USDA Natural Resources Conservation Service

Ecological site AX002X02X001
Portland Basin Dry Douglas-fir Forest

Last updated: 12/03/2024
Accessed: 01/11/2025

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 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.

This MLRA includes a variety of ecological sites. Many are characterized by forest vegetation but some were maintained as prairie, savanna, or oak woodland through cultural burning prior to Euro-American settlement. In the northern part of this MLRA Puget Sound has a moderating effect on temperature and humidity is generally higher. Douglas-fir (Pseudotsuga menziesii) is widespread throughout. Oregon white oak (Quercus garryana) is common on valley bottoms and surrounding slopes in the south. In the north its historic extent is more limited, occurring on warm aspects, with exposed and droughty conditions, and areas affected by rain shadowing from local ranges, particularly east of the Olympic Mountains. Big leaf maple (Acer macrophyllum) is common as a codominant or sub canopy tree across many sites. Pacific madrone grows in areas close to saltwater, or within drier forest sites with well-drained soils. Western hemlock (Tsuga heterophylla) and western red cedar (Thuja plicata) are common in wetter portions of the MLRA. 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 Portland Basin and Hills Land Resource Unit (LRU B) is in southwestern Washington and northwestern Oregon. The LRU extends north to the Cowlitz River and transitions to the Willamette Valley in the south. The Columbia River Gorge limits the eastern extent, and influence of tidewater at Cathlamet identifies the northwestern extent. Elevation ranges from sea level to about 2,000 feet. Major landforms include glaciofluvial terraces along the Columbia River, as well as residual hills and foothills surrounding the basin. Areas of Columbia River flood plain are present in Washington and more extensively in Oregon. Residual hills are composed primarily of Quaternary-Pliocene and Tertiary volcanic and sedimentary rocks. The lower-relief basin is composed primarily of sediment from catastrophic Quaternary glacial flooding from Glacial Lake Missoula.

The Columbia River splits this LRU between Oregon and Washington.

In Washington, mean annual precipitation ranges from 35 to 60 inches. Within this LRU most falls as rain between October and May. Occasional snowfall occurs between 1000- and 2000-feet elevation but is usually not persistent; below 1000 feet snow is uncommon. The frost-free period ranges from 160 to 220 days. Locations near the Columbia River Gorge experience strong winds and infrequent ice storms with little winter snow. Average daily maximum temperatures in summer at Vancouver, Washington, are 1 to 3 degrees F warmer compared to Seattle or Olympia, Washington (Agricultural Climate Information System, 2007a, 2007b).

Classification relationships

Relationship to Other Established Classifications:

This site is related to plant associations PSME-ABGR/FEOC, PSME-ABGR/HODI/POMU, PSME-ARME/GASH, PSME-ARME/HODI/LOHI, PSME/GASH-HODI, SPME/HODI-SYAL, SPME/ROGY-HODI, in Chappell (2006). It bears resemblance to A3716 Pseudotsuga menziesii - Abies grandis - Arbutus menziesii Forest & Woodland Alliance within the National Vegetation Classification System (USNVC 2024).

Ecological site concept

This site is on a variety of landforms and aspects in the Portland Basin and Hills LRU. Most of the annual precipitation is received from October through April, primarily as rain. 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 of the forest sites in the area. Douglas-fir is typically the dominant tree species. Other tree species may occur alongside Douglas-fir in this site, especially Pacific madrone (Arbutus menziesii) in the areas most exposed to prevailing winds and sun. Lesser amounts of western red cedar (Thuja plicata) and grand fir (Abies grandis) may be present. Oceanspray (*Holodiscus discolor*), Cascade barberry (Berberis nervosa, known locally as Oregongrape), and salal (*Gaultheria shallon*) are common shrubs. Pacific poison oak (Toxicodendron diversilobum) grows in some places.
This site can be compared to the Puget Lowlands Dry Douglas Fir Forest site in LRU A to the north, which is similar but has a lower summer temperature and higher amounts of summer precipitation Thus plant growth and moisture content often decline more rapidly in late spring and early summer in LRU B as opposed to LRU A, especially for grasses and other herbaceous species.

Associated sites

AX002X02X007	**Portland Basin Wet Forest**
AX002X02X008	**Portland Basin Riparian Forest**

Similar sites

F002XN901WA	**Douglas-fir - Pacific madrone/oceanspray/rattlesnake plantain**
AX002X01X001	**Puget Lowlands Dry Forest**

Table 1. Dominant plant species

Tree	(1) *Pseudotsuga menziesii*
Shrub	(1) *Holodiscus discolor*
Herbaceous	(1) *Goodyera oblongifolia*

Legacy ID

F002XB001WA

Physiographic features

Table 2. Representative physiographic features

Landforms	(1) Bluff (2) Terrace
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	Not specified
Ponding frequency	Not specified
Elevation	0–457 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)	170-220 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	508-1,778 mm

Influencing water features

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

Soil features

Surface textures: Gravelly sandy loams, gravelly silt loams, gravelly loams, and gravelly loamy sands
Soil family textures: Loamy-skeletal
Parent material: Alluvium, glacial drift, and residuum
Soil depth: 20 to more than 60 inches. Lithic contacts are possible restrictions.
Soil drainage: Well drained, and somewhat excessively drained are most common. Somewhat poorly drained may occur but is uncommon.
Available water capacity in the top 40 inches: 2.5 to 7.5 in/in
pH in water: 5.6 to 7.3
Soil is dry in all parts from 75 to 90 consecutive days.

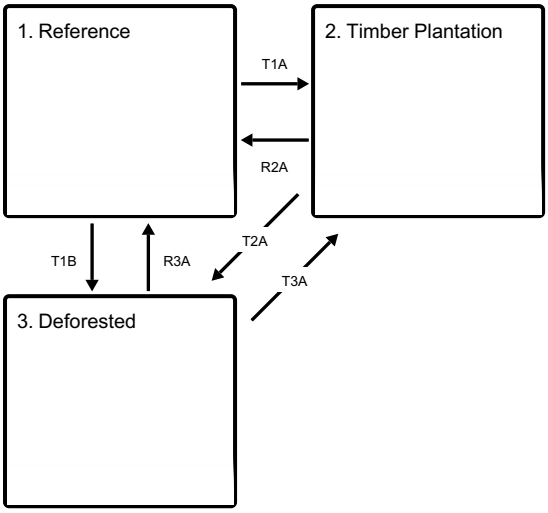
Ecological dynamics

This ecological site shifts between different stand developmental stages according to occurrence and frequency of disturbances that cause overstory mortality. Natural disturbances include winter storms with strong winds and low to moderate intensity fires. Fires historically occurred with greater frequency than at present due to changes in land management and fire suppression by current local, state and Federal agencies. Cultural fire was used in many parts of this LRU by tribes prior to and at the onset of European settlement and had a strong influence on site dynamics in this and many other sites (Agee 1993). The main contemporary human impacts have been fire suppression, timber harvest and management, grazing with large livestock, conversion to cropland agriculture, or urban development. When trees are removed the site may be maintained in a non-forest state by controlling tree regeneration. In a state managed for timber there are some distinct differences from naturally developed stands or reference stand conditions. With typical even-aged timber management, conditions tend toward a much stronger

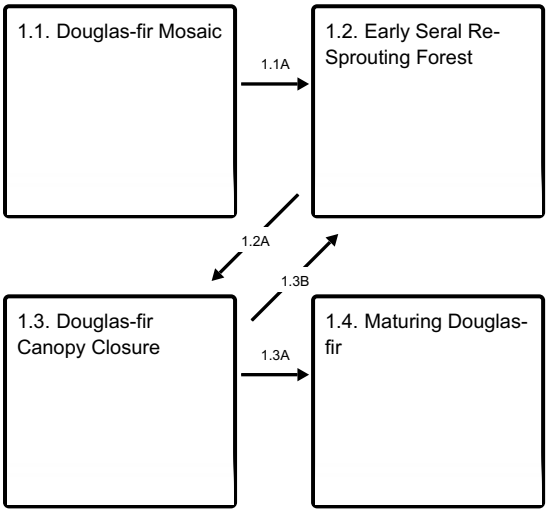
dominance of Douglas-fir over other tree species, and some structural elements of the site often decline, such as understory vegetation and snags (Cline et al. 1980).

State and transition model

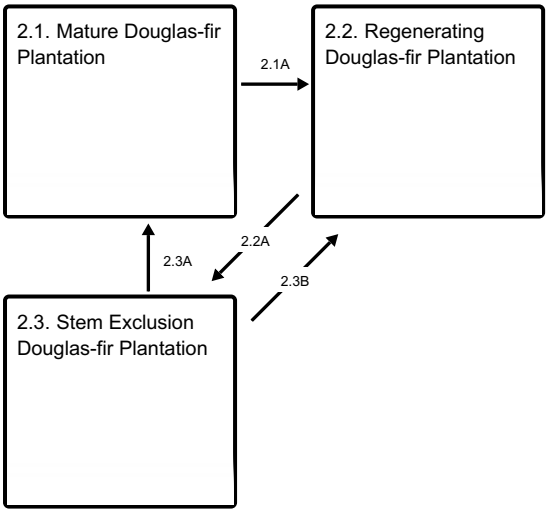
Ecosystem states



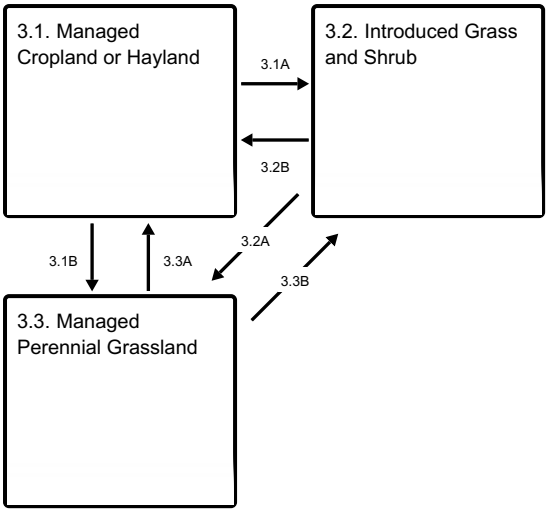
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference

Community 1.1
Douglas-fir Mosaic

Structure is a mosaic of mature, large overstory trees of mixed age and canopy position, and occasional canopy openings Douglas-fir is the most common tree species, occupying dominant or emergent canopy positions and often exceeding 100 years of age. Pacific madrone establishes and becomes codominant in some areas that have high exposure to sun and wind. Forest canopy is generally continuous over large areas. Moderate sized (2-5 acres) canopy gaps intermittently interrupt the overstory canopy. These are created by small patches of overstory tree mortality from native pests and diseases, storm damage and surface fires which occasionally exhibit short durations of increased intensity. Standing snags are present both within gaps and occasionally elsewhere; remnants of former trees that were killed by fire, pests or disease. These may persist for decades, especially those of larger stature. Tree seedlings are emerging within canopy gaps and represent the surrounding overstory composition. If present, madrone will often regenerate both from seed and by resprouting from burned or damaged stems. . Gaps also contain shrubs and vines with vigorous new growth or increased density owing to improved light levels. Oceanspray (*Holodiscus discolor*), Cascade barberry (Berberis nervosa), hairy honeysuckle (*Lonicera hispidula*), dwarf rose (*Rosa gymnocarpa*), California hazelnut (*Corylus cornuta*), California blackberry (*Rubus ursinus*), and salal (*Gaultheria shallon*) are common shrubs and vines. When fire occurs, many of these understory species may also resprout from the root collar, rhizomes, or shallow subsurface roots. A rich mix of herbaceous species are present, especially in canopy gaps.

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- Pacific madrone (*Arbutus menziesii*), tree
- oceanspray (*Holodiscus discolor*), shrub
- dwarf rose (*Rosa gymnocarpa*), shrub
- Cascade barberry (*Mahonia nervosa*), shrub
- California hazelnut (*Corylus cornuta var. californica*), shrub
- hairy honeysuckle (*Lonicera hirsuta*), shrub
- salal (*Gaultheria shallon*), shrub
- California blackberry (*Rubus ursinus*), shrub
- western rattlesnake plantain (*Goodyera oblongifolia*), other herbaceous
- Pacific bleeding heart (*Dicentra formosa*), other herbaceous
- western brackenfern (*Pteridium aquilinum*), other herbaceous

Community 1.2
Early Seral Re-Sprouting Forest

Structure is a single story shrub. This community consists of a mix of regenerating trees, shrubs, forbs and grasses

over a large area that has recently experienced a significant overstory tree mortality event, usually high severity fire. Snags and other large woody debris are abundant. Species composition is diverse, with young trees representing pre-fire dominant species of Douglas-fir or madrone, while many shrub and herbaceous species have increased or expanded opportunistically; some species that were not apparent prior to the disturbance may regenerate from persistent seed banks. Vegetation is often very dense and vigorous, and most species exhibit accelerated growth in the high light conditions. Shrub growth response is emblematic of many species' ability to resprout from the root collar, rhizomes, or shallow subsurface roots. If present, madrone will also regenerate by resprouting from burned or damaged stems with rapid initial growth of many sprouts from each surviving parent stump. This resprouting mix will typically dominate while young Douglas-fir trees have yet to emerge above this tall shrub layer. Shrubs often include oceanspray, California blackberry, salal, California hazelnut, and Cascade barberry. If introduced to the site, non-native Himalayan blackberry (*Rubus armeniacus*) and Scotch broom (*Cytisus scoparius*) may become abundant in this phase, usually at the expense of native shrubs and trees. A rich mix of herbaceous species are typically present.

Dominant plant species

- Pacific madrone (*Arbutus menziesii*), tree
- oceanspray (*Holodiscus discolor*), shrub
- California blackberry (*Rubus ursinus*), shrub
- Cascade barberry (*Mahonia nervosa*), shrub
- salal (*Gaultheria shallon*), shrub
- California hazelnut (*Corylus cornuta var. californica*), shrub
- Himalayan blackberry (*Rubus armeniacus*), shrub
- Scotch broom (*Cytisus scoparius*), shrub
- western brackenfern (*Pteridium aquilinum*), other herbaceous

Community 1.3
Douglas-fir Canopy Closure

Structure is single story with diminished understory, infrequent small gaps. This community consists of a forest undergoing canopy closure from natural regeneration. Douglas-fir has overcome early shrub dominance across much of the forest by forcing its way through gaps in shrub cover or occupying space opened up by successive minor disturbances. If present, madrone has occupied the site alongside re-sprouting shrubs since the early seral re-sprouting forest phase but has now overtopped the shrub layer and often exhibits a multi-stemmed tree form in a dominant canopy position. With canopy closure, competition for sunlight has led to a diminished understory that favors more shade tolerant species such as Cascade barberry and salal. Other shrub species resembling the composition typical of the previous early seral re-sprouting forest phase are limited to infrequent small gaps in the canopy where Douglas-fir or madrone were not able to establish. Tree density is variable, but there is minimal vertical overstory differentiation due to the tree layer being relatively even aged. The herbaceous component is limited but present.

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- Pacific madrone (*Arbutus menziesii*), tree
- Cascade barberry (*Mahonia nervosa*), shrub
- salal (*Gaultheria shallon*), shrub

Community 1.4
Maturing Douglas-fir

Structure is single story with canopy that is beginning to thin. This community consists of maturing Douglas-fir forest. Madrone may be present in the overstory or regenerating in the understory but has largely been forced into a subdominant position by the increasing height of Douglas-fir. The forest canopy is now fully closed and is starting to differentiate vertically, becoming more complex as some trees are suppressed and die and the canopy has lifted high above the forest floor resulting in a more open understory. A mix of shrubs and herbs has persisted in the understory and some species that do well with dappled light such as dwarf rose are expanding. Shade tolerant species also perform well, such as cascade barberry and salal. Herbaceous species typical of the reference Douglas-fir mosaic phase such as Pacific bleeding heart (Dicentra Formosa) have begun to reappear.

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- Pacific madrone (*Arbutus menziesii*), tree
- oceanspray (*Holodiscus discolor*), shrub
- salal (*Gaultheria shallon*), shrub
- Cascade barberry (*Mahonia nervosa*), shrub
- dwarf rose (*Rosa gymnocarpa*), shrub
- California blackberry (*Rubus ursinus*), shrub
- Pacific bleeding heart (*Dicentra formosa*), shrub

Pathway 1.1A
Community 1.1 to 1.2

This pathway occurs from a stand-replacing fire in which all or nearly all overstory trees are killed.

Pathway 1.2A
Community 1.2 to 1.3

This pathway represents growth over time with only very minor or no additional disturbances.

Pathway 1.3B
Community 1.3 to 1.2

This pathway occurs from a stand-replacing fire in which all or nearly all overstory trees are killed.

Pathway 1.3A
Community 1.3 to 1.4

This pathway represents growth over time. Minor disturbances may occur without disrupting this pathway, such as low-intensity fires, understory fuels management, pockets of pests or disease, and damage from weather events. These may help accelerate advancement toward pathway 1.4A by opening space for more understory species and creating more structural complexity.

State 2
Timber Plantation

Community 2.1
Mature Douglas-fir Plantation

Structure is single story forest of even-aged trees. This community phase is the management-controlled climax condition for a Douglas-fir plantation. The overstory is exclusively or near exclusively Douglas-fir and is even-aged. Trees are usually less than 100 years old. Trees are relatively evenly spaced, owing to their having been artificially established on a tight grid; there are typically no significant canopy gaps and little complexity in canopy structure. The understory may be somewhat sparse to relatively well-vegetated with a mix of highly shade-tolerant shrubs and herbaceous species, especially Cascade barberry (Berberis nervosa) or salal (*Gaultheria shallon*). Large snags are very few or absent.

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- Cascade barberry (*Mahonia nervosa*), shrub
- salal (*Gaultheria shallon*), shrub

Community 2.2
Regenerating Douglas-fir Plantation

Structure is single story small trees and shrubs. This community consists of regenerating Douglas-fir forest over a large area that has been opened by timber harvest. Species composition is strongly controlled by management actions. The site is typically planted with Douglas-fir while non-timber shrubs and trees are controlled to facilitate planted seedling survival, resulting in a dense, young forest with low tree species diversity. Shrubs and mixed herbaceous species typically occupy space between planted saplings. These may include oceanspray, California blackberry, salal, and Cascade barberry. Introduced Himalayan blackberry (*Rubus armeniacus*) and Scotch broom (*Cytisus scoparius*) are often present and may be abundant, usually at the expense of native shrubs or planted trees. Snags are very few or absent. Downed woody debris may be abundant or limited depending on thoroughness of its reduction during the prior timber harvest.

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- Cascade barberry (*Mahonia nervosa*), shrub
- salal (*Gaultheria shallon*), shrub
- oceanspray (*Holodiscus discolor*), shrub
- California blackberry (*Rubus ursinus*), shrub
- Himalayan blackberry (*Rubus armeniacus*), shrub
- Scotch broom (*Cytisus scoparius*), shrub
- western brackenfern (*Pteridium aquilinum*), other herbaceous

Community 2.3
Stem Exclusion Douglas-fir Plantation

This community is the interim point in a Douglas-fir plantation between regeneration and the mature state. Composition is exclusively or near exclusively Douglas-fir, and the stand is very dense, having been artificially established on a grid and tended with weed control methods to maximize Douglas-fir survival. A pre-commercial thin is often applied at or shortly before this phase to reduce inter-tree competition and maintain high growth rates. The understory is often very sparse, particularly if pre-commercial thinning is not performed, owing to the very limited light that reaches the forest floor. Only highly shade tolerant species such as cascade barberry (Berberis nervosa) occur, if present at all. Snags are very few or absent. Downed woody debris may be abundant or limited depending on thoroughness of its reduction during the prior timber harvest.

Dominant plant species

- Douglas-fir (*Pseudotsuga menziesii*), tree
- Cascade barberry (*Mahonia nervosa*), shrub

Pathway 2.1A
Community 2.1 to 2.2

This pathway represents even-aged harvest of a mature Douglas-fir plantation followed by Douglas-fir planting. This pathway may also result from a stand-replacing fire followed by a salvage harvest and replanting of Douglas-fir. Site preparation and removal of woody material to limit fire hazard is usually performed prior to planting.

Pathway 2.2A
Community 2.2 to 2.3

This pathway represents growth of an even-aged Douglas-fir plantation alongside active weed controls to limit competition with undesired species. Thinning of Douglas-fir saplings and pruning may or may not occur, depending on stand density or fire hazard concerns. Disturbances, such as fire, pests, and disease, are discouraged and controlled if possible.

Pathway 2.3A
Community 2.3 to 2.1

This pathway represents growth of an even-aged Douglas-fir plantation that is maturing and dominates the overstory. Light thinning may or may not occur, depending on stand density or fire hazard concerns. Disturbances,

such as fire, pests, and disease, are discouraged and controlled if possible.

Pathway 2.3B
Community 2.3 to 2.2

This pathway results from a stand-replacing fire or a major pest or disease event that kills all or nearly all trees, followed by replanting of Douglas-fir. Salvage harvesting may occur if there is sufficient commercially viable material in the stand. Site preparation and removal of woody material to limit fire hazard is usually performed prior to planting.

State 3
Deforested

Community 3.1
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 3.2
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*).

Dominant plant species

- Himalayan blackberry (*Rubus armeniacus*), shrub
- California blackberry (*Rubus ursinus*), shrub
- Scotch broom (*Cytisus scoparius*), shrub
- tall fescue (*Schedonorus arundinaceus*), grass
- orchardgrass (*Dactylis glomerata*), grass
- red fescue (*Festuca rubra*), grass
- western brackenfern (*Pteridium aquilinum*), other herbaceous

Community 3.3
Managed Perennial Grassland

Structure is perennial herbaceous species. 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*).

Dominant plant species

- tall fescue (*Schedonorus arundinaceus*), grass

- orchardgrass (*Dactylis glomerata*), grass
- red fescue (*Festuca rubra*), grass

Pathway 3.1A
Community 3.1 to 3.2

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 3.1B
Community 3.1 to 3.3

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 3.2B
Community 3.2 to 3.1

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 3.2A
Community 3.2 to 3.3

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 3.3A
Community 3.3 to 3.1

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 3.3B
Community 3.3 to 3.2

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 represents a shift to a Douglas-fir timber plantation management system. This transition is typically initiated by clear cut of old forest in the reference state but can be initiated after a large stand-replacing fire in the reference state. Management actions include even-aged harvests and replanting of evenly spaced Douglas-fir. Other tree species, especially non-conifers such as madrone, are heavily controlled to promote maximum dominance and growth of Douglas-fir.

Transition T1B
State 1 to 3

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 phase in state 1.

Transition R2A
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. This transition can be initiated from any community phase in state 2.

Transition T2A
State 2 to 3

This transition is caused by an intentional clearing of land or a stand replacing fire in state 2, 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 phase in state 2.

Restoration pathway R3A
State 3 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 phase in state 3.

Restoration pathway T3A
State 3 to 2

This transition occurs with a change in land management from a cleared non-forest state to a Douglas-fir plantation. The site is typically treated mechanically or with fire to prep the seed bed before planting Douglas-fir on an even spacing. Competing species are heavily controlled to improve seedling survival and growth. This transition can be initiated from any community phase in state 3.

Additional community tables

Other references

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Approval

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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.

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Date	01/11/2025
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:**