Ecological site F002XB004OR
Fragipan Hill Group

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 located in western Washington and Oregon. It occupies a forearc basin between coast ranges and the Cascade Mountain volcanic arc. The northern part contains Pleistocene drift, outwash, 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, with a long growing season. Mean annual precipitation ranges from 20 to 60 inches, falling mostly in fall, winter, and spring. Summers are dry. Soil temperature regime is mesic and 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 (Arbutus menziesii) occurs in areas close to salt water. Western hemlock (Tsuga heterophylla) is codominant with Douglas-fir in the north. Floodplains usually contain 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 (Soil Survey Staff, 2006).

LRU notes

The Portland Basin and Hills Land Resource Unit (LRU B) is located in northwest Oregon and southwest Washington. It includes the Portland Basin and surrounding hills. Isolated areas of LRU C (Willamette Valley) occur below 400 feet in the Tualitan Valley on loamy or silty Missoula Flood deposits. The Columbia River Gorge borders this LRU on the east. Brackish tidewater beginning near the town of Cathlamet marks the northwestern limit of this LRU along the Columbia River floodplain. Elevation ranges from sea level to about 1200 feet. Topography is flat to steep. Major landforms include the Columbia River floodplain, glaciofluvial terraces, hills, and foothills. The valley floor is underlain by Pleistocene fluvial deposits (Rowland Formation). Hills and foothills are underlain by Eocene to Pliocene sedimentary rocks (Yamhill, Nestucca, Scotts Mills, Molalla, and Troutdale Formations), Miocene Columbia River Basalt, or Plio-Pleistocene Boring Lavas (Orr et al., 1992). Gravelly or sandy Late Pleistocene Missoula Flood deposits can occur below 400 feet elevation. Hills are covered in loess, and fragipans (brittle subsoil layers) are common.

Mean annual precipitation ranges from 35 to 60 inches. Most falls as rain between October and May. The frost-free period ranges from 160 to 210 days. Ice storms occur each winter. Locations near the Columbia River Gorge experience strong winds. Most locations experience less summer moisture stress compared with the main Willamette Valley; summertime average daily maximum temperatures at Vancouver, WA are 1 to 3 degrees F cooler compared with Corvallis, OR (Agricultural Climate Information System, 2007a, 2007b).

Cultural fire use prior to Euro-American settlement was apparently less than in the main Willamette Valley, though it

was used in some areas. General Land Office (GLO) land surveys conducted between 1851 and 1910 indicate that forest and woodland communities were more prevalent than prairies and savannas (Hulse et al., 2002). Forested reference community phases have been chosen for these upland ecological sites.

Presence of Oregon white oak (*Quercus garryana*), and absence of western hemlock (Tsuga heterophylla) distinguish this area from coast range (MLRA 1) and Cascade mountain (MLRA 3) ecological types in Oregon. Relative abundance of western redcedar (*Thuja plicata*) helps distinguish this are from the Willamette Valley (LRU C).

Classification relationships

This ecological site group occurs in mosaic with well drained forested sites similar to the following LANDFIRE Biophysical Setting (BpS):
• LANDFIRE Biophysical Setting: North Pacific Dry Douglas-fir Forest and Woodland (0710350)

Ecological site concept

This site occurs on loess-covered hills. A fragipan restricts roots and impedes the downward movement of water. Consequently, a perched water table is located within 20 inches of the soil surface during early spring. The rooting zone is dry 45 to 60 consecutive days during the summer. The seasonal water table restricts rooting depth for most conifers. The reference plant community is bigleaf maple - red alder / beaked hazelnut / forbs.

Table 1. Dominant plant species

Tree	(1) *Acer macrophyllum* (2) *Alnus rubra*
Shrub	(1) *Corylus cornuta*
Herbaceous	Not specified

Physiographic features

Landform: hills
Parent material: loess
Elevation: 200 to 1200 feet
Slope: 0 to 30 percent
Flooding: none
Ponding: none

This site occurs on the Dolph geomorphic surface located around the edge of the Portland Basin (Balster and Parsons, 1968; Reckendorf, 1993).

Table 2. Representative physiographic features

Landforms	(1) Hill
Flooding frequency	None
Ponding frequency	None
Elevation	200–1,200 ft
Slope	0–30%

Climatic features

Mean annual air temperature: 50 to 54 degrees F
Mean annual precipitation: 45 to 60 inches
Frost free period: 165 to 210 days

Influencing water features

Perched water tables rise above 20 inches of the soil surface, and the rooting zone is saturated during the early growing season.

Wetland description

None

Soil features

Drainage class: somewhat poorly or poorly drained
Parent material: loess
Soil restrictive feature(s): a fragipan (brittle subsoil layer) occurs in most soils
Soil moisture regime: aquic or xeric
Soil temperature regime: mesic
Particle-size family(s): fine-silty
Soil mineralogy: mixed
Cation exchange capacity: superactive
Soil reaction: moderately or strongly acid

Perched water tables rise above 20 inches of the soil surface, and the rooting zone is saturated during the early growing season. Fragipans are often present. Soils classify as Inceptisols. Additions of loess have rejuvenated and increased the fertility of these soils; cation-exchange activity class is higher compared with soils on the Dolph geomorphic surface in the Willamette Valley (LRU C).

Soils correlated with this site include Delena, Powell, Borges, and Wollent.

Ecological dynamics

Central Concept

This site occurs on loess-covered hills. Soils are silty. A fragipan restricts roots and impedes the downward movement of water. Consequently, a perched water table is located within 20 inches of the soil surface during early spring. The rooting zone is dry 45 to 60 consecutive days during the summer which is typical for upland sites in this LRU. The seasonal water table restricts rooting depth for most conifers. Deciduous forest tends to develop. The reference plant community is bigleaf maple - red alder / beaked hazelnut / forbs.

Disturbance

This site developed under a mixed-severity to low-severity fire regime; the estimated mean fire return interval is 36 years (Kertis et al., 2007). Cultural burning was not focused here prior to Euro-American settlement. General Land Office (GLO) surveys noted mainly conifer forest. Woodlands were rare. Fire has been suppressed since modern wildland fire suppression efforts began.

Tree-throw occurs in forested communities especially where a seasonal water table exists in the soil profile. Pocket gophers (Thomomys spp.) make burrows and mounds in early-seral communities (Oregon Department of Fish and Wildlife).

Plant Composition

Conifer forest was typical prior to Euro-American settlement but modern fire suppression efforts have generally led to denser forest stands through the proliferation of shade-tolerant, fire-intolerant species. However, prairie or savanna can be created and maintained on this site.

Representative native plants are listed below. Not all species are present within the same community phase. Plant lists (especially for grasses, grasslikes, and forbs) are incomplete.

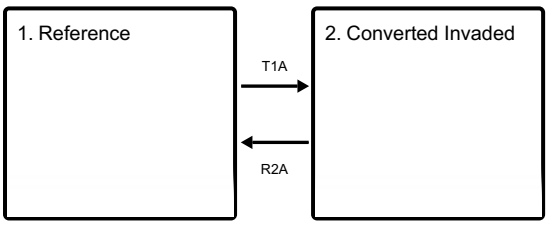
TREES:
Douglas-fir (*Pseudotsuga menziesii*)
western redcedar (*Thuja plicata*)
grand fir (*Abies grandis*)
Oregon ash (*Fraxinus latifolia*)
red alder (*Alnus rubra*)
bigleaf maple (*Acer macrophyllum*)
ponderosa pine (*Pinus ponderosa*)
Oregon white oak (*Quercus garryana*)
Pacific dogwood (*Cornus nuttallii*)
cascara buckthorn (*Frangula purshiana*)

SHRUBS:
vine maple (*Acer circinatum*)
Cascade barberry (*Mahonia nervosa*)
salal (*Gaultheria shallon*)
common snowberry (*Symphoricarpos albus*)
creeping snowberry (*Symphoricarpos mollis*)
Saskatoon serviceberry (*Amelanchier alnifolia*)
beaked hazelnut (*Corylus cornuta*)
Indian plum (*Oemleria cerasiformis*)
rose (Rosa spp.)
California blackberry (*Rubus ursinus*)
black hawthorn (*Crataegus douglasii*)
Oregon crab apple (*Malus fusca*)
Pacific poison oak (*Toxicodendron diversilobum*)
oceanspray (*Holodiscus discolor*)
hollyleaved barberry (*Mahonia aquifolium*)

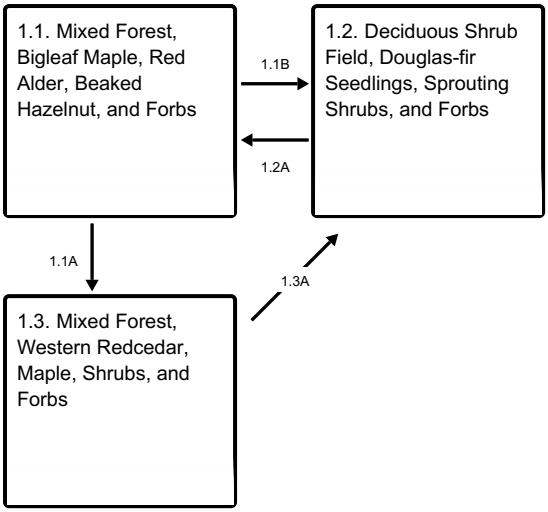
GRASSLIKES:
sedge (Carex spp.)
rush (Juncus spp.)

State and transition model

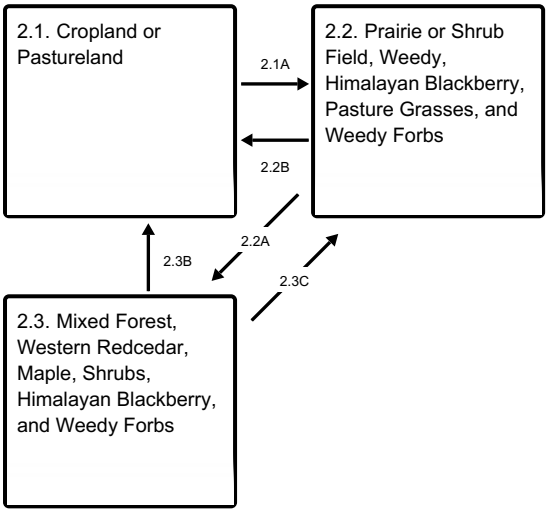
Ecosystem states



State 1 submodel, plant communities



State 2 submodel, plant communities



State 1
Reference

This state represents the disturbance regime prior to Euro-American settlement and the absence of invasive plant species. Natural fire regime was mixed severity. Typical fire return interval is approximately 35 to 100 years.

Community 1.1
Mixed Forest, Bigleaf Maple, Red Alder, Beaked Hazelnut, and Forbs

Fire return interval 35 to 100 years Structure: mixed forest The overstory consists of bigleaf maple, red alder, Douglas-fir, Oregon ash, and western redcedar. Douglas-fir are present, but seasonally saturated soils limit their rooting depth. Individuals may die or blow over after they reach a certain size. The understory consists of shade-tolerant shrubs including beaked hazelnut, vine maple, and common snowberry. Western redcedar can regenerate in the understory. Shade-tolerant grasslikes and forbs are present.

Community 1.2
Deciduous Shrub Field, Douglas-fir Seedlings, Sprouting Shrubs, and Forbs

Structure: shrubfield The shrub layer consists mainly of sprouting woody species present in the previous community. Douglas-fir regenerates from seed. Willow may also appear. Shade-intolerant grasses, grasslikes, and forbs are present.

Community 1.3
Mixed Forest, Western Redcedar, Maple, Shrubs, and Forbs

Structure: mixed forest The overstory consists mainly of western redcedar, bigleaf maple, and Oregon ash. Red alder is relatively short-lived and may drop out of the stand unless renewed by disturbance. Western redcedar can regenerate in the shade, is long-lived, and may dominate the overstory Douglas-fir may be absent because individuals may have died or blown over due to restricted rooting depth. The understory consists of shade-tolerant shrubs including beaked hazelnut, vine maple, and common snowberry. Shade-tolerant grasslikes and forbs are also present. This is the late-successional community expected to form in the absence of disturbance.

Pathway 1.1B
Community 1.1 to 1.2

This pathway represents fire or clearcutting where stumps are left intact.

Pathway 1.1A
Community 1.1 to 1.3

This pathway represents growth over time.

Pathway 1.2A
Community 1.2 to 1.1

This pathway represents growth over time

Pathway 1.3A
Community 1.3 to 1.2

This pathway represents fire or clearcutting where stumps are left intact.

State 2
Converted Invaded

This state represents post-cultivation conditions that may best fit within land-use models in future work. Weedy invasive species are usually present and competitive. Fire is excluded. Hydrology is not altered by draining or filling.

Community 2.1
Cropland or Pastureland

Structure: annual or perennial crop, tame pasture, or orchard

Community 2.2
Prairie or Shrub Field, Weedy, Himalayan Blackberry, Pasture Grasses, and Weedy Forbs

Structure: weedy shrubfield or prairie This community consists mainly of weeds such as Himalayan blackberry (*Rubus armeniacus*), naturalized pasture grasses, or non-native annual grasses. Himalayan blackberry is aggressive following ground disturbance. Introduced perennial pasture grasses including tall fescue (*Schedonorus arundinaceus*) and creeping bentgrass (*Agrostis stolonifera*) are competitive in open conditions. Winter-annual grasses such as ripgut brome (*Bromus diandrus*) are common in frequently-disturbed areas. Forbs such as Canada thistle (*Cirsium arvense*) and bull thistle (*Cirsium vulgare*) are common. Scotch broom (*Cytisus scoparius*) is characteristic of clearcut forest.

Community 2.3
Mixed Forest, Western Redcedar, Maple, Shrubs, Himalayan Blackberry, and Weedy Forbs

Structure: Closed deciduous forest The overstory consists mainly of western redcedar, bigleaf maple, and Oregon ash. Red alder is relatively short-lived and may eventually disappear from the stand unless renewed by disturbance. Western redcedar can regenerate in the shade, is long-lived, and may dominate the overstory. The understory has low species diversity and consists of weedy, shade-tolerant shrubs and forbs. Himalayan blackberry may persist

under forest canopy. Shining geranium (*Geranium lucidum*) and slender false brome (*Brachypodium sylvaticum*) invade forest understories. English holly (*Ilex aquifolium*) and sweet cherry (*Prunus avium*) do not require ground disturbance in order to establish. English ivy (*Hedera helix*) is also shade-tolerant.

Pathway 2.1A
Community 2.1 to 2.2

This pathway represents abandonment. Tillage and other management ceases.

Pathway 2.2B
Community 2.2 to 2.1

This pathway represents resumed tillage and agricultural management.

Pathway 2.2A
Community 2.2 to 2.3

This pathway represents continued abandonment and growth over time. Soil develops a litter layer.

Pathway 2.3B
Community 2.3 to 2.1

This pathway represents tree and stump removal with resumed tillage and agricultural management.

Pathway 2.3C
Community 2.3 to 2.2

This pathway represents tree removal alone.

Transition T1A
State 1 to 2

This pathway represents tree and stump removal and tillage to the extent that root systems and seed banks of native plants are depleted. Soil litter layer is removed. Invasive plant species are introduced.

Restoration pathway R2A
State 2 to 1

This pathway represents weed control and replanting forest trees.

Additional community tables

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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	10/03/2023
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:**

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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:**
