USDA Natural Resources
Conservation Service

Ecological site F003XN921WA
Frigid/Udic Coniferous

Last updated: 5/10/2024
Accessed: 05/17/2024

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

This ecological site falls within the National Vegetation Classification Group G240 - North Pacific Maritime Douglas-fir-Western Hemlock Forest.

This ecological site includes the following USDA Forest Service Plant Association Groups: Mesic GASH-BENE, Mesic POMU, Moist POMU.

Associated sites

F003XN920WA	**Frigid Riparian Forest** Frigid riparian forests.
F003XN922WA	**Frigid/Udic Active Natural Disturbance** Frigid/udic active natural disturbance.
F003XN924WA	**Low Cryic/Udic West Coniferous** Low cryic/udic west side coniferous forests.

Table 1. Dominant plant species

Tree	(1) *Tsuga heterophylla* (2) *Thuja plicata*
Shrub	(1) *Acer circinatum* (2) *Vaccinium parvifolium*
Herbaceous	(1) *Linnaea borealis* (2) *Polystichum munitum*

Physiographic features

This native plant community occurs across many landscape positions generally at lower elevations along the west slope of the North Cascades. Dominating the mountain slopes of the frigid/udic soil temperature/moisture regime, this site also extends to some stream terraces of glacial valleys.

This ecological site has only been mapped within the boundary of the North Cascades National Park Complex.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Valley side (3) Stream terrace
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	None to occasional
Ponding frequency	None
Elevation	244–1,189 m
Slope	5–100%
Water table depth	51 cm
Aspect	Aspect is not a significant factor

Climatic features

This ecological site receives most of its annual precipitation from October to April. The mean annual precipitation ranges from 35 to 106 inches and the mean annual temperature ranges from 37 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)	90 days
Freeze-free period (average)	120 days
Precipitation total (average)	2,692 mm

Influencing water features

In general, this ecological site is not influenced by wetland or riparian water features but may be found on stream terraces or adjacent to wetland and riparian areas. Occasionally and for brief amounts of time, the site may be flooded by adjacent rivers and streams but overall this has an insignificant influence on the plant community. Typically the Deerlick or Skymo soil series are present in the areas subject to flooding.

Soil features

Applicable soils: Cosho, Damnation, Deerlick, Easy, Ledeir, Ragged, Skymo, Thorton, Tricouni. Based on the composition of detailed soil map units and dominance of mountain slope landform positions, modal soils under this ecological site are the Cosho, Ragged, Thorton, and Tricouni soil series.

The soils that support this native plant community occur in the frigid soil temperature regime and the udic soil moisture regime. These soils are moderately well to well drained and range from shallow bedrock controlled soils to very deep soils. Generally these soils have a mantle of material with significant volcanic ash influence overlying glacial till or colluvium. The upper mantle is characterized by a low bulk density and a high water holding capacity. Soil moisture is not a limiting factor to forest growth on these soils owing to abundance of precipitation and the inherent water holding properties of soils influenced by volcanic ash. Under ideal soil forming conditions enhanced by landscape stability and therefore longevity of pedogenic processes, Spodosols such as the Easy and Ledeir soil series will develop in soils with volcanic ash influence. Soil properties of these Spodosols are very similar to the other soils found under this native plant community, but morphologically Spodosols are visually distinct because of the typically bright albic and spodic horizon sequence in the upper soil profile. Weak expression of this morphology may be visible in the Andisols and Inceptisols of this grouping but generally these soils exhibit an ochric epipedon and cambic subsurface diagnostic horizon.

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

Table 4. Representative soil features

Surface texture	(1) Ashy sandy loam (2) Ashy loamy sand
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderately rapid to rapid
Soil depth	25 cm
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–10%
Available water capacity (0-101.6cm)	10.49–40.61 cm
Soil reaction (1:1 water) (0-101.6cm)	3.5–6.5
Subsurface fragment volume <=3" (Depth not specified)	5–65%
Subsurface fragment volume >3" (Depth not specified)	0–35%

Ecological dynamics

This site is found in the cool, moist, lower slopes of the Cascades up to approximately 4600 feet, depending on aspect. It can be found lower in elevation on north- and east-facing slopes and higher on south- and west-facing ones. Western hemlock (*Tsuga heterophylla*) and western redcedar (*Thuja plicata*) are the dominant overstory species, often with a co-dominant Douglas-fir (*Pseudotsuga menziesii*) component. The heavy shade of a hemlock/redcedar forest favors the gradual replacement of Douglas-fir with these more shade-tolerant trees in the absence of a major disturbance. Paper birch (*Betula papyrifera*), grand fir (*Abies grandis*) and bigleaf maple (*Acer macrophyllum*) may all be present, but only as minor overstory components. The most common disturbance on this site is patchy, small pockets of wind-thrown overstory trees, which often occur in conjunction with either root-, butt- or stem-rot. The resulting openings in the canopy allow some sunlight to reach the forest floor, which benefits the understory. The historic fire regime would have been one of low frequency (150-300+ years) and moderate to high intensity. These fires would, in effect, be stand-replacing although individual trees or patches of trees would survive, providing a seed source for reestablishment. The more open the forest canopy, the more dense and diverse the understory. There have been very minimal post-European settlement impacts on the dynamics of this ecological site. Sporadic mining and timber harvests occurred from circa 1870 through World War II but the rough terrain

prevented sustained efforts. The construction of the three Skagit River dams (Diablo, Ross and Gorge) required intensive, but narrowly focused, logging. Vine maple (*Acer circinatum*), red huckleberry (*Vaccinium parvifolium*), Cascade Oregongrape (*Mahonia nervosa*), prince's pine (*Chimaphila umbellata*) and salal (*Gaultheria shallon*) are the main shrub species in areas where there is a relatively low overstory canopy closure while twinflower (*Linnaea borealis*), western swordfern (*Polystichum munitum*), western rattlesnake plantain (*Goodyera oblongifolia*) broadleaf starflower (*Trientalis borealis* ssp. latifolia) and western brackenfern (*Pteridium aquilinum*) are common forbs.

State and transition model

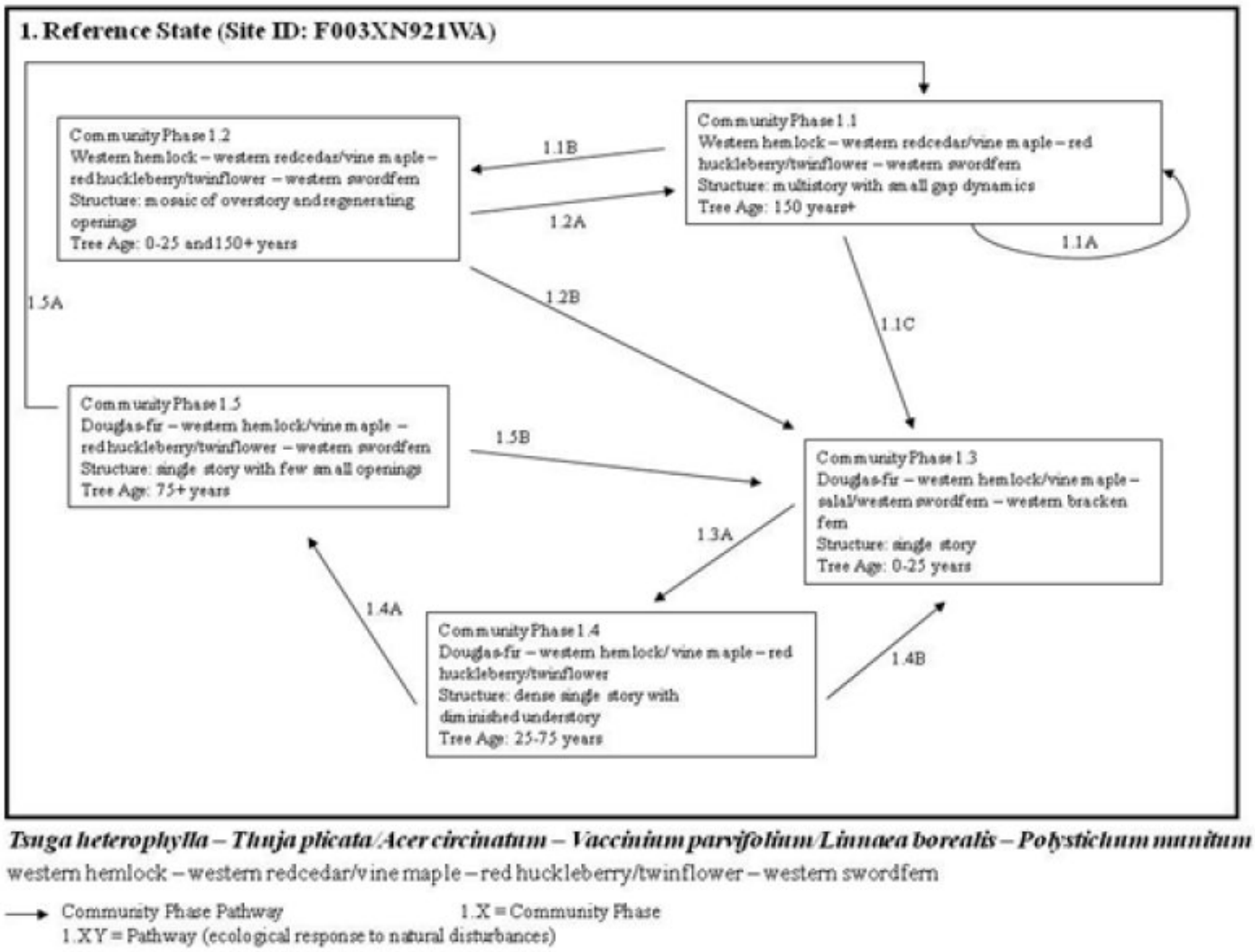

Figure 4. F003XN921WA

State 1
Reference State

Community 1.1
Western hemlock - western redcedar/vine maple - red huckleberry

Figure 5. Reference Community

Structure: multistory with small gap dynamics. Western hemlock is the most common overstory species in the historic climax plant community. Western redcedar and Douglas-fir will both be present but there will be minimal Douglas-fir regeneration; grand fir and bigleaf maple would be much smaller components. The dense canopy created by multiple age groups of hemlocks may block most of the sunlight from the forest floor, leading to a sparse understory in some areas. At times vine maple will have this same effect where it grows in thick clumps. Gaps in the mid-canopy and overstory which allow sunlight to reach the ground are where the majority of the understory plants would be found. If there is no mid-canopy the understory will be more continuous. The most common natural disturbance on these sites would be the small gap dynamics following the death of one or two trees. Understory species included in the Canopy Cover Summary table had at least a 50% rate of constancy in 68 inventory plots. For specific data contact site author or your local NRCS office.

Community 1.2
Western hemlock - western redcedar/vine maple - Cascade Oregongrape

Structure: mosaic of mature overstory and regenerating openings. CP 1.2 retains some areas that resemble CP 1.1 but also contains moderate sized (2-5 acres) openings. Historically, this spatial pattern would have been caused by pockets of disease (such as annosum root rot or laminated root rot), minor insect infestations or possibly low- to moderate-intensity fires. Depending on the seed sources present, the patches may contain any of the previously mentioned overstory species as well as paper birch and red alder. Many of the shrub species found in the ecological site (including vine maple, red huckleberry, Cascade Oregongrape, bald-hip rose) also respond well to increased sunlight and may delay or even prevent reforestation of the newly formed openings.

Community 1.3
Douglas-fir – western hemlock/vine maple – salal/western swordfern

Structure: single story/shrub. CP 1.3 is forestland in regeneration, possibly with scattered remnant mature trees; species composition depends on the natural seed sources present and the intensity of disturbance. When resulting from a moderate- to severe fire event, there is a good possibility for shrubs to out-compete tree seedlings. Vine maple, red huckleberry, salal, dwarf rose and Cascade Oregongrape (which may have been only moderately abundant previously) all have the capability to rapidly recover and spread when top-killed, slowing successful overstory regeneration. Seed sources for tree species would be from the surrounding, undisturbed forest and any survivors of the disturbance and would result in a mixed stand which could include Douglas-fir, western hemlock, red alder, paper birch, western redcedar and bigleaf maple.

Community 1.4
Douglas-fir – western hemlock/vine maple – red huckleberry/twinflower

CP 1.4 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. red huckleberry or twinflower) will begin to increase. Over time the forest will begin to self-thin due to the elevated competition. Species composition depends on the original seed source(s) available; the forest could be single or

mixed-species including Douglas-fir, western hemlock, red alder, paper birch, western redcedar and bigleaf maple.

Community 1.5
Douglas-fir – western hemlock/vine maple – red huckleberry/twinflower – western swordfern

CP 1.5 is a maturing forest which is starting to differentiate vertically. Individual trees are dying (whether due to insects, disease, competition or windthrow) allowing some sunlight to reach the forest floor. This allows for an increase in the understory as well as some pockets of overstory tree species regeneration.

Pathway 1.1A
Community 1.1 to 1.2

This pathway is one of minor disturbances which maintain the overall structure of the reference community. The death of one or two trees allows sunlight into the understory, promoting forbs and shrubs as well as the regeneration of overstory species. This perpetuates a multi-storied forest.

Pathway 1.1B
Community 1.1 to 1.2

This pathway represents a larger disturbance – an insect infestation, wind storm or rot pocket would create this forest structure. Areas of regeneration would range from approximately 2 to 5 acres.

Pathway 1.1C
Community 1.1 to 1.3

This pathway represents a major stand-replacing disturbance such as a high-intensity fire, large scale wind event or major insect infestation.

Pathway 1.2A
Community 1.2 to 1.1

This pathway represents growth over time with no further significant disturbance. The areas of regeneration pass through the typical stand phases – competitive exclusion, maturation, understory reinitiation – until they resemble the old-growth structure of the reference community.

Pathway 1.2B
Community 1.2 to 1.3

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

Pathway 1.3A
Community 1.3 to 1.4

This pathway represents growth over time with no further major disturbance.

Pathway 1.4B
Community 1.4 to 1.3

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

Pathway 1.4A
Community 1.4 to 1.5

This pathway represents continued growth over time with no further major disturbance.

Pathway 1.5A
Community 1.5 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 and a more diversified understory.

Pathway 1.5B
Community 1.5 to 1.3

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

Additional community tables

Table 5. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)	Diameter (Cm)	Basal Area (Square M/Hectare)
Tree							
grand fir	ABGR	*Abies grandis*	Native	–	–	–	–
bigleaf maple	ACMA3	*Acer macrophyllum*	Native	–	–	–	–
Douglas-fir	PSME	*Pseudotsuga menziesii*	Native	–	–	–	–
western redcedar	THPL	*Thuja plicata*	Native	–	–	–	–
western hemlock	TSHE	*Tsuga heterophylla*	Native	–	–	–	–

Table 6. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (M)	Canopy Cover (%)
Forb/Herb					
claspleaf twistedstalk	STAM2	*Streptopus amplexifolius*	Native	0.3–0.9	1–25
broadleaf starflower	TRBOL	*Trientalis borealis ssp. latifolia*	Native	–	1–15
bride's bonnet	CLUN2	*Clintonia uniflora*	Native	–	1–15
liverleaf wintergreen	PYAS	*Pyrola asarifolia*	Native	–	1–5
western rattlesnake plantain	GOOB2	*Goodyera oblongifolia*	Native	–	1–5
Fern/fern ally					
western swordfern	POMU	*Polystichum munitum*	Native	0.3–0.9	1–60
common ladyfern	ATFI	*Athyrium filix-femina*	Native	0.3–0.9	1–30
western brackenfern	PTAQ	*Pteridium aquilinum*	Native	0.3–1.2	1–25
Shrub/Subshrub					
salal	GASH	*Gaultheria shallon*	Native	0.3–1.8	1–60
vine maple	ACCI	*Acer circinatum*	Native	0.6–7.6	1–55
Cascade barberry	MANE2	*Mahonia nervosa*	Native	0.3–0.9	1–40
red huckleberry	VAPA	*Vaccinium parvifolium*	Native	0.3–2.4	1–35
pipsissewa	CHUM	*Chimaphila umbellata*	Native	–	1–15
twinflower	LIBO3	*Linnaea borealis*	Native	–	1–15
dwarf rose	ROGY	*Rosa gymnocarpa*	Native	0.3–1.5	1–10
Vine/Liana					
orange honeysuckle	LOCI3	*Lonicera ciliosa*	Native	0.3–6.1	1–5

Table 7. 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*	55	85	157	204	90	–	–	
Douglas-fir	*PSME*	75	110	85	155	90	–	–	
western redcedar	*THPL*	60	90	0	0	0	–	–	

Inventory data references

Type Locality Plot ID: 08-TMR-008

Type locality

Location 1: Whatcom County, WA	
Township/Range/Section	T37N R12E S31
UTM zone	N
UTM northing	5390293
UTM easting	625187
Latitude	48° 39′ 10″
Longitude	121° 18′ 4″

Other references

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Contributors

Kathy Smith

Approval

Kirt Walstad, 5/10/2024

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	05/17/2024
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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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):**

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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:**
