Ecological site F002XB003OR
Gravelly Terrace Group

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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

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

Relationship to Other Established Classifications This ecological site group is similar to following USDA Forest Service Plant Associations (McCain and Diaz, 2001) which emphasize late-successional plant communities: • grand fir / poison oak (CWS622) • grand fir / California hazel / inside-out flower (CWS555) • grand fir / oceanspray / sword fern (CWS529) • grand fir / vine maple / sword fern (CWS527) • Douglas-fir / poison oak (CDC124) • Douglas-fir / California hazel - snowberry / sword fern (CDS312) • Douglas-fir / oceanspray - snowberry (CDS217) This ecological site group also fits within 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 glaciofluvial terraces. Most instances are flat or gently sloping, but terrace escarpments may be steep. Soils are very deep and well drained with a coarse or moderately coarse textured subsoil. The rooting zone is dry 45 to 80 consecutive days during the summer which can be longer than normal for upland sites in this LRU. Conifer forest tends to develop. The reference plant community is grand fir - Douglas-fir. Deciduous shrubs and forbs dominate the understory during forested phases. Most of the area has been urbanized.

Table 1. Dominant plant species

Tree	(1) *Abies grandis* (2) *Pseudotsuga menziesii*
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

Landform: glaciofluvial terraces
Parent material: sandy and gravelly glaciofluvial deposits
Elevation: 100 to 400 feet
Slope: 0 to 60 percent
Flooding: none
Ponding: none

This site occurs on the Champoeg geomorphic surface in the Portland Basin (Balster and Parsons, 1968; Reckendorf, 1993).

Table 2. Representative physiographic features

Landforms	(1) Fluvial terrace
Flooding frequency	None
Ponding frequency	None
Elevation	30 – 120 m
Slope	0 – 60 %

Climatic features

Mean annual air temperature: 50 to 54 degrees F
Mean annual precipitation: 40 to 60 inches
Frost free period: 165 to 210 days

Influencing water features

None

Wetland description

None

Soil features

Drainage class: well drained
Parent material: sandy and gravelly glaciofluvial deposits
Soil restrictive feature(s): none
Soil moisture regime: xeric
Soil moisture subclass: typic
Soil temperature regime: mesic
Particle-size family(s): fine-loamy; coarse-loamy over sandy or sandy-skeletal
Soil mineralogy: mixed
Cation exchange capacity: superactive
Soil reaction: slightly to strongly acid

Soils formed in gravelly and sandy Missoula Flood sediments. The rooting zone is dry 45 to 80 consecutive days during the summer which can be longer than most sites in this LRU. Soils classify as Inceptisols or Alfisols.

Soils correlated with this site include Multnomah and Latourell.

Table 3. Representative soil features

Parent material	(1) Glaciofluvial deposits
Family particle size	(1) Coarse-loamy over sandy or sandy-skeletal

Ecological dynamics

Central Concept

This site occurs on glaciofluvial terraces. Most instances are flat or gently sloping, but terrace escarpments may be steep. Soils are very deep and well drained with a coarse or moderately coarse textured subsoil. The rooting zone is dry 45 to 80 consecutive days during the summer which can be longer than normal for upland sites in this LRU. Conifer forest tends to develop. The reference plant community is grand fir - Douglas-fir. Deciduous shrubs and forbs dominate the understory during forested phases. Most of the area has been urbanized.

Range in Variability

Variation in soils and landscape position may define subtypes with distinct reference communities. Some southern exposures and convex slopes support drought-tolerant communities too dry for grand fir. Northern exposures and concave slopes may support plant communities where grand fir (Abies grandis) regenerates in the understory (McCain and Diaz, 2001).

Disturbance

Fire is the dominant natural landscape level driver. Mixed severity and low severity fires dominate in this vegetation type. This type is transitional from the high frequency/low severity of the valley floor (likely assisted by cultural burning) and the lower frequency mixed severity regime of the higher elevation western hemlock types. Frequency of cultural burning generally decreased with distance from human settlements (Christy and Alverson, 2011). Given the location of this type, fire frequency may be quite variable. Historical fire has varied from 20-100 years mean fire return intervals (MFRI) (Weisberg 1997, Robbins 2004, Spies et al. 2018). Fire has been suppressed since modern wildland fire suppression efforts began. Wind, insects and pathogens, and infrequent landslides may also shape forest composition and pattern at finer scales. Human management is prevalent in this type, with activities such as regeneration harvest and thinning occurring within its range and dominating phase trajectories over fire (Spies et al. 2013). Tree-throw occurs in forested communities. 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 fire suppression has generally led to denser forest stands. Savanna can be created and maintained on this site with difficulty due to competing woody vegetation and lack of frequent fire.

Grand fir - Douglas-fir forests have some of the highest levels of plant diversity compared with all western Oregon forests (McCain and Diaz 2001). Representative native plants are listed below. Not all species are present within the same community phase. Plant lists (especially for graminoids and herbs) are incomplete.

TREES:
Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco)
grand fir (Abies grandis (Douglas ex D. Don) Lindl)
bigleaf maple (Acer macrophyllum Pursh)
Oregon white oak (Quercus garryana Douglas ex Hook)
western redcedar (Thuja plicata)
Pacific dogwood (Cornus nuttallii)
ponderosa pine (Pinus ponderosa Lawson & C. Lawson)
Pacific madrone (Arbutus menziesii Pursh)

SHRUBS:
vine maple (Acer circinatum Pursh)
Cascade barberry (Mahonia nervosa (Pursh) Nutt.)
cascara buckthorn (Frangula purshiana (DC.) A. Gray ssp. Purshiana)
common snowberry (Symphoricarpos albus (L.) S.F. Blake)
creeping snowberry (Symphoricarpos mollis Nutt.)
beaked hazelnut (Corylus cornuta Marshall)
dwarf rose (Rosa gymnocarpa Nutt.)
California blackberry (Rubus ursinus Cham. & Schltdl.)
Pacific poison oak (Toxicodendron diversilobum (Torr. & A. Gray) Greene)
oceanspray (Holodiscus discolor (Pursh) Maxim)
hollyleaved barberry (Mahonia aquifolium (Pursh) Nutt)
common whipplea (Whipplea modesta Torr.)

HERBS:
western swordfern (Polystichum munitum (Kaulf.) C. Presl)
sweetcicely (Osmorhiza berteroi DC.)
white insideout flower (Vancouveria hexandra (Hook.) C. Morren & Decne.)
starflower (Trientalis borealis Raf.)
woodland strawberry (Fragaria vesca L)
American trailplant (Adenocaulon bicolor Hook.)
sweet after death (Achlys triphylla (Sm.) DC.)
Columbian windflower (Anemone deltoidea Hook)
pale bellflower (Campanula scouleri Hook. ex A. DC.)
largeleaf sandwort (Moehringia macrophylla (Hook.) Fenzl)
western brackenfern (Pteridium aquilinum (L.) Kuhn)
snowqueen (Synthyris reniformis (Douglas ex Benth.) Benth.)
sweetscented bedstraw (Galium odoratum (L.) Scop.)
houndstongue hawkweed (Hieracium cynoglossoides Arv. -Touv.)
evergreen violet (Viola sempervirens Greene)
twinflower (Linnaea borealis L)
yerba Buena (Clinopodium douglasii (Benth.) Kuntze)

GRAMINOIDS:
Columbia brome (Bromus vulgaris (Hook.) Shear)
western fescue (Festuca occidentalis Hook.)
bearded fescue (Festuca subulata Trin.)
California fescue (Festuca californica Vasey)
sedge species (Carex L.)

Structural Descriptions Used in State and Transition Model
Phases are described by size class, cover class and layering. Size class description refers to either the average diameter of the dominant and co-dominant trees (quadratic mean diameter or qmd) in the state and transition model or the general sizes by species in the following narrative.
Size Class
Grass Forb/Seedling Sapling Pole Small Medium Large/Giant
DBH (inches) NA 0.1-4.9 5-9.9 10-19.9 20-29.9 =30
Canopy Cover Class
Open Moderate Closed
Canopy cover (%) 60

State and transition model

Additional community tables

Table 4. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 5. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 6. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 7. Community 1.4 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 8. Community 1.5 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Other references

Agricultural Climate Information System. (2007). WETS Station Data for Corvallis State University, OR, 1971-2000. [Online]. Available at http://agacis.rcc-acis.org/?fips=41003 (accessed on 5/7/2020).

Agricultural Climate Information System. (2007). WETS Station Data for Vancouver 4 NNE, WA, 1971-2000. [Online]. Available at http://agacis.rcc-acis.org/?fips=53011 (accessed on 5/7/2020).

Balster, C.A. and R.B. Parsons. (1968). Geomorphology and soils Willamette Valley, Oregon. Oregon State University Experiment Station Special Report 265. https://ir.library.oregonstate.edu/downloads/mg74qm961

Brown, Martin J., Jane Kertis and Mark H. Huff. (2013). Natural tree regeneration and coarse woody debris dynamics after a forest fire in the western Cascade Range. USDA Forest Service Pacific Northwest Research Station Research Paper PNW-RP-592.

Christy, J., and E. Alverson. (2011). Historical vegetation of the Willamette Valley, Oregon, circa 1850. Northwest Science. 85(2):93-107. https://doi.org/10.3955/046.085.0202

Christy, J.A., E.R. Alverson, M.P. Dougherty, S.C. Kolar, C.W. Alton, S.M. Hawes, L. Ashkenas and P. Minear. (2011). GLO historical vegetation of the Willamette Valley, Oregon, 1851-1910. ArcMap shapefile, Version 2011_04. Oregon Biodiversity Information Center, Portland State University. Available at http://www.pdx.edu/sites/www.pdx.edu.pnwlamp/files/glo_willamette_2011_04.zip (accessed on 11/14/2019).

Franklin, J. and C. Dyrness. (1973). Interior valleys of western Oregon. p. 110-129. In Natural Vegetation of Oregon and Washington. United States Department of Agriculture Forest Service, Pacific Northwest Forest and Range Experiment Station. General Technical Report PNW-8.

Halpern, Charles B. (1988). Early successional pathways and the resistance and resilience of forest communities. Ecology 69(6):1703-1715.

Halpern, Charles B. (1989). Early successional patterns of forest species: interactions of life history traits and disturbance. Ecology. 70(3): 704-720.

Hulse, D., S. Gregory, and J. Baker. (2002). Presettlement Vegetation circa 1850. p. 38-39. In Pacific Northwest Ecosystem Research Consortium (ed.) Willamette River Basin Planning Atlas: Trajectories of Environmental and Ecological Change. [Online]. Available at http://www.fsl.orst.edu/pnwerc/wrb/Atlas_web_compressed/4.Biotic_Systems/4b.presetveg_web.pdf (accessed on 9/28/2015).

Johannessen, C. L., W.A. Davenport, A. Millet, and S. McWilliams. (1971). The vegetation of the Willamette Valley. Annals of the Association of American Geographers. 61(2):286-302.

Kertis, J., T. DeMeo, and K. Kopper. (2007). North Pacific Dry Douglas-fir Forest and Woodland. p. 90-93. In LANDFIRE Biophysical Setting Model Descriptions. [Online]. Available at https://www.landfire.gov/national_veg_models_op2.php (accessed on 6/3/2020).

McCain, C., and N. Diaz. (2001). Field guide to the forested plant associations of the westside central Cascades of northwest Oregon. United States Department of Agriculture Forest Service, Pacific Northwest Region. Technical Paper R6-NR-ECOL-TP-02-02. https://ecoshare.info/2009/12/16/plant-associations-of-the-west-central-cascades/

Mellen-McLean, Kim, Bruce G. Marcot, Janet L. Ohmann, Karen Waddell, Elizabeth A. Willhite, Steven A. Acker, Susan A. Livingston, Bruce B. Hostetler, Barbara S. Webb, and Barbara A. Garcia. (2017). DecAID, the decayed wood advisor for managing snags, partially dead trees, and down wood for biodiversity in forests of Washington and Oregon. Version 3.0. USDA Forest Service, Pacific Northwest Region and Pacific Northwest Research Station; USDI Fish and Wildlife Service, Oregon State Office; Portland, Oregon. https://apps.fs.usda.gov/r6_DecAID

Oakley, B.B. and J.F. Franklin. (1998). Bitter cherry (Prunus emarginata) distribution, successional dynamics, and implications for the role of the seed bank. Can. J. Bot. 76: 1725-1732

Orr, E., Orr, W., and Baldwin, E. (1992). Willamette Valley. p. 203-221. In Geology of Oregon. 4th ed. Kendall/Hunt Publishing Company.

Parsons, R.B. and C.A. Balster (1966). Morphology and genesis of six “red hill” soils in the Oregon Coast Range. Soil Science Society of America Journal, 30(1), pp.90-93. https://acsess.onlinelibrary.wiley.com/doi/pdf/10.2136/sssaj1966.03615995003000010031x

Reckendorf, F. (1993). Geomorphology, stratigraphy, and soil interpretations, Willamette Valley, Oregon. p. 178-199. In J.M. Kimble (ed.) Proceedings of the Eighth International Soil Management Workshop: Utilization of Soil Survey Information for Sustainable Land Use. Oregon, California, and Nevada. 11-24 July 1992; May 1993. United States Department of Agriculture Soil Conservation Service National Soil Survey Center.

Robbins, Danielle (2004). Temporal and spatial variability of historic fire frequency in the southern Willamette Valley foothills of Oregon. MS thesis Oregon State University 112 pp.

Schoeneberger, P.J., D.A. Wysocki, E.C. Benham, and Soil Survey Staff. (2012). Field book for describing and sampling soils, Version 3.0. Natural Resources Conservation Service, National Soil Survey Center, Lincoln, NE.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. (2006). Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. Agricultural Handbook 296. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_050898.pdf

Soil Survey Staff. (2014). Keys to Soil Taxonomy, 12th ed. USDA-Natural Resources Conservation Service, Washington, DC.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Official Soil Series Descriptions. Online. Available at https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053587 (accessed 2019 to 2020).

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) Database for Oregon (multiple counties). [Online]. Available at https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm (accessed in 2020).

Weisberg, Peter J. (1997). Fire history and fire regimes of the Bear-Marten watershed. Unpubl report to Eugene District, BLM.

Yeats, R.S., E.P. Graven, K.S. Werner, C. Goldfinger, and T. Popowski. (1996). Tectonics of the Willamette Valley, Oregon. p. 183-222. In Rogers, Albert M., Walsh, Timothy J., Kockelman, William J., and Priest, George R. (ed.) Assessing earthquake hazards and reducing risk in the Pacific Northwest. US Geological Survey Professional Paper 1560.

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	
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:**
