USDA Natural Resources Conservation Service

Ecological site F003XN920WA
Frigid Riparian Forest

Last updated: 1/29/2025
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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.

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

Classification relationships

Related National Park Service Plant Alliances: *Populus balsamifera* ssp. trichocarpa-(Acer, Alnus) Riparian Alliance, *Populus balsamifera* ssp. trichocarpa-(Pseudotsuga, Picea, Tsuga) Riparian Forest Alliance. (Crawford 2009)

This ecological site includes the following USDA Forest Service Plant Association Groups: Moist POMU and Wet Shrub (Western Hemlock series). (Henderson 1992, p.32)

Associated sites

F003XN924WA	**Low Cryic/Udic West Coniferous**
F003XN927WA	**Frigid/Xeric Coniferous**
F003XN921WA	**Frigid/Udic Coniferous**
F003XN922WA	**Frigid/Udic Active Natural Disturbance**

Table 1. Dominant plant species

Tree	(1) *Populus balsamifera ssp. trichocarpa* (2) *Alnus rubra*

Shrub	(1) *Acer circinatum* (2) *Rubus spectabilis*
Herbaceous	(1) *Asarum caudatum* (2) *Athyrium filix-femina*

Physiographic features

This native plant community typically occurs on lower landscape positions of glacially carved valleys in the North Cascades. Generally this site is located on gently sloping or flat floodplains and terraces of streams and rivers. Occasionally, this site may be found extending to adjacent mountain slopes closely associated with stream and river systems.

This ecological site has only been mapped within the boundary of the North Cascades National Park Complex. This site, where mapped, ranged from 360 to 4600 feet in elevation. The table below refers to the representative elevations of this site.

Table 2. Representative physiographic features

Landforms	(1) Flood plain (2) Stream terrace (3) Terrace
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	None to occasional
Ponding frequency	None
Elevation	244–975 m
Slope	0–15%
Water table depth	30 cm
Aspect	Aspect is not a significant factor

Climatic features

This ecological site receives most of its annual precipitation from October to April. In the first table below, the mean annual precipitation range for this ecological site is provided. In the second table, the minimum and maximum monthly values for precipitation and air temperature are listed for all areas where this ecological site has been assigned to soil delineations. Total annual precipitation across these areas ranges from 21 to 104 inches and annual air temperature ranges from 39 to 51 degrees Fahrenheit. Generally this site occupies areas with warm dry summers and cool wet winters.

Precipitation and temperature data in the tables below was extracted from: PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu, created February 2004. Information from the Ross Dam weather station was used by the PRISM Climate Group to generate climate data for the North Cascades region.

Table 3. Representative climatic features

Frost-free period (average)	85 days
Freeze-free period (average)	102 days
Precipitation total (average)	1,778 mm

Influencing water features

This site supports vegetation that tolerates occasional flooding of the site and periodic saturation within the soil

profile. Generally this site is located on gently sloping or flat floodplains and terraces of streams and rivers. Occasionally, this site may be found extending to adjacent mountain slopes closely associated with stream and river systems. As such, seasonally high water tables are common and soils typically display some evidence of periodic flooding by nearby streams.

Soil features

Applicable soils: Nohokomeen, Roland, Sandalee

The soils that support this native plant community are commonly associated with streams and rivers. As such, these soils are somewhat poorly drained and have seasonally high water tables. The soils typically display some evidence of periodic flooding from nearby streams, such as zones of stratified sediment or thin buried organic layers. The soils have a frigid soil temperature regime and coarse-loamy particle size control section.

A blank entry under soil depth column indicates no depth restriction within the soil profile.

For more information on soils and their terminology, please refer to Soil taxonomy: A Basic System of Soil Classification for Making and Interpreting Soil Surveys (Soil Survey Staff, 1999; http://soils.usda.gov/technical/classification/taxonomy/).

Table 4. Representative soil features

Surface texture	(1) Ashy sandy loam (2) Fine sandy loam (3) Sandy loam
Family particle size	(1) Loamy
Drainage class	Somewhat poorly drained
Permeability class	Moderately rapid to very rapid
Soil depth	152 cm
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–10%
Available water capacity (0-101.6cm)	21.77–40.61 cm
Soil reaction (1:1 water) (0-101.6cm)	4.5–6.5
Subsurface fragment volume <=3" (Depth not specified)	0–30%
Subsurface fragment volume >3" (Depth not specified)	0–25%

Ecological dynamics

This disturbance-driven site is found along active river floodplains with meandering channels and seasonally high water tables. Black cottonwood (*Populus balsamifera* ssp. trichocarpa) and red alder (*Alnus rubra*) are the most common overstory species on these sites but the forest often has a variety of species. Western redcedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), paper birch (*Betula papyrifera*), grand fir (*Abies grandis*) and Douglas-fir (*Pseudotsuga menziesii*) can all be found on this site. The most common natural disturbance is flooding, with the volume and longevity of the flooding determining the effect on the forest dynamics. Both black cottonwood and red alder have evolved to germinate most successfully on bare mineral soil, which is present after flood scouring. The longer the ecological site goes between major flood events, the more diverse the overstory becomes, as conifers become established. The understory on these sites is often shrubby with vine maple (*Acer circinatum*), salmonberry (*Rubus spectabilis*), devilsclub (*Oplopanax horridus*), prickly currant (*Ribes lacustre*), and red elderberry (*Sambucus racemosa*) providing a frequently dense subcanopy. On the more flood prone areas of the site, the shrubs may be less dense, allowing more light to reach the forest floor. These sites will have an increased herb layer with common ladyfern (*Athyrium filix-femina*), wild-ginger (*Asarum caudatum*), western brackenfern

(*Pteridium aquilinum*), queencup bead lily (*Clintonia uniflora*), starry false lily of the valley (*Maianthemum stellatum*) and western swordfern (*Polystichum munitum*) filling in the gaps.

State and transition model

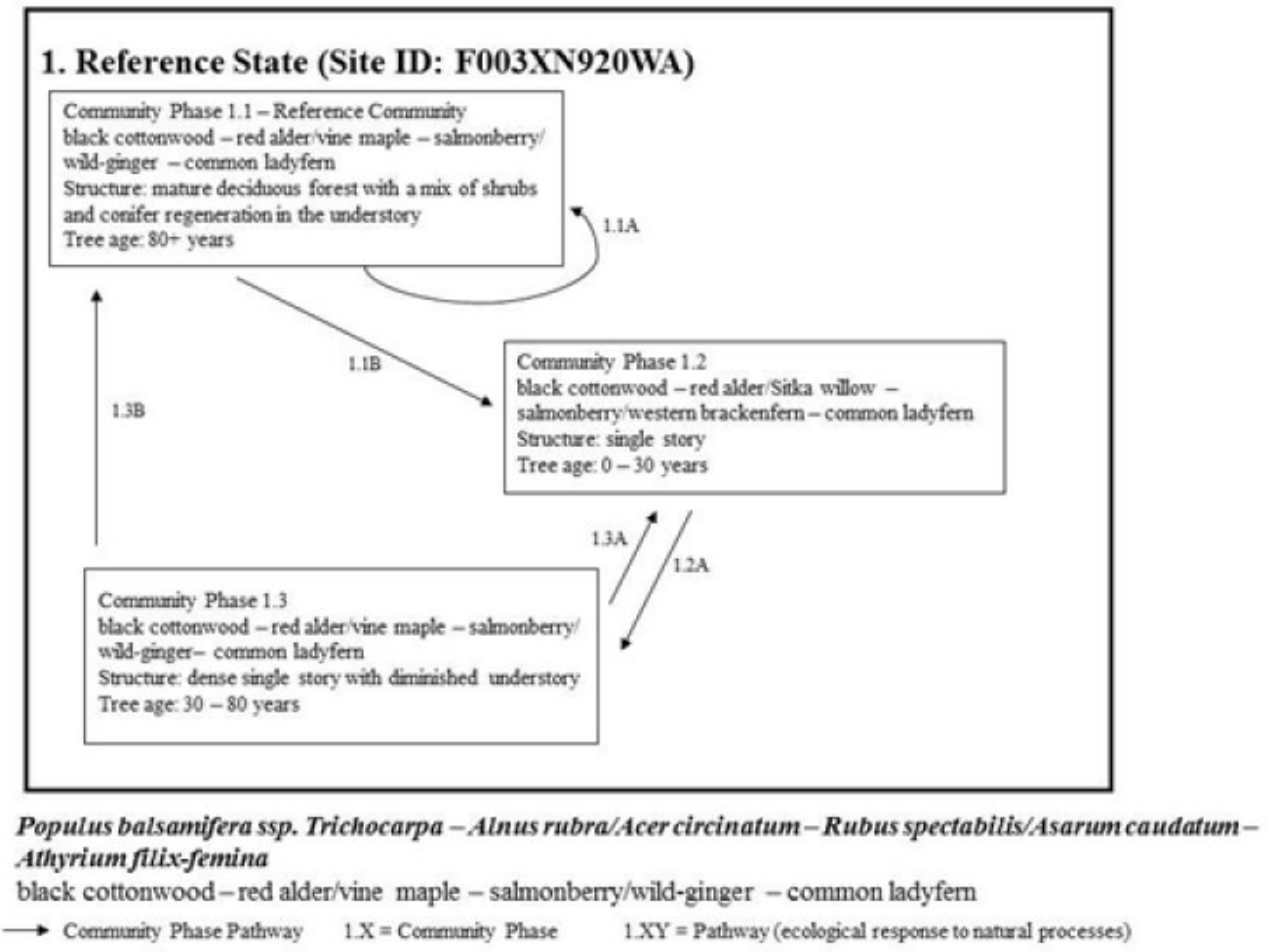

Figure 6. State and Transition Model

State 1
Reference

Community 1.1
Black Cottonwood, Red Alder, Vine Maple, Salmonberry, Wild Ginger, and Common Ladyfern

Structure: mature deciduous forest with a mix of shrubs and conifer regeneration in the understory. Black cottonwood is the dominant overstory canopy species in Community Phase 1.1 -Reference Community in that it will often be 20 to 50 feet taller than the red alder trees which often represent a higher percentage in the species composition of the forest. Black cottonwood is also somewhat longer lived (by as much as 100 years) than red alder, which starts to actively decline after 60 to 80 years. The Reference Community connotes a lack of major flooding for several decades, allowing these pioneering deciduous species to form a mature canopy. Over this amount of time, secondary coniferous species such as western redcedar, western hemlock and true firs will seed in underneath. The lack of flooding also allows for a vigorous shrub understory which can include vine maple, salmonberry, devilsclub, red elderberry and prickly currant. Common disturbances on these sites include small gap dynamics (1/2 acre or smaller openings) following the decline of the red alder canopy and minor flood scouring.

Community 1.2
Black Cottownwood, Red Alder, Scouler’s Willow, Salmonberry, Western Brackenfern, and

Common Ladyfern

Structure: single story/shrub. CP 1.2 is forestland in regeneration/stand initiation, possibly with scattered remnant mature trees. Black cottonwood, red alder and Sitka willow (along with other Salix species) are all early seral species evolved to pioneer mineral soils after a major disturbance. Their light seeds can be transported long distances both by wind and water, allowing for the rapid recolonization of available sites. Most of the shrubs common to these sites, such as vine maple, salmonberry and red elderberry, can readily regenerate vegetatively, sprouting from the root crown that has been buried by flood deposits. These shrubs will compete initially with seedlings and saplings until the tree species overtop them. The disturbance also allows for seral forb species such as western brackenfern and fringecup (*Tellima grandiflora*) to become established.

Community 1.3
Black Cottonwood, Red Alder, Vine Maple, Salmonberry, Wild Ginger, and Common Ladyfern

Structure: dense single story with diminished understory CP 1.3 is a forest in the competitive exclusion stage, possibly with scattered remnant mature trees; there is increasing competition among individual trees for the available water and nutrients. Canopy closure is almost 100%, leading to a diminished understory, however some understory species better adapted to at least partial shade (e.g. salmonberry, vine maple) will have a continued presence. Over time the forest will begin to self-thin due to the elevated competition and species which do not tolerate shade well, such as Sitka willow and western brackenfern, will decrease in cover.

Pathway 1.1B
Community 1.1 to 1.2

This pathway represents a major (100 year plus) flood event resulting in complete or near-complete loss of overstory.

Pathway 1.1A
Community 1.1 to 1.2

This pathway represents one of minor disturbances which maintain the overall structure of the Reference Community. The death of one to several trees allows sunlight into the understory promoting forbs and shrubs as well as regenerating overstory species. Soil deposition following minor flood scouring events will temporarily set back the understory community while not disturbing the overstory composition.

Pathway 1.2A
Community 1.2 to 1.3

This pathway represents growth over time.

Pathway 1.3B
Community 1.3 to 1.1

This pathway represents no further major disturbance. Continued growth over time, as well as ongoing mortality, leads to continued vertical diversification. The community begins to resemble the structure of the reference community, with small pockets of regeneration (both deciduous and coniferous) and a more diversified understory.

Pathway 1.3A
Community 1.3 to 1.2

This pathway represents a major flood disturbance leading to the stand initiation phase of forest development.

Additional community tables

Table 5. 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
western hemlock	*TSHE*	60	80	164	197	90	–	–	
Douglas-fir	*PSME*	80	100	98	136	90	–	–	
red alder	*ALRU2*	90	110	101	135	40	–	–	
red alder	*ALRU2*	50	70	0	0	0	–	–	
western redcedar	*THPL*	55	75	0	0	0	–	–	

Inventory data references

Type Location ID: 08-TMR-001

Type locality

Location 1: Skagit County, WA	
Township/Range/Section	T36N R11E S21
UTM zone	N
UTM northing	5383449
UTM easting	619932
Latitude	48° 35′ 33″
Longitude	-121° 22′ 25″
General legal description	Willamette Meridian T36N R11E S21

Other references

Agee, J.K. 1993. Fire ecology of Pacific Northwest forests. Covelo, CA: Island Press. 493 pages.

Crawford, R. C., C. B. Chappell, C. C. Thompson, and F. J. Rocchio. 2009. Vegetation classification of Mount Rainier, North Cascades, and Olympic National Parks. Natural Resource Technical Report NPS/NCCN/NRTR—2009/211. National Park Service, Fort Collins, Colorado. 58 pages.

Fire Effects Information System, [Online].
U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer).
http://www.fs.fed.us/database/feis/

Henderson, J., R. Lesher, D. Peter, and D. Shaw. 1992. Field guide to the forested plant associations of the Mt. Baker-Snoqualmie National Forest. Technical paper R6-Ecol-TP-028-91.

Miller, Margaret M.; Miller, Joseph W. 1976. Succession after wildfire in the North Cascades National Park complex. In: Proceedings, annual Tall Timbers fire ecology conference: Pacific Northwest; 1974 October 16-17; Portland, OR. No. 15. Tallahassee, FL: Tall Timbers Research Station: 71-83. [6574]

Perry, D.A. Forest Ecosystems. Baltimore, MD: The Johns Hopkins University Press; 1994. 649 pages.

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

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.
http://soils.usda.gov/technical/classification/taxonomy/

Contributors

Kathryn Smith

Approval

Kirt Walstad, 1/29/2025

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	01/29/2025
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:**
