USDA Natural Resources
Conservation Service

Ecological site F002XN902WA
Western hemlock - Douglas-fir/Cascade Oregongrape

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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 to plant associations PSME-TSHE/GASH/POMU, PSME-TSHE/HODI/POMU, PSME-TSHE/MANE, PSME-TSHE/TITRLA in Chappell, C.B. 2006. Upland plant associations of the Puget Trough ecoregion, Washington. Natural Heritage Rep. 2006-01. Washington Department of Natural Resources, Natural Heritage Program, Olympia , Wash. [http://www.dnr.wa.gov/nhp/refdesk/communities/pdf/intro.pdf].

Table 1. Dominant plant species

Tree	(1) *Tsuga heterophylla* (2) *Pseudotsuga menziesii*
Shrub	(1) *Mahonia nervosa*
Herbaceous	Not specified

Physiographic features

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Mountain slope

Flooding frequency	None
Ponding frequency	None
Elevation	3–732 m
Slope	5–75%
Water table depth	51 cm
Aspect	N, E, NW

Climatic features

The climate is characterized by warm dry summers and mild moist winters. Precipitation is received mostly in the ealy fall to late winter.

Table 3. Representative climatic features

Frost-free period (average)	220 days
Freeze-free period (average)	
Precipitation total (average)	1,143 mm

Influencing water features

Soil features

Applicable soil series:
Constitution, Kahboo, Pickett, Skipjack

Table 4. Representative soil features

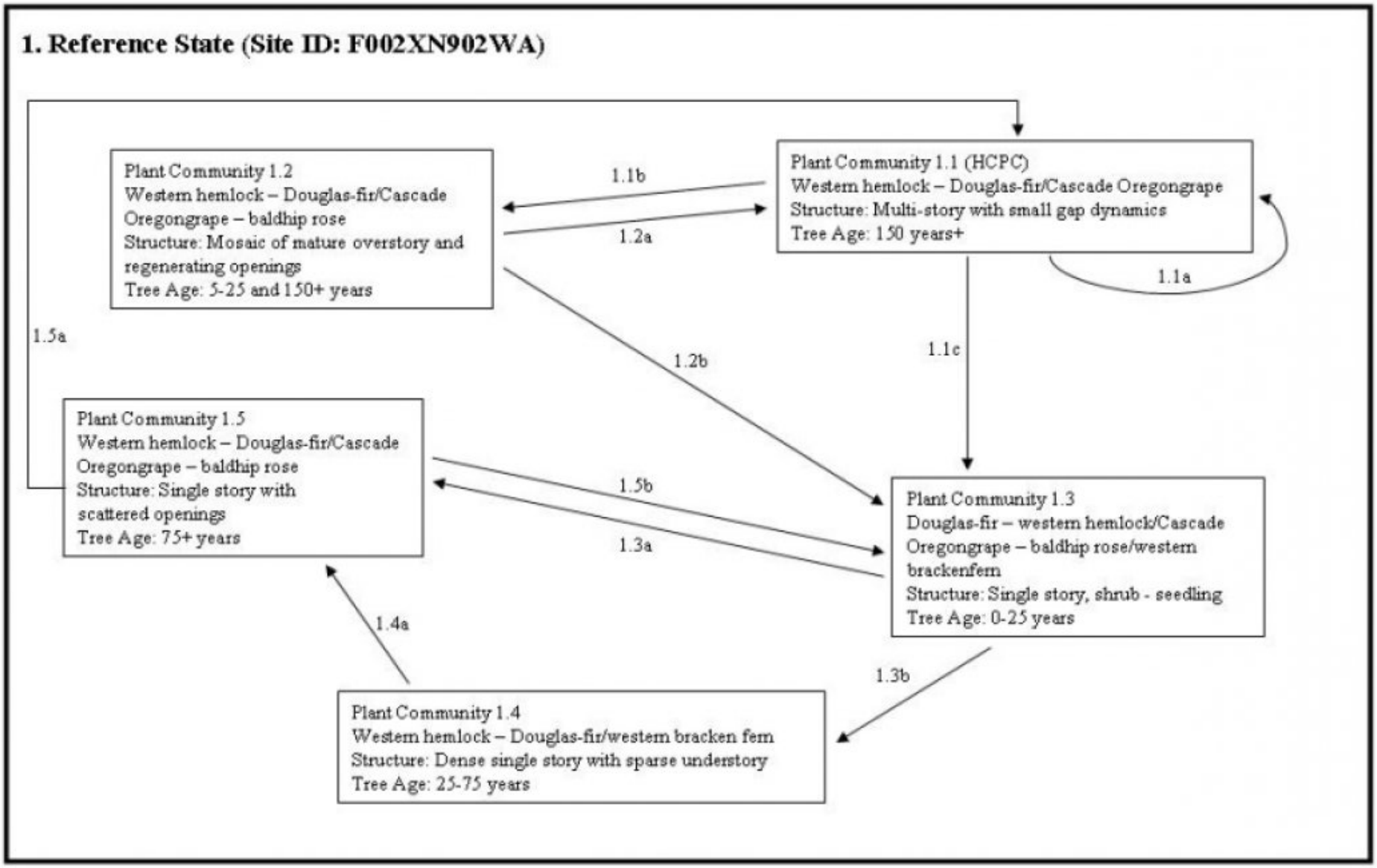
Surface texture	(1) Sandy loam (2) Gravelly fine sandy loam (3) Very gravelly loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderately rapid to rapid
Soil depth	25 cm
Available water capacity (0-101.6cm)	7.11–24.38 cm
Soil reaction (1:1 water) (0-101.6cm)	3.5–6

Ecological dynamics

These sites are only found within the rain shadow of the Puget Trough. They are relatively cool, moist sites on gentle to steep slopes. The historic plant climax community (HPCP) is dominated by western hemlock with a minority of Douglas-fir and western redcedar.

Wind storms, insects and diseases (particularly root- and butt-rots) are the main disturbance agent on these sites, causing mostly small patch-sized disruptions. If the opening created is large enough, Douglas-fir would likely seed in. Smaller gaps would be dominated by one or more of the many shrub species.

Cutting practices could easily shift these forests to a Douglas-fir dominated community, but this would have to be maintained by steady management. Without intervention, shade tolerant hemlock would infill and eventually replace the majority of the Douglas-fir, moving back to the HPCP



Tsuga heterophylla – Pseudotsuga menziesii/Mahonia nervosa

Western hemlock – Douglas-fir/Cascade Oregongrape

→ Community Phase Pathway
HCPC = Historic Climax Plant Community

1.X = Plant Community Phase
1.Xy = Pathway (ecological response to natural and/or management disturbances)

State 1
Reference State

Community 1.1
Western hemlock - Douglas-fir/Cascade Oregongrape

PC 1.1 (HCPC) – western hemlock – Douglas-fir/Cascade Oregongrape Structure: multistory with small gap dynamics. Western hemlock, a highly shade-tolerant species, dominates this plant community. Douglas-fir, even though it is intermediate in tolerance, will persist in the HCPC due to its longevity. Armillaria root rot can be a locally common disease which will kill young hemlocks and Douglas-firs and weaken older trees, leaving them susceptible to windthrow and insect attacks. The small openings created by the death of one or two trees allow sunlight into the understory, benefiting shrubs and forbs and releasing advanced regeneration. Western hemlock is also prone to other root rots and pockets of dead and dying trees can occasionally extend for several acres, allowing enough sunlight for the regeneration of less shade tolerant species.

Forest overstory. Typically dominated by western hemlock, Douglas-fir is usually present and occasionally codominant. Western redcedar, Sitka spruce and red alder may or may not be present as minor components.

Forest understory. The understory is often sparse due to the dense canopy of western hemlock. Where there are holes in the canopy, shrub species dominate.

Community 1.2
Western hemlock – Douglas-fir/Cascade Oregongrape – prickly currant

Structure: mosaic of mature overstory with regenerating openings. PC 1.2 retains much of the structure of PC 1.1 but also contains moderate sized areas of regeneration and/or shrub communities. These openings can be created by large pockets of disease, windthrow or uneven-aged harvesting (group selection or shelterwood with reserves). Depending on the seed sources present, the seedling patches may contain hemlock, western redcedar or Douglas-fir as well as baldhip rose, trailing blackberry or prickly currant. With no further management, some patches may be dominated by shrubs for several years, until the overstory canopy closes.

Community 1.3
Douglas-fir – western hemlock/Cascade Oregongrape – baldhip rose/western

PC 1.3 is forestland in regeneration; species composition depends on the natural seed sources present and the intensity of management. Western hemlock is a prolific seed producer and this often leads to dense, single-species stands. Douglas-fir has faster height growth than hemlock, however, and if seedlings become established at the same time as hemlock it will persist in the stand. Western hemlock stands can benefit from precommercial thinning as early as 10- to 15-years old; this would release the remaining trees, allowing for increased growth rates. If the stand is dense and not thinned, intermediate and suppressed individuals will eventually die due to strong competition. Shrubs and forbs in this plant community include baldhip rose, dull Oregongrape, brackenfern and stinging nettle. As the overstory canopy closes, however, the understory will decline.

Community 1.4
Western hemlock – Douglas fir/Cascade Oregongrape – baldhip rose

Structure: dense single story with sparse understory. PC 1.4 continues the ‘stem exclusion’ phase of forest development. The canopy has fully closed, leading to competition for water and nutrients. The stand appears relatively uniform with little vertical diversity and the understory is often very sparse due to the lack of sunlight.

Community 1.5
Maturing forest Western hemlock – Douglas-fir/Cascade Oregongrape – baldhip rose

Structure: single story with scattered openings. PC 1.5 is maturing forest. Although the canopy remains generally closed, the stand is starting to differentiate vertically. The death of scattered individuals allows more sunlight to reach the forest floor, benefiting understory species and advanced regeneration. Pockets of baldhip rose, trailing blackberry, prickly currant and western swordfern can all be found in this plant community.

Pathway 1.1a
Community 1.1 to 1.2

This pathway represents a larger disturbance (several acres). Large openings can be caused by disease, windthrow or group selection harvest. Full sunlight would benefit Douglas-fir and alder seedlings as well as hemlocks and may initially lead to a more diverse forest. If a seed source is present, these gaps may become dominated by shrubs such as baldhip rose and prickly currant. This community could persist for many years until the canopy gradually closes again.

Pathway 1.1b
Community 1.1 to 1.3

This is the pathway of a major disturbance. Historically this would have been a large-scale windthrow event or, more rarely, a stand-replacing fire; in modern times a block harvest, with or without a post-harvest prescribed fire would initiate this pathway. Regeneration can be either natural or planted.

Pathway 1.2a
Community 1.2 to 1.1

This pathway represents growth over time with no further management or major disturbance. The areas of regeneration pass through the typical stand phases – competitive exclusion, maturation, understory re-initiation – until they resemble the old-growth structure of the HCPC.

Pathway 1.3b
Community 1.3 to 1.4

This is the pathway of no active management. Overtime, less competitive trees will die out but the effect will not be as immediate as with thinning.

Pathway 1.3a
Community 1.3 to 1.5

This pathway indicates management and growth over time. Precommercial thinning early on allows trees more room to grow, increasing potential yield, and may also improve overall wind firmness in the future.

Pathway 1.4a
Community 1.4 to 1.5

This pathway represents growth over time, with or without management. The stand could carry a commercial thinning at this point, which would reduce competition and allow for increased growth. If not thinned, the competition will lead to the ongoing mortality of suppressed trees.

Pathway 1.5a
Community 1.5 to 1.1

This is the pathway of growth over time with no major disturbances or further management. The diversity of understory species increases as the stand begins to regain the horizontal and vertical diversity characteristic of old-growth forests.

Pathway 1.5b
Community 1.5 to 1.3

This pathway represents intensive management focusing on wood products. Block harvest, with or without a post-harvest prescribed fire, followed by either planting or natural seeding will reestablish a young stand.

Additional community tables

Wood products

Site Index data, by species, derived from:

Pseudotsuga menziesii: King, James E. 1966. Site index curves for Douglas-fir in the Pacific Northwest . Weyerhaeuser Company, Forestry Research Center. Forestry Paper 8. USDA NRCS curve # 795.

Tsuga heterophylla: Wiley, Kenneth N. Site index tables for western hemlock in the Pacific Northwest. Weyerhaeuser Company, Western Forestry Research Center Forestry Paper No. 17. USDA NRCS curve # 995.

CMAI data, by species, derived from:

Pseudotsuga menziesii: Chambers, C. Washington State Department of Natural Resources Technical Report #20.

Tsuga heterophylla: Appendix 2 of Wiley, K.N. 1978. Net and gross yields for natural stands of western hemlock in the Pacific Northwest. Weyerhaeuser Forestry Paper No. 19.

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
Douglas-fir	*PSME*	90	115	116	163	–	–	–	
western hemlock	*TSHE*	60	100	57	136	–	–	–	

Other references

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/

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

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

Contributors

Kathryn E. Smith

Approval

Kirt Walstad, 5/09/2024

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	05/18/2024
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):**

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:

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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:**
