USDA Natural Resources
Conservation Service

Ecological site AX001X01X107
Frigid Udic Alluvial Terrace 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): 001X–Northern Pacific Coast Range, Foothills, and Valleys

This area consists of a long and narrow range of mountains with associated foothills and valleys that parallels the Pacific Ocean. This area is entirely within the Pacific Border Province of the Pacific Mountain System in Oregon and Washington. MLRA 1 is bounded on the north by the highest elevations of the Olympic Mountains and the strait of Juan de Fuca, and by the Klamath Mountains on the south. The Washington portion of this MLRA is primarily composed of young Tertiary sedimentary rocks (siltstone and sandstone) mixed with some volcanic rocks of the same age. Glacial till and outwash deposits are also found in the northern half of this area in Washington. Much of this area is accreted terrane formed by tectonic processes. The average annual precipitation ranges from 60 to 200 inches (1,525 to 5,580 millimeters), increasing with elevation. Most of the precipitation in this area occurs during low-intensity, Pacific frontal storms and is evenly distributed throughout fall, winter, and spring.

The dominant soil orders in this MLRA are Andisols, Inceptisols, and Ultisols. Soil depths broadly range from shallow to very deep. Soils are primarily well drained, however poorly drained soils may be found in depressional areas and on alluvial floodplains. Surface textures are typically medial and loamy or clayey. Soils in this area dominantly have a mesic or frigid temperature regime and a udic moisture regime. Soils with aquic moisture regimes and cryic temperature regimes also occur.

Ecological site concept

Frigid Udic Alluvial Terrace Forest sites occur on high terraces and colluvial aprons in river

valleys. This site occurs is in the transitional zone between floodplain forests and upland forests. Unlike the floodplain forests, flooding occurs very rarely on this site. Mesic Udic Alluvial Terrace sites are characterized by a dense overstory of western hemlock (Tsuga heterophylla) and Douglas-fir (Pseudotsuga menziesii). Western hemlock is a shade-tolerant species, and may continually regenerate in the shaded understory, while Douglas-fir is shade-intolerant and will not regenerate in the absence of adequate sunlight. The understory shrub layer is dominated by salmonberry (*Rubus spectabilis*), red huckleberry (Vaccinium parvifolium), and vine maple (*Acer circinatum*). The forb layer is typically composed of western swordfern (*Polystichum munitum*), twinflower (Linnaea borealis), youth on age (Tolmiea menziesii), pacific trillium (Trillium ova tum), common ladyfern (Athyrium filix-femina), false lily of the valley (Maianthemum dilatatum), and redwood-sorrel (Oxalis oregana).

Associated sites

AX001X01X406	**Frigid Udic Forest** Frigid Udic Forest sites are upland forest sites found above Frigid Udic Alluvial Terrace Forest sites.
AX001X01X407	**Frigid Udic Moist Forest** Frigid Udic Moist Forest sites are upland forest sites found above Frigid Udic Alluvial Terrace Forest sites.
AX001X01X408	**Frigid Udic Dry Forest** Frigid Udic Dry Forest sites are upland forest sites found above Frigid Udic Alluvial Terrace Forest sites.
AX001X01X200	**Temperate Wet Meadow** Temperate Wet Meadows are found on depressions and seeps adjacent to or surrounded by Frigid Udic Alluvial Terrace Forest sites. Temperate Wet Meadow sites lack tree cover.

Similar sites

AX001X01X003	**Mesic Udic Alluvial Terrace Forest** Mesic Udic Alluvial Terrace Forest sites occur at intermediate elevations between Isomesic Udic Alluvial Terrace Forests and Frigid Udic Alluvial Terrace Forests. Mesic Udic Alluvial Terrace Forest sites are distinguished by their lack of both Sitka spruce (Picea sitchensis) and Pacific silver fir (Abies amabilis).
AX004A01X005	**Isomesic Udic Alluvial Terrace Forest** Isomesic Udic Alluvial Terrace Forest sites occur at lower elevations in the Sitka Spruce belt and are readily distinguished by the presence of Sitka spruce (Picea sitchensis).

Table 1. Dominant plant species

Tree	(1) *Tsuga heterophylla* (2) *Abies amabilis*
Shrub	(1) *Vaccinium ovalifolium* (2) *Rubus spectabilis*
Herbaceous	(1) *Tiarella trifoliata* (2) *Athyrium filix-femina*

Legacy ID

F001XA107WA

Physiographic features

This site primarily occurs on terraces and colluvial aprons on river valleys. Frigid Udic Alluvial Terrace Forest sites are found on alluvial terraces which only very rarely flood. These sites display an intermediate character, existing in the ecotone between Temperate Floodplain Shrublands and upland forest sites.

Table 2. Representative physiographic features

Landforms	(1) River valley > Terrace (2) River valley > Colluvial apron
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Very rare
Ponding frequency	None
Elevation	450–1,100 m
Slope	0–15%
Water table depth	150 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

This site occurs in a frigid temperature regime, and udic moisture regime. Precipitation arrives mostly via low-intensity, Pacific frontal storms. Precipitation is unevenly distributed, with the lowest amounts on the leeward side of the Coast Range mountains. Precipitation falls largely as snow in higher elevations. Precipitation is evenly distributed throughout the fall, winter, and spring, while summers are dry. Air temperatures vary significantly along the elevation gradient.

Table 3. Representative climatic features

Frost-free period (characteristic range)	90-150 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	2,007-2,997 mm

Influencing water features

This site may be subject to very rare, brief flooding. Flooding may only occur in years with above average snowfall. Water features on site do not significantly influence plant community dynamics on site.

Soil features

The soils are very deep, have very high or high Ksat throughout, and are well drained. The soils are formed from mixed geology alluvium. Soil surface textures range loam and sandy loam texture classes, with gravelly to extremely gravelly texture modifiers. Clay content is eight to 17 percent from zero to 75 cm, and five to 15 percent from 75 to 150 cm. The soil series for this ecological site are Lolocreek and Lapoetcreek. Although representative of this site, these soils may exist across multiple ecological sites because of naturally variable slope, texture, rock fragments, and pH. An on-site soil pit and the most current ecological site key are necessary to classify a site.

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Loam (2) Sandy loam
Drainage class	Well drained
Soil depth	150 cm
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0–5%
Available water capacity (0-101.6cm)	7.62–20.32 cm
Soil reaction (1:1 water) (0-25.4cm)	4.5–5.5
Subsurface fragment volume <=3" (0-50.8cm)	0–35%
Subsurface fragment volume >3" (0-50.8cm)	0–60%

Ecological dynamics

Mesic Udic Alluvial Terrace sites are subject to disturbance from windstorm events, wildfires, floods, and mass movement events. Windthrow may create small gaps in the overstory canopy that favor understory regeneration. Frequent windthrow creates varied-age patches of trees. Root and butt rot fungi exacerbate trees' susceptibility to windthrow. Wildfires are an additional source of disturbance, though they occur much less frequently. The fire regime of this forest type is characterized by infrequent, severe fire events. The fire return interval is very high, 100 to nearly 1,000 years (FEIS, 2012). Flooding events may occur very rarely. Since these sites are generally located on high stream terraces, a large volume of water is required for streams to overflow to this level. Alluvial terrace forest sites experience less than one percent probability of flooding in any year. When they do occur, intense flood events may cause tree mortality, scour the mineral soil surface, and can remove existing vegetation from the site.

Any stand-replacing disturbance that removes overstory tree species will generally favor the regeneration of shade-intolerant species in its aftermath. Douglas-fir is a highly shade-intolerant tree species and generally requires a stand-replacing wildfire event to clear canopy for successful recruitment and regeneration. In the absence of large-scale disturbance, more shade-tolerant western hemlock will continually regenerate and gradually succeed Douglas-fir. The longevity of Douglas-fir preserves evidence of historical high-intensity wildfire events. Sufficiently destructive windthrow or flood events may create conditions favorable for Douglas-fir recruitment, but not as reliably as do wildfire events.

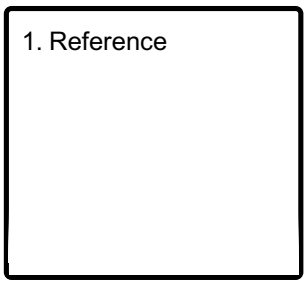
Red alder recruits quickly regenerate in the aftermath of stand-replacing disturbance, accompanied by Sitka willow (*Salix sitchensis*) and coastal hedgenettle (*Stachys chamissonis*). Bigleaf maple will be the next tree species to establish on the site, while salmonberry (*Rubus spectabilis*) and California blackberry, locally known as trailing blackberry, (*Rubus ursinus*) typically establish. As time passes, shrub and forb layers develop discrete from the overstory layers, dominated by salmonberry, vine maple (*Acer circinatum*), and western swordfern (*Polystichum munitum*). By this point, Douglas-fir has likely established on the site. Western hemlock will slowly regenerate in the shaded understory and will gradually replace bigleaf maple, and eventually will become the dominant tree species on the site. At this point, the forest canopy is composed of a single, dense stratum. Canopy stratification will be encouraged by tree maturation, as well as by mortality induced by small-scale disturbances. Increased vertical stratification promotes diversity and abundance of shrubs and forbs, allowing a return to reference community conditions.

Changes in disturbance frequency or intensity through human alteration of the natural fire regime and a changing climate may promote shifts in community structure and function. For example, fire suppression efforts will likely shift communities further towards a shade-tolerant western hemlock-dominated seral stage. (Reed, 2010) Alternatively, increased fire frequency in some areas due to human activity will encourage Douglas-fir recruitment and

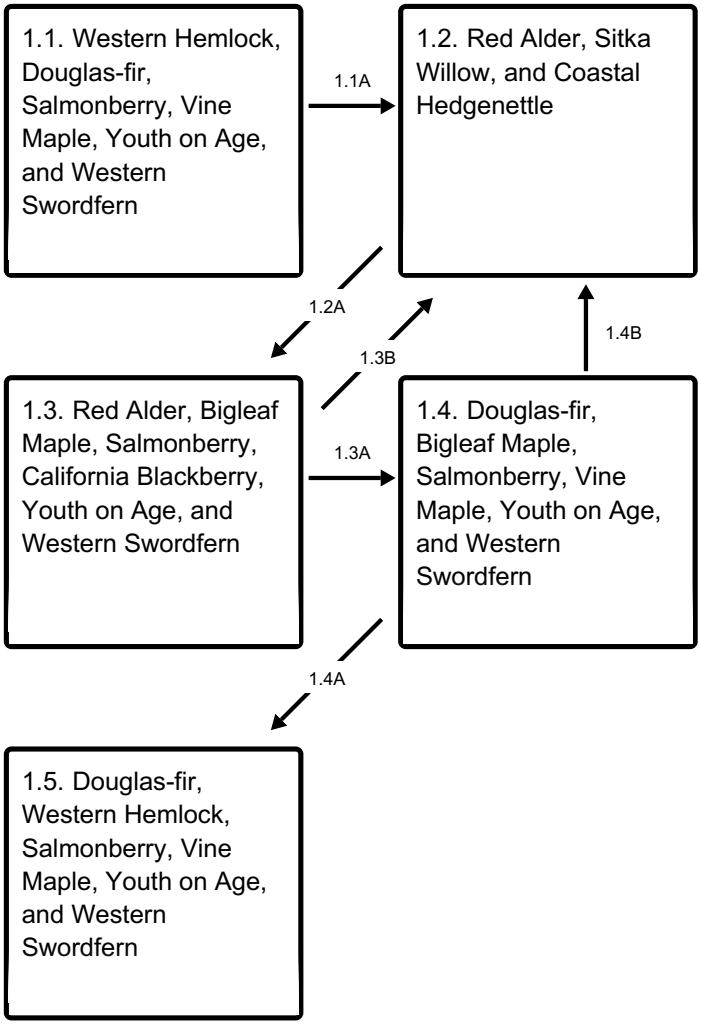
establishment. (Gavin, 2015)

State and transition model

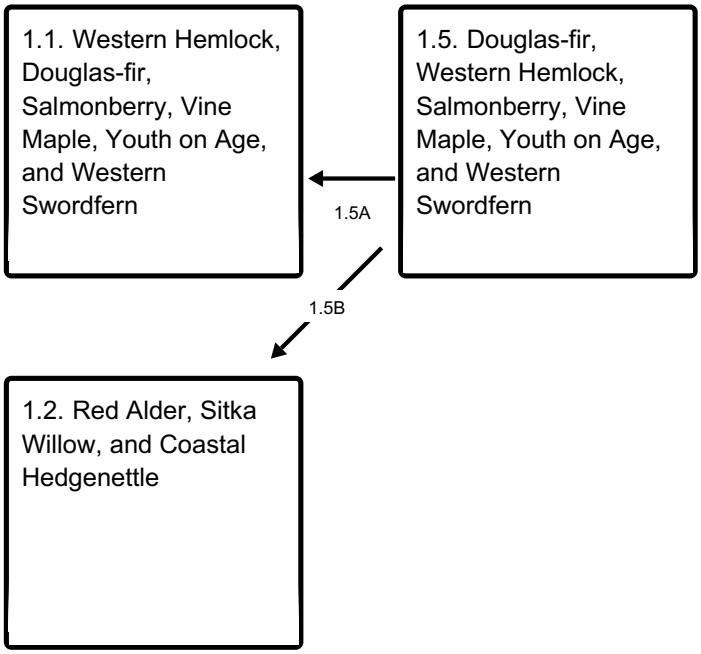
Ecosystem states



State 1 submodel, plant communities



Communities 1, 5 and 2 (additional pathways)



1.1A - High-intensity disturbance

1.2A - Time without disturbance

1.3B - High-intensity disturbance

1.3A - Time without disturbance

1.4B - High-intensity disturbance

1.4A - Time without disturbance

1.5A - Time without severe disturbance

1.5B - High-intensity disturbance

State 1
Reference

The Reference state is comprised of five communities is varying stages of regeneration. Communities in the Reference state range from a sparse, emergent understory of shrubs and forbs that is found in the early aftermath of disturbance, to mature stands of conifers.

Dominant plant species

- western hemlock (*Tsuga heterophylla*), tree
- Pacific silver fir (*Abies amabilis*), tree
- vine maple (*Acer circinatum*), tree
- Douglas-fir (*Pseudotsuga menziesii*), tree
- oval-leaf blueberry (*Vaccinium ovalifolium*), shrub
- salmonberry (*Rubus spectabilis*), shrub
- rusty menziesia (*Menziesia ferruginea*), shrub
- threeleaf foamflower (*Tiarella trifoliata*), other herbaceous
- common ladyfern (*Athyrium filix-femina*), other herbaceous
- coastal hedgenettle (*Stachys chamissonis*), other herbaceous
- western swordfern (*Polystichum munitum*), other herbaceous

Community 1.1
Western Hemlock, Douglas-fir, Salmonberry, Vine Maple, Youth on Age, and Western Swordfern

Structure: multistory with small gap dynamics Western hemlock and Douglas-fir are the dominant tree species in the reference community. Individual mortality of mature trees creates small canopy gaps. Western hemlock tolerates shade and will continually regenerate in the understory. Deciduous regeneration is generally limited to canopy gaps. The understory consists of diverse shrub, forb, and grass layers.

Community 1.2
Red Alder, Sitka Willow, and Coastal Hedgenettle

Structure: sparse understory of emergent shrubs, forbs, and grasses This community follows a stand-replacing disturbance event. Red alder, Sitka willow, and coastal hedgenettle quickly establish where the canopy has been removed.

Community 1.3
Red Alder, Bigleaf Maple, Salmonberry, California Blackberry, Youth on Age, and Western Swordfern

Structure: shrubby single story with scattered understory of trees, shrubs, forbs, and grasses This community follows the initial phase of regeneration post-disturbance. As time progresses, bigleaf maple successfully establishes. The shrub and forb layers gradually diversify as slow-growing species begin to regenerate.

Community 1.4
Douglas-fir, Bigleaf Maple, Salmonberry, Vine Maple, Youth on Age, and Western Swordfern

Structure: deciduous forest with a mix of shrubs, forbs, and grasses, with conifer regeneration in the understory Douglas-fir recruits have established on the site and largely replaces red alder. Vine maple is a significant understory shrub component in this community.

Community 1.5
Douglas-fir, Western Hemlock, Salmonberry, Vine Maple, Youth on Age, and Western Swordfern

Structure: single story with few small openings Western hemlock begins to replace bigleaf maple as the subdominant tree species and will continually regenerate in the shaded understory. The canopy consists mainly of a single, dense layer. The dense canopy results in lowered understory productivity relative to the reference community. As time

progresses, individual tree mortality and small-scale disturbance will act on the site to create canopy gaps and increase vertical stratification.

Pathway 1.1A
Community 1.1 to 1.2

Stand-replacing disturbance events such as high-intensity fire, catastrophic windstorms, and floods open the forest canopy and lead to the stand initiation phase of development.

Pathway 1.2A
Community 1.2 to 1.3

Time without disturbance allows regeneration, growth, and progression to a later seral stage.

Pathway 1.3B
Community 1.3 to 1.2

Stand-replacing disturbance events such as high-intensity fire, catastrophic windstorms, and floods open the forest canopy and lead to the stand initiation phase of development.

Pathway 1.3A
Community 1.3 to 1.4

Time without disturbance allows regeneration, growth, and progression to a later seral stage.

Pathway 1.4B
Community 1.4 to 1.2

Stand-replacing disturbance events such as high-intensity fire, catastrophic windstorms, and floods open the forest canopy and lead to the stand initiation phase of development.

Pathway 1.4A
Community 1.4 to 1.5

Time without disturbance allows regeneration, growth, and progression to a later seral stage. Individual tree mortality creates small canopy openings.

Pathway 1.5A
Community 1.5 to 1.1

Time without disturbance allows regeneration, growth, and progression to a later seral stage. Vertical stratification increases and forb diversity increases. Individual tree mortality

creates varied-age patches.

Pathway 1.5B
Community 1.5 to 1.2

Stand-replacing disturbance events such as high-intensity fire, catastrophic windstorms, and floods open the forest canopy and lead to the stand initiation phase of development.

Additional community tables

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	04/09/2026
Approved by	Grant Petersen
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:

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):**

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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:**

17. **Perennial plant reproductive capability:**