USDA Natural Resources
Conservation Service

Ecological site AX001X01X001
Temperate Flood Plain Shrubland

Last updated: 5/15/2025
Accessed: 04/10/2026

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): 001X–Northern Pacific Coast Range, Foothills, and Valleys

This area consists of a long and narrow range of mountains with associated foothills and valleys that parallels the Pacific Ocean. This area is entirely within the Pacific Border Province of the Pacific Mountain System in Oregon and Washington. MLRA 1 is bounded on the north by the highest elevations of the Olympic Mountains and the strait of Juan de Fuca, and by the Klamath Mountains on the south. The Washington portion of this MLRA is primarily composed of young Tertiary sedimentary rocks (siltstone and sandstone) mixed with some volcanic rocks of the same age. Glacial till and outwash deposits are also found in the northern half of this area in Washington. Much of this area is accreted terrane formed by tectonic processes. The average annual precipitation ranges from 60 to 200 inches (1,525 to 5,580 millimeters), increasing with elevation. Most of the precipitation in this area occurs during low-intensity, Pacific frontal storms and is evenly distributed throughout fall, winter, and spring.

The dominant soil orders in this MLRA are Andisols, Inceptisols, and Ultisols. Soil depths broadly range from shallow to very deep. Soils are primarily well drained, however poorly drained soils may be found in depressional areas and on alluvial floodplains. Surface textures are typically medial and loamy or clayey. Soils in this area dominantly have a mesic or frigid temperature regime and a udic moisture regime. Soils with aquic moisture regimes and cryic temperature regimes also occur.

Ecological site concept

Temperate Flood Plain Shrubland sites occur on low terraces in river valleys that are frequently flooded, i.e., the average probability of flooding is greater than 50 percent for any given year. Frequent flooding from alpine snowmelt creates a nutrient poor substrate that favors pioneering species well-adapted to nitrogen deficient environments. Black cottonwood (*Populus balsamifera* ssp. trichocarpa) and red alder (*Alnus rubra*) are the most common climax trees on this site. Willow (Salix spp.) are common in the understory shrub layer, accompanied by California blackberry (*Rubus ursinus*), locally known as trailing blackberry. Coastal hedgenettle (Stachys chamissonis) and Virginia strawberry (*Fragaria virginiana*) are common forbs occurring on this site.

Associated sites

AX001X01X200	**Temperate Wet Meadow** Temperate Wet Meadow sites are located on depressions and seeps adjacent to or surrounded by Temperate Flood Plain Shrublands. Temperate Wet Meadow sites are indicated by lack of tree cover.

Similar sites

F004AA001WA	**Udic Flood Plain Forest** Temperate Flood Plain Shrublands are located between stream channels and Isomesic Udic Flood Plain Forest sites. Temperate Flood Plain Shrublands are indicated by greater relative shrub cover versus tree cover.
AX001X01X002	**Mesic Udic Flood Plain Forest** Temperate Flood Plain Shrublands are located between stream channels and Mesic Udic Flood Plain Forest sites. Temperate Flood Plain Shrublands are indicated by greater relative shrub cover versus tree cover.

Table 1. Dominant plant species

Tree	(1) *Populus balsamifera ssp. trichocarpa* (2) *Alnus rubra*
Shrub	(1) *Salix* (2) *Rubus spectabilis*
Herbaceous	(1) *Stachys chamissonis* (2) *Fragaria virginiana*

Legacy ID

F001XA001WA

Physiographic features

Temperate Flood Plain Shrubland sites primarily occur on the flood plains and lowest terraces of river valley systems. These sites are located directly adjacent to rivers and often receive flood water from the adjacent rivers, particularly during the spring and summer snowmelt. Due to their position in the flood plain and on low terraces, intense flood events and readily scour away the mineral soil surface and remove significant amounts of vegetation from the site. Temperate Flood Plain Shrubland sites exist across a wide elevational gradient since flood influence is the primary contributor to site character.

Table 2. Representative physiographic features

Landforms	(1) River valley > Flood plain (2) River valley > Terrace
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Rare to frequent
Ponding frequency	None
Elevation	50–1,100 m
Slope	0–15%
Water table depth	150 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

This site occurs in a in isomesic, mesic, and frigid temperature regimes, and udic moisture regimes. Precipitation arrives mostly via low-intensity, Pacific frontal storms. Precipitation is unevenly distributed, with the lowest amounts on the leeward side of the Coast Range mountains. Precipitation falls largely as snow in higher elevations. Precipitation is evenly distributed throughout the fall, winter, and spring, while summers are dry. Air temperatures vary significantly along the elevation gradient.

Table 3. Representative climatic features

Frost-free period (characteristic range)	90-240 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	991-2,997 mm

Influencing water features

This site is located adjacent to stream channels and is subject to flooding. Frequency and duration of flooding events varies along with interannual variations in seasonal precipitation. Dominant plants must be able to tolerate periods of flooding and saturated soil conditions.

Soil features

The soils that support this ecological site span a wide range of elevations and therefore temperatures. Muscott, Fourstream, and Steeplerock soils are somewhat excessively drained, very deep, formed from mixed geology alluvium, and are found on flood plains or alluvial terraces in river valleys. Saturated hydraulic conductivity is very high throughout. They have a rare, occasional, or frequent flooding frequency. These soils have a texture class of sandy loam, loamy sand, or sand throughout and greater than 35 percent rock fragments throughout the control section. These sites are frequently disturbed by flooding which is the main limiting factor to plant growth, although they also have a relatively low available water capacity. Although representative of this site, these soils may exist across multiple ecological sites because of naturally variable slope, texture, rock fragments, and pH. An on-site soil pit and the most current ecological site key are necessary to classify a site.

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Extremely gravelly sandy loam (2) Loamy sand (3) Very cobbly sand
Drainage class	Somewhat excessively drained
Soil depth	150 cm
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	0.41–2.69 cm
Soil reaction (1:1 water) (0-25.4cm)	4.5–5.5
Subsurface fragment volume <=3" (0-50.8cm)	5–65%
Subsurface fragment volume >3" (0-50.8cm)	0–40%

Ecological dynamics

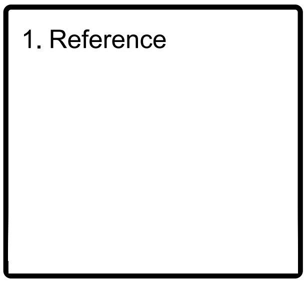
Temperate Flood Plain Shrubland sites are frequently disturbed by flooding events. Alpine snowmelt generates large amounts of water and may result in high-intensity floods capable of scouring the soil surface to bare gravels. Flooding events create a very nutrient-poor substrate. Due to the high frequency of disturbance events, this site is primarily dominated by colonizing species, including black cottonwood (*Populus balsamifera* ssp. trichocarpa) and red alder (*Alnus rubra*). Both species have the capacity for nitrogen fixation. Red alder forms symbioses with Frankia species in its root nodules, while black cottonwood hosts a variety of endophytic diazotrophic species (Doty et al., 2016). Nitrogen-fixing trees contribute available nitrogen to the system through litter addition and root exudates. Increased soil nitrogen levels promote primary productivity of other species on the site.

In the immediate aftermath of a surface scouring flooding event, willow species (Salix spp.) are generally the first to recruit to the site. The most common willow species found on this site are Scouler's willow (*Salix scouleriana*) and Sitka willow (*Salix sitchensis*). While willow regenerates as the top canopy stratum, dwarf fireweed (*Chamerion latifolium*), horsetail (Equisetum spp.), and bentgrass (Agrostis spp.) establish in the yet sparse understory. Within a few years, red alder and black cottonwood recruits have begun to establish. Both red alder and black cottonwood require significant amounts of sunlight to reach them to successfully germinate. As trees recruit to the site, the understory community begins to develop. California blackberry (*Rubus ursinus*), locally known as trailing blackberry, and Virginia strawberry (*Fragaria virginiana*) commonly establish in the understory. As time progresses, black cottonwood forms an overstory canopy and the understory becomes more diverse, consisting of a mix of shrubs, forbs, grasses, and regenerating conifers. In this reference community, salmonberry (Rubus spectabils) is common. While conifer regeneration will often begin to occur at this point, frequent recurrence of flooding generally prevents conifers from successfully establishing on this site.

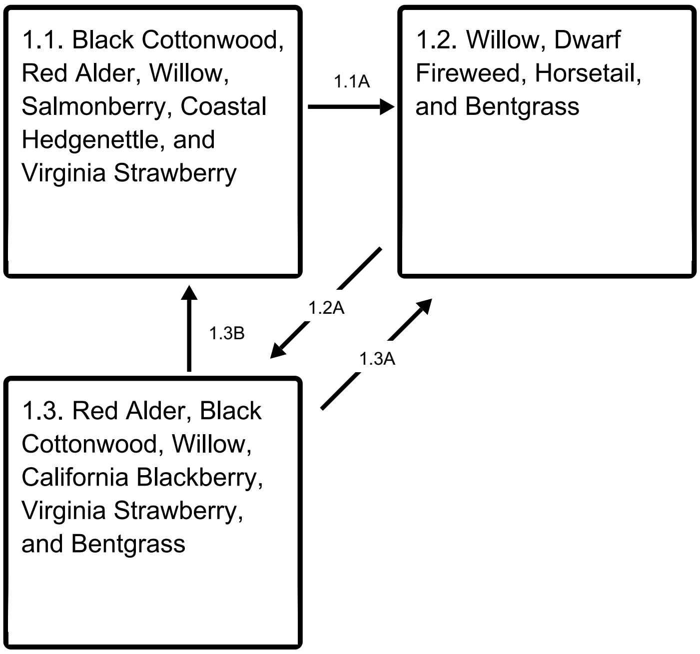
Windthrow events are a potential source of disturbance on this site. Blowdown events may impact individual trees or entire stands, depending on severity. Black cottonwood is particularly prone to windthrow due to its high susceptibility to rot. Blown-down logs trap sediment, accelerating the accumulation of fine particulate matter. Black cottonwood commonly regenerates asexually and may recruit through root suckering on fallen logs (Steinberg, 2001). Black cottonwood also has the capacity for coppice sprouting after top-kill, whether resulting from windthrow or fire events. The influences of fire on these riparian sites are not yet fully understood. High soil moisture and poor fuel conditions inhibit fires on this site. Fires have previously been observed burning in upland areas, stopping at the edge of riparian zones (Agee, 1993). If this site does burn, it certainly experiences a very high fire-return interval, greater than 100 years (FEIS, 2012). Wildfire occurrence may be limited to prolonged periods of drought. If they occur, fires are typically mixed to high intensity, often stand-replacing. Stand-replacing wildfires open the canopy and favor the establishment of pioneering, shade-intolerant species. Wildfire events tend not to produce enduring effects on this site due to the much higher frequency of flooding events.

State and transition model

Ecosystem states



State 1 submodel, plant communities



1.1A - high intensity disturbance

1.2A - time without disturbance

1.3B - time without disturbance

1.3A - high intensity disturbance

State 1
Reference

The Reference state is comprised of three communities is varying stages of regeneration. Communities in the reference state range from a sparse, emergent understory of shrubs, forbs, and grasses that is found in the early aftermath of disturbance, to mature stands of deciduous trees and shrubs.

Dominant plant species

- black cottonwood (*Populus balsamifera ssp. trichocarpa*), tree
- red alder (*Alnus rubra*), tree
- willow (*Salix*), shrub
- California blackberry (*Rubus ursinus*), shrub
- salmonberry (*Rubus spectabilis*), shrub

- bentgrass (*Agrostis*), grass
- coastal hedgenettle (*Stachys chamissonis*), other herbaceous
- horsetail (*Equisetum*), other herbaceous
- Virginia strawberry (*Fragaria virginiana*), other herbaceous

Community 1.1
Black Cottonwood, Red Alder, Willow, Salmonberry, Coastal Hedgenettle, and Virginia Strawberry

Structure: deciduous forest with a mix of shrubs, forbs and grasses and conifer regeneration in the understory Black cottonwood and red alder are the dominant tree species in the reference community. Individual mortality of mature trees, especially black cottonwood, may occur. Tree death creates small canopy openings to allow deciduous regeneration. Coniferous species may be in the early stages of recruitment and regeneration in the understory, but mature individuals are generally not present. The understory consists of diverse shrub, forb, and grass layers.

Community 1.2
Willow, Dwarf Fireweed, Horsetail, and Bentgrass

Structure: sparse understory of emergent shrubs, forbs, and grasses This community is found in the wake a severe flooding event. Willow quickly establishes where the canopy is removed. Red alder and black cottonwood seeds may begin to germinate in areas where sunlight continues to reach the mineral soil surface. If downed cottonwood individuals remain on the site, regeneration may occur through sprouting.

Community 1.3
Red Alder, Black Cottonwood, Willow, California Blackberry, Virginia Strawberry, and Bentgrass

Structure: shrubby single story with scattered understory of trees, shrubs, forbs, and grasses This community is an intermediate seral stage. As time progresses, red alder and black cottonwood can successfully establish. As further time passes, black cottonwood will begin to form an overstory canopy layer. The shrub and forb layers gradually diversify as slow-growing species successfully regenerate.

Pathway 1.1A
Community 1.1 to 1.2

High-intensity disturbance. Severe flooding event that removes existing vegetation and scours the mineral soil surface.

Pathway 1.2A
Community 1.2 to 1.3

Time without disturbance allows regeneration, growth, and progression to a later seral stage.

Pathway 1.3B
Community 1.3 to 1.1

Time without disturbance allows regeneration, growth, and progression to a later seral stage. Vertical stratification increases and forb diversity increases. Individual tree mortality creates varied-age patches.

Pathway 1.3A
Community 1.3 to 1.2

High-intensity disturbance. Severe flooding event that removes existing vegetation and scours the mineral soil surface.

Additional community tables

Other references

Breemen, Nico van. "How Sphagnum Bogs down Other Plants." Trends in Ecology & Evolution 10, no. 7 (July 1, 1995): 270–75. 90007-1.

Dwire, K. and Kauffman, J. 2003. Fire and Riparian Ecosystems in Landscapes in the Western United States. Forest Ecology and Management, Vol. 178 pg. 61-74.

Franklin, Jerry F.; Cromack, Kermit, Jr.; Denison, William; [and others]. 1981. Ecological characteristics of old-growth Douglas-fir forests. Gen. Tech. Rep. PNW-118. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station. 48 p. [7551]

Gavin, D., Brubaker, L. (2015). The Modern Landscape of the Olympic Peninsula. In: Late Pleistocene and Holocene Environmental Change on the Olympic Peninsula, Washington. Ecological Studies, vol 222. Springer, Cham. https://doi.org/10.1007/978-3-319-11014-1_1

Geertsema, Marten & Pojar, James. (2007). Influence of landslides on biophysical diversity — A perspective from British Columbia. Geomorphology. 89. 55-69. 10.1016/j.geomorph.2006.07.019.

Goheen, E.M. and Willhite, E.A. 2006. Field Guide to Common Diseases and Inspect Pests of Oregon and Washington Conifers. Portland, Oregon: USDA Forest Service, Pacific Northwest Region R6-NR-FID-PR-01-06.

Hanley, D.P and D.M. Baumgartner. 2002. Forest Ecology in Washington. Washington State University Extension Publishing. Technical Report EB 1943.

Hanson, E.J., D.L. Azuma and B.A. Hiserote. 2002. Site Index Equations and Mean Annual Increment Equations for Pacific Northwest Research Station Forest Inventory and Analysis Inventories, 1985-2001. USDA Forest Service Pacific Northwest Research Station, Research Note PNW-RN-533.

Hemstrom, M., Franklin, J. 1982. Fire and Other Disturbances of the Forests in Mount Rainier National Park. Quaternary Research, Vol 18 pp 32-61.

James K. Agee and Mark H. Huff. 1987. Fuel succession in a western hemlock/Douglas-fir forest. Canadian Journal of Forest Research. 17(7): 697-704. https://doi.org/10.1139/x87-112

Nielsen, E. M., R. L. Brunner, C. Copass and L. K. Wise, 2021. Olympic National Park map class descriptions. National Park Service, Fort Collins.

Pojar J., and MacKinnon. 1994. Plants of the Pacific Northwest Coast. Lone Pine, Vancouver, British Columbia. 528 pages.

PRISM Climate Group, Oregon State University, http://prism.orgeonstate.edu, visited October 2023.

Reed Wendel, Darlene Zabowskl "Fire History within the Lower Elwha River Watershed, Olympic National Park, Washington," Northwest Science, 84(1), 88-97, (1 January 2010)

Rochefort, R.M. and Peterson, D.L. 1996. Temporal and Spatial Distribution of Trees in Subalpine Meadows of Mount Rainier National Park. Arctic and Alpine Research, Vol. 28, No. 1 pp 52-59.

Seastedt, T.R., Adams, G.A. 2001. Effects of Mobile Tree Islands on Alpine Tundra Soils. Ecology, Vol 82 pp 8-17.

Smith, K., G. Kuhn, and L. Townsend. 2008. Culmination of Mean Annual Increment for Indicator Tree Species in the State of Washington. USDA-NRCS Technical Note Forestry-9.

United States Department of Agriculture, Forest Service, 2015. Silvics Manual Vol 1. http://na.fs.fed.us/spfo/pubs/silvics_manual/Volume_1/vol1_Table_of_contents.htm, visited December 2015.

United States Department of Agriculture, Natural Resources Conservation Service, and United States Department of the Interior, National Park Service. 2014. Ecological Site Descriptions for North Cascades National Park Complex, Washington.

United States Department of Agriculture, Natural Resources Conservation Service, and

United States Department of the Interior, National Park Service. Ecological Site Descriptions for Mount Rainier National Park, Washington.

Van Pelt, R. 2007. Identifying Mature and Old Forests in Western Washington. Washington State Department of Natural Resources, Olympia, WA. 104
Washington Department of Natural Resources, Natural Heritage Program. 2015. Ecological Systems of Washington State. A Guide to Identification.

Wood, David, and Moral, Roger del. "Mechanisms of Early Primary Succession in Subalpine Habitats on Mount St. Helens." Ecology 68, no. 4 (1987).

Zhao, Yunpeng, Chengzhu Liu, Simin Wang, Yiyun Wang, Xiaoqing Liu, Wanqing Luo, and Xiaojuan Feng. "'Triple Locks' on Soil Organic Carbon Exerted by Sphagnum Acid in Wetlands." Geochimica et Cosmochimica Acta 315 (December 2021): 24–37. https://doi.org/10.1016/j.gca.2021.09.028.

Contributors

Max Ross
Abigail Field
Alec Haulotte
Erin Kreutz
Erik Dahlke

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	04/10/2026
Approved by	Grant Petersen
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):**

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

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

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

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:

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

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

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

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:**

17. **Perennial plant reproductive capability:**