Ecological site F043CY605OR
Cool Moist Conifer Mountains and Plateaus
(PSME-PIPO/CARU)

Last updated: 4/04/2025
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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): 043C–Blue and Seven Devils Mountains

This MLRA covers the Blue and Seven Devils Mountains of Oregon, Washington and Idaho. The area is characterized by thrust and block-faulted mountains and deep canyons composed of sedimentary, metasedimentary, and volcanic rocks. Elevations range from 1,300 to 9,800 feet (395 to 2,990 meters). The climate is characterized by cold, wet winters and cool, dry summers. Annual precipitation, mostly in the form of snow, averages 12 to 43 inches (305 to 1,090 millimeters) yet ranges as high as 82 inches (2,085 millimeters) at upper elevations. Soil temperature regimes are predominately Frigid to Cryic and soil moisture regimes are predominately Xeric to Udic. Mollisols and Andisols are the dominant soil orders. Ecologically, forests dominate but shrub and grass communities may occur on south aspects and lower elevations as well as in alpine meadow environments. Forest composition follows moisture, temperature and elevational gradients and typically ranges from ponderosa pine and Douglas-fir plant associations at lower elevations, grand fir at middle elevations and subalpine fir and Engelman spruce at upper elevations. Historical fire regimes associated with these forest types range from frequent surface fires in ponderosa pine - Douglas Fir forest types to mixed and stand replacing fire regimes in grand fir and subalpine fir types. A large percentage of the MLRA is federally owned and managed by the U.S. Forest Service for multiple uses.

Classification relationships

U.S. National Vegetation Classification Standard (NVCS) Central Rocky Mountain Grand fir - Douglas-fir Forest & Woodland Alliance (A-3362) Central Rocky Mountain Mesic Grand fir-Douglas-fir Forest Group (G211) USDA Forest Service Ecological Sub-region M332 “Blue Mountains”. LANDFIRE BpS model 10450: Northern Rocky Mountain Dry-Mesic Montane Mixed-Conifer Forest Plant Assoc. Of Blue and Ochoco Mountains (R6 E TP-036-92) Douglas-fir/big huckleberry - CDS821 Douglas-fir/common snowberry - CDS624 (modal) Douglas-fir/ninebark - CDS711 Douglas-fir/oceanspray - CDS611 Douglas-fir/pinegrass - CDG112 Grand fir/birchleaf spirea - CWS322 Grand fir/elk sedge - CWG111 Grand fir/pinegrass - CWG113 (modal) Lodgepole pine(grand fir)/pinegrass - CLG21 Plant Assoc. Of Wallowa-Snake Province (R6 E 255-86) Douglas-fir/common snowberry - CDS622 Douglas-fir/pinegrass - CDG121 Douglas-fir/Rocky Mountain maple-ninebark - CDS722 Douglas-fir/spirea - CDS634 Grand fir/pinegrass - CWG112 Grand fir/spirea - CWS321

Ecological site concept

This ecological site occurs mainly on forested backslopes of mid to high elevation mountain slopes, and plateaus. They typically have a frigid temperature regime and xeric moisture regime. Parent materials are typically derived from basalt or other igneous extrusive geologies (andesite, dacite, ignimbrites, etc.) with an influence of volcanic ash in the surface. They are well drained with adequate available water capacity. An open overstory of mature Douglas-fir codominant with ponderosa pine with lesser amounts of grand fir and western larch represents the historical condition of this site. This composition was maintained by frequent low intensity fires, yet presently due to widespread fire suppression, much of this forest type includes a much higher proportion of grand fir and Douglas-fir, relative to ponderosa pine. These sites represent a transition between drier ponderosa pine and Douglas-fir communities and wetter grand fir communities. Common understory species include pinegrass, elk sedge, heartleaf arnica, snowberry and spiraea. This is a provisional ecological site that groups characteristics at a broad scale with little to no field verification and is subject to extensive review and revision before final approval. All data herein was developed using existing information and literature and should be considered provisional and contingent upon field validation prior to use in conservation planning.

Associated sites

F043CY503OR	**Mountain Riparian Forest (PIEN/ALIN)** Occupying adjacent moderate to high-energy riparian areas
F043CY603OR	**Cool Wet Conifer Mountains and Plateaus (ABGR/VAME/LIBO)** Occupying adjacent soils with higher soil moisture due to aspect or landscape position
F043CY607OR	**Cool Moist Conifer Foothills and Mountains (PIPO-PSME/SYAL)** Occupying adjacent shallower soils with lower soil moisture

Similar sites

F043CY603OR	**Cool Wet Conifer Mountains and Plateaus (ABGR/VAME/LIBO)** Lower number of dry days (<45), Engelman spruce and grand fir more common.
F043CY607OR	**Cool Moist Conifer Foothills and Mountains (PIPO-PSME/SYAL)** Somewhat shallower soils, warmer climate, greater dry days (60-90)

Table 1. Dominant plant species

Tree	(1) *Pseudotsuga menziesii* (2) *Pinus ponderosa*
Shrub	Not specified
Herbaceous	(1) *Calamagrostis rubescens*

Physiographic features

This site occurs on forested backslopes of plateaus and mountain slopes within the Blue and Wallowa mountains of Oregon. This site occurs on all aspects with typical slopes between 7.5 - 50% but occasionally as steep as 65%. Slope profiles are most commonly convex or linear across and down slopes, and occasionally concave. Elevations are typically between 4,100 - 5,175 ft (1,250 - 1,575 m) but can range from 3,150 - 6,000 ft (950 - 1,825 m). This site does not experience flooding or ponding and no water table is present within the upper two meters of soil.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope (2) Mountains > Plateau
Flooding frequency	None
Ponding frequency	None

Elevation	1,250 – 1,580 m
Slope	10 – 50 %
Ponding depth	0 cm
Water table depth	250 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	960 – 1,830 m
Slope	0 – 70 %
Ponding depth	Not specified
Water table depth	Not specified

Climatic features

The climate of this site is characterized by intermountain weather patterns. Winters are cool and wet with considerable snowfall and summers are cool and dry with occasional convective thunderstorms bringing measurable precipitation. Compared to continental systems influencing interior Rocky Mountain landscapes, these storms are less frequent and therefore summer precipitation is often lower. Mean annual precipitation is typically between 20 - 29 inches (510 – 735 mm) but ranges from 17 – 35 inches (430 – 890 mm). Mean annual temperatures are typically 39 - 43 °F (3 - 6°C) but range from 37 – 45°F (2.5 - 7°C). The soil temperature regime is Frigid and the moisture regime is Xeric with between 45 – 60 dry days per year. Frost free days average 30 to 100 per year. Climate graphs are populated from the closest available weather stations and are included to represent general trends rather than representative values.

Table 4 Representative climatic features

Frost-free period (characteristic range)	30-100 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	510-740 mm
Frost-free period (average)	

Freeze-free period (average)	
Precipitation total (average)	610 mm

- (1) AUSTIN 3 S [USC00350356], Prairie City, OR
- (2) MEACHAM [USW00024152], Pendleton, OR

Influencing water features

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

Soil features

Soils that typify this site concept are typically moderately deep to very deep and well drained. Subsurface horizons are typically skeletal with coarse fragment ranges from very gravelly to extremely cobbly or stony. The family particle size class is typically loamy-skeletal but may vary. The soil moisture control sections are usually moist but are dry for 45 to 60 days following the summer solstice. These soils have typically developed in colluvium and/or residuum from basalt, other hard igneous extrusive geologies as well as metasedimentary and metavolcanic rocks. Mount Mazama volcanic ash is often mixed in the upper layer yet rarely in significant quantities to qualify as Andisols. See Analulu, Getaway, and Larabee for modal series concepts.

Table 5. Representative soil features

Parent material	(1) Colluvium – volcanic rock (2) Residuum – volcanic rock (3) Residuum – metasedimentary rock (4) Residuum – metavolcanics (5) Volcanic ash – volcanic rock
Surface texture	(1) Ashy loam (2) Gravelly silt loam (3) Cobbly loam (4) Stony sandy loam
Family particle size	(1) Ashy over loamy-skeletal (2) Clayey-skeletal (3) Fine (4) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid

Depth to restrictive layer	50 – 200 cm
Soil depth	50 – 200 cm
Surface fragment cover <=3"	0 – 50 %
Surface fragment cover >3"	0 – 50 %
Available water capacity (0-101.6cm)	7.62 – 19.56 cm
Soil reaction (1:1 water) (0-101.6cm)	5.6 – 7.3
Subsurface fragment volume <=3" (10.2-152.4cm)	0 – 30 %
Subsurface fragment volume >3" (10.2-152.4cm)	0 – 40 %

Ecological dynamics

In its historical reference condition, a mature forest with an open stand structure was the most common expression of this ecological site. In this representative stage, widely spaced, older mature Douglas-fir (Pseutotsuga menziesii) and ponderosa pine (Pinus ponderosa) dominate the upper canopy layer, with mature grand fir (Abies grandis) and limited western larch (Larix occidentalis) in the mid-and upper layer(s) of the forest. Lodgepole pine (Pinus contorta) may also be found on this site, especially during early development phases following fire. Pinegrass (Calamagrosis rubescens) and elk sedge (Carex geyeri) dominate the herbaceous vegetation layer along lesser amounts of forbs that commonly include strawberry (Fragaria spp.), heartleaf arnica (Arnica cordifolia), common yarrow (Achillea millefolium), white hawkweed (Hieracium albiflorum) and tailcup lupine (Lupinus caudatus). Shrub species found on this site may include common snowberry (Symphoricarpos albus), creeping Oregon grape (Berberis repens), baldhip rose (Rosa gymnocarpa), birchleaf spirea (Spirea betulifolia), service berry (Amalanchier alnifolia) Scouler's willow (Salix scouleriana) and mallow ninebark (Physocarpus malvaceus).

The modal plant associations that define this ecological site group concept are the widespread Douglas fir/Common snowberry and Grand fir/Pinegrass associations (as described in Johnson and Clausnitzer 1992, and Johnson and Simon 1987). Additional closely related plant associations include Douglas-fir/Pinegrass and Douglas-fir/Ninebark. Within MLRA 43C in Oregon, these communities exist in areas with greater moisture than pure ponderosa pine and ponderosa pine Douglas-fir forests and the warm and dry end of the climate range supporting grand fir forests. This site group corresponds to the USFS potential vegetation group "Dry Upland Forest" and plant association group "Warm Dry Upland Forest".

Dry mixed conifer forests were historically subject to frequent surface fires primarily ignited by lightning strikes and Native American cultural burning practices. These fires would have likely occurred at less than 35-year intervals and approximated Landfire fire regime group 1 (0-35 year frequency, surface severity). Landfire estimated average fire return intervals for this forest type are 135 years, 110 years and 30 years for replacement, mixed and surface severity fires respectively. Frequent, low intensity fires would have decreased the density of young regenerating understory conifers, such as Douglas-fir and grand fir which are less tolerant of fire when young. Overtime, these fires, would have favored the development of mature, uneven-aged stands of Douglas-fir and ponderosa pine with open canopies. Less frequent mixed and surface severity fires would have increased the spatial and structural heterogeneity of these forests by creating patches of regeneration and removing portions of overstory components.

Fire-resistant ponderosa is well-adapted to fire, often surviving low severity fire when very young and developing increasing resistance with age by growing thick bark and self-thinning lower limbs. Douglas-fir is intolerant of fire until later developmental stages (~40 years) at which time it's resistance is bolstered by very thick bark and deepening root habit. Western larch exhibits similar protective bark attributes, along with an open growing crown (i.e. low foliage volumes) that makes this species less vulnerable to consumption or scorch damage in the event of a crown fire. Grand fir is very intolerant of fire when young yet with advanced maturity gains some moderate resistance due to thickened bark and deep roots. Lodgepole pine is susceptible to mortality from fire with thin bark even with maturity, yet is well adapted to colonize following fire with prolific seed production and cones sometimes exhibiting serotiny. With longer time between fire, increased development of understory fuels such as young conifers, shrubs and down wood, along with the development of a closed canopy, can promote an increased frequency of stand replacing fires and insect outbreaks. Much of this site currently exists within this condition, as long-term fire exclusion has allowed for understory infill of shade tolerant Douglas-fir and grand fir and increases in fuel loads.

Understory species in these forests were adapted to respond to this fire driven disturbance regime. The dominant graminoids, such as elk sedge and pinegrass, will resprout from rhizomes and increase in cover following fire. Many shrubs found on site, including spiraea and snowberry, would also resprout from crowns or rhizomes following fire. These and other shrubs including serviceberry, may respond to high severity fire by forming dense shrubfields on sites where they were present prior to disturbance. Understory forbs, such as common yarrow and heartleaf arnica, may resprout from rhizomes while others, such as lupine, can effectively respond to post fire conditions that may delay the reestablishment of other species, such as low soil nutrient levels, by fixing their own nitrogen.

As a forested site with a productive herbaceous component in the understory, much of these forests were historically subject to livestock grazing, especially cattle and sheep, and use by native ungulates such as elk and mule deer. Often adjacent to climax grand fir sites with more dense understories and higher shrub cover, these sites may attract increased use. Prolonged historical use by these ungulates may have altered the composition of understory herbaceous and shrub communities. A decrease in preferred perennial grasses such as pinegrass as well as trampling impacts, may parallel increases in forbs such as heartleaf arnica, strawberry, vetch (Vicia spp.) and lupine, elk sedge and exotic annual grasses such as cheatgrass (Bromus tectorum), Medusahead rye (Taeniatherum caput-medusae), and North Africa grass (Ventenata dubia). Increases in exotic grasses have been associated with other impacts as well, including off highway vehicle use and proximity to human development. At high levels, the impacts of these invasions on nutrient cycling, wildlife habitat and fire cycles may be severe, yet this site may be less prone to widespread invasion than drier forest types.

In addition to direct impacts of wildfire, disturbance factors that resulted in the death of mature trees included injury from lightning strikes, wind events, weather extremes, and the collective influence of various biotic damage agents. Ponderosa pine is prone to injury or mortality from bark beetles, pine engraver, mistletoe, and other adapted insects and diseases. Douglas-fir is often killed or weakened by Douglas-fir beetle and other wood borers, tussock moth and western spruce budworm. These agents often cause "secondary effect" post-fire mortality when fire stresses, but does not outright kill, individual mature Douglas-fir. Endemic bark beetle results in patch mortality, whereas epidemic outbreaks typically cause larger scale mortality. Root disease, age, overstocking, and other biotic and abiotic stressors will also impact the health and well-being of individual Douglas-fir trees, often leading to mortality. Western larch is susceptible to damage from dwarf mistletoe, needlecast and various fungi. Larch casebearer, sawfly, spruce budworm and tussock moth are common defoliators of larch.

The state and transition model below represents a generalized and simplified version of forest change in response to major disturbance types in this ecological site. It does not attempt to model the potential effects of climate change on ecosystem function or process. Emerging evidence is suggesting that climate change is leading to hotter and drier conditions in western forests that will increase fire frequency and extent and lengthen fire seasons (Halofsky et al. 2020). When combined with the interacting impacts of fire suppression, drought, and insect outbreaks, it is possible that this ecological system will experience unpredictable ecosystem shifts and additional alternative states. As evidence increases, this model will likely undergo alterations and updates to reflect our emerging understanding.

State and transition model

Additional community tables

Table 6. Community 1.1 plant community composition

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

Table 7. Community 1.2 plant community composition

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

Table 8. Community 1.3 plant community composition

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

Table 9. Community 1.4 plant community composition

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

Table 10. Community 1.5 plant community composition

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

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Contributors

Andrew Neary - Concept development for 2020 PES initiative
Kurt Moffit - Initial PES grouping

Approval

Kirt Walstad, 4/04/2025

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	02/12/2025
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):**

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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:**
