USDA Natural Resources Conservation Service

Ecological site F004AA004WA
Aquic 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): 004A–Sitka Spruce Belt

This resource area is along the coast of the Pacific Ocean. It is characterized by a marine climate and coastal fog belt. The parent material is primarily glacial, marine, or alluvial sediment and some scattered areas of Tertiary sedimentary rock and organic deposits. Glacial deposits are dominant in the northern part of the MLRA in Washington; marine and alluvial deposits and eolian sand are dominant along the southern part of the Washington coast and extending into Oregon. The mean annual precipitation ranges from 52 to 60 inches near the beaches to more than 190 inches in the inland areas of the MLRA.
Andisols and Inceptisols are the dominant soil orders in the MLRA, but Spodosols, Entisols, and Histosols are also present. The soils are shallow to very deep and very poorly drained to somewhat excessively drained. They are on hilly marine terraces and drift plains; coastal uplands, hills, and foothills; flood plains; and coastal dunes, marshes, and estuaries.
The soil temperature regimes of MLRA 4A are moderated by the proximity to the Pacific Ocean, which eases the differences between the mean summer and winter temperatures. The seasonal differences in temperature are more pronounced in adjacent MLRAs further inland. Included in MLRA 4A are soils in cooler areas at higher elevations or on northerly aspects that have an isofrigid temperature regime.
The soil moisture regimes of MLRA 4A are typified by soils that do not have an extended dry period during normal years. Many of the soils further inland in MLRA 2 have a dry period in summer. Soils in low-lying areas and depressions of MLRA 4A are saturated in the rooting zone for extended periods due to a high water table or long or very long periods of flooding or ponding.

LRU notes

The Northern Sitka Spruce Belt land resource unit (LRU A) of MLRA 4A is along the northwest coast of the Olympic Peninsula to the Chehalis River in Washington State. The parent material is dominantly glacial deposits derived from continental or alpine sources. This LRU extends from the northwesternmost corner of the Olympic Peninsula south to the northern edge of Grays Harbor. It is bounded on the west by the Pacific Ocean and on the east by the Olympic Mountains. Several major rivers carved valleys through the glacially derived landscape and deposited more recent alluvium. These include the Sol Duc, Bogachiel, Hoh, Queets, Quinault, and Humptulips Rivers.

Ecological site concept

This ecological site is at low elevations (less than 1,500 feet) on the western coastline of the Olympic Peninsula. The site receives abundant precipitation and has persistent fog in summer. It consists of forested wetlands in depressions and on glacial outwash terraces and till plains that have a seasonal high water table. The site is strongly influenced by physiography and hydrology; thus, it provides rare and unique habitats along the coast of the Pacific Ocean.
The most common overstory species are western redcedar (Thuja plicata), western hemlock (Tsuga heterophylla), and Sitka spruce (Picea sitchensis). Because the soils are saturated much of the year, conifers may grow only on nurse logs or in higher microsites and they commonly are short and stunted (Roccio, 2015). Western redcedar has

a shallow, dense network of fine roots that make it well adapted to forested swamps. Common understory species in the higher, drier microsites include salal (Gaultheria shallon), rusty menziesia (Menziesia ferruginea), and deer fern (Blechnum spicant). The wetter depressions dominantly support American skunkcabbage (Lysichiton americanus), but a variety of sedges may be present (Carex spp.).
The most common natural disturbance is ponding. The volume and longevity of the ponding determine the effect on the dynamics of the forest. The site is also subject to windthrow following large coastal storms. The trees on the site are particularly susceptible to windthrow because the rooting depth is restricted by the seasonal high water table and long periods of ponding that extend into the growing season. Fallen trees that have exposed root systems and large woody debris are common. Windthrow results in canopy openings that allow more sunlight to reach the forest floor, which leads to a shrubby understory. Logging and agricultural disturbances in adjacent areas may alter the hydrology and increase the susceptibility of this site to an infestation of invasive species.

Table 1. Dominant plant species

Tree	(1) *Thuja plicata* (2) *Tsuga heterophylla*
Shrub	Not specified
Herbaceous	(1) *Lysichiton americanus* (2) *Blechnum spicant*

Physiographic features

Table 2. Representative physiographic features

Landforms	(1) Outwash plain > Outwash terrace (2) Till plain
Elevation	0–1,500 ft
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

The maritime climate is characterized by cool, moist summers and cool, wet winters. The mean annual precipitation is 75 to 185 inches. Coastal fog provides supplemental moisture in summer. Snowfall is rare, and it is not persistent when it occurs. The mean annual air temperature is 47 to 51 degrees F.

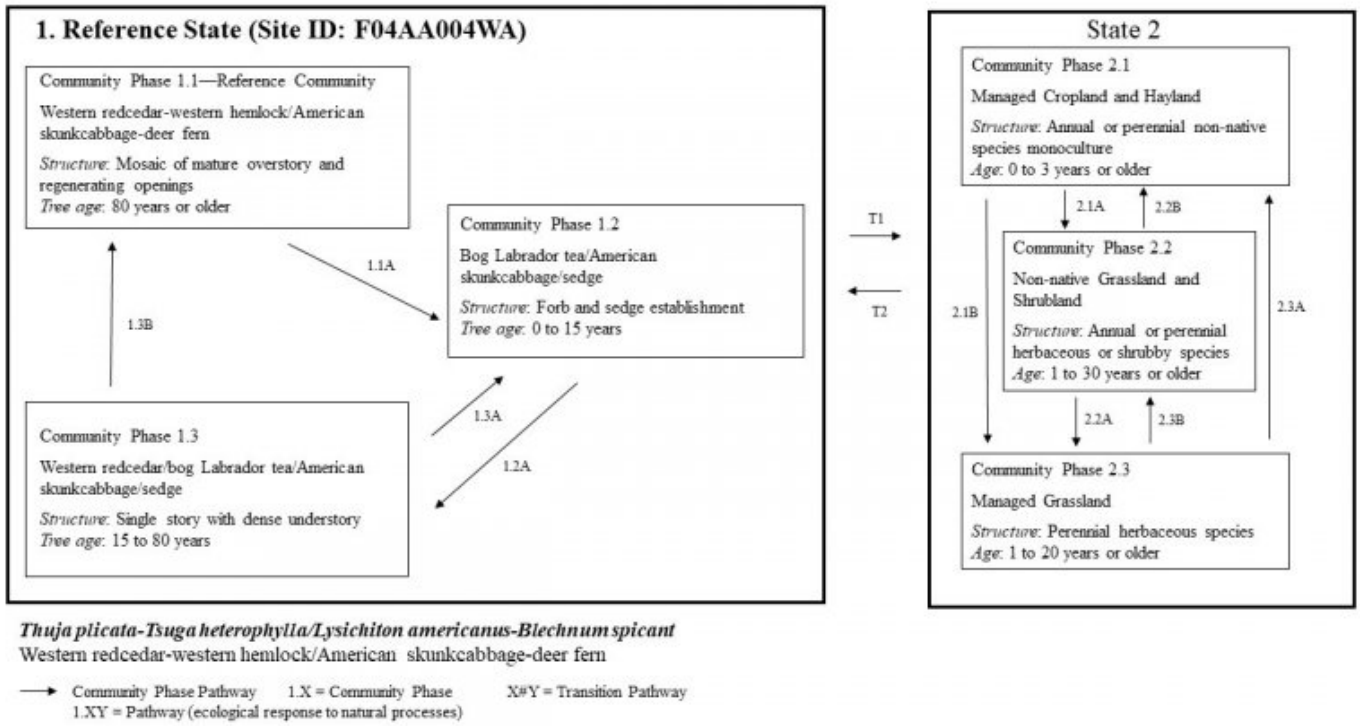
Influencing water features

Soil features

The soils that support this ecological site are in the isomesic soil temperature regime and aquic soil moisture regime. This site typically is subject to residual ponding or a seasonal high water table. The water table commonly is at or near the surface for much of the growing season, and the rate of organic decomposition is slow due to anaerobic conditions. The seasonal high water table and ponding dynamics may be altered by artificial drainage of the site or adjacent areas. A thin organic horizon consisting of decomposing twigs, needles, and litter is on the surface of the soils, which protects them from wind and water erosion.

Ecological dynamics

State and transition model



State 1
Reference

Community 1.1
Western Redcedar, Western Hemlock, American Skunkcabbage, and Deer Fern

Structure: Mosaic of mature overstory and regenerating openings The reference community represents a lack of major disturbance from windthrow or ponding for at least 80 years, which allows the pioneering species to form a mature canopy. Western redcedar is the dominant overstory species. Western hemlock, Sitka spruce, and shore pine are present, but only in drier microsites such as nurse logs and mounds. Red alder (*Alnus rubra*) may be in some areas; however, the site dominantly supports conifers. The overstory canopy closure typically is less than 50 percent, which results in a very dense, productive understory. The lack of disturbance and sparse canopy cover promote the growth of shrubs and forbs. Shrubs commonly are restricted to nurse logs, stumps, and higher microsites. Understory species include American skunkcabbage, deer fern, sweet gale (*Myrica gale*), cascara (*Frangula purshiana*), oval-leaf blueberry (*Vaccinium ovalifolium*), red huckleberry (*Vaccinium parvifolium*), evergreen huckleberry (*Vaccinium ovatum*), rusty menziesia, salmonberry (*Rubus spectabilis*), and multiple species of sedges. Common disturbances include small gap dynamics (1/2-acre openings or smaller) following windstorms and excessive ponding.

Dominant plant species

- western redcedar (*Thuja plicata*), tree
- western hemlock (*Tsuga heterophylla*), tree
- Sitka spruce (*Picea sitchensis*), tree
- beach pine (*Pinus contorta var. contorta*), tree
- red alder (*Alnus rubra*), tree
- Cascara buckthorn (*Frangula purshiana*), tree
- sweetgale (*Myrica gale*), shrub
- California huckleberry (*Vaccinium ovatum*), shrub
- oval-leaf blueberry (*Vaccinium ovalifolium*), shrub
- rusty menziesia (*Menziesia ferruginea*), shrub
- salmonberry (*Rubus spectabilis*), shrub
- red huckleberry (*Vaccinium parvifolium*), shrub
- American skunkcabbage (*Lysichiton americanus*), other herbaceous
- deer fern (*Blechnum spicant*), other herbaceous

Community 1.2
Bog Labrador Tea, American Skunkcabbage, and Sedge

Structure: Forb and sedge establishment Community phase 1.2 represents a forest that is undergoing regeneration or stand initiation immediately following excessive ponding or windthrow. Scattered remnant mature trees and shrubs and an abundance of woody debris may be in some areas. Loss of the overstory and the fallen trees may impact the hydrology by resulting in more ponding for longer durations. Successful regeneration is dependent on a local seed source, an adequate seedbed, and sufficient light and water (Nierenberg, 2000). Rapid recolonization is limited to plants that are well adapted to saturated soil conditions for much of the year. American skunkcabbage, bog Labrador tea (*Ledum groenlandicum*), and sedges begin to re-establish during this phase.

Dominant plant species

- American skunkcabbage (*Lysichiton americanus*), other herbaceous
- bog Labrador tea (*Ledum groenlandicum*), other herbaceous

Community 1.3
Western Redcedar, Bog Labrador Tea, American Skunkcabbage, and Sedge

Structure: Single story with dense understory Community phase 1.3 is an early seral forest in regeneration. Scattered remnant mature trees may be present. Western redcedar regenerates successfully in disturbed areas; it reproduces on fallen branches and trees (Minore, 1990). Shrubs such as rusty menziesia and oval-leaf blueberry also become established on fallen trees and in higher microsites. Deer fern, salmonberry, bog Labrador tea, and American skunkcabbage tend to be the most prolific understory species in this community phase.

Dominant plant species

- western redcedar (*Thuja plicata*), tree
- rusty menziesia (*Menziesia ferruginea*), shrub
- oval-leaf blueberry (*Vaccinium ovalifolium*), shrub
- salmonberry (*Rubus spectabilis*), shrub
- American skunkcabbage (*Lysichiton americanus*), grass
- deer fern (*Blechnum spicant*), grass
- bog Labrador tea (*Ledum groenlandicum*), grass

Pathway 1.1A
Community 1.1 to 1.2

This pathway represents excessive ponding that results in a shallow rooting zone. The trees are susceptible to windthrow, which may create pockets of fallen trees larger than 1 acre in size. Catastrophic windstorms may be stand replacing.

Pathway 1.2A
Community 1.2 to 1.3

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

Pathway 1.3B
Community 1.3 to 1.1

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

Pathway 1.3A
Community 1.3 to 1.2

This pathway represents a disturbance of excessive ponding that results in a shallow rooting zone. The trees are susceptible to windthrow, which may create pockets of fallen trees larger than 1 acre in size. Catastrophic windstorms may be stand replacing.

State 2
Converted

Community 2.1
Managed Cropland and Hayland

Community phase 2.1 may consist of a range of crops, including annually planted species, short-lived perennial species, and more permanent shrubby plants. Hay and grasses and legumes for silage are included in this community phase. Structure: Annual or perennial non-native species monoculture

Community 2.2
Non-Native Grassland and Shrubland

Community phase 2.2 is characterized by low-level agronomic or management activity such as adding soil nutrients, intensive grazing management, regular mowing, or weed control. This plant community commonly consists dominantly of introduced weedy species. Areas that have extremely low fertility or are subject to heavy grazing pressure have a higher proportion of annual, stoloniferous, or rhizomatous species. Wetland areas support dominantly non-native rhizomatous grasses. The plant community may include remnants of introduced pasture species that commonly are seeded. Structure: Annual or perennial herbaceous or shrubby species

Community 2.3
Managed Grassland

Community phase 2.3 receives regular agronomic inputs, including adding soil nutrients and other soil amendments such as lime, implementing grazing management plans, regular mowing, controlling weeds, and reseeding as needed. This plant community typically includes introduced perennial pasture and hay species that commonly are seeded. In areas of historic native grassland, mixtures of perennial and annual native species may be seeded and managed by appropriate agronomic and livestock management activities. Minor amounts of introduced species that commonly are in non-native grassland and shrubland communities (community phase 2.2) are in this phase. Structure: Perennial herbaceous species

Pathway 2.1A
Community 2.1 to 2.2

In the absence of agronomic and livestock management activities, seeds from surrounding weedy plant communities will be transported to the site by wind, floodwater, animals, or vehicle traffic. Adapted species will become established. Management activities include tilling, adding soil nutrients and other soil amendments such as lime, mowing, burning, harvesting or chemically controlling vegetation, planting to desirable herbaceous species,

and implementing grazing management plans.

Pathway 2.1B
Community 2.1 to 2.3

This pathway represents agronomic and livestock management activities, including tilling, adding soil nutrients and other soil amendments such as lime, mowing, burning, harvesting or chemically controlling vegetation, planting to desirable herbaceous species, and implementing grazing management plans.

Pathway 2.2B
Community 2.2 to 2.1

This pathway represents agronomic activities such as tilling, adding soil nutrients and other soil amendments such as lime, mowing, burning, harvesting or chemically controlling vegetation, and planting to desirable crop species.

Pathway 2.2A
Community 2.2 to 2.3

This pathway represents agronomic and livestock management activities, including tilling, adding soil nutrients and other soil amendments such as lime, mowing, burning, harvesting or chemically controlling vegetation, planting to desirable herbaceous species, and implementing grazing management plans.

Pathway 2.3A
Community 2.3 to 2.1

This pathway represents agronomic activities, including tilling, adding soil nutrients and other soil amendments such as lime, mowing, burning, harvesting or chemically controlling vegetation, and planting to desirable crop species.

Pathway 2.3B
Community 2.3 to 2.2

In the absence of agronomic and livestock management activities, seeds from surrounding weedy plant communities will be transported to the area by wind, floodwater, animals, or vehicle traffic. Adapted species will become established. Management activities include tilling, adding soil nutrients and other soil amendments such as lime, mowing, burning, harvesting or chemically controlling vegetation, planting to desirable herbaceous species, and implementing grazing management plans.

Transition T1A
State 1 to 2

This pathway represents a change in land use, including modifications to the hydrologic function to develop pasture and agriculture. Non-native seed disbursement is introduced (intentionally or unintentionally), which alters the reference community.

Restoration pathway T2A
State 2 to 1

This pathway represents a transition to restore the natural hydrologic function and native plant habitat. Native seed sources and extensive management and mitigation of brush and invasive species are needed to restore the community.

Additional community tables

Inventory data references

National vegetation classification: G610 North Pacific Maritime Poor Fen & Bog Forest and Woodland Group
Forest association: CEGL001787 Thuja plicata-Tsuga heterophylla/Lysichiton americanus/Sphagnum spp.

Ecological Systems of Washington State community type: North Pacific Bog and Fen & Sphagnum Bog

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Approval

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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	05/07/2024
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):**

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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:**
