Orford cedar (*Chamaecyparis lawsoniana*) can be important. Sub-canopy deciduous trees are tanoak (*Lithocarpus densiflorus*), California laurel (*Umbellularia californica*), Pacific dogwood (*Cornus nuttallii*), golden chinquapin (*Castanopsis chrysophylla*) and to a lesser extent, big leaf maple (*Acer macrophyllum*).

Representative shrubs are evergreen huckleberry (*Vaccinium ovatum*), Pacific rhododendron (*Rhododendron macrophyllum*), Oregon grape (*Mahonia nervosa*), salal (*Gaultheria shallon*), California hazelnut (*Corylus cornuta*), and red huckleberry (*Vaccinium parvifolium*).

Western sword fern (*Polystichum munitum*) dominates the herb layer and often is the only prominent herbaceous species due to the dense cover of shrubs.

**Landscape Setting.** The south coast mixed deciduous cover type is common in the southwestern Coast Range where frost, drought and fire are less likely to occur, namely the coastal margin and low elevation forests. Tanoak, California laurel, and Pacific dogwood are susceptible to frost and cannot compete with higher elevation forest types when they are continually set by frost damage. Similarly, the Coast Range north of Coos Bay is too cold for this cover type to thrive.

**References.** Atzet and Wheeler 1984, Atzet *et al.* 1996, Jimerson *et al.* 1996, Frenkel and Kiilsgaard 1984.



## SHRUBLAND AND GRASSLAND TYPES

### *SISKIYOU MOUNTAINS SERPENTINE SHRUBLAND (85)*

**Geographic Distribution.** Occurs throughout southwestern Oregon in scattered mosaics with the Jeffrey Pine type. Most abundant in the foothills of the Illinois River Valley, also found in the Rogue Valley. This type is also associated with serpentine soil plant communities and its distribution and occurrence closely follows the Jeffrey Pine Forest and Woodlands type.

**Structure and Appearance.** Medium to tall shrubland that may have shrub canopy closures greater than 60% although most stands have canopies that are less dense with dispersed overstory. Scattered Jeffrey pine (*Pinus jeffreyi*) and incense cedar (*Calocedrus decurrens*) commonly occur in the type, at less than 10% canopy cover.

Forb layer is diverse, but sparse in appearance. Like the Jeffrey Pine type, these shrublands tend to have a lot of exposed bedrock and gravel scattered among the vegetation.

**Composition.** Shrub layer is dominated by hoary manzanita (*Arctostaphylos canescens*), white leaf manzanita (*A. viscida*), and buckbrush ceanothus (*Ceanothus cuneatus*). Other associated shrubs are huckleberry oak (*Quercus vaccinifolia*), dwarf ceanothus (*Ceanothus pumilus*) and coffeeberry (*Rhamnus californica*).

Forbs are diverse, but most of forb cover comes from grasses. Red fescue (*Festuca rubra*), Idaho fescue (*F. idahoensis*), Lemmon's needlegrass (*Stipa lemmonii*), blue wildrye (*Elymus glaucus*), big squirreltail (*Sitanion jubatum*), and pacific bluegrass (*Poa gracillima*) are commonly found. Other forbs are rock fern (*Aspidotis densa*), common yarrow (*Achillea millefolium*), spreading phlox (*Phlox diffusa*), deadly zigadenus (*Zigadenus venenosus*), and sulphurflower (*Eriophyllum umbellatum*).

**Landscape Setting.** These shrublands typically are found at low elevations on southerly aspects. They are successional to Jeffrey Pine woodlands. However, slow plant growth due to general poor site quality and an active fire frequency maintain these shrublands as persistent features in the regions vegetation.

**References.** Jimerson *et al.* 1995, Atzet *et al.* 1996, Frenkel and Kiilsgaard 1984, Kagan and Caicco 1992.

## WILLOW-HAWTHORN SHRUBLAND (87)

**Geographic Distribution.** Valley bottom riparian shrubland formerly widespread along low gradient streams. Currently most prevalent in the Willamette and Grand Ronde River Valleys.

**Structure and Appearance.** Tall shrubland with dense cover of willows (*Salix* spp.) and/or black hawthorn (*Crataegus douglasii*). Shrubs are interspersed with dense patches of spirea and sedge meadows in poorly drained reaches and tufted hairgrass (*Deschampsia caespitosa*) prairie on better drained soils.

**Composition.** Overstory willow species include (*Salix sitchensis*, *S. rigida*, *S. fluviatilis*, in western Oregon, and *S. lasiandra*, *S. exigua*, *S. geyeriana*, and *S. lutea*) in eastern Oregon. Black hawthorn is generally present in varying degrees of dominance. Other western Oregon shrubs include blackberry (*Rubus ursinus* and *R. spectabilis*), sticky currant (*Ribes lacustre*), Indian plum (*Oemleria cerasiformis*), and Douglas spirea (*Spiraea douglasii*).

Eastern Oregon shrubs include western birch (*Betula occidentalis*), snowberry (*Symphoricarpos albus*), mockorange (*Philadelphus lewisii*), and red osier dogwood (*Cornus sericea*).

Forbs and grasses common to this type include cowparsnip (*Hieracleum lanatum*), stinging nettle (*Urtica dioica*), common rush (*Juncus effusus*), horsetail (*Equisetum arvense*), camas (*Camassia quamash*), tufted hairgrass, buttercup (*Ranunculus occidentalis*), marsh sedge (*Carex obnupta*), bluejoint reedgrass (*Calamagrostis canadensis*), and blue wildrye (*Elymus glaucus*).

**Landscape Setting.** This type occurs on broad, low elevation floodplains that seasonally flood and maintain high water tables. Agriculture or other wetland/riparian types usually border this shrub dominant type.

**References.** Klock 1998, Chappell *et al.* 1998, Kagan and Caicco 1992, Kovalchik 1986.

## MANZANITA DOMINANT SHRUBLAND (89)

**Geographic Distribution.** This is a primary colonizing vegetation type following fires both wild in southern margin of the eastern Cascades, and to lesser extent in the Siskiyou Mountains along the California border.

**Structure and Appearance.** Shrub layer dominates the early successional development of this cover type. Older stands have emergent conifers gradually to be replaced by conifer overstory.

**Composition.** Greenleaf manzanita (*Arctostaphylos patula*) dominates the shrub layer in this cover type. Other associated shrubs would be bitterbrush (*Purshia tridentata*), chokecherry (*Prunus virginiana*), pinemat manzanita (*A. nevadensis*), and snowbrush (*Ceanothus velutinus*).

**Landscape Setting.** Forms a mosaic with mixed conifer, lodgepole, and ponderosa pine forest cover types. This type is not prominent on the map because many of the stands are excluded because they are less than 250 acres in size.

**References.** Hopkins 1979, Mozingo 1986.

## MOUNTAIN MAHOGANY SHRUBLAND (90)

**Geographic Distribution.** Mainly found in the mountain ranges of southeastern Oregon, i.e. Steens, Trout Creek and Pueblo Mountains. This cover type is commonly encountered but generally exists as units that are too small to be mapped. The most extensive representation of this is found on the rimrock canyons of the Steens Mountain.

**Structure and Appearance.** Widely dispersed tall shrubland with rock talus and rock outcrops between shrubs. Mountain mahogany (*Cercocarpus ledifolius*) grows in the soil pockets within the rocky slopes along with big sagebrush (*Artemisia tridentata*), bitterbrush (*Purshia tridentata*) and purple sage (*Salvia dorrii*).

**Composition.** Mountain mahogany is the dominant overstory vegetation with occasional western juniper (*Juniperus occidentalis*). Shrub layer also contains big sagebrush, bitterbrush, purple sage, low sage (*Artemisia arbuscula* or *A. cana*), and several buckwheats (*Eriogonum strictum* and *E. caespitosum*).

**Landscape Setting.** Occurs on the steep, rocky slopes of mountains in southeastern Oregon. It usually appears as a minor component within the western juniper woodland type, or it grades in and out of sagebrush steppe.

**References.** Kagan and Caicco, 1992, Mozingo 1986.

## *SAGEBRUSH STEPPE (91)*

**Geographic Distribution.** The predominant cover type of the Owyhee Uplands ecoregion of southeastern Oregon. Sagebrush steppe is a common vegetation element in the watersheds of the Malheur, Powder, and Burnt Rivers. Sagebrush steppe is also commonly found in the non-cultivated portions of the Columbia River basin.

**Structure and Appearance.** Complicated mosaic of grasses (mostly introduced) and shrubs (mostly the differing varieties of big sagebrush). Historically, this type contained a predominance of bunchgrasses with scattered shrubs. Overgrazing has shifted the composition to favor sagebrush.

**Composition.** Shrub layer always contains some mixture of sagebrush and sagebrush-like vegetation. The three common subspecies of big sagebrush, Wyoming (*Artemisia tridentata* var. *wyomingensis*), basin (*A. tridentata* var. *tridentata*), and mountain (*A. tridentata* var. *vaseyana*) will grow with shorter varieties of sagebrush (rigid (*Artemisia rigida*), low (*A. arbuscula*), silver (*A. cana*) and three-tip [*A. tripartata*]) along with rabbitbrush (*Chrysothamnus viscidiflorus* and *C. nausosus*), based on local environment and site history.

A variety of bunchgrasses are associated with this type although they rarely comprise much of the stand due to grazing pressure. Some of the characteristic native grasses of this type are Great Basin wildrye (*Elymus cinereus*), Thurber needlegrass (*Stipa thurberiana*), Indian ricegrass (*Oryzopsis hymenoides*), blue bunch wheatgrass (*Agropyron spicatum*), Idaho fescue (*Festuca idahoensis*), bluegrass (*Poa secunda*), and sand dropseed (*Sporobolus cryptandrus*). In many areas, these have given way to cheatgrass (*Bromus tectorum*), and crested wheatgrass (*Agropyron cristatum*).

**Landscape Setting.** The sagebrush steppe primarily is adjacent to the big sagebrush type. These two types may, in fact, weave together in complicated mosaics at the edges of the Basin and Range ecoregion and in the interior uplands. Distinction between the two types is complicated and therefore somewhat crude and inexact in its depiction on the map.

**References.** Johnson and Simon 1986, Johnson and Clausnitzer 1987, Crawford *et al.* 1999, Franklin and Dyrness 1973.

## LOW-DWARF SHRUBLAND (93)

**Geographic Distribution.** These dwarf sagebrush types are sporadically found throughout eastern Oregon, generally on areas with shallow basalt soils. The low sagebrush (*Artemisia arbuscula*) cover type is most extensive east of the Guano Valley in Lake and Harney counties and in the ancient pluvial lake basins of northern Lake County. Rigid sagebrush (*Artemisia rigida*) is common in Oregon's Basin and Range along the Columbia River between Arlington and Boardman, and along the margins of the Blue Mountains. Black sagebrush (*Artemisia nova*) dominates scabland flats in extreme southeastern Oregon, in Malheur and southeastern Harney Counties. Low and rigid sagebrush are both infrequently found in the forests of the eastern Cascades and northeastern Oregon, where soils are too shallow to permit tree growth.

**Structure and Appearance.** Low sagebrush (*A. arbuscula*) or rigid sagebrush (*Artemisia rigida*) are the primary dominants and often the only shrub in the stand. Sandberg bluegrass (*Poa secunda*) is commonly found.

**Composition.** A dwarf sagebrush shrub (black sagebrush, rigid sagebrush, low sagebrush, or silver sagebrush [*Artemisia cana*]) dominates the shrub layer with occasional big sagebrush (*A. tridentata*) and bitterbrush (*Purshia tridentata*). Several shrubby buckwheat species (*Eriogonum douglasii* and *E. strictum*) and purple sage (*Salvia dorrii*) are prominent on steep, rocky slopes within the cover type.

The forb layer is diverse, but usually composed of ephemeral annual forbs, or scabland perennials (*Lomatium cous*, *Balsamorhiza serrata*, *B. hookeri*, *Lewisia rediviva*, *Erigeron* and *Phlox* spp.), although grasses provide most of the forb cover. Cheatgrass, Sandberg bluegrass, bottlebrush squirreltail (*Sitanion hystrix*) and onespoke oatgrass (*Danthonia unispicata*) are the most frequently encountered.

**Landscape Setting.** The dwarf sagebrush usually are the dominant vegetation in shallow soil, rocky conditions that exclude the formation of other sagebrush and shrub types. In most cases, they do not form extensive landscape-level covers but rather are part of the larger big sagebrush and sagebrush steppe mosaic.

**References.** Hopkins 1979, Kagan and Caicco 1992, Shiftlet 1994, Dealy *et al.* 1981.

## *SALT DESERT SCRUB SHRUBLAND (95)*

**Geographic Distribution.** Most extensive in the alkaline playa lake basins of the Great Basin ecoregion of Harney, Lake and Malheur Counties. Especially prominent around Lake Abert, Malheur, Alvord, and the Warner Lakes.

**Structure and Appearance.** Low to tall shrub communities comprised of dispersed alkali-tolerant vegetation. Salt desert scrub is a catchall term that describes several differing environments. On the most saline sites, that also are seasonally flooded, black greasewood (*Sarcobatus vermiculatus*) and winterfat (*Erotia lanata*) dominate. Sites with better drainage support a variety of shrubs and several grasses.

**Composition.** Characteristic shrubs that are commonly associated with salt desert scrub complexes are shadscale (*Atriplex confertifolia*), hopsage (*Grayia spinosa*), budsage (*Artemisia spinescens*), Mormon tea (*Ephedra viridis*), rabbitbrush (*Chrysothamnus nauseous*), saltbush (*Atriplex nuttallii*) and greenmolly (*Kochia americana*).

**Landscape Setting.** Salt desert scrub is surrounded by big sagebrush or sagebrush steppe cover types. The most extensive areas are always associated with the large, ephemeral lakes of the region. However, there are numerous, small pockets of this cover type scattered sporadically throughout southeastern Oregon.

**References.** Mozingo 1986, Demming *et al.* 1978, Shiftlet 1994, Dealy *et al.* 1981.

## BIG SAGEBRUSH SHRUBLAND (96)

**Geographic Distribution.** The most common vegetative cover type in eastern Oregon. It appears as a mosaic with shrub-steppe communities along mountain range foothills and expansive extents in the valley floor.

**Structure and Appearance.** Medium to tall shrub community dominated by the three varieties of big sagebrush, mountain big sagebrush (*Artemisia tridentata* var. *vaseyana*), basin big sage (*A. tridentata* var. *tridentata*), and Wyoming big sage (*A. tridentata* var. *wyomingensis*). Some stands support a diversity of forbs and grass species; however, due to grazing pressure the dominant forb is cheatgrass (*Bromus tectorum*). Crested wheat grass (*Agropyron cristatum*) from nearby CRP (Crop Reserve Program) lands can seed into these stands.

**Composition.** *Artemisia tridentata* varieties dominate the canopy layer. Other shrubs found in this type include: bitterbrush (*Purshia tridentata*, identified and described as a separate type), rabbitbrush (*Chrysothamnus nauseosus* and *C. viscidiflorus*), threetip sagebrush (*Artemisia tripartata*), silver sagebrush (*Artemisia cana*) and shadscale (*Atriplex confertifolia*).

Herbaceous plants found in this type include pussytoes (*Antennaria corymbosa*), spreading phlox (*Phlox diffusa*), Hoods phlox (*P. hoodii*), and longleaf phlox (*P. longifolia*), starved milk vetch (*Astragalus miser*), bigseed lomatium (*Lomatium macrocarpum*), nineleaf lomatium (*Lomatium triternatum*) Cusick=s penstemon (*Penstemon cusickii*), and arrowleaf balsamroot (*Balsamorhiza sagittata*).

Native grasses range from present to abundant based on site history and beneficial soil/water relations. Commonly encountered native bunchgrasses include bluebunch wheatgrass (*Agropyron spicatum*), Sandberg=s bluegrass (*Poa secunda*), junegrass (*Koeleria macrantha*), Idaho fescue (*Festuca idahoensis*), Great Basin wildrye (*Elymus cinereus*) and in more disturbed situations bottlebrush squirreltail (*Sitanion hystrix*). Introduced annual grasses are primarily cheatgrass and crested wheatgrass.

**Landscape Setting.** Big sagebrush occurs throughout the arid basins and valleys of western United States. In Oregon, it is the 2<sup>nd</sup> largest (to Douglas fir/western hemlock/western red cedar) cover type mapped in this study. Big sagebrush thrives in regions of low precipitation (mostly in the 8 to 14 inch range). The big sage type is bordered on its upland margin by western juniper, eastside mixed conifer, or ponderosa pine types.

**References.** Tisdale 1994, Shiftlet 1994, Dealy et al 1981, Dobler et al. 1996.

## *BIG SAGEBRUSH B BITTERBRUSH SHRUBLAND (97)*

**Geographic Distribution.** Occurs throughout eastern and central Oregon east of the Cascade crest. While widespread in its occurrence, the big sagebrush (*Artemisia tridentata*)-bitterbrush (*Purshia tridentata*) is largely restricted to porous, well-drained, sandy soils.

**Structure and Appearance.** Medium-tall shrubland steppe with grass dominant understory. Big sagebrush and bitterbrush are co-dominant in the canopy layer.

**Composition.** Other shrubs commonly encountered in this type besides big sagebrush and bitterbrush would be low sagebrush (*Artemisia arbuscula*), rigid sage (*A. rigida*), gray and green rabbitbrush (*Chrysothamnus nauseosus* and *C. viscidiflorus*). Mountain mahogany (*Cercocarpus ledifolius*) and purple sage (*Salvia dorrii*) are associated with this type in southwestern Oregon.

The herbaceous layer in this type ranges widely in composition and coverage. Associated plants include northern mule ears (*Wyethia amplexicaulis*), cluster tarweed (*Madia glomerata*), line-leaf fleabane (*Erigeron filifolius*), sagebrush mariposa (*Calochortus macrocarpus*), death-camas (*Zigadenus venenosus*), primrose (*Oenothera pallida*), desert parsley (*Lomatium macrocarpum*), and several species of buckwheat (*Eriogonum spp.*). Commonly encountered grasses are several species of wheatgrass, crested, downy and bluebunch (*Agropyron cristata*, *A. dasytachyum*, and *A. spicatum*), cheatgrass (*Bromus tectorum*), Indian ricegrass (*Oryzopsis hymenoides*), needle-and-thread grass (*Stipa comata*), and Sandberg=s bluegrass (*Poa secunda*).

**Landscape Setting.** Because of the close relationship this cover type has with sandy, alluvial soils it is mostly found on deposition features; primarily alluvial terraces above streams and on bajadas at the base of the arid mountain ranges in southeastern Oregon. The type generally appears as a small component of the larger big sagebrush and sagebrush-steppe types.

**References.** Shiftlet 1994, Taylor 1994, Mozingo 1986, Kagan and Caicco 1992, Dealy *et al.* 1981.



## *NORTHEASTERN OREGON CANYON GRASSLAND AND SHRUBLAND (103)*

**Geographic Distribution.** Occurs on steep canyon slopes in the mountains of northeastern Oregon. This type is most extensive in the Hell=s Canyon and Grand Ronde River canyon of Wallowa and Baker Counties.

**Structure and Appearance.** Bunchgrasses and shrub dominant patches form a mosaic vegetation cover type. On steep slopes with poor soil development, grasses dominate with stringers of shrubs, especially mockorange (*Philadelphus lewisii*), oceanspray (*Holodiscus discolor*), and Rocky Mountain maple (*Acer glabrum*). Where deeper soils exist, shrub development is usually more extensive along with widely scattered ponderosa pine (*Pinus ponderosa*) and Douglas fir (*Pseudotsuga menziesii*).

**Composition.** Predominant grasses found in this cover type are Idaho fescue (*Festuca idahoensis*), blue bunch wheatgrass (*Agropyron spicatum*), Wheeler=s bluegrass (*Poa nervosa*), Sandberg=s bluegrass (*P. secunda*), mountain brome (*Bromus carinatus*), cheatgrass (*B. tectorum*), junegrass (*Koeleria nitida*), western needlegrass (*Stipa occidentalis*), sand dropseed (*Sporobolus cryptandrus*) and red three awngrass (*Aristida longiseta*).

Predominant shrubs are: mountain big sagebrush (*Artemisia tridentata* var. *vaseyana*), bitterbrush (*Purshia tridentata*), ninebark (*Physocarpus malvaceus*), hackberry (*Celtis reticulata*), snowberry (*Symphoricarpos albus*), buffaloberry (*Shepherdia canadensis*), and sumac (*Rhus glabrum*),

**Landscape Setting.** Occupies the hot, dry environments of the river canyons of northeastern Oregon. This type grades in and out of ponderosa pine and/or mixed conifer forest that occupy the benches and more suitable environments.

**References.** Johnson and Simon 1987, Kagan and Caicco 1992.

## ALPINE GRASSLANDS AND SHRUBLANDS (105)

**Geographic Distribution.** This cover type depicts the vegetated areas above upper treeline in the highest mountains throughout Oregon.

**Structure and Appearance.** Dwarf shrubs dominate this cover type, and thickly compacted *Carex* species that form a grass-like cover called sedge turf. Widely scattered, low stature conifers are also common in this type.

**Composition.** Shrub layer is dominated by several prostrate shrubs; red mountain heather (*Phyllodoce empetrifomis*), green mountain heather (*P. glanduliflora*), white mountain heather (*Cassiope mertensiana*), or crowberry (*Empetrum nigrum*). Other dwarf shrubs found in this cover type include cinquefoil (*Potentilla fruticosa*), juniper (*Juniperus communis*), bearberry (*Arctostaphylos uva-ursi*) and willows (*Salix spp.*).

Alpine sedge turf usually contains one or more of the following: alpine black sedge (*Carex nigricans*), capitate sedge (*C. capitata*), dunhead sedge (*C. phaeocephala*), or showy sedge (*C. spectabilis*).

**Landscape Setting.** This cover type always occurs above timberline. Typically this type occurs as a mosaic with alpine parkland and alpine fell and snowfields. These types usually are not very extensive and therefore not mapped.

## FOREST GRASSLAND MOSAIC (106)

**Geographic Distribution.** Common in ponderosa pine and mixed conifer types of northeastern Oregon, and in the eastern Cascades.

**Structure and Appearance.** Mosaic of bunchgrass grasslands and conifer forest. Most common in the foothills and lower elevation ranges, this type is indicative of the hottest and driest forested conditions. In mid elevations this type is almost always found on southerly aspects.

**Composition.** Ponderosa pine (*Pinus ponderosa*), Douglas fir (*Pseudotsuga menziesii*), lodgepole pine (*P. contorta*) and grand fir (*Abies grandis*) are the most common overstory trees in northeastern Oregon. While in the eastern Cascades, ponderosa pine, Douglas fir, white fir (*Abies concolor*), and incense cedar (*Calocedrus decurrens*) are the common overstory conifers.

The shrub layer is poorly represented in this type. Birchleaf spirea (*Spiraea betulifolia*), baldhip rose (*Rosa gymnocarpa*), and snowberry (*Symphoricarpos albus*) can be found but typically are not present in significant amounts.

Grasses and grass-like plants dominate the forb layer. Idaho fescue (*Festuca idahoensis*) usually is the dominant grass. Other grasses that in combination can form co-dominance within the stand are bluebunch wheatgrass (*Agropyron spicatum*), junegrass (*Koeleria macrantha*), Sandberg bluegrass (*Poa secunda*) and western needlegrass (*Stipa occidentalis*). Cheatgrass (*Bromus tectorum*), and bottlebrush squirreltail (*Sitanion hystrix*) are also present to co-dominant in most stands, especially those stands which are heavily grazed by cattle. Ross= and elk sedge (*Carex rossii* and *C. geyeri*) are common associates in this type.

**Landscape Setting.** The type can inter-grade with several conifer forest and woodland types, typically those most tolerant of hot, dry conditions. At lower elevations the type can grade into western juniper woodlands, particularly in the eastern Cascades.

**References.** Volland 1985, Johnson and Simon 1987, Topik *et al.* 1988, Hopkins 1979, Atzet *et al.* 1996.

## SUBALPINE PARKLAND (110)

**Geographic Distribution.** The highest elevation forest zone in the Cascades, Blues, and Wallowa Mountain ranges of Oregon.

**Structure and Appearance.** Subalpine parkland is distinctive from subalpine grassland and shrublands due to the presence of the clumpy, scattered tree pockets throughout the cover type. Conifer overstory typically ranges from 10 to 30% cover. Ground layer can be a dense layer of low-lying shrubs, sedge or grass turf, or montane wetland bogs.

**Composition.** Subalpine parkland conifer composition varies by region. In the Blues and Wallowas the parkland is usually subalpine fir (*Abies lasiocarpa*), Engelmann spruce (*Picea engelmannii*), or lodgepole pine (*Pinus contorta*). In the Cascades, mountain hemlock (*Tsuga mertensiana*), subalpine fir, silver fir (*Abies amabilis*), and to a lesser extent Alaska yellow cedar (*Chamaecyparis nootkatensis*). In the southern Cascades mountain hemlock, Shasta red fir (*Abies magnifica* var. *shastensis*), and whitebark pine (*Pinus albicaulis*).

The shrub layer is similar in composition to the subalpine shrubland and grassland cover type, where commonly associated shrubs are: red mountain heather (*Phyllodoce empetrifloris*), green mountain heather (*P. glanduliflora*), white mountain heather (*Cassiope mertensiana*), or crowberry (*Empetrum nigrum*). Other dwarf shrubs found in this cover type include cinquefoil (*Potentilla fruticosa*), juniper (*Juniperus communis*), bearberry (*Arctostaphylos uva-ursi*) and willows (*Salix spp.*).

Alpine sedge turf usually indicates poorly drained soils, or persistent snow pack well into the growing season, and contains one or more of the following; alpine black sedge (*Carex nigricans*), capitata sedge (*C. capitata*), dunhead sedge (*C. phaeocephala*), or showy sedge (*C. spectabilis*).

On drier sites, the forb layer is characterized by either elk or Ross= sedge (*Carex geyeri* or *C. rossii*), smooth woodrush (*Luzula hitchcockii*), Drummond=s rush (*Juncus drummondii*), or green fescue (*Festuca viridula*).

**Landscape Setting.** Forms the high elevation limit to tree growth. Usually is a mosaic with alpine fell and snowfields and the alpine shrubland and grassland.

**References.** Hopkins 1979, Johnson and Simon 1986, Johnson and Clausnitzer 1987, Hemstrom *et al.* 1987, Volland 1988, Atzet *et al.* 1996, Crawford *et al.* 1999.

## MODIFIED GRASSLAND (112)

**Geographic Distribution.** Extensive grasslands of northeastern Oregon that formerly were composed of native bunchgrasses. Presently, these grasslands are used primarily for pasture. Most lands in this type are seeded to cultivated grasses. This type is common in the foothills of the Wallowa and Blue Mountains in Grant, Union, and Wallowa Counties.

**Structure and Appearance.** Medium-tall grasslands composed of a variety of orchard and perennial bunch grasses. Shrubs are virtually nonexistent and a negligible part of total plant cover. Forbs can be diverse, but largely inconspicuous amongst the grasses.

**Composition.** Undisturbed remnants of this type are typically dominated by bluebunch wheatgrass (*Agropyron spicatum*). Idaho fescue (*Festuca idahoensis*), Sandberg=s bluegrass (*Poa secunda*), and prairie junegrass (*Koeleria macrantha*) are common associates. Less abundant, but common in the type are sand dropseed (*Sporobolus cryptandrus*), threeawn (*Aristida longiseta*), and needle-and-thread grass (*Stipa comata*).

Forbs commonly found in this type include yarrow (*Achillea millefolium*), milk vetch (*Astragalus* spp.), arrowleaf balsamroot (*Balsamorhiza sagittata*), biscuitroot (*Lomatium macrocarpum*), spreading phlox (*Phlox longifolia*), salsify (*Tragopogon dubius*) and mullein (*Verbascum thapsus*).

**Landscape Setting.** Generally restricted to foothill margins of northeastern Oregon mountains. Native bunchgrasses are more prevalent on steep hillsides and remote sections of the type. With gentle terrain and proximity to valley bottom agriculture grass species composition shifts to introduced orchard grasses.

**References.** Mayfield and Kjelson 1982, Johnson and Simon 1987, Johnson and Klausnitzer, Tisdale 1994, Johnson 1994

## COASTAL STRAND AND HEADLANDS (113)

**Geographic Distribution.** This narrow strip of vegetation borders the coastline and runs the length of the Oregon coast.

**Structure and Appearance.** This cover type combines several distinct vegetation types, deflation plains, and headlands. Deflation plain vegetation types can be lumped into two general situations, 1) dry meadow, and 2) marsh community. Hummocky ridges of European beach grass (*Ammophila arenaria*) and wet reaches, which contain a variety of herbaceous plants and willows, characterize deflation plains. Headland vegetation is a mosaic of grass and shrublands that grow on promontories adjacent to the shoreline and grade into coastal forest cover types.

**Composition.** The hummocky ridges that separate the sandy beaches from the wet deflation plains are dominated by European beach grass, an introduced grass that was originally planted for dune stabilization purposes and has spread throughout the coastal strand to become a dominating influence on vegetation development. Other herbaceous vegetation commonly found on these ridges is seashore bluegrass (*Poa macrantha*), beach pea (*Lathyrus littoralis*), and seashore lupine (*Lupinus littoralis*). The marshy deflation plain vegetation includes: Hooker's willow (*Salix hookeriana*), slough sedge (*Carex obnupta*), Pacific silver weed (*Potentilla pacifica*), and salt rush (*Juncus lesueurii*).

Headland vegetation shrub layer includes: salal (*Gaultheria shallon*), evergreen huckleberry (*Vaccinium ovatum*), salmonberry (*Rubus spectabilis*), and elderberry (*Sambucus racemosa*). South coast shrublands will also contain, or be dominated by, coyote bush (*Baccharis pilularis*) and the introduced gorse (*Ulex europaeus*) and Scotch broom (*Cytisus scoparius*).

Grasses dominate the forb layer in headland vegetation. Native dominant grasses are red fescue (*Festuca rubra*), and pacific reedgrass (*Calamagrostis nutkatensis*). Blue wildrye (*Elymus glaucus*), California danthonia (*Danthonia californica*), and Sitka brome (*Bromus sitchensis*) can be found. These grasslands also contain a variety of introduced grasses as they were managed for sheep grazing earlier in this century.

**Landscape Setting.** This type is poorly represented on the map because its distribution is not extensive enough to be mapped in most areas. The type grades in and out of coastal forest types and estuarine and palustrine wetland types.

**References.** Crawford *et al.* 1999, Weideman 1974, Ripley 1984

## *WET MEADOW (114)*

**Geographic Distribution.** Montane herbaceous meadows of grass-like plants, primarily members of the *Carex* tribe. Soil must be saturated to moist throughout the growing season for the *Carex* to dominate. Soil surface is seasonally flooded from May-June from snowmelt. Occurs throughout most mountain ranges in eastern Oregon. This type is poorly represented on the map because these meadows typically are smaller than the minimum map unit.

**Structure and Appearance.** *Carex* dominant meadows with dense sedge turf the primary vegetation layer. If the area is not grazed there are a number of *Carex* species that will occupy these sites. Grazing reduces species complexity and shifts dominance to Nebraska sedge (*Carex nebraskensis*).

**Composition.** *Carex* species form the majority of species diversity in this type. Commonly occurring *Carex* members include beaked sedge (*Carex rostrata*), water sedge (*C. aquatilis*), wooly sedge (*C. lanuginosa*), thickheaded sedge (*C. pachystachya*), and lenticular sedge (*C. lenticularis*). Drier microsites will typically contain tufted hair grass (*Deschampsia caespitosa*). Forbs are not abundant in this type.

**Landscape Setting.** Montane meadows where sub-surface soil conditions, or shallow ground water table maintain moist soils through the growing season. The type exists as small, discrete entities through the mountains of eastern Oregon and the eastern Cascades.

**References.** Kovalchik 1986, Johnson and Simon 1987, Johnson and Clausnitzer 1992, Kagan and Caicco 1992.

## *GRASS-SHRUB-SAPLING or REGENERATING YOUNG FOREST (121)*

**Geographic Distribution.** Common throughout the mountains of Oregon.

**Structure and Appearance.** Captures the range of successional conditions following timber harvest. Site preparation following timber harvest is a ground scarification and burning of slash and large woody debris, followed by seeding of a mix of annual grasses to retard soil erosion and planting conifer seedlings. As the stand matures there may be a phase where resprouting shrub vegetation, or dormant shrub seeds germinated by prescription fire, dominate the overstory canopy layer. Later in the successional phase the conifer saplings have emerged through the shrub canopy and formed continuous canopies.

**Composition.** A variety of shrubs and forbs can be present in this cover type based on regional flora and site history.

**Landscape Setting.** Appears as a patchwork mosaic woven into surrounding local forest cover types. The several large, continuous polygons that appear on the map in south-central and northeastern Oregon are burned over lands from fires in the 1980=s.

## OTHER TYPES

### *ALKALI PLAYA (122)*

**Geographic Distribution.** Found in Harney, Lake, and Malheur Counties of southeastern Oregon. These barren flats are commonly associated with the larger pluvial lake basins of Alvord, Summer, Malheur, Catlow, and Pueblo Lakes.

**Structure and Appearance.** Barren, alkali flats that are seasonally flooded.

**Composition.** Alkali playas are largely devoid of vegetation.

**Landscape Setting.** This cover type is surrounded by the salt desert scrub, big sagebrush, or sagebrush steppe cover types.

**References.** Kagan and Caicco 1992, Mozingo 1987

### *URBAN (124)*

**Geographic Distribution.** Urban areas depicted on the map are those cities and municipalities identified in the Oregon state service center digital urban area coverage.

### *AGRICULTURE (125)*

**Geographic Distribution.** Found throughout Oregon. Agriculture is identified as those lands that have been modified for growing crops and/or animal husbandry.

### *TIDAL FLATS (126)*

**Geographic Distribution.** Tidal flats are features associated with bays and estuaries along the Oregon coast. There are also a number of tidal flats in the lower Columbia River extending east to about Clatskanie.

**Structure and Appearance.** These are the sand-soil-muck surfaces that becomes exposed during low tide.

**Composition.** Tidal flats are basically devoid of significant amounts of rooted vegetation.

**Landscape Setting.** Forms the boundary layer between estuarine, or palustrine wetlands and open water habitats in Oregon's bays, estuaries, and the lower reaches of the Columbia and many coastal rivers.

**References.** Cowardin *et al.* 1978



## LAVA FLOWS (127)

**Geographic Distribution.** This cover type is found mostly in southeastern Oregon and eastern Cascades Mountains.

**Structure and Appearance.** Surface lava flows that are largely unvegetated (less than 15% vegetation cover). In eastern Oregon, lava flows may be thinly vegetated with sagebrush, primarily big sagebrush (*Artemisia tridentata*) and annual grasses, especially cheatgrass (*Bromus tectorum*). The lava flows in the Cascades tend to be largely unvegetated with scattered pockets of soil that are deep enough to sustain vegetation. In these soil pockets, shrubs such as gooseberry (*Ribes cereum*), or snowbush (*Ceanothus velutinus*), or conifers, especially lodgepole pine (*Pinus contorta*) can survive.

## COASTAL DUNES (128)

**Geographic Distribution.** The coastal dunes of Oregon attain their greatest development between Florence and Coos Bay where they form a continuous surface that extends several miles inland. Dunes can form through a variety of processes that are influenced by local topography, prevailing wind direction, and source supply of sand. While dunes can be found throughout the length of the Oregon coast they mostly are small, discrete features that do not show up in the vegetation map.

**Structure and Appearance.** Coastal dunes, as they relate to this vegetation description, are sparsely vegetated. Dunes are regions of actively moving sand and only a few types of plants do well in this environment, and typically are grasses or grass-like plants.

**Composition.** The most commonly encountered plants encountered on these dunes are European beach grass (*Ammophila arenaria*), seashore bluegrass (*Poa macrantha*), American dune grass (*Elymus mollis*) and large-headed sedge (*Carex macrocephala*). Other forbs are beach morning glory (*Convolvulus soldanella*), beach knotweed (*Polygonum paronychia*), yellow abronia (*Abronia latifolia*) and silver beach weed (*Franseria chamissonis*).

**Landscape Setting.** Coastal dunes can appear as a mosaic with coastal forest, estuarine and palustrine wetlands and coastal strand vegetation.

**References.** Weideman *et al.* 1974, Ripley 1984

## ALPINE FELL and SNOWFIELDS (129)

**Geographic Distribution.** This cover type depicts the non-vegetated areas above upper treeline in the highest mountains throughout the state. Persistent snow cover and rock talus slopes dominate the local landscape. Found in above timberline environments on the higher peaks and ranges of the Cascades, Steens, and ranges in northeastern Oregon.

## OPEN WATER (130)

**Geographic Distribution.** Lakes, ponds, and reservoirs larger than 10 acres that occur throughout Oregon.

## *NATIONAL WETLAND INVENTORY (135) & GAP PALUSTRINE FOREST (200)*

**Geographic Distribution.** Palustrine forest wetlands are characterized by overstory canopy vegetation greater than 18 feet in height. All water regime influences: lacustrine, riverine, and tidal margin is included. Palustrine forests, indeed all riparian vegetation systems, occur along the interface between aquatic and terrestrial ecosystems. The distribution of this type is a function of surface hydrologic features.

**Structure and Appearance.** Dominant overstory vegetation is trees. Canopies range from open to closed and in well-developed stands are typically multi-storied. The tree layer can be dominated by deciduous, conifer, or mixed canopies. The shrub layer, both tall and low, generally forms dense thickets. Forb layer is abundant and diverse.

**Composition.** Common eastern Oregon deciduous canopy trees in this type are: black cottonwood (*Populus trichocarpa*), white alder (*Alnus rhombifolia*), quaking aspen (*Populus tremuloides*), and peachleaf willow (*Salix amygdaloides*). Conifer trees in eastern Oregon palustrine forests typically do not dominate the overstory. Ponderosa pine (*Pinus ponderosa*), lodgepole pine (*P. contorta*), and Douglas fir (*Pseudotsuga menziesii*) are the most commonly encountered overstory conifers.

Western Oregon palustrine forests common deciduous trees include: big leaf maple (*Acer macrophyllum*), red alder (*Alnus rubra*), western ash (*Fraxinus latifolia*), black cottonwood Oregon white oak (*Quercus garryana*), and pacific willow (*Salix lucida*). Conifers commonly dominate the overstory in many western Oregon palustrine forest conditions. Lodgepole pine is common in bogs and deflation plains in the coastal margin. Western red cedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), Douglas fir, and grand fir (*Abies grandis*).

**Landscape Setting.** Palustrine forests tend to be narrow, linear features that closely follow the moving watercourse.

**References.** Chappell *et al.* 1999, Kagan and Caicco 1992, Kovalchik 1986

*NATIONAL WETLAND INVENTORY (136)*  
*& GAP PALUSTRINE SHRUBLAND (201)*

**Geographic Distribution.** Palustrine shrublands, like palustrine forests, are vegetation cover types closely associated with surface hydrologic features. These tall shrub riparian areas are most prominent along low gradient streams that meander through the broad valleys and pluvial basins of eastern Oregon. The type is very common in the Silvies and Woods River basins.

**Structure and Appearance.** Dense, tall shrubs dominate the canopy layer of this type.

**Composition.** Eastern Oregon palustrine shrublands tend to be dominated by willow species (*Salix spp.*). Other shrubs found in these settings include chokecherry (*Prunus virginiana*), bog birch (*Betula glandulosa*), bog blueberry (*Vaccinium occidentale*), snowberry (*Symphoricarpos albus*), wax currant (*Ribes cereum*), and Douglas spirea (*Spiraea douglasii*).

Western Oregon palustrine shrublands are also dominated by willow species, especially Sitka willow (*Salix sitchensis*) and Hooker's willow (*S. hookeriana*), Douglas spirea, red-osier dogwood (*Cornus sericea*), snowberry, and black hawthorn (*Crataegus douglasii*).

**References.** Cowardin *et al.* 1979, Kovalchik 1986, Franklin 1972.

*NWI (137)*  
*& GAP ESTUARINE EMERGENT WETLAND (202)*

**Geographic Distribution.** Common wetland vegetation that borders Oregon=s coastal river mouths, bays, and estuaries. Estuarine emergent vegetation is occupied by plants that can withstand inundation by salt and brackish water.

**Structure and Appearance.** Herbaceous wetlands composed of grass, grass-like, and forbs. Vegetation composition and pattern is strongly influenced by tidal inundation and elevational position within the salt marsh.

**Composition.** The lowest salt marsh plant community occupies exposed tidal flats during periods of low tides and is characterized by such halophytic plants as seashore saltgrass (*Distichlis spicata*), pickleweed (*Salicornia virginica*), jaumea (*Jaumea carnosa*), shore podgrass (*Triglochin maritimum*), and saltmarsh sedge (*Carex lyngbyei*).

The intermarsh community (higher elevation, less flooding) commonly associated plants include redtop bentgrass (*Agrostis alba*), rush (*Juncus articulatus*), Pacific potentilla (*Potentilla pacifica*), yarrow (*Achillea millefolium*), sea-watch angelica (*Angelica lucida*), giant vetch (*Vicia gigantea*), Pacific waterwort (*Oenanthe sarmentosa*), and Douglas aster (*Aster subspicatus*).

The transition zone (upper elevation saltmarsh to terrestrial upland) is characterized by salmonberry (*Rubus spectabilis*), bracken (*Pteridium aquilinum*), sword fern (*Polystichum munitum*), common velvetgrass (*Holcus lanatus*), Alaska fringe cup (*Tellima grandiflora*), red alder (*Alnus rubra*), Sitka spruce (*Picea sitchensis*), and western hemlock (*Tsuga heterophylla*).

**Landscape Setting.** Borders the cover types of open water and adjacent upland types. Agriculture is a common bordering cover type as many of Oregon=s estuaries are diked to permit dairy cattle grazing.

**References.** Weideman 1986, Frenkel and Eilers 1976, Mitchell 1981, Cowardin *et al.* 1982.

*NWI (138)*  
*& GAP PALUSTRINE EMERGENT WETLAND (203)*

**Geographic Distribution.** Freshwater herbaceous wetlands distributed throughout the state. Especially prevalent in the Klamath Basin, Malheur-Harney and Warner Lakes basins, the Grande Ronde Valley, Willamette Valley, and the coastal margin.

**Structure and Appearance.** Medium tall (2-4 feet) to tall (>4 feet) grass, or grass-like plants that occur in dense mosaics depending on substrate and water depth.

**Composition.** Commonly associated herbaceous plants in this type, cattail (*Typha latifolia*), several bulrush species (*Scirpus olneyi*, *S. acutus*, *S. validus*, and *S. americanus*), burreed (*Sparganium emersum* and *S. eurycarpum*), flourish in shallow standing water situations. In the drier reaches of this type where the surface may dry out but subsurface is persistently wet numerous sedge (*Carex* spp.) and rush (*Juncus* spp.) dominate. Spikerush, (*Eleocharis* spp.) also can be an important component in this seasonal flooded margin.

Grasses that are commonly associated with this type are blue wildrye (*Elymus glaucus*), tufted hair grass (*Deschampsia caespitosa*), bluejoint reedgrass (*Calamagrostis canadensis*), reed canary grass (*Phalaris arundinacea*), American sloughgrass (*Beckmannia syzigachne*) and northern mannagrass (*Glyceria borealis*).

**Landscape Setting.** This type is restricted to perennially flooded regions, or where the ground water lies just below the soil surface. Some type of agriculture typically borders emergent wetlands. Their silty soils are very fertile and are drained and converted to agriculture wherever possible.

**References.** Chappell *et al.* 1998, Christy and Titus 1996, Kovalchik 1986.

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# 1998 OR-GAP LAND COVER FOR OREGON - METADATA

- I. Identification Information
- II. Data Quality Information
- III. Spatial Data Organization Information
- IV. Spatial Reference Information
- V. Entity and Attribute Information
- VI. Distribution Information
- VII. Metadata Reference Information

## I. *Identification Information*

### *Citation:*

*Originator:* Oregon Gap Analysis

*Publication Date:* 19980630

*Title:* Land Cover for Oregon

*Geospatial Data Form:* Map

*Publication Information:*

*Publication Place:* Corvallis, Oregon

*Publisher:* Northwest Habitat Institute, Corvallis, Oregon

*Online Linkage:* URL:[http://www.nwhi.org/nhiweb/projects.html/#or\\_veg](http://www.nwhi.org/nhiweb/projects.html/#or_veg)

### *Description:*

This layer is the land cover/land use layer data compiled for the Oregon Gap Analysis Project. The primary purpose of this data is to provide information on the geographic distribution of land cover within the state of Oregon. The secondary purpose of the data is to assist wildlife biologists for the purposes of mapping vertebrate species habitat associations and distributions.

### *Background:*

Oregon was a pilot GAP analysis project and completed its first generation land cover map in 1992. That map, *Oregon Current Vegetation*, Kagan and Caicco (1992) utilized a process of manual interpretation of hardcopy color composites of the 23 Landsat scenes that wholly, or partly encompass the state. Vegetation polygons were drawn on mylar acetate overlays and later digitized. The digital layer was created using Arc/Info GIS software. That polygonal coverage resides with the national GAP Analysis program.

In 1994, the Ecological Analysis Center of the Oregon Dept. of Fish and Wildlife started the second generation vegetation mapping effort using Landsat TM digital data and conventional remote sensing analysis and classification techniques. Details of that mapping project are described in the following sections.

### *Time Period of Content:*

*Time Period of Information:* Thematic Mapper imagery dates for vegetation mapping ranged from 1991 to 1993.

*Currentness Reference:* Publication date of sources

### *Status:*

*Progress:* Complete

*Maintenance and Update Frequency:* There are no current plans for updating the land cover data, though the National Gap program indicates a possible 10-year update interval.

***Spatial Domain:******Bounding Coordinates:***

*West Bounding Coordinate:* 65853.500

*East Bounding Coordinate:* 718028.500

*North Bounding Coordinate:* 510192.500

*South Bounding Coordinate:* 24692.500

***Keywords:***

*Theme Keyword:* Surface vegetation

*Theme Keyword:* Land Cover

*Theme Keyword:* Habitat

*Theme Keyword:* Landuse

*Place Keyword:* Oregon

***Access Constraints:*** None***Use Constraints:***

There are no constraints to the use of this data. However, this data was produced with an intended application at the state, or ecoregional level, with an accuracy in detail and precision based on USGS 1:100,000 maps. The data was created to provide a coarse-filter approach to vegetation/wildlife habitat relationships where not every occurrence of animal habitat is mapped, only large, generalized distributions. Therefore, this dataset is most valid when used in analysis of 1:100,000 applications or greater.

***Point of Contact:******Contact Information:***

*Contact person:* Jimmy Kagan

*Contact Organization:* Oregon Natural Heritage Program

*Contact Address:* 821 SE 14<sup>th</sup> Ave.

*City:* Portland

*State:* Oregon

*Country:* USA:

*Postal Code:* 97214

*Contact Voice Telephone:* 503-731-3070 ext. 332

***Browse Graphic:***

*Browse Graphic File Name:* [www.nwhi.org/nhiweb/stveg100.jpg](http://www.nwhi.org/nhiweb/stveg100.jpg)

*Browse Graphic File Description:* Generalized color map of land cover types in Oregon

*Browse Graphic File Type:* JPEG

***Data Set Credit:***

Chris Kiilsgaard and Charley Barrett. Northwest Habitat Institute, Corvallis, Oregon.

***Native Set Environment:***

The land cover dataset was created in Erdas Imagine software and exported to an Arc/Info vector format with polygon topology. Arc/Info software version 7.03 running on a Unix Sun SPARC workstation. The format for distribution is an Arc/Info export file.

***Cross Reference******Citation Information:***

*Originator:* O=Neil, T.A., R. Steidl, WD Edge, and B. Csuti.

*Publication Date:* 1995.

*Title:* Using wildlife communities to improve vegetation classification for conserving biodiversity.

*Publication Information:* vol. 9 (6): 1482-1491.

*Publisher:* Conservation Biology

*Cross Reference*

*Citation Information*

*Originator:* Barrett, C.W.

*Publication Date:* 1998.

*Title:* Airborne Videography as a Classification and Validation Technique for Landsat TM-Based Vegetation Mapping.

*Publication Information:* Masters Thesis

*Publisher:* Oregon State University

*Cross Reference*

*Citation Information*

*Originator:* Bruner, H.A. and C. W. Kiilsgaard

*Publication Date:* undetermined

*Title:* Assessment of Habitat Map Accuracy for the Willamette Valley Ecoregion, Oregon.

*Publication Information:* manuscript in preparation

*Publisher:* N/A

*Cross Reference*

*Citation Information*

*Originator:* Csuti, B, A.J. Kimmerling, T.A. O'Neil, M.M. Shaughnessey, E.P. Gaines and M.M. Huso

*Publication Date:* 1997

*Title:* Atlas of Oregon Wildlife: Distribution, Habitat, and Natural History

*Publication Information:*

*Publisher:* Oregon State University Press, Corvallis, Oregon

*Cross Reference*

*Citation Information*

*Originator:* Cowardin, L.M., V. Carter, F. Golet, and E. LaRoe

*Publication Date:* 1992

*Title:* Classifications of wetlands and deepwater habitats of the United States

*Publication Information:*

*Publisher:* US Fish & Wildlife Service FWS/OBS-79/31

## **II. Data Quality Information:**

### **Attribute Accuracy**

*Attribute Accuracy Report:* An overall map accuracy of 81% for the Willamette Valley Ecoregion was achieved. Accuracy was determined from 2,319 field-based sample points located from a stratified random grid (Bruner and Kiilsgaard, 1998).

In order to determine relative sample size for each land cover class per county, the proportion of total county area for each class was calculated. Any land cover class with fewer than 15 occurrences/county and a proportion of the total mapped county area <0.0015 was assessed for classification accuracy by examination of sample points from all of the polygons occurring on the map in each county.

Each county was stratified for sampling area by creating a buffer of 0.5 km from public road access. Map accuracy assessment data was recorded as vegetation/land use versus actual vegetation/land use class verified for each sample point, as well as ranked (0-5) according to the field investigator's confidence in visual access and correct classification of vegetation/land use for the sample point.

Error matrices were generated for each county, along with an analysis of each class accuracy and error type. Vegetation/land use class accuracy (the number of correctly classified sample points for each class divided by the total points sampled for each class) was determined on a county and complete map basis.

An overall map accuracy of 78% was achieved for the northern half of the Coast Range Ecoregion (Barrett 1998), using aerial videography as accuracy assessment protocol. Accuracy assessment was conducted only within the Coast Range and Willamette Valley Ecoregions. Lack of funding precluded accuracy assessment throughout the rest of the state.

### ***Quantitative Attribute Accuracy Assessment***

*Attribute Accuracy Value:* Based on a formal stratified random field checking methodology overall map accuracy was 81%. Map accuracy is raised to 93% if the 6 agricultural classes are lumped into a single agriculture class.

*Logical Consistency Report:* All polygons are closed and adjacent polygons do not have identical attributes. Each map unit was tested with the ARC LABELERROR command to confirm every polygon has one and only one label.

*Completeness Report:* The minimum mapping unit for polygons in this coverage is 100 hectares for upland cover types. Data from several ancillary data sets were incorporated into this coverage and may, or may not, comply with the 100 ha mmu. Wetland/riparian vegetation data from the National Wetland Inventory (NWI) and urban area boundaries from the Oregon state service center were merged with vegetation data. Many of the NWI polygons were resolved at a finer resolution although the exact mmu is not stated in that coverage's metadata. Vegetation/land use data is recorded as a single attribute. Where NWI data differed from our interpretation those polygons carry the attribute label with an NWI prefix before each vegetation label (i.e. NWI-estuarine emergent).

Vegetation classification is based on dominant overstory composition. The minimum canopy closure criterion is 10% for woodland, 30% for forest, and 30% for shrub categories. Meaning woodlands must have greater than 10% and less than 30% crown closure. Shrubland classes must have more than 30% shrub occupancy.

Species must consistently be associated with the type and comprise 30% of the overstory to be named in the vegetation label.

*Horizontal Positional Accuracy:* N/A

*Horizontal Positional Accuracy Explanation:* N/A

*Vertical Positional Accuracy:* N/A

*Vertical Positional Accuracy Explanation:* N/A

### ***Lineage***

*Source Information*

*Source Citation:*

*Citation Information:*

*Originator:* Various sources

*Publication Date:* 1991-1993

*Title:* Landsat Thematic Mapper Satellite Images

*Type of Source Media:* online

*Source time Period of Content:*

*Time Period Information:*

*Range of Dates/Times:*

*Beginning:* 1991

*Ending:* 1993

*Source Currentness Reference:* ground condition

*Source Citation Abbreviation:* TM image

*Source Contribution:* The 23 TM images that wholly, or partly cover the state were used to interpret land cover conditions.

*Source Information*

*Source Citation:*

*Citation Information:*

*Originator:* US Fish and Wildlife Service

*Publication Date:* updated as additional data becomes available

*Title:* The National Wetland Inventory

*Type of Source Media:* online

*Source time Period of Content:*

*Time Period Information:*

*Range of Dates/Times:*

*Beginning:* 1988

*Ending:* 1:24,000 scale NWI maps are still being compiled for Oregon

*Source Currentness Reference:* publication date

*Source Citation Abbreviation:* USFWS- NWI data

*Source Contribution:* Wetland/riparian vegetation data from this coverage was incorporated into this mapping project.

*Source Information*

*Source Citation:*

*Citation Information:*

*Originator:* Oregon State Service Center for Geographic Information Systems

*Publication Date:* 1996

*Title:* City Limits, 1:24,000 scale

*Type of Source Media:* online

*Source time Period of Content:*

*Time Period Information*

*Range of Dates/Times:*

*Beginning:* 1995

*Ending:* 1996

*Source Currentness Reference:* publication date

*Source Citation Abbreviation:* city limits

*Source Contribution:* City limit boundaries for all incorporated municipalities within Oregon. This coverage was joined with the vegetation/land use data and used to portray the Aurban@ class.

***Process Step***

***Process Description:*** Each of the 23 Landsat TM scenes that were used in the classification of Oregon=s vegetation underwent a 2 phase, multi-step process. The major steps involved with the two phases are briefly described below.

Phase I: Image preparation, Radiometric Preview, and Image Analysis

- 1) *Partitioning imagery into ecoregional similarity.* Previous mapping efforts by the NWHI staff have demonstrated that whenever classification takes place over a large land area, (such as a TM scene), the

problem of signature extension severely compromises classification effort. Ecoregional partitioning reduces spectral complexity displayed in a full TM scene, and groups vegetation types into more probable associations.

- 2) *Construct derivative bands.* A normalized difference vegetation index, NDVI, and the first three principal component bands of a Tasseled Cap Transformation algorithm was incorporated with TM bands 1-5 and 7 to form a 10 band image. This image will be the basis of all subsequent spectral analysis.
- 3) *Conversion of TM imagery to TIFF format files.* A three band (bands 3, 4 and 5) image was subset from the 10 band image and converted to a TIFF which was downloaded to a lap top computer for field reconnaissance purposes.
- 4) *Conversion of vector format ancillary data.* Coverages which assist the analyst during field verification, especially the road and stream networks were converted to a DXF format and brought into the lap top computer to display over the TIFF images.

#### Phase II Image Classification, Field Verification, Accuracy Assessment

- 1) *Unsupervised classification of the 96-97 scene ecoregion.* Initial classification procedures start with a sufficiently large number of spectral clusters (generally between 100-150), to form mutually exclusive spectral signatures. These signatures are then run through a maximum likelihood classifier to produce the initial spectral cluster map.
- 2) *Preliminary assignment of spectral class to vegetation class.* Linking spectral clusters to vegetation information classes is first done through an on-screen examination of the clusters overlaid on the image. In many cases the information class is spectrally distinct enough that cluster labeling is very straight forward. However, there will always be a number of spectral clusters that are indeterminable at this stage, as well as, information classes that do not readily lend themselves to an identification (like palustrine forest). Which is the reason for the iterative process to determine spectral/information class relationships.
- 3) *Field verification of spectral-vegetative condition.* This process involves recording vegetation identity at known points within the image. This entailed linking our GPS unit to the TIFF version of the TM scene through Field Notes software and recording field training sites. A database was developed for each ecoregion using the Field Notes software that includes XY coordinates, the vegetation/land cover class, and environmental variables that may be useful to the analyst in future processing iterations. The database was brought into ARC/INFO as a point location file and displayed over the various thematic classifications. Other ancillary data, (the NWI and stream and road network data )were utilized extensively with the TIFF data to assist in cover type identification.
- 4) *Refinement-reclassification of spectral class to vegetative condition.* This step begins the process of winnowing the scene into identifiable and unidentifiable, or probable spectral classes. Once the analyst was confident of the relationship between spectral cluster and land cover class that class is masked out of succeeding classification iterations. Once the probable spectral classes were identified, separate classifications were performed where each class partitioned into many spectral classes and, if possible, those classes are related to probable land cover types and masked out. Further refinement of spectral cluster/land cover type was accomplished through the use of ancillary data as logical operators. For example, deep shadows in mountainous terrain typically are confused with water signatures. By using a digital elevation model, the analyst can overlay that spectral class on all slopes less than 1% and quickly ascertain those areas which are too steep to pond water.
- 5) *Field verification of probable spectral-vegetation classes.* If the analyst cannot confidently relate spectral cluster to land cover class, another field visit was often necessary to uncover the spectral cluster identity.

- 6) *Editing the refined coverage.* As a last step in the classification phase the analyst used on screen editing of those areas which are too obscure to classify by conventional image processing techniques. Typically, these were the cloud, cloud shadow, or smoke obscured areas. Aerial photo interpretation of recent aerial photography became the interpretation basis for the classification within these obscured regions.
- 7) *Accuracy assessment* Accuracy assessment techniques and procedures are available in a manuscript by Bruner and Kiilsgaard, listed in the citation information of section I.

### III. *Spatial Data Organization Information*

*Native Data Structure:* spatial vector

### IV. *Spatial Reference Information*

*Geographic Coordinate Units:* Degrees, minutes and decimal seconds

*Map Projection Name:* Lambert

*Map Projection Description:*

*Projection:* Lambert

*Units:* meters

*Spheroid:* GRS 1980

*Datum:* NAD83

*Parameters:*

*1<sup>st</sup> standard parallel:* 43 0 0.000

*2<sup>nd</sup> standard parallel:* 45 30 0.000

*central meridian:* -120 30 0.000

*latitude of projections origin:* 41 45 0.000

*false easting (meters):* 400000.000

*false northing (meters)* 0.0

*Distance Resolution:* 25 meters

*Altitude Resolution:* N/A

### V. *Entity and Attribute Information*

#### *Attribute Labels*

VALUE	CLASS_NAME
32	<i>Sitka Spruce-W. Hemlock Maritime Forest</i>
33	<i>Mountain Hemlock Montane Forest</i>
34	<i>True Fir-Hemlock Montane Forest</i>
35	<i>Montane Mixed Conifer Forest</i>
37	<i>Shasta Red Fir-Mountain Hemlock Forest</i>
39	<i>Whitebark-Lodgepole Pine Montane Forest</i>
40	<i>Ponderosa Pine Dominant Mixed Conifer Forest</i>
41	<i>Northeast Ore. Mixed Conifer Forest</i>
42	<i>Jeffery Pine Forest and Woodland</i>
43	<i>Serpentine Conifer Woodland</i>
44	<i>Lodgepole Pine Forest and Woodland</i>
45	<i>Subalpine Fir-Lodgepole Pine Montane Conifer</i>
46	<i>Coastal Lodgepole Forest</i>
49	<i>Douglas Fir-W. Hemlock-W. Red Cedar Forest</i>
50	<i>Douglas Fir-Port Orford Cedar Forest</i>
51	<i>Douglas Fir-Mixed Deciduous Forest</i>

52	<i>Douglas Fir-White Fir/Tanoak-Madrone Mixed Forest</i>
53	<i>Douglas Fir/White Oak Forest</i>
54	<i>Ponderosa Pine Forest and Woodland</i>
56	<i>Douglas Fir Dominant-Mixed Conifer Forest</i>
57	<i>Ponderosa Pine/White Oak Forest and Woodland</i>
58	<i>Ponderosa Pine-W. Juniper Woodland</i>
59	<i>Ponderosa-Lodgepole Pine on Pumice</i>
61	<i>Western Juniper Woodland</i>
63	<i>Red Alder Forest</i>
64	<i>Red Alder-Big Leaf Maple Forest</i>
65	<i>Alder/Cottonwood Riparian Gallery</i>
66	<i>Aspen Groves</i>
67	<i>Mixed Conifer/Mixed Deciduous Forest</i>
68	<i>Cottonwood Riparian Gallery</i>
72	<i>Siskiyou Mtns Mixed Deciduous Forest</i>
75	<i>Oregon White Oak Forest</i>
77	<i>South Coast Mixed Deciduous Forest</i>
85	<i>Siskiyou Mtns Serpentine Shrubland</i>
87	<i>Hawthorn-Willow Shrubland</i>
89	<i>Manzanita Dominant Shrubland</i>
90	<i>Mountain Mahogany Shrubland</i>
91	<i>Sagebrush Steppe</i>
93	<i>Low-Dwarf Sagebrush</i>
95	<i>Salt Desert Scrub Shrubland</i>
96	<i>Big Sagebrush Shrubland</i>
97	<i>Bitterbrush-Big Sagebrush Shrubland</i>
103	<i>Northeast Ore. Canyon Grassland</i>
105	<i>Subalpine Grassland</i>
106	<i>Forest-Grassland Mosaic</i>
110	<i>Subalpine Parkland</i>
112	<i>Modified Grassland</i>
113	<i>Coastal Strand</i>
114	<i>Wet Meadow</i>
121	<i>Grass-shrub-sapling or Regenerating young forest</i>
122	<i>Alkali Playa</i>
124	<i>Urban</i>
125	<i>Agriculture</i>
126	<i>Exposed Tidal Flat</i>
127	<i>Lava Flow</i>
128	<i>Coastal Dunes</i>
129	<i>Alpine Fell-Snowfields</i>
130	<i>Open Water</i>
135	<i>Palustrine Forest</i>
136	<i>Palustrine Shrubland</i>
137	<i>Estuarine Emergent</i>
138	<i>Palustrine Emergent</i>
200	<i>NWI Palustrine Forest</i>
201	<i>NWI Palustrine Shrubland</i>
202	<i>NWI Estuarine Emergent</i>
203	<i>NWI Palustrine Emergent</i>



## **VI. Distribution Information**

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## **VII. Metadata Reference Information**

*Metadata Creation Date:* 19990102

*Metadata Standard Name:* Metadata Standards for Gap Analysis

*Metadata Contact:* Chris Kiilsgaard

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