USDA Natural Resources Conservation Service

Ecological site R002XC007OR Valley Swale Group

Last updated: 11/27/2024
Accessed: 05/14/2025

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 Willamette Valley land resource unit (LRU C) is located in northwestern Oregon. It is bounded by the Portland Basin to the north and the Umpqua Valley to the south. Topography is generally flat to hilly. Major landforms include floodplains and alluvial terraces, glaciolacustrine terraces, hills, and foothills. The valley floor is underlain by Pleistocene fluvial deposits (Rowland Formation). Valley borders and foothills are underlain by Eocene to Pliocene sedimentary rocks (Yamhill, Spencer, and Nestucca Formations) or, in some western areas, Eocene pillow basalts (Siletz River Volcanics). Other hills consist of Miocene Columbia River Basalt (Yeats et al., 1996; Orr et al., 1992). Locations below 400 feet elevation are covered with late Pleistocene silts deposited by the Missoula Floods (Willamette Silts).
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. Snowfall occasionally occurs in winter, but snow cover rarely lasts longer than a few days. Ice storms usually occur at least once each winter. Winter storm winds come from the south. Fair-weather winds during summer come from the north.
Prior to Euro-American settlement, fire was used in this LRU to maintain early-seral plant communities for food and fiber. General Land Office (GLO) land surveys conducted between 1851 and 1910 documented widespread prairies and savannas (Hulse et al., 2002). Fire exclusion since Euro-American settlement allowed many of these to succeed to forested communities (Johannessen et al., 1971; Day, 2005). Historic prairies and savannas were less common at the north end of the Willamette Valley, but an island of these types occurred in the Tualitan Valley. In general, fire frequency decreased with distance from human settlements (Christy and Alverson, 2011).
Presence of Oregon white oak and absence of western hemlock distinguish this area from the coast range (MLRA

1) and Cascade mountains (MLRA 3). This LRU is distinguished from Portland Basin and Hills (LRU B) by low-frequency occurrence of species common in the Umpqua and Rogue valleys, including California black oak (Quercus kelloggii), Pacific madrone (Arbutus menziesii), incense cedar (Calocedrus decurrens), and white alder (Alnus rhombifolia) (Franklin and Dyrness, 1973).

Classification relationships

This ecological site group is similar to following plant associations (Christy, 2004) which emphasize observed plant communities with unspecified successional status:
• Oregon ash/snowberry association
• Oregon ash/slough sedge association
• Oregon ash/aquatic sedge association

Ecological site concept

This site occurs in swales on glaciolacustrine terraces. Soils are very deep, poorly or somewhat poorly drained. Clay layers may perch water and restrict rooting depth such that soils saturated in winter and early spring become droughty in early summer. Early season saturation alternating with mid-to-late season droughtiness can create favorable conditions for bulbs and forbs by reducing competition from perennial grasses.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Deschampsia cespitosa* (2) *Danthonia californica*

Physiographic features

Landform: swales and depressions on glaciolacustrine terraces
Parent material: silty and clayey glaciolacustrine deposits
Elevation: 100 to 400 feet
Slope: 0 to 3 percent
Flooding: frequent; brief to long (low-velocity)
Ponding: frequent; long

This site occurs on the Calapooyia and Senecal geomorphic surfaces of the Willamette Valley floor (Balster and Parsons, 1968; Reckendorf, 1993).

Table 2. Representative physiographic features

Landforms	(1) Depression (2) Swale (3) Terrace
Flooding duration	Brief (2 to 7 days) to long (7 to 30 days)
Flooding frequency	Frequent
Ponding duration	Long (7 to 30 days)
Ponding frequency	Frequent
Elevation	30–122 m
Slope	0–3%
Aspect	Aspect is not a significant factor

Climatic features

Mean annual air temperature: 50 to 54 degrees F

Mean annual precipitation: 35 to 45 inches
Frost free period: 165 to 210 days

Influencing water features

Soils are very deep, poorly or somewhat poorly drained. Clay layers may perch water and restrict rooting depth such that soils saturated in winter and early spring become droughty in early summer.

Wetland description

No correlated wetlands at this time.

Soil features

Drainage class: poorly or somewhat poorly drained
Parent material: silty and clayey glaciolacustrine deposits
Soil restrictive feature(s): some soils shave an abrupt textural change between topsoil and subsoil
Soil moisture regime: aquic
Soil moisture subclass: xeric or typic
Soil temperature regime: mesic
Particle-size family(s): fine
Soil mineralogy: smectitic
Soil reaction: moderately acid to neutral (pH increases with depth)

Soils formed in thick deposits of Missoula Flood sediments. The subsoil is clayey. Clay layers may perch water and impede roots such that soils saturated in early spring become droughty by early summer. Alfisols or Inceptisols are typical.

Soils correlated with this site include Dayton, Amity, Concord, Holcomb, Huberly, Verboort, and Aloha.

Table 3. Representative soil features

Parent material	(1) Glaciolacustrine deposits
Family particle size	(1) Fine
Drainage class	Poorly drained to somewhat poorly drained

Ecological dynamics

Central Concept

This site occurs in swales on glaciolacustrine terraces. Soils are very deep, poorly or somewhat poorly drained. Clay layers may perch water and restrict rooting depth such that soils saturated in winter and early spring become droughty in early summer. Early season saturation alternating with mid-to-late season droughtiness can create favorable conditions for bulbs and forbs by reducing competition from perennial grasses. Prairie was typical prior to Euro-American settlement, but deciduous forest tends to develop in the absence of very frequent fire. The reference plant community is a prairie consisting of tufted hairgrass - California oatgrass.

Range in Variability

Variation in soils and landscape position may define subtypes with distinct reference communities. Flooding versus ponding may be ecologically significant, but these conditions are not differentiated here. Mollisols on somewhat poorly drained soils such as Amity or Holcomb series may be transitional to Valley Terrace Group.

Disturbance

This site developed under a cultural burning regime. Fire return interval was approximately 1 to 2 years (Christy and

Alverson, 2011). Fire has been generally excluded since Euro-American settlement began around 1850. Tree-throw occurs in forested communities.

Plant Composition

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. An asterisk (*) indicates plant species representative of the pre-settlement reference community (Christy and Alverson, 2011).

GRASSES:
tufted hairgrass (*Deschampsia cespitosa*) *
California oatgrass (*Danthonia californica*) *

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

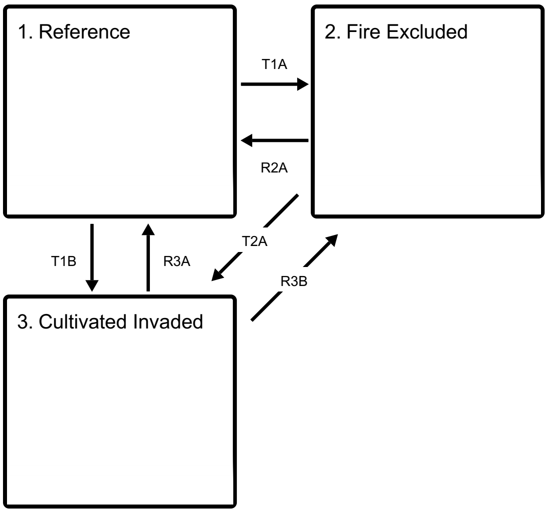
FORBS:
small camas (*Camassia quamash* ssp. maxima) *
Suksdorf's large camas (*Camassia leichtlinii* ssp. suksdorfii) *
brodiaea (Brodiaea spp.) *
triteleia (Triteleia spp.) *
checker lily (*Fritillaria affinis*) *
desertparsley (Lomatium spp.) *
yampah (Perideridia spp.) *
tarweed (Madia spp.) *

TREES:
Oregon ash (*Fraxinus latifolia*)
Oregon white oak (*Quercus garryana*)
ponderosa pine (*Pinus ponderosa*)
cascara buckthorn (*Frangula purshiana*)

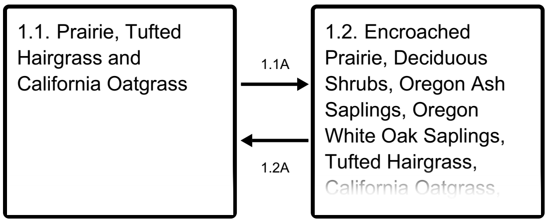
SHRUBS:
rose (Rosa spp.)
rose spirea (*Spiraea douglasii*)
black hawthorn (*Crataegus douglasii*)
Oregon crab apple (*Malus fusca*)
common snowberry (*Symphoricarpos albus*)
creeping snowberry (*Symphoricarpos mollis*)
Saskatoon serviceberry (*Amelanchier alnifolia*)
beaked hazelnut (*Corylus cornuta*)
Indian plum (*Oemleria cerasiformis*)
California blackberry (*Rubus ursinus*)

State and transition model

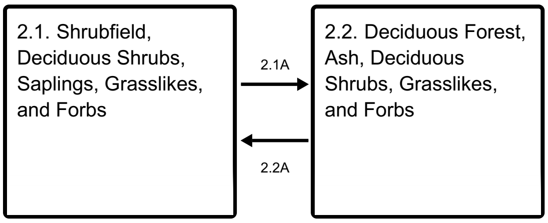
Ecosystem states



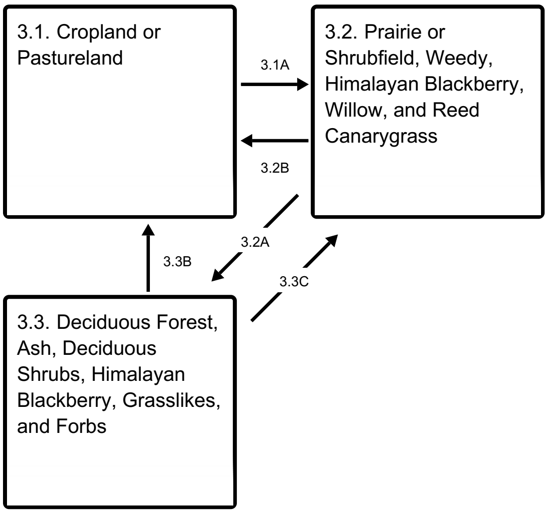
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference

This state represents the disturbance regime prior to Euro-American settlement and the absence of invasive plant species. Typical fire return interval is approximately 1 to 2 years.

Community 1.1
Prairie, Tufted Hairgrass and California Oatgrass

Structure: prairie This community consists of perennial grasses, grasslikes, and shade-intolerant forbs. Tufted hairgrass, California oatgrass, sedges, rushes, and forbs including camas are abundant. Fire return interval 1-2 years

Community 1.2
Encroached Prairie, Deciduous Shrubs, Oregon Ash Saplings, Oregon White Oak Saplings, Tufted Hairgrass, California Oatgrass, Grasslikes, and Forbs

Structure: Encroached prairie. Deciduous shrubs, deciduous saplings (especially Oregon ash), grasses, forbs, and bulbs. Grasses, forbs, and bulbs persist and are not completely shaded out. Deciduous shrubs and saplings grow from seed. Oregon ash grows more rapidly than oak.

Pathway 1.1A
Community 1.1 to 1.2

This pathway represents an unusually long period without fire during which woody vegetation begins to grow within the prairie.

Pathway 1.2A
Community 1.2 to 1.1

This pathway represents renewed cultural burning.

State 2
Fire Excluded

This state represents fire-exclusion with minimal ground disturbance. The impact of invasive species is small.

Community 2.1
Shrubfield, Deciduous Shrubs, Saplings, Grasslikes, and Forbs

Structure: deciduous shrubfield This community is dominated by Oregon ash saplings and deciduous shrubs. Sprouting from stumps is vigorous when this community results from tree felling. Willow, black cottonwood, or alder may sprout or otherwise establish where local disturbance exposes mineral soil. This may happen along banks of drainageways, in flood deposits, or along roads.

Community 2.2
Deciduous Forest, Ash, Deciduous Shrubs, Grasslikes, and Forbs

Structure: deciduous forest The overstory is dominated by Oregon ash. The understory consists of shade-tolerant deciduous shrubs, grasslikes, and forbs. Willow and cottonwood decline in the absence of disturbance and with increasing shade. This is the late-successional community which develops in the absence of disturbance.

Pathway 2.1A
Community 2.1 to 2.2

This pathway represents growth over time.

Pathway 2.2A
Community 2.2 to 2.1

This pathway represents tree removal where stumps are left intact.

State 3
Cultivated 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 3.1
Cropland or Pastureland

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

Community 3.2
Prairie or Shrubfield, Weedy, Himalayan Blackberry, Willow, and Reed Canarygrass

Structure: weedy shrubfield or prairie This community consists mainly of weeds such as reed canarygrass (*Phalaris arundinacea*) and Himalayan blackberry (*Rubus armeniacus*). Introduced perennial pasture grasses including tall fescue (*Schedonorus arundinaceus*) and creeping bentgrass (*Agrostis stolonifera*) may be present. Forbs such as Canada thistle (*Cirsium arvense*) and bull thistle (*Cirsium vulgare*) may also be present. If flooding occurs, weed seeds can be imported with floodwaters. Willow and black cottonwood may establish from seed, especially where mineral soil is exposed. Flooding during this community phase will favor establishment of native trees and shrubs from seed. All deciduous species present in the previous community will sprout or otherwise respond vigorously to increased light availability.

Community 3.3
Deciduous Forest, Ash, Deciduous Shrubs, Himalayan Blackberry, Grasslikes, and Forbs

Structure: deciduous forest The overstory is dominated by Oregon ash. The understory has low species diversity and consists of weedy, shade-tolerant shrubs, grasslikes, and forbs. Himalayan blackberry may persist under forest canopy. If reed canarygrass was present in the previous community, it will decrease in the shade of a closed forest canopy (Kim, et al. 2006).

Pathway 3.1A
Community 3.1 to 3.2

This pathway represents abandonment. Tillage and other management ceases.

Pathway 3.2B
Community 3.2 to 3.1

This pathway represents resumed tillage and agricultural management.

Pathway 3.2A
Community 3.2 to 3.3

This pathway represents growth over time. Soils develop a litter layer consisting mainly of leaves.

Pathway 3.3B
Community 3.3 to 3.1

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

Pathway 3.3C
Community 3.3 to 3.2

This pathway represents tree removal alone.

Transition T1A
State 1 to 2

This pathway represents cessation of fire over a period long enough that shade-intolerant perennials in the reference community do not recover dominance following removal of woody vegetation. Soil develop a litter layer consisting mainly of leaves.

Transition T1B
State 1 to 3

This pathway represents tillage to the extent that root systems and seed banks of native plants are depleted. Invasive plants are introduced.

Restoration pathway R2A
State 2 to 1

This pathway represents tree removal, prescribed fire or mowing, seeding prairie species, and weed control.

Transition T2A
State 2 to 3

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

Restoration pathway R3A
State 3 to 1

This pathway represents tree removal (if needed), weed control, seeding prairie species, and prescribed fire or mowing.

Restoration pathway R3B
State 3 to 2

This pathway represents weed control and, if needed, replanting trees.

Additional community tables

Inventory data references

Adams, A. B., Dale, V. H., Smith, E. P., and Kruckeberg, A. R. (1987). Plant survival, growth form and regeneration following the 18 May 1980 eruption of Mount St. Helens, Washington. Northwest Science, 61(3): 160-170. http://research.wsulibs.wsu.edu/xmlui/bitstream/handle/2376/1760/v61%20p160%20Adams%20et%20al.PDF?sequence

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).

Agee, J. K. (1993). Fire ecology of Pacific Northwest forests. Island Press, Washington, D.C.

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

Buechling, A., Alverson, E., Kertis, J., and Fitzpatrick, G. (2008). Classification of oak vegetation in the Willamette Valley. Oregon Natural Heritage Information Center, Oregon State University. Portland, OR. https://ir.library.oregonstate.edu/concern/technical_reports/hq37vt243

Christy, J., and Alverson, E. (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., Alverson, E.R., Dougherty, M.P., Kolar, S.C., Alton, C.W., Hawes, S.M., Ashkenas, L., and Minear, P.

(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).

Christy, J. (2004). Native freshwater plant associations of northwestern Oregon. Oregon Natural Heritage Information Center, Oregon State University. https://ir.library.oregonstate.edu/concern/defaults/2z10wt98x

Darris, D.C., and Gonzalves, P. (2018). California Oatgrass. [Online] Available at https://plants.usda.gov/plantguide/pdf/pg_daca3.pdf (accessed on 5/11/2020).

Day, J.W. (2005). Historical savanna structure and succession at Jim's Creek, Willamette National Forest, Oregon. M.S. thesis. University of Oregon, Eugene. https://pages.uoregon.edu/bartj/current_research/oak_sav_plan_rest/Day_thesis.pdf

Franklin, J., and Dyrness, C. (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.

Hulse, D., Gregory, S., and Baker, J. (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., Davenport, W.A., Millet, A., and McWilliams, S. (1971). The vegetation of the Willamette Valley. Annals of the Association of American Geographers. 61(2):286-302.

Kim, K.D., Ewing, K., and Giblin, D. E. (2006). Controlling *Phalaris arundinacea* (reed canarygrass) with live willow stakes: a density-dependent response. Ecological Engineering. 27(3): 219-227. http://depts.washington.edu/waipc/docs/Phalaris%20arundinacea.pdf

Oregon Department of Fish and Wildlife. Pocket Gophers. [Online]. Available at https://myodfw.com/wildlife-viewing/species/pocket-gophers (accessed on 5/21/2020).

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 Balster, C.A. (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.

Schoeneberger, P.J., Wysocki, D.A., Benham, E.C., 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).

Thilenius, J.F. (1964). Synecology of the white-oak (*Quercus garryana* Douglas) woodlands of the Willamette Valley, Oregon. Ph.D. diss. Oregon State University, Corvallis. https://ir.library.oregonstate.edu/downloads/0c483m76v

Thilenius, J.F. (1968). The *Quercus garryana* forests of the Willamette valley, Oregon. Ecology, 49(6), pp.1124-1133. https://esajournals.onlinelibrary.wiley.com/doi/pdf/10.2307/1934496

Yeats, R.S., Graven, E.P., Werner, K.S., Goldfinger, C. and Popowski, T. (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, 11/27/2024

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:**

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:**