

Ecological site AX002X01X001

Puget Lowlands Dry Forest

Last updated: 12/03/2024
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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): 002X–Willamette and Puget Sound Valleys

The Willamette and Puget Sound Valleys Major Land Resource Area (MLRA 2) is in western parts of Washington and Oregon. It occupies a forearc basin between the Coast Ranges and the Cascade Mountain volcanic arc. The northern part contains Pleistocene drift, outwash, and lacustrine and glaciomarine deposits associated with continental glaciers. The southern part contains Late Pleistocene deposits from glacial outburst floods (Missoula Floods).

Climate is mild and moist, and the growing season is long. Mean annual precipitation ranges from 20 to 60 inches, received mostly in fall, winter, and spring. Summers are dry. The soil temperature regime is mesic, and the soil moisture regimes are xeric and aquic.

Most sites in this MLRA can support forested vegetation, but some were maintained as prairie, savanna, or woodland through cultural burning prior to Euro-American settlement. Puget Sound has a moderating effect on temperatures, and humidity can be higher in the northern part of the MLRA. Douglas-fir (*Pseudotsuga menziesii*) is widespread throughout. Oregon white oak (*Quercus garryana*) is common on uplands in the south and on warm, exposed or droughty sites in the north. Pacific madrone grows in areas close to saltwater. Western hemlock (*Tsuga heterophylla*) is codominant with Douglas-fir in the north. Flood plains typically contain Brayshaw black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) and red alder (*Alnus rubra*). Oregon ash (*Fraxinus latifolia*) is typical of forested wetlands in the south.

Forestry, urban development, and cultivated agriculture are currently the most extensive land uses (USDA, Agriculture Handbook 296, 2022).

LRU notes

The Puget Sound Trough Lowlands Land Resource Unit (LRU) is bounded to the north by the Frasier River Valley at the international border with Canada and extends south to the Cowlitz River. To the west lie Puget Sound and the Strait of Juan De Fuca; to the east lie the foothills of the Cascade Range. The LRU is affected by the proximity of climate-moderating saltwater. Modest annual swings in temperature, winters that seldom experience freezing temperatures, adequate rainfall, and warm, dry summers support small-scale agriculture and forestry. This climate also supports the largest population and highest population density in the Northwest. Aside from isolated areas affected by local rain shadows and marine-influenced fog, the climate is consistent throughout the Puget Lowlands.

The LRU represents the furthest southern extent of repeated advances of continental glaciers in western Washington. Glacial drift is the predominant parent material. The LRU also includes intermittent areas of glacially modified, resistant bedrock and several alluvial systems. Volcanic ash is present but intermittent. Soil moisture varies considerably over short distances. This variability creates a mosaic of small plant communities. Soil drainage can be restricted by dense glaciomarine sediments or till. This restriction can create widespread areas of seasonal high water tables and ponding. In places, soils that developed in deep, unconsolidated, coarse-textured sandy drift

or in bedrock-restricted colluvium have low available water capacity. South-facing areas near shorelines and minor outwash plains are typically some of the drier areas in the LRU. Precipitation increases with elevation and distance from Puget Sound.

Ecological site concept

This site is within rain shadows. It is on bedrock, dense till hills, bluffs, outwash plains, and other warmer, typically south-facing aspects in the Puget Lowlands. Most of the annual precipitation is received from October through April, primarily as rain. Snow is rare. Soils are primarily coarse-textured and well drained or somewhat excessively drained. The soils generally have low plant-available moisture. The site is not impacted by a seasonal high water table. This site is among the warmest and driest forest sites in the region. The site is common along the Puget Sound shoreline.

Associated sites

AX002X01X002	Puget Lowlands Tidal Flat
AX002X01X004	Puget Lowlands Forest

Similar sites

AX002X02X001	Portland Basin Dry Douglas-fir Forest
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Table 1. Dominant plant species

Tree	(1) <i>Pseudotsuga menziesii</i>
Shrub	(1) <i>Holodiscus discolor</i>
Herbaceous	(1) <i>Goodyera oblongifolia</i>

Legacy ID

F002XA001WA

Physiographic features

The site is on south-facing slopes of bedrock or till hills, terraces on outwash plains, and near-shore bluffs.

Table 2. Representative physiographic features

Flooding frequency	None
Ponding frequency	None
Elevation	0–91 m
Slope	5–30%
Aspect	W, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Flooding frequency	None
Ponding frequency	None
Elevation	0–305 m
Slope	0–60%

Climatic features

Mean annual air temperature: 48 to 52 degrees Fahrenheit

Table 4. Representative climatic features

Frost-free period (characteristic range)	160-240 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	508-889 mm

Influencing water features

This site is not influenced by water from a wetland or stream.

Soil features

Surface textures: Gravelly sandy loams and gravelly loamy sands

Soil family textures: loamy-skeletal; Loamy-skeletal

Parent material: Glacial drift, including outwash or till

Soil depth: 20 to more than 60 inches. Lithic or densic contacts are possible restrictions.

Soil drainage: Somewhat poorly drained to somewhat excessively drained. Well drained and somewhat excessively drained are most common.

Available water capacity in the top 40 inches: 1 to 2 in/in.

pH in water: 5.1 to 7.3

Soil is dry in all parts from 75 to 90 consecutive days.

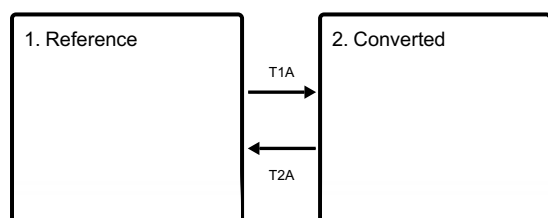
Ecological dynamics

These sites are found within the rainshadow of the Puget Trough, situated mainly on south facing slopes and ridges. The majority of annual precipitation is received from October through to March. Temperatures are high in the summer and the soils generally have low moisture, making them some of the hottest and driest conifer sites in the region. Douglas-fir is the dominant tree species in the historic climax plant community. Pacific madrone will establish itself as a minor component in some instances but may be major component where disturbance has occurred and Douglas-fir has not regenerated successfully.

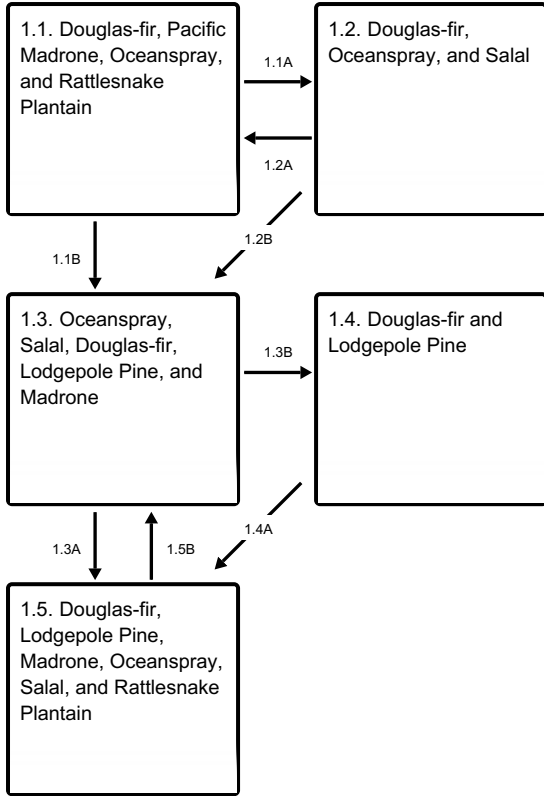
Natural disturbances such as fires and wind storms have played a role in the development of this site, as have human endeavors such as timber harvesting and conversion to cropland. The natural fire regime appears to be one of low to moderate intensity fires on a 30 to 100 year frequency.

State and transition model

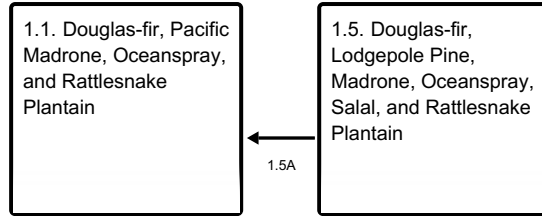
Ecosystem states



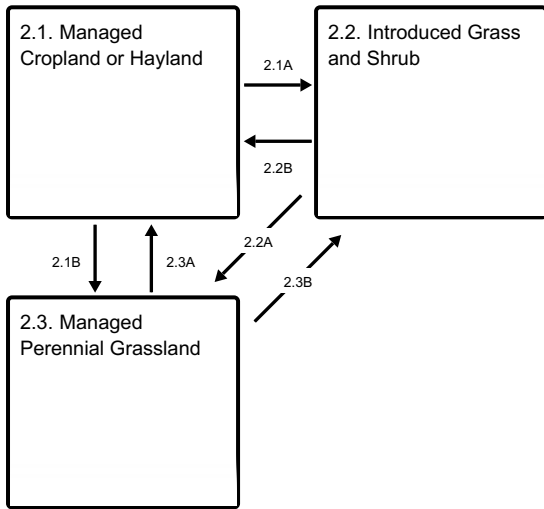
State 1 submodel, plant communities



Communities 1 and 5 (additional pathways)



State 2 submodel, plant communities



State 1 Reference

**Community 1.1
Douglas-fir, Pacific Madrone, Oceanspray, and Rattlesnake Plantain**

Structure is multistory with small gap dynamics. Douglas-fir is the dominant tree species in the historic climax plant community. Pacific madrone will establish itself as a minor component in some instances but may occasionally be major component. As Douglas-fir ages it can withstand more serious fire intensities; additionally, following fire or other stresses, trees generally produce copious amounts of seed. This situation would allow the site to develop into one that contains several age classes of Douglas-fir. Pacific madrone, a thin barked species, will be top-killed by fire but can sprout prolifically from underground burls, provided it receives adequate sunlight. Madrone also favors mineral soil for seedling establishment, competing with coniferous seedlings. If Douglas-fir does not re-occupy the site quickly, Pacific madrone will take advantage of the disturbed mineral soil and become a major component of the community, as will oceanspray. If a seed source is present, lodgepole pine will also become established on these sites.

Forest overstory. Dominated by Douglas-fir with varying amounts of madrone (0 to 20percent); lodgepole pine may be present (up to 30 percent on some locations); grand fir and western redcedar present in small numbers (less than 5 percent)

Forest understory. Shrub species dominate.

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- Pacific madrone (*Arbutus menziesii*), tree
- oceanspray (*Holodiscus discolor*), shrub
- western rattlesnake plantain (*Goodyera oblongifolia*), other herbaceous

Community 1.2

Douglas-fir, Oceanspray, and Salal

Structure: Mosaic of mature overstory and regenerating openings This community retains some areas that resemble community 1.1 but also contains moderate sized (2 to 5 acres) areas of regeneration. Moderate to intense fires, pockets of disease, or uneven-aged management (group selection or shelterwood with reserves) can create this plant community. Depending on the seed sources that are present, patches of seedling and sapling may contain Douglas-fir, madrone, Oregon white oak, and/or lodgepole pine as well as oceanspray, dwarf rose and Cascade barberry (*Mahonia nervosa*, known locally as Oregongrape). Both harvesting and fire can spur the growth of pioneering species. Lodgepole pine can out-compete Douglas-fir in height growth early, but a mixed species stand results if the seedling density isn't too high. In the absence of further management, some patches may be dominated by shrub species until their coverage gradually diminishes due to shading by the overstory, which can take many years.

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- Pacific madrone (*Arbutus menziesii*), tree
- beach pine (*Pinus contorta* var. *contorta*), tree
- Oregon white oak (*Quercus garryana*), tree
- oceanspray (*Holodiscus discolor*), shrub
- dwarf rose (*Rosa gymnocarpa*), shrub
- Cascade barberry (*Mahonia nervosa*), shrub

Community 1.3

Oceanspray, Salal, Douglas-fir, Lodgepole Pine, and Madrone

Structure is single story shrub. Community 1.3 consists of forestland in regeneration. Species composition depends on the natural seed sources present and the intensity of management. If the regeneration is planted, Douglas-fir is most likely be selected. Douglas-fir, lodgepole pine, Pacific madrone and Oregon white oak are the common tree species available for natural seeding while typical shrubs include oceanspray, trailing blackberry, dwarf rose and Cascade barberry (*Mahonia nervosa*, known locally as dull Oregongrape).

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- Pacific madrone (*Arbutus menziesii*), tree
- beach pine (*Pinus contorta* var. *contorta*), tree
- oceanspray (*Holodiscus discolor*), shrub
- salal (*Gaultheria shallon*), shrub

Community 1.4

Douglas-fir and Lodgepole Pine

Structure is single story with diminished understory This community typically consists of the "stem exclusion" phase of stand development. The overstory canopy is closed, leading to intense competition for sunlight and a diminished

understory. These stands are typically very dense and have minimal vertical differentiation.

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- beach pine (*Pinus contorta* var. *contorta*), tree
- oceanspray (*Holodiscus discolor*), shrub
- Cascade barberry (*Mahonia nervosa*), shrub

Community 1.5

Douglas-fir, Lodgepole Pine, Madrone, Oceanspray, Salal, and Rattlesnake Plantain

Structure is single story with scattered openings This community consists of maturing forest. Although still basically single-story in appearance, the stand is starting to differentiate vertically. Some sunlight reaches the forest floor, allowing for an increased understory of mainly shrub species.

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- beach pine (*Pinus contorta* var. *contorta*), tree
- Pacific madrone (*Arbutus menziesii*), tree
- oceanspray (*Holodiscus discolor*), shrub
- salal (*Gaultheria shallon*), shrub
- western rattlesnake plantain (*Goodyera oblongifolia*), other herbaceous

Pathway 1.1A

Community 1.1 to 1.2

This pathway represents a larger disturbance with moderate to high intensity fires or major wind storms would be the natural disruptive forces while a group selection or shelterwood (with reserves) harvest would represent the human-initiated community. Areas of regeneration would generally range from 2 to 5 acres in size.

Pathway 1.1B

Community 1.1 to 1.3

This is the pathway of a major disturbance, such as a stand-replacing fire or clear-cut, followed by prescribed fire, with the intention of regeneration.

Pathway 1.2A

Community 1.2 to 1.1

This pathway indicates growth over time with no additional disturbances. 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 community 1.1.

Pathway 1.2B

Community 1.2 to 1.3

This pathway represents intensive management, such as a change from uneven-aged management to even-aged management. Block harvest with a post-harvest burn leads to a plant community in the stand initiation stage. Site preparation and planting improved seedlings lead to a single-species stand. No further management leads to a mixed species stand that is dependent on natural seed sources.

Pathway 1.3B

Community 1.3 to 1.4

This pathway represents absence of management and denotes only growth over time. Without active management, large areas can be dominated by various shrubs until they are gradually shaded out by the overstory, which can

take many years.

Pathway 1.3A **Community 1.3 to 1.5**

This pathway represents growth over time in conjunction with active management. Precommercial thinning, commercial thinning, or both, combined with understory control, lower the stand density and decrease competition between trees.

Pathway 1.4A **Community 1.4 to 1.5**

This pathway represents growth over time, with or without thinning. If an area is not thinned, mortality occurs in the intermediate and suppressed trees.

Pathway 1.5A **Community 1.5 to 1.1**

This pathway represents no further management. Growth over time leads to continued vertical differentiation, including scattered pockets of reproduction and an increase in the number of shrubs and forbs.

Pathway 1.5B **Community 1.5 to 1.3**

This pathway represents intensive management focused on wood products. Clear-cutting, prescribed fire, or other site preparation and tree planting are the management steps.

State 2 **Converted**

Community 2.1 **Managed Cropland or Hayland**

Structure is annual or perennial non-native species monoculture. This community consists of a range of crops, including annually planted species, short-lived perennial species, and more permanent shrubby crops. Hay and grasses and legumes for silage are included in this community.

Community 2.2 **Introduced Grass and Shrub**

Structure is annual or perennial herbaceous or shrubby species. Community 3.2 is characterized by low-level or more intermittent management activity such as occasional or light grazing or sporadic mowing. This plant community is dominated by introduced weedy species and the less frequent disturbance supports a more shrubby character. The site is grazed, mowed or burned often enough to prevent re-establishment of forest. Dominant shrubs are typically invasive rhizomatous species that form thickets such as Himalayan blackberry (*Rubus armeniacus*) or those that develop a robust seedbank and flourish in open conditions such as Scotch broom (*Cytisus scoparius*). Some tougher native shrub species such as California blackberry (*Rubus ursinus*) may be interspersed. Wetter areas commonly support non-native rhizomatous grasses. Between shrub thickets introduced pasture species such as tall fescue (*Schedonorus arundinaceus*), orchardgrass (*Dactylis glomerata*) and red fescue (*Festuca rubra*) are common. Fire and soil disturbing activities often favors an increase in western brackenfern (*Pteridium aquilinum*).

Community 2.3 **Managed Perennial Grassland**

This community is an introduced grassland that receives regular grazing or mowing disturbance and may include soil amendments such as fertilizers or lime. Weeds are aggressively controlled and desired herbaceous species are

reseeded as necessary. Grazing, mowing and other weed control actions prevent the phase from transitioning to a forested state. This plant community is typically dominated by introduced perennial pasture species that are seeded after clearing. Common species include tall fescue (*Schedonorus arundinaceus*), orchardgrass (*Dactylis glomerata*) and red fescue (*Festuca rubra*).

Pathway 2.1A **Community 2.1 to 2.2**

This pathway occurs by a reduction in frequent agronomic management disturbance (e.g. discontinued seedbed preparation, harvesting, mowing, etc.) which provides opportunity for grasses, forbs, shrub and bramble-forming species to establish. Intermittent disturbances, such as periodic grazing, targeted mowing or prescribed fire may maintain this community, preventing it from advancing to a forested state.

Context dependence. This pathway occurs by a reduction in frequent agronomic management disturbance (e.g. discontinued seedbed preparation, harvesting, mowing, etc.) which provides opportunity for grasses, forbs, shrub and bramble-forming species to establish. Intermittent disturbances, such as periodic grazing, targeted mowing or prescribed fire may maintain this community, preventing it from advancing to a forested state.

Pathway 2.1B **Community 2.1 to 2.3**

This pathway occurs by intentional establishment of a perennial grass-dominated plant community. Often, the site will be prepped for seeding and desired pasture species artificially sown. In some cases, simply discontinuing crop production activities may allow the site to transition to grass, provided emergence of woody shrubs or trees is actively controlled with mowing, fire, or chemical treatment. Consistent grazing is essential to the maintenance of this community and to prevent development of woody shrubs. Other maintenance practices, such as targeted mowing, prescribed fire, chemical treatment, or other mechanical treatment are utilized as needed.

Pathway 2.2B **Community 2.2 to 2.1**

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

Pathway 2.2A **Community 2.2 to 2.3**

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

Pathway 2.3A **Community 2.3 to 2.1**

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

Pathway 2.3B **Community 2.3 to 2.2**

This pathway occurs by a reduction in grazing and associated management disturbance (e.g. discontinued seedbed preparation, harvesting, mowing, etc.) which provides opportunity for shrubs and bramble-forming species and other weedy, invasive species to establish. Intermittent disturbances, such as periodic grazing, targeted mowing or prescribed fire may maintain this community, preventing it from advancing to a forested state.

Transition T1A

State 1 to 2

This transition is caused by an intentional clearing of land or a stand replacing fire in state 1, followed by intense, frequent disturbance such as grazing, mowing, crop production, or frequent fire to prevent trees from re-establishing. This transition can be initiated from any community in state 1.

Transition T2A

State 2 to 1

This restoration occurs by artificial or natural re-establishment over time of species resembling overstory and understory diversity typical of the reference state. Intentional planting, site preparation, and control of competing invasive weeds will accelerate this transition. This transition can be initiated from any community in state 2.

Additional community tables

Inventory data references

Relationship to Other Established Classifications:

This site is related to plant associations PICO-PSME/GASH, PSME-ABGR/FEOC, PSME-ABGR/HODI/POMU, PSME-ARME/GASH, PSME-ARME/HODI/LOHI, PSME/GASH-HODI, SPME/HODI-SYAL, SPME/ROGY-HODI, and QUGA-PSME/SYAL/POMU in Chappell (2006). 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, WA. https://file.dnr.wa.gov/publications/amp_nh_upland_puget.pdf (accessed 29 January 2021).

Other references

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Approval

Kirt Walstad, 12/03/2024

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	12/22/2024
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:

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:**
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17. **Perennial plant reproductive capability:**
-