USDA Natural Resources Conservation Service

Ecological site AX002X02X003
Portland Basin Bogs and Fens

Last updated: 12/03/2024
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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 002X–Willamette and Puget Sound Valleys

The Willamette and Puget Sound Valleys Major Land Resource Area (MLRA 2) is in western parts of Washington and Oregon. It occupies a forearc basin between the Coast Ranges and the Cascade Mountain volcanic arc. The northern part contains Pleistocene drift, outwash, and lacustrine and glaciomarine deposits associated with continental glaciers. The southern part contains Late Pleistocene deposits from glacial outburst floods (Missoula Floods).

Climate is mild and moist, and the growing season is long. Mean annual precipitation ranges from 20 to 60 inches, received mostly in fall, winter, and spring. Summers are dry. The soil temperature regime is mesic, and the soil moisture regimes are xeric and aquic.

Most sites in this MLRA can support forested vegetation, but some were maintained as prairie, savanna, or woodland through cultural burning prior to Euro-American settlement. Puget Sound has a moderating effect on temperatures, and humidity can be higher in the northern part of the MLRA. Douglas-fir (Pseudotsuga menziesii) is widespread throughout. Oregon white oak (Quercus garryana) is common on uplands in the south and on warm, exposed or droughty sites in the north. Pacific madrone grows in areas close to saltwater. Western hemlock (*Tsuga heterophylla*) is codominant with Douglas-fir in the north. Flood plains typically contain Brayshaw black cottonwood (Populus balsamifera ssp. trichocarpa) and red alder (Alnus rubra). Oregon ash (Fraxinus latifolia) is typical of forested wetlands in the south.

Forestry, urban development, and cultivated agriculture are currently the most extensive land uses (USDA, Agriculture Handbook 296, 2022).

LRU notes

The Portland Basin and Hills Land Resource Unit (LRU B) is in southwestern Washington and northwestern Oregon. The LRU extends north to the Cowlitz River and transitions to the Willamette Valley in the south. The Columbia River Gorge limits the eastern extent, and influence of tidewater at Cathlamet identifies the northwestern extent. Elevation ranges from sea level to about 2,000 feet. Major landforms include glaciofluvial terraces along the Columbia River, as well as residual hills and foothills surrounding the basin. Minor areas of Columbia River flood plain are present in Washington and more extensively in Oregon. Residual hills are composed primarily of Quaternary-Pliocene and Tertiary volcanic and sedimentary rocks. The lower-relief basin is composed primarily of sediment from catastrophic Quaternary glacial flooding from Glacial Lake Missoula.

The Columbia River splits this LRU between Oregon and Washington.

In Washington, mean annual precipitation ranges from 35 to 60 inches. Most falls as rain between October and May. The frost-free period ranges from 160 to 220 days. Locations near the Columbia River Gorge experience strong winds and infrequent ice storms with little winter snow. Average daily maximum temperatures in summer at

Vancouver, Washington, are 1 to 3 degrees F warmer compared to Seattle or Olympia, Washington (Agricultural Climate Information System, 2007a, 2007b).

Oregon white oak and Douglas-fir are common north of the Columbia River in Washington. Western redcedar and western hemlock grow in areas of higher moisture, at higher elevations, or on protected aspects.

Ecological site concept

These plant communities typically grow in depressional areas that have an accumulation of undecomposed or partially decomposed organic matter and a high water table. These general kinds of bog and fen wetlands are distinguished by pH, nutrient availability, and hydrologic dynamics. Fens have groundwater within the rooting zone of vascular plants. Bogs have peat built up above the influence of groundwater. The vegetation in true bogs is limited by the water available from precipitation and is only in areas of high precipitation. The soils generally have a water table at or near the soil surface for much of the winter and spring, and the water table is often at or within a few feet of the soil surface for the remainder of the year. These soils are typically nutrient-poor and acidic.

This site can be compared to the Puget Lowlands Bog and Fens site in LRU A, which is similar but has lower summer temperatures and higher amounts of summer precipitation. The climate may be moister during the growing season in LRU A, leading to a shorter recovery between disturbances than in LRU B.

Associated sites

AX002X02X007	**Portland Basin Wet Forest**
AX002X02X008	**Portland Basin Riparian Forest**

Similar sites

AX002X01X003	**Puget Lowlands Peat Wetlands**
R002XN603WA	**Bog or Fen**

Table 1. Dominant plant species

Tree	(1) *Pinus contorta var. contorta*
Shrub	(1) *Ledum groenlandicum*
Herbaceous	(1) *Carex*

Legacy ID

R002XB003WA

Physiographic features

Table 2. Representative physiographic features

Landforms	(1) Depression (2) Swale
Flooding frequency	None
Ponding duration	Very long (more than 30 days)
Ponding frequency	None to frequent
Elevation	0–91 m
Slope	0–5%
Ponding depth	0–51 cm
Water table depth	0–20 cm

Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

Mean annual air temperature: 46 to 50 degrees Fahrenheit

Table 3. Representative climatic features

Frost-free period (characteristic range)	150-240 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	508-1,778 mm

Influencing water features

Wetland description

Palustrine–Emergent Wetland

Soil features

Surface textures: Gravelly sand, muck, and silt
Soil family textures: Sandy
Parent material: Herbaceous organic material, glacial drift, and alluvium
Soil depth: More than 60 inches
Soil drainage: Very poorly drained
Available water capacity in the top 40 inches: 0.6 to 36 in/in
pH in water: 5.1 to 6.5

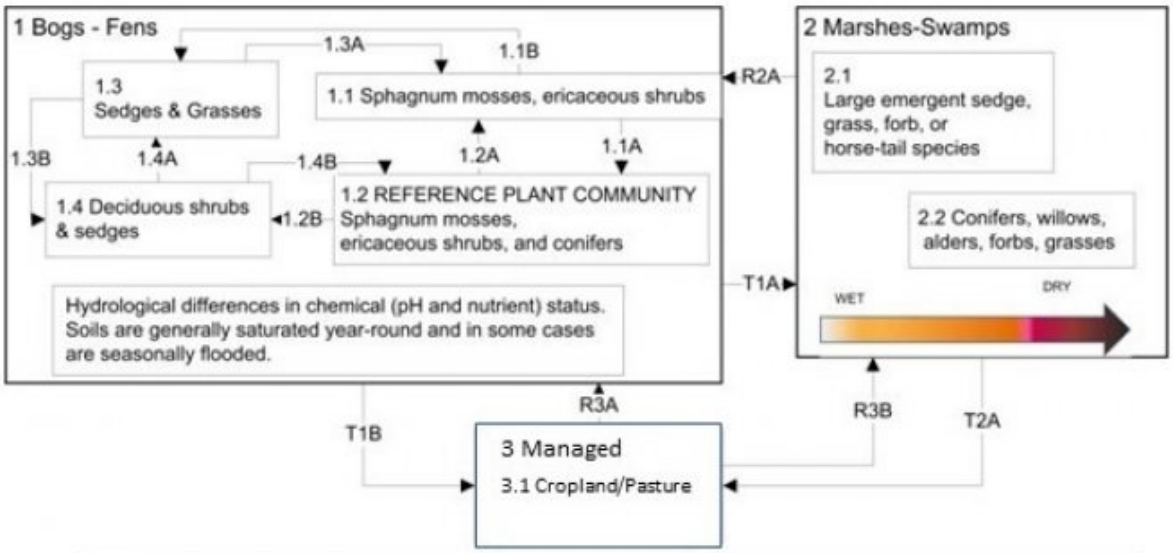
Ecological dynamics

These areas may have historically been kept free of extensive brush and tree cover by burning. Typical native plant species include Labrador tea (*Ledum groenlandicum*), salal (*Gaultheria shallon*), rose spirea (*Spiraea douglasii*), sedges (Carex spp.), and minor amounts of lodgepole pine (*Pinus contorta*).

These wetland plant communities grow primarily in organic soils or develop in organic soils overlying mineral material. These wetlands are typically patch communities in river valleys, in depressions, around lakes and marshes, or on slopes. Near saltwater, these organic soils are characterized by an abundance of sodium cations from oceanic precipitation.

Organic soils, the most common, are identified as poor or rich fens and bogs. The types are commonly intermixed. Sphagnum characterizes poor fens and bogs (pH <5.5). The two are categorized together here. “Brown mosses” and sedges characterize rich fens (pH >5.5). Mire profiles may be flat, raised (domed), or sloping. In Washington, however, most are flat with only localized hummock development.

State and transition model



LEGEND
1.1A, 2.1A, T2B =No Fire or Other Disturbance material
1.1B = Increased water
1.3A, 1.3B = Lack of disturbance, lowered fertility
1.4A = Brush control, increased water, fertility
1.4B = Restoration to original, lower water levels, lack of vegetative disturbance
1.2A, 2.3A, 2.4A, 2.2A, 2.3B = Fire or Brush Control or Other Disturbance
R2A, R3A, R3B = Restoration of water regime
T1A = Beaver dam/Impoundment, Dredging, Mining & Other increase in water flows
T1B, T2A = Drainage/Removal or reduction of water inflows & removal of woody

Soil Characteristics	Water Regime		Wetland Type	Vegetation Groups
> 40 cm (16 inches) fibric/ mesic peat	perennially saturated but local areas of surface drying are common	**+/- ombrotrophic environments (fed primarily by rainwater - hydrologically isolated) Nutrient poor Acidic: pH < 5.5**	Bogs	Sphagnum mosses, ericaceous shrubs, and conifers
			Poor Fens	
		minerotrophic environments (fed by surface water, or groundwater, or both) Groundwater-fed pH > 5.5	Fens	Deciduous shrubs, sedges, and brown mosses
Mineral soils or well-humified peat	Temporary shallow flooding (0.1–1.0 m) Significant water flow		Swamps	Conifers, willows, alders, forbs, grasses leafy mosses
	Temporary shallow flooding (0.1–1.0 m) or sub-irrigation		Meadows/ Wet Prairies	Sedge, grass, forb
	Protracted shallow flooding (0.1–2.0 m)		Marshes	Large emergent sedge, grass, forb, or horse-tail species
	Permanent deep flooding (0.5–2 m)		Shallow waters	Aquatic species Emergent vegetation < 10% cover

State 1
Reference

Community 1.1
Sphagnum Moss Mounds and Ericaceous Shrubs

The surface topography in this community consists of well developed hummocks and hollows that create a diverse array of drier hummock tops to wetter hollows. *Kalmia microphylla*, *Ledum groenlandicum*, and *Vaccinium oxycoccos* are commonly codominant.

Dominant plant species

- bog Labrador tea (*Ledum groenlandicum*), shrub
- western Labrador tea (*Ledum glandulosum*), shrub
- alpine laurel (*Kalmia microphylla*), shrub
- small cranberry (*Vaccinium oxycoccos*), shrub
- sphagnum (*Sphagnum*), other herbaceous

Community 1.2
Open Fens, Peatlands, and Shrubswamps

This plant community grows adjacent to open fens, peatlands and shrub swamps. The tree layer is dominated by *Pinus contorta*. *Tsuga heterophylla*, *Thuja plicata*, or both may be abundant in drier sites but are suppressed or killed in waterlogged soils. *Pinus contorta* is also killed by extended flooding. The dense shrub layer is comprised of *Gaultheria shallon*, *Ledum glandulosum*, *Vaccinium oxycoccos*, *Kalmia microphylla*, and *Empetrum nigrum*. Most trees and shrubs grow on elevated microsites, such as decaying logs, stumps, and old root wads. The herb layer is dominated by *Carex obnupta*, *Blechnum spicant*, *Pteridium aquilinum*, and *Sanguisorba officinalis*. Sphagnum mosses are conspicuous. Stands are typically stunted in stature but are subject to windthrow during severe winter storms. Stands appear to be self- perpetuating in the absence of major disturbance.

Dominant plant species

- beach pine (*Pinus contorta var. contorta*), tree
- western hemlock (*Tsuga heterophylla*), tree
- western redcedar (*Thuja plicata*), tree
- salal (*Gaultheria shallon*), shrub
- western Labrador tea (*Ledum glandulosum*), shrub
- bog Labrador tea (*Ledum groenlandicum*), shrub
- small cranberry (*Vaccinium oxycoccos*), shrub
- alpine laurel (*Kalmia microphylla*), shrub
- black crowberry (*Empetrum nigrum*), shrub
- western brackenfern (*Pteridium aquilinum*), other herbaceous
- slough sedge (*Carex obnupta*), other herbaceous
- deer fern (*Blechnum spicant*), other herbaceous
- great burnet (*Sanguisorba officinalis*), other herbaceous

Community 1.3
Emergents

This community consists of wetlands or the portion of wetlands dominated by emergent (mostly graminoid) species where standing water is seasonally or, more typically, semipermanently present. It is confined to limited areas in suitable flood-plain or basin topography. Typical locations are along the borders of ponds, lakes, or reservoirs that have more open basins and a permanent water source throughout all or most of the year. Most areas are semipermanently flooded, but some marshes have seasonal hydrologic flooding. Water is at or above the surface for most of the growing season. The community is dominated by emergent herbaceous species, mostly grasslike species (Carex and grasses) but also some forbs. Grasses are more abundant on the drier portions of the wetland.

Community 1.4

Shrub Encroachment

This community consists of areas that have increased growth of woody shrubs and small trees.

Dominant plant species

- bog Labrador tea (*Ledum groenlandicum*), shrub
- western Labrador tea (*Ledum glandulosum*), shrub
- alpine laurel (*Kalmia microphylla*), shrub
- salal (*Gaultheria shallon*), shrub
- black crowberry (*Empetrum nigrum*), shrub

Pathway 1.1A
Community 1.1 to 1.2

This pathway represents an absence of fire or other disturbances that allows the cover of shrubs and trees to increase.

Pathway 1.1B
Community 1.1 to 1.3

This pathway represents a change in water regime to more inflow and outflow from the site or to increased water depth. Causes can include beaver dam impoundment, dredging, mining activity, or changes in local surface hydrology.

Pathway 1.2A
Community 1.2 to 1.1

This pathway represents fire, woody harvest, or other disturbances that removes conifers.

Pathway 1.2B
Community 1.2 to 1.4

This pathway represents change in water regime to more inflow and outflow from the site or to increased water depth. Causes may include beaver dam impoundment, dredging, mining activity, or changes in local surface hydrology.

Pathway 1.3A
Community 1.3 to 1.1

This pathway represents restoration of lower water levels and reduction in the amount of water moving into and out of the site. Also included are a reduction in disturbance by fire or mechanical means and a diminishing of fertility caused by reduction in water flows or fertilizer application.

Pathway 1.3B
Community 1.3 to 1.4

This pathway represents limited restoration of lower water levels and reduction in water moving into and out of the site. Also included are limited reduction in disturbance, which allows the shrub layer to reestablish, and limited diminishing of fertility caused by reduction in water flows or fertilizer application.

Pathway 1.4B
Community 1.4 to 1.2

This pathway represents restoration of lower water levels and reduction in water moving into and out of the site. Also included are reduction of disturbance, by either fire or mechanical means, and diminishing of fertility caused by reduction in water flows or fertilizer application.

Pathway 1.4A
Community 1.4 to 1.3

This pathway represents increases in disturbance, water levels, or site fertility. Change in water regime can include increased inflow and outflow from the site or increased water depth. Causes may include beaver dam impoundment, dredging, mining activity, or changes in local surface hydrology. Disturbance to vegetation may occur through fire or mechanical disturbance. Fertility may increase because of the chemical composition of the increased water flow or because of decomposition of vegetation.

State 2
Hydrologically Altered

Marshes and swamps

Community 2.1
Disturbance Affected Graminoids

The major agents of wetland disturbances in this community are beavers, floods, landslides, tsunamis, windthrow, fire, and people. People affect the water regime with impoundments, drainage systems, cropping, road building, dredging, mining, and other changes. These wetland disturbance agents shape the development of different types of vegetation by mediating the supply, movement, and chemistry of water and sediments. This community consists of wetlands or the portion of wetlands dominated by emergent (mostly graminoid) species where standing water is seasonally or, more typically, semipermanently present. Depending on the water regime, these plant communities are dominated by emergent herbaceous species, mostly graminoids (Carex, Scirpus, Schoenoplectus, Eleocharis, Juncus, and *Typha latifolia*) but also some forbs. The most serious invasive species of emergent marsh and wet prairie are *Phalaris arundinacea* (reed canarygrass), *Agrostis stolonifera* (redtop or creeping bentgrass), *Poa pratensis* (Kentucky bluegrass), and *Alopecurus pratensis* (meadow foxtail).

Dominant plant species

- sedge (*Carex*), grass
- bulrush (*Scirpus*), grass
- bulrush (*Schoenoplectus*), grass
- spikerush (*Eleocharis*), grass
- rush (*Juncus*), grass
- broadleaf cattail (*Typha latifolia*), grass

Community 2.2
Shrub Swamps

Shrub swamps and wetlands are dominated by shrubs that tolerate a variable water regime. Plant community structure ranges from scattered shrubs that have an intervening herbaceous component to dense, impenetrable stands of Salix, *Cornus sericea*, and *Spiraea douglasii*. Depending on water regime and disturbances, this plant community is seral to alder and conifer forests.

Dominant plant species

- willow (*Salix*), shrub
- redosier dogwood (*Cornus sericea*), shrub
- rose spirea (*Spiraea douglasii*), shrub

State 3
Converted

Community 3.1
Cropland and Pastureland

This community grows in areas where dikes and artificial drainage allow for development of farmland. Dikes can also lead to development of freshwater meadows.

Transition T1A
State 1 to 2

This transition represents a change in water regime to more inflow and outflow from the site or to increased water depth. Causes include beaver dam impoundment, dredging, mining activity, or changes in local surface hydrology.

Transition T1B
State 1 to 3

This transition represents drainage of an area to lower the water table enough to grow the selected crop. Practices can include ditching, installing tile drainage, diverting water inflows, and removing woody material.

Restoration pathway R2A
State 2 to 1

This transition represents reduction in period of inundation and restoration of freshwater influence through such processes as accretion of sediment and decaying organic matter.

Transition T2A
State 2 to 3

This transition represents drainage of an area to lower the water table enough to grow the selected crop. Practices can include ditching, installing tile drainage, diverting water inflows, and removing woody material.

Restoration pathway R3A
State 3 to 1

This restoration pathway represents restoring the water regime through depth control structures and/or management of water inflows and outflows.

Restoration pathway R3B
State 3 to 2

This restoration pathway represents restoring the water regime through depth control structures and/or management of water inflows and outflows.

Additional community tables

Inventory data references

Relationship to Other Established Classifications

National Vegetation Classification Group: G284 North Pacific Bog and Acidic Fen Group and A2514 Bog and Acidic Fen Alliance

Washington Department of Natural Resources Ecological Systems of Washington State: North Pacific Bog and Fen

Other references

United States National Vegetation Classification. 2016. United States National Vegetation Classification Database, V2.0. Federal Geographic Data Committee, Vegetation Subcommittee, Washington DC. (accessed 20 October 2020).

Washington Department of Natural Resources, Natural Heritage Program. 2015. Ecological systems of Washington State. A Guide to identification.

Contributors

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Approval

Kirt Walstad, 12/03/2024

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	05/14/2025
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
