Ecological site F003XN940WA
Southern Washington Cascades Frigid Riparian Forest

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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): 003X–Olympic and Cascade Mountains

Steep mountains and narrow to broad, gently sloping valleys characterize this MLRA. A triple junction of two oceanic plates and one continental plate is directly offshore from Puget Sound. Subduction of the oceanic plates under the westerly and northwesterly moving continental plate contributes to volcanic activity in the Cascade Mountains. Movement among these plates has resulted in major earthquakes and the formation of large stratovolcanoes. The Cascade Mountains consist primarily of volcanic crystalline rock and some associated metasedimentary rock. The mean annual precipitation is dominantly 60 to 100 inches, but it is 30 to 60 inches on the east side of the Cascade Mountains. The soil orders in this MLRA are dominantly Andisols, Spodosols, and Inceptisols and minor areas of Entisols and Histosols. The soils are dominantly in the frigid or cryic temperature regime and the udic moisture regime. The soils generally are shallow to very deep, well drained, ashy to medial, and loamy or sandy. They are on mountain slopes and ridges.

Ecological site concept

This ecological site is on the flat, historic flood plains and terraces of river valleys. The soils that support this site have a seasonal high water table. Riparian ecological sites typically differ in topography, vegetation, geomorphology, and microclimate from areas of the surrounding uplands that support forest ecosystems (Dwire, 2003). The most common natural disturbance is flooding. The volume and longevity of the flooding determine the effect on the dynamics of the forest. The soils are in the frigid soil temperature regime and the udic soil moisture regime. They formed in alluvium derived from andesite mixed with volcanic ash. Growth of the forest is not limited by soil moisture because of the abundance of precipitation and the inherent water-holding properties of soils influenced by volcanic ash. Black cottonwood (Populus balsamifera ssp. trichocarpa) and western hemlock (Tsuga heterophylla) are the most common overstory species. Western redcedar (Thuja plicata), red alder (Alnus rubra), bigleaf maple (Acer macrophyllum), grand fir (Abies grandis), and Douglas-fir (Pseudotsuga menziesii) are present. During longer periods between major floods, conifers establish and the overstory becomes more diverse. With the absence of disturbance, it is expected that the maturation and succession of the vegetation will result in an old-growth conifer forest.

Associated sites

F003XN944WA	**Southern Washington Cascades Low Cryic Riparian Forest** Both ecological sites F003XN944WA and F003XN940WA are influenced by flood dynamics and have similar disturbance patterns; however, elevation distinguishes the sites. Ecological site F003XN940WA is at an elevation of 1,600 to 2,100 feet, and site F003XN944WA is at an elevation of more than 2,100 feet. Site F003XN944WA supports species more common at higher elevations, such as Pacific silver fir. The productivity of the forest on site F003XN940WA is higher as a result of the longer growing season, warmer temperatures, and reduced snowpack.

Similar sites

F003XN943WA	**Southern Washington Cascades Frigid Coniferous Forest** Ecological site F003XN940WA, Southern Washington Cascades Frigid Riparian Forest, is similar to site F003XN943WA, Southern Washington Cascades Frigid Coniferous Forest. Site F003XN940WA is in an earlier forest successional stage because of frequent disturbance. It is expected that over a long period of time without disturbance, ecological site F003XN940WA will mature to resemble site F003XN943WA.

Table 1. Dominant plant species

Tree	(1) *Populus balsamifera ssp. trichocarpa* (2) *Tsuga heterophylla*
Shrub	(1) *Mahonia nervosa*
Herbaceous	(1) *Goodyera oblongifolia*

Physiographic features

This ecological site is on flood plains and terraces of river valleys (elevation 1,600 to 2,100 feet) in Mount Rainier National Park. Slope commonly is 0 to 10 percent.

Table 2. Representative physiographic features

Landforms	(1) River valley > Flood plain (2) River valley > Terrace
Flooding frequency	None to rare
Ponding frequency	None
Elevation	490 – 640 m
Slope	0 – 10 %
Water table depth	50 – 180 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

Most of the annual precipitation is received in October through March. The mean annual precipitation is 75 to 84 inches, and the annual air temperature is 32 to 60 degrees F. Generally, the summers are temperate and dry and the winters are cool and wet.

Table 3 Representative climatic features

Frost-free period (characteristic range)	80-130 days

Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	1,910-2,130 mm

Influencing water features

This site is at low elevations on terraces and flood plains in Mount Rainier National Park. The site is not subject to ponding. Flooding is rare; however, 100- or 500-year floods may dramatically alter the landscape. The water table typically rises in spring and recedes in fall.

Soil features

Applicable soils: Carbon, Comet
Applicable soil map units in Mount Rainier National Park: 6100, 6101
The soils that support this ecological site are in the frigid soil temperature regime and udic soil moisture regime. The Carbon soils are moderately well drained, and the Comet soils are somewhat excessively drained. Both soils are very deep. The soils are on flood plains and terraces of river valleys. They formed in alluvium derived from andesite mixed with volcanic ash. The Carbon soils have a seasonal high water table at a depth of 20 to 40 inches at some time during the growing season. Both soils are subject to rare periods of flooding in April, May, October, and November. The Comet soils have more than 35 percent rock fragments in the control section. The soils are coarse textured and are primarily ashy loamy sand and ashy sandy loam. Podsolization in not evident because of the relatively young age of the soils. The soils have an umbric epipedon and may have a cambic horizon. Soil moisture is not a limiting factor to forest growth because of the abundance of precipitation and the inherent water-holding properties of soils influenced by volcanic ash. A thin organic horizon consisting of decomposing twigs, needles, and litter is on the soil surface. This horizon helps to protect the soils from wind and water erosion.

Table 4. Representative soil features

Parent material	(1) Alluvium – andesite (2) Volcanic ash
Surface texture	(1) Very gravelly, ashy sandy loam (2) Very cobbly, ashy loamy coarse sand (3) Extremely gravelly, ashy loamy sand
Drainage class	Moderately well drained to somewhat excessively drained
Soil depth	150 cm
Surface fragment cover <=3"	20 – 60 %
Surface fragment cover >3"	0 – 30 %
Available water capacity (Depth not specified)	7.37 – 15.49 cm

Soil reaction (1:1 water) (Depth not specified)	5.1 – 10
Subsurface fragment volume <=3" (Depth not specified)	0 – 60 %
Subsurface fragment volume >3" (Depth not specified)	0 – 60 %

Ecological dynamics

This ecological site is on flat, historic flood plains and terraces along rivers. The soils have a seasonal high water table. Riparian ecological sites typically differ in topography, vegetation, geomorphology, and microclimate from the surrounding uplands that support forest ecosystems (Dwire, 2003). The frequency of flooding is rare; however, the volume and longevity of the flooding determine the effect on the dynamics of the forest. Small, frequent periods of peak flow do not tend to impact the flow of the channels, but they commonly transport a considerable amount of sediment. Extreme rain-on-snow flooding and debris flows can alter the stream channels through incision or aggradation and remove existing vegetation along the flood plain, resulting in a stand-replacing event (Czuba, 2012).
Black cottonwood (Populus balsamifera ssp. trichocarpa) and western hemlock (Tsuga heterophylla) are the most common overstory species. Western redcedar (Thuja plicata), red alder (Alnus rubra), bigleaf maple (Acer macrophyllum), grand fir (Abies grandis), and Douglas-fir (Pseudotsuga menziesii) are present. Black cottonwood and red alder germinate most successfully on the bare mineral soil scoured by flooding.
The understory commonly is shrubby. It includes Cascade Oregon grape (Mahonia nervosa), vine maple (Acer circinatum), salmonberry (Rubus spectabilis), and devilsclub (Oplopanax horridus). Scattered areas of western rattlesnake plantain (Goodyera oblongifolia), ladyfern (Athyrium filix-femina), Canadian wildginger (Asarum caudatum), western brackenfern (Pteridium aquilinum), queencup beadlily (Clintonia uniflora), starry false lily of the valley (Maianthemum stellatum), and western swordfern (Polystichum munitum) are present. The shrubs may be less dense in the more flood-prone areas, allowing more light to reach the forest floor.
Location on the landscape is the most important factor determining species composition. Conifers are prevalent on the terraces and adjacent hillsides, and deciduous species are on the active flood plains that are subject to more frequent fluvial disturbances (Villarian, 2009). During longer periods between major floods, conifers establish and the overstory becomes more diverse. With the absence of disturbance, it is expected that the maturation and succession of the vegetation will result in an old growth conifer forest.

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 6. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height M	Canopy Cover (%)	Diameter Cm	Basal Area (square M/hectare)
Tree							
western hemlock	TSHE	*Tsuga heterophylla*	Native	–	–	–	–
western redcedar	THPL	*Thuja plicata*	Native	–	–	–	–
Douglas-fir	PSME	*Pseudotsuga menziesii*	Native	–	–	–	–
black cottonwood	POBAT	*Populus balsamifera ssp. trichocarpa*	Native	–	–	–	–
red alder	ALRU2	*Alnus rubra*	Native	–	–	–	–

Table 7. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (m)	Canopy Cover (%)

Forb/Herb					
redwood-sorrel	OXOR	*Oxalis oregana*	Native	0-1.8	0-50
sweet after death	ACTR	*Achlys triphylla*	Native	0.3-3.7	0-20
western rattlesnake plantain	GOOB2	*Goodyera oblongifolia*	Native	0.3-1.8	0-5
Fern/fern ally					
western swordfern	POMU	*Polystichum munitum*	Native	3.7-14.6	0-55
Shrub/Subshrub					
Cascade barberry	MANE2	*Mahonia nervosa*	Native	1.8-7.3	10-35
vine maple	ACCI	*Acer circinatum*	Native	7.3-109.7	15-25
dwarf rose	ROGY	*Rosa gymnocarpa*	Native	0-1.8	0-5

Table 8. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 9. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 10. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 11. Representative site productivity

Common Name	Symbol	Site Index Low	Site Index High	CMAI Low	CMAI High	Age Of CMAI	Site Index Curve Code	Site Index Curve Basis	Citation
Douglas-fir	*PSME*	185	–	195	–	60	–	–	

Inventory data references

Other Established Classifications U.S. Department of Agriculture, Forest Service, plant association: TSHE/GASH-BENE U.S. Department of the Interior, National Park Service, plant association: POPBAL/GAUSHA/POLMUN, PSUMEN-TSUHET/GAUSHA/POLMUN

Type locality

Location 1: Pierce County, WA	
Township/Range/Section	T15N R07E S34
Latitude	46° 44′27″
Longitude	121° 34′5″

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Contributors

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Approval

Kirt Walstad, 1/30/2025

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	05/10/2024
Approved by	
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:**

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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:**
