Ecological site F009XY005WA
Frigid Xeric Loamy Basalt Mountains and Plateaus Douglas-fir Cool Dry Grass

Last updated: 11/21/2023
Accessed: 05/12/2025

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): 009X–Palouse and Nez Perce Prairies

Almost all of MLRA 9 lies within the Walla Walla Plateau Section of the Columbia Plateaus Province of the Intermontane Plateaus. The area is characterized by an undulating basalt plateau that has been highly dissected. The major streams have cut deep, steep-walled canyons. The plateau is nearly level to steeply sloping, and its surface is moderately dissected or strongly dissected. Slopes are mostly hilly and steep. Some areas in the southeastern portion of this MLRA are in the Blue Mountain Section of the Columbia Plateaus Province. Small areas on the eastern edge of the area are in the Northern Rocky Mountains Province of the Rocky Mountain System.

Classification relationships

Ecological Site Description (ESD)
Section I: Ecological Site Characteristics Ecological Site Identification and Concept

Site ID: F009XY005WA
Site name: Frigid Xeric Loamy Basalt Mountains and Plateaus, Douglas-fir Cool Dry Grass. ("DF-CDG") Plant association: PSMEG/CARU series

Major land resource area (MLRA): 9 - Palouse & Nez Perce Prairie
LRU – Common Resource Area (CRA):
9.3 – Palouse and Nez Perce Prairies - Dissected Loess Uplands
9.4 – Palouse and Nez Perce Prairies - Deep Loess Foothills
Relationship to other identified systems:
The modal plant association of the ecological site is aligned to the following classification systems:
• U.S. National Vegetation Classification Standard (NVCS) Central Rocky Mountain Douglas-fir -Pine Forest Group (G210).
• NVS Central Rocky Mountains Douglas-fir - Ponderosa Pine / Herbaceous Understory Alliance (A-3395).
• Washington State's Natural Heritage Program's "Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest" -- NatureServe/WNHP code CEGL000429.
• USDA Forest Service Ecological Sub-region M332G "Blue Mountains".
• LANDFIRE Bps model 10450.
• Ecoclass Seral Stage Code CDG112 (Blue-Ochoco PA, 1991).

Included Plant Associations:

No other plant associations are associated with this ecological site, it is comprised of just the singular PSME/CARU association.

Ecological site concept

The Frigid Xeric Loamy Basalt Mountains and Plateaus, Douglas-fir Cool Dry Grass ecological site (ES) is mainly found in Asotin County, but occurs in Garfield and Columbia County as well. It is the least extensive of the forested ecological sites. The singular plant association is Douglas-fir/pinegrass: *Pseudotsuga menziesii*/ Calamagrostis rubescens (PSMEG/CARU), Ecoclass id is CDG112, and Blue/Ochoco is the base plant association reference.

Associated sites

F009XY004WA	**Warm-Frigid Xeric Loamy Foothills of Basalt Mountains and Plateaus Douglas-fir Warm Dry Shrub**

Similar sites

F009XY004WA	**Warm-Frigid Xeric Loamy Foothills of Basalt Mountains and Plateaus Douglas-fir Warm Dry Shrub**

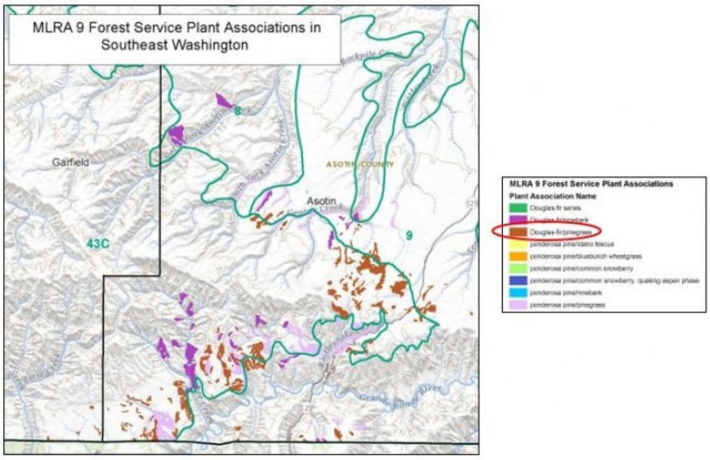


Figure 1.

Table 1. Dominant plant species

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

Physiographic features

This site occurs predominately on backslopes of hills and mountains of basalt plateaus. The landscape is part of the Columbia basalt plateaus.

Physiographic Division: Intermontane Plateau
Physiographic Province: Columbia Plateau
Physiographic Section: Blue Mountain Section

Landscapes: mountains and hills
Landform: mountain and hill slopes, broad ridges and basalt plateaus

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope (2) Hills > Hillslope (3) Ridge (4) Plateau

Flooding frequency	None
Ponding frequency	None
Elevation	762–1,372 m
Slope	3–40%
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	Not specified
Slope	3–90%

Climatic features

Taxonomic soil climate is primarily a frigid temperature regime and xeric moisture regime.

Table 4. Representative climatic features

Frost-free period (characteristic range)	85-130 days
Freeze-free period (characteristic range)	94-137 days
Precipitation total (characteristic range)	457-610 mm
Frost-free period (actual range)	60-140 days
Freeze-free period (actual range)	82-146 days
Precipitation total (actual range)	432-1,016 mm
Frost-free period (average)	75 days
Freeze-free period (average)	115 days
Precipitation total (average)	635 mm

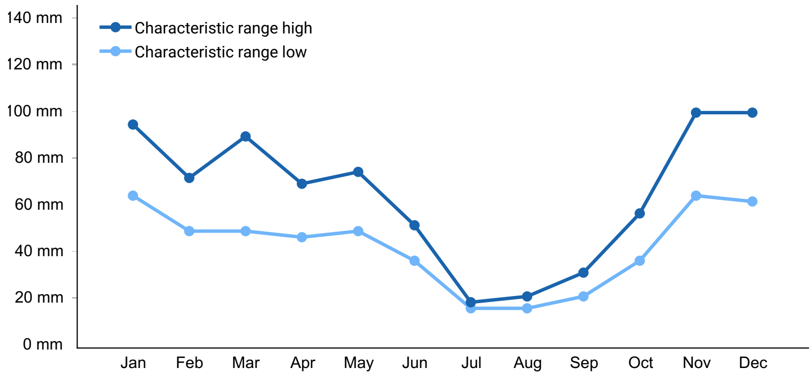


Figure 2. Monthly precipitation range

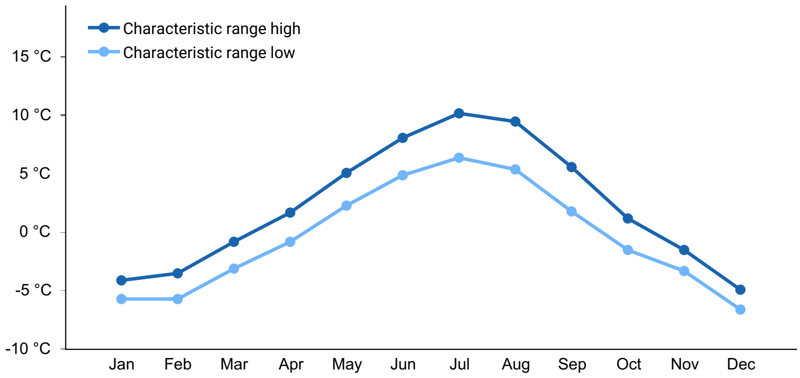


Figure 3. Monthly minimum temperature range

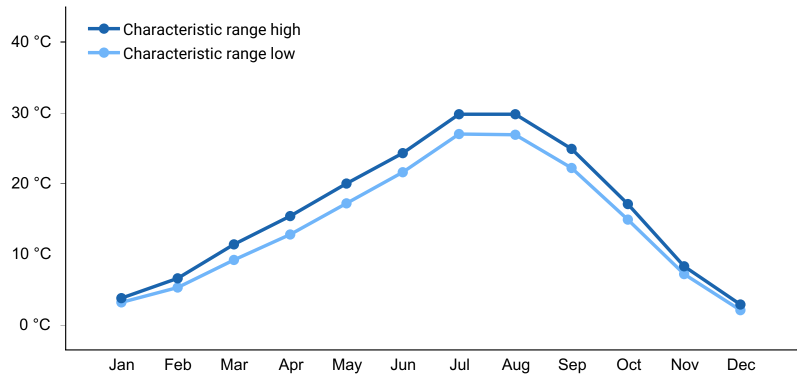


Figure 4. Monthly maximum temperature range

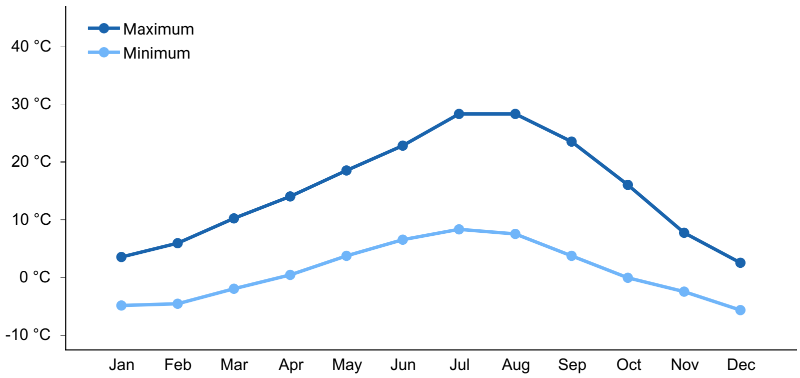


Figure 5. Monthly average minimum and maximum temperature

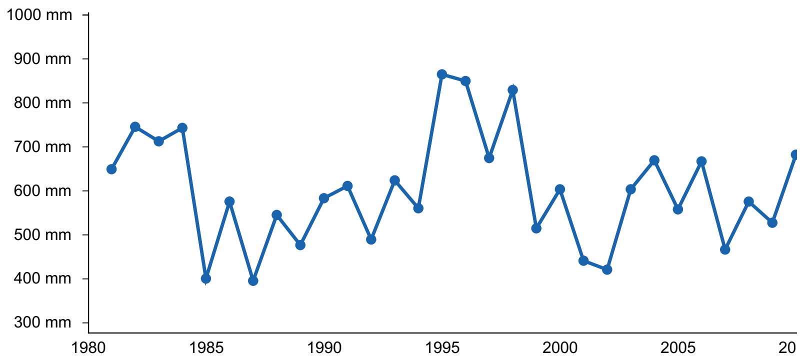


Figure 6. Annual precipitation pattern

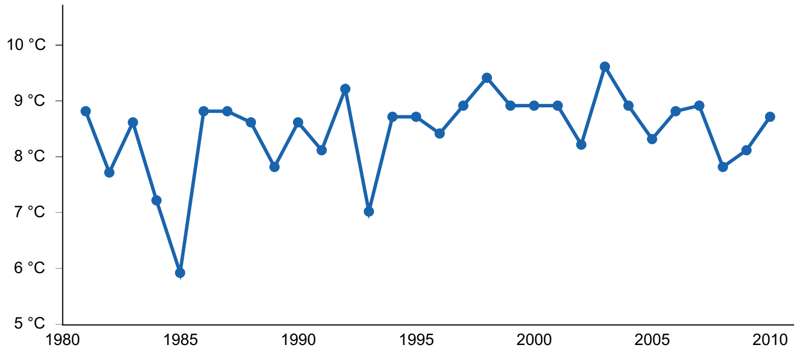


Figure 7. Annual average temperature pattern

Climate stations used

- (1) POMEROY [USC00456610], Pomeroy, WA
- (2) MEACHAM [USW00024152], Pendleton, OR
- (3) ELGIN [USC00352597], Elgin, OR

Influencing water features

N/A

Wetland description

N/A

Soil features

The Frigid Xeric Loamy Basalt Mountains and Plateaus, Douglas-fir Cool Dry Grass ecological site is associated with several soil mapunit components. The components are dominantly Vitrandic and Ultic taxonomic subgroups of Argixerolls great groups of the Mollisol taxonomic order. Soils are dominantly moderately deep to very deep and have average available water capacity (AWC) of about 7.0 inches (17.8 cm) in the 0 to 40 inches (0 to 100 cm) depth range.

Soil parent material is dominantly loess over colluvium or residuum from basalt with influence of volcanic ash deposits in upper horizon.

The associated soils are Cloverland, Klickson, Larkin and similar soils.

Dominate soil surface is silt loam to gravelly ashy loam.

Dominant particle-size class is fine-silty, but includes loamy-skeletal

Table 5. Representative soil features

Parent material	(1) Loess–basalt
Surface texture	(1) Silt loam (2) Gravelly, ashy loam
Family particle size	(1) Fine-silty (2) Loamy-skeletal
Drainage class	Moderately well drained to well drained
Depth to restrictive layer	152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%

Available water capacity (0-101.6cm)	7.87–21.08 cm
Calcium carbonate equivalent (Depth not specified)	0%
Electrical conductivity (Depth not specified)	0 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0
Soil reaction (1:1 water) (0-25.4cm)	5.6–7.3
Subsurface fragment volume <=3" (Depth not specified)	0–30%
Subsurface fragment volume >3" (Depth not specified)	0–30%

Ecological dynamics

Open, park-like stands characterized the late seral development state of this ecological site. In this representative plant community phase, widely spaced, older mature Ponderosa pine (*Pinus ponderosa*) dominated the upper canopy layer, with both mature Douglas-fir (Pseutotsuga menziesii) and limited western larch (*Larix occidentalis*) in the mid and upper layer(s) of the forest. Low severity ground fires were frequent, occurring at typical intervals of 20 to 35 years, which maintained these mature forests in a “park-like” appearance. Fires were started by natural lightning (mainly in summer), and by Native Americans (mainly in the spring and fall). Mixed and stand replacement fires are less frequent than surface fires, but they both occurred under natural, historic conditions.

Pinegrass (Calamagrosis rubescens) and elk sedge (*Carex geyeri*) dominate the understory vegetation of this ecological site. These grasses were present along with lesser amounts of low and moderate growing shrub species. Shrub growth was kept in check from the impacts of the repetitive surface and mixed severity fires. Oregon grape (Berberis repens), baldhip rose (*Rosa gymnocarpa*), birchleaf spirea (Spirea betulifolia), and an occasional common snowberry (*Symphoricarpos albus*) and pinemat manzanita (Arcotostiaphylos nevadensis) were some of the shrubs encountered in pre-European forests operating under natural conditions.

Very limited amounts of grand fir (*Abies grandis*) could be found reproducing and growing in shaded pockets on more moist micro-sites, especially where ground fire had been absent for a longer period of time, but it was historically restricted in expression over most of this ESD due to climatic restrictions and by the species vulnerability to fire kill. Low levels of early seral lodgepole pine (*Pinus contorta*) could also occur at times.

The Douglas-fir potential vegetation “series” (a series is named for the dominant fine scale climax tree species) occupy positions which are transitional from the warmer and dryer moisture gradient from the Ponderosa pine (*Pinus ponderosa*) series, progressing to the moister and cooler grand-fir (*Abies grandis*) series. Vegetative transitions are often gradual in the absence of abrupt changes in soil types, aspect, or other features that exert strong influence on the expression of the potential natural plant community (PNC).

The Douglas-fir/pinegrass (PSME/CARU) plant association is the only potential vegetation type (PVT) in this particular ecological site. This plant association is collectively a part of the extensive and broad “Dry Mixed Conifer Forest” group of the northwestern United States (this group also includes other Douglas-fir plant association(s), and the warmer and drier Grand fir associations).

Ponderosa pine is the dominant early seral forested conifer species of the ecological site under pre-European historic conditions. Ponderosa pine, a long-lived species (averaging 300 years, but capable of up to a 750-year life span), establishes in the early successional stage following favorable disturbance episodes, and typically persists in the overstory into the climax ecological plant community phase. Western larch (also an early seral species) is similar to Ponderosa pine in terms of fire adaptation, longevity and seral status; however, it would occur less frequently in this ecological site due to climatic moisture limitations.
The increase in moisture for this ecological site (compared to the dryer Ponderosa pine series) allows Douglas-fir (a mid-seral species) to establish under partial shade given an adequate seed source, with the natural progression in

age and size classes under favorable conditions. In the late pole size class, typically around 40 years of age, Douglas-fir trees begin to acquire fire resistance similar to that of Ponderosa pine, developing a thick, corky bark that protects individual Douglas-fir trees from low intensity surface fires. 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. The very limited number of grand fir (late seral) trees that were able to germinate and persist into the older age and size classes would gain resistance to surface fire as their root systems grew deeper into the soil, and as their bark thickened, especially near the ground surface.

In addition to the direct impacts of wildfire, other abiotic disturbance factors that can affect all tree species include injury from direct lightning strikes, wind events, and weather extremes (e.g. snow, ice and drought damage).

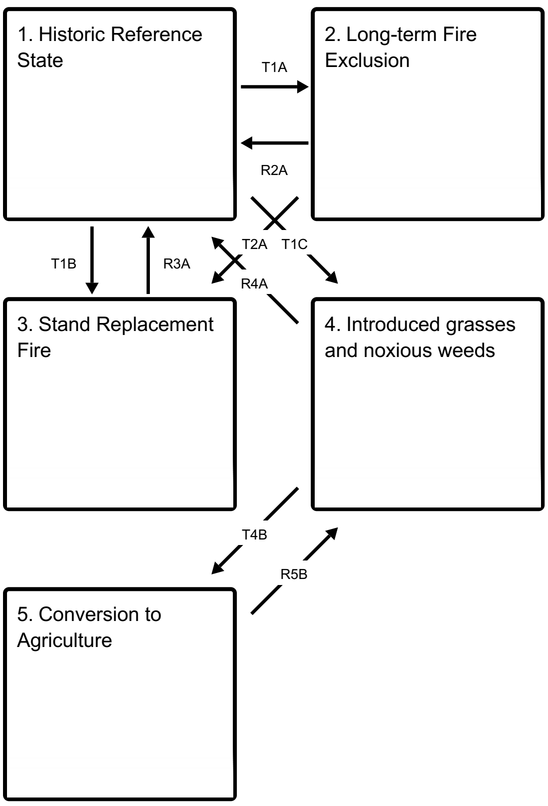
Ponderosa pine is prone to damage or outright mortality from bark beetles, pine engraver, mistletoe, and other adapted insects and diseases. Douglas-fir is often killed or weakened by Douglas-fir beetle and other wood borers, tussock moth and western spruce budworm. These agents often cause “secondary effect” post-fire mortality when lower severity fire stresses, but does not outright kill, individual mature Douglas-fir. The stress is often in the form of foliar reduction or cambial scorch. This is also referred to as delayed mortality.

Endemic bark beetle often results in patchy mortality, whereas epidemic outbreaks cause larger impact 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.

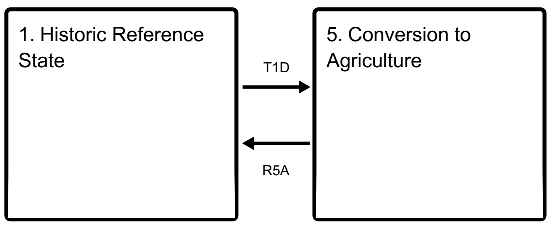
Human caused fire exclusion within the past 100 years (the Post-European period) has drastically changed the structural expression of the present forest in this ecological site, resulting in an increase in the proportion of mid and limited late serial tree species, a reduction of Ponderosa pine recruitment in the understory, and corresponding increases in crown density and in fuel loading and continuity.

State and transition model

Ecosystem states



States 1 and 5 (additional transitions)



T1A - Long-term fire exclusion (50 to 100 plus) years (resulting in Alternative State 2).

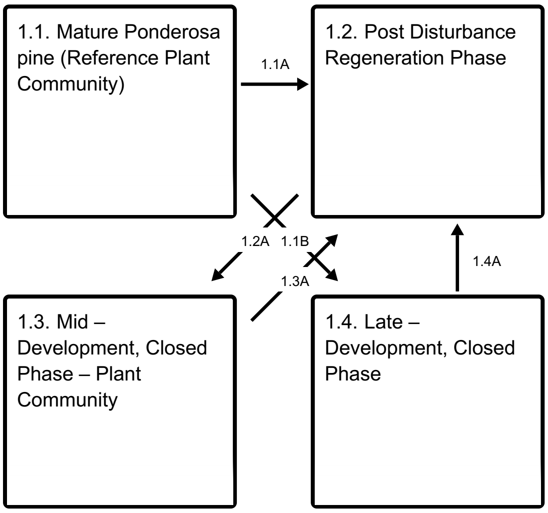
T1B - A widespread catastrophic (also referred to as “stand replacing”) fire event occurs as a natural (but relatively rare) event in any phase within the Reference State.

T1C - Introduced cool-season grasses invading sites near homesteads, pastureland, and other converted land.

T1D - Site converted to annual cropland, pasture, or hayland (leading to Alternative State 5).

R5B - Site preparation and reseeding with native forest vegetation is applied followed by grazing protection on sites that have been converted to non-forest land use(s) for a long period of time (this process is referred to as afforestation).

State 1 submodel, plant communities



1.1A - Overstory mortality include “mixed” stand replacement fire events, and single tree to cluster mortality due to beetle kill, mistletoe, windthrow, and storm damage.

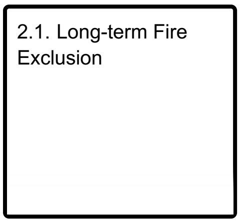
1.1B - With time and the absence of major disturbance events, the stand develops into a mature and over-mature cohort.

1.2A - The stand develops relatively intact and grows from seedling/sapling to pole/small sawtimer size classes.

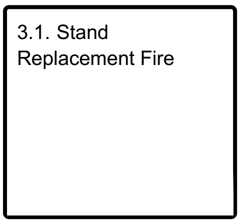
1.3A - The stand develops to the mature phase. Stands have thinned as size classes increased, primarily from stress induced bark beetle mortality.

1.4A - A fire event severe enough to eliminate the majority of the overstory, or less severe “mixed” severity fires which creates random patch openings, occurs.

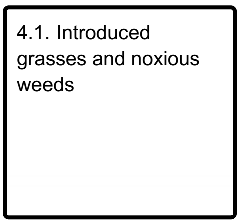
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 5 submodel, plant communities

5.1. Conversion to Agriculture

State 1
Historic Reference State

The Historical Reference State has a variable but predictable plant expression across the landscape. In the larger context, these forests tended to be heterogeneous and spatially complex. A wide array of wildlife species benefited from the edge effects created by the spatial intersections within the larger landscape, and by naturally occurring snags and large woody debris. Under a commonly occurring short-term (repetitive) historic surface fire regime, the mature ponderosa pine plant community (PC 1.1) was likely the most prevalent of the Reference State. Douglas-fir recruitment and establishment were held in check by surface fires. These forests are comprised of pure, self-replacing stands that function under the ecological parameters that were described in the section entitled "Ecological Dynamics of the Site." As stated, fire was the most important disturbance agent in the reference state of the ecological site. The fire regime of the Historic Reference State is summarized as follows: Fire Regime Group Fire Interval (years) I 8 Replacement Mixed Low Fire Severity (% of all fires) 15 18 67 Range of Fire Return Intervals (RFRI- years) 70-400 70-175 8-35 Average Fire Return Interval (AFRI-years) 135 110 30 Source: BpS model 910450 The historic regime average size of any given wildfire event was 1,000 acres. Fire Severity Classes: Replacement, greater than 75 percent kill or top kill of the upper canopy layer; Mixed 26 to 75 percent, and low severity, less than 25 percent. Across the overall landscape, stand structure was expressed by a combination of patch openings, clumpy (dense or overstocked) tree groups which were most often pole size or smaller, and as well-spaced mature overstory trees encompassing larger stand groups. These mosaic patterns could occur over the landscapes in a scale of upwards of tens of thousands of acres. Disturbances from fire and other biotic and abiotic sources impacted much smaller areas within the larger landscape, on the order of thousands of acres. Following a fire or other widespread disturbance in which the vast majority of conifer species are eliminated in a stand replacement event, the key to re-establishing the reference state was dependent on the successful recruitment of early and mid-seral species by seed coming from adjacent sites, or from seed provided by the few remnant surviving seed bearing trees, or from viable soil banked seed. Larger sized patches or impacted areas approaching landscape level scales, isolated from seed sources and devoid of remnant conifer of any size class, tend to revert to long term grass/shrub conditions. When the understory was impacted by wildfire (with or without overstory impacts), fire adapted species responded well following a light to moderately severe fire impact at the surface. Pine grass and elk sedge usually survived and are rejuvenated by the surface. Fireweed, scour willow, serviceberry and spirea, and lesser amounts of common snowberry, snowbrush ceanothus all increase following these events. Production Interpretations of the PSME/CARU Reference State: Site Index Site index (SI) and the resulting derivation of the Culmination of Mean Annual Increment (CMAI) are different indicators of site quality, as well as an indicator of potential yield and of the general economic rotation age of a site. Site index is a common unit of measure for forest trees and stands. It is a simple measure of the age and height of dominant and co-dominant trees, usually referenced to 50 or 100 years of age. The Culmination of Mean Annual Increment, is expressed as the cubic foot volume at that point (age) where periodic and mean annual increment rates intersect—in other words, where the annual incremental volume growth is at a maximum over the lifespan of a (well managed) stand. The NRCS (formerly the Soil Conservation Service) typically projects site index and corresponding CMAI values of the forested soils within a survey area, but older survey projects (such as this project) were often lacking in this sample data for this estimation. A site index value of 83 was assigned to this ecologic site during the Asotin County soil survey process (using Meyer, NRCS ADP code 600—this is a 100-year curve based on total tree age). The CMAI value is 74 cubic feet per acre per year at 40 years. It is unknown how many field plots were taken by the survey crew during the soil survey process. Stand Density Index (SDI) Reineke's Stand Density Index (SDI) is another indexed system which is commonly utilized as an indicator of site quality. SDI is often used to obtain productivity and stocking projections. NRCS does not include SDI interpretations for the forested soils identified in a soil survey area. SDI expresses stand density (the number of trees per unit area) at a standard average dbh (the diameter at breast height, four and half feet above the ground surface). In the English system, the SDI is indexed at a dbh of 10 inches, as derived from the quadratic mean diameter (QMD: the diameter of the tree of arithmetic mean basal area). Maximum density (Max SDI) is the theoretical biological carrying capacity of the site. Stocking guides can be developed from density parameters in order to manage for future desired conditions, specific to defined management objectives. In most cases the objective is a sustainable production of wood products. Stocking guidelines are normally expressed at the "full stocking" or "normal density" SDI level, which is approximately 80 percent of the stocking density defined as the Max SDI for the site. The plant association for the ecologic site (PSME/CARU) was derived from the Plant Associations of the Blue and Ochoco Mountains (USFS, Wallowa-Whitman NF, 1992), and a number of productivity projections that were subsequently developed by the Umatilla National Forest for these associations. The following summary of SI/SDI and various growth parameters is from Umatilla NF publications, derived from PSME/CARU plant association plot data. This summary is based in the reference sources listed below the chart and fully detailed in the reference section. Plant Association Site Index GBA** CMAI*** Max SDI**** Full Stocking UZ LZ PSME/CARU (CDG112) Ponderosa Pine Meyer Barrett 106 ft2/ac 55 ft2/ac/yr. 329 263 197 132 75* (see note) 83 Douglas-fir 83 133 ft2/ac 55 ft2/ac/yr. 330 264 198 132 Western Larch 55 no value 65 ft2/ac/yr. 55 no value Grand fir 50 no value 40 ft2/ac/yr. 48 no value Douglas-fir 53 90 ft2/ac 50 ft2/ac/yr. 229 183 137 92 50 yr. BH curves: DF (Cochran), WL (Cochran), GF (Cochran) Note: these are all unique, stand-alone references—see WP-SILV-39 for specific reference citations. 100 yr. BH curve: PP (Barrett, Meyer) Umatilla National Forest Site Quality and Productivity Data, continued: The site index for all conifer species is best represented in UNF White Paper F14-SO-WP-SIL-39 (2014 revision), on Table 3. * Note that the Meyer PP SI value comes from Table 3 in Cochran (1984). Western larch and grand fir had limited sample sizes. ** Growth Basal Area (GBA) is originally from Hall (1989) Ecol. Tech Paper 007-88, then brought forward in Cochran et. al.(1994) in PNW-RN-513. GBA is included as a historically referenced productivity value. *** A more recent production metric is the "Culmination of Mean Annual Increment" (CMAI) which is defined on page 7 of SIL-5. The CMAI yield capability estimations for various tree species measured within associated UNF plant associations is given in subsequent tables of this same reference. The NRCS will use CMAI to project yield estimations for forested soil series (by management level tree species) identified in a modern era soil survey. CMAI values are associated with NRCS calculated SI values from representative soil sample plots. NRCS identifies the year at which the CMAI occurs for any given soil series and tree species. Note again that this estimation is not provided in this MLRA in SE Washington. **** Maximum SDI values are derived from Table 3 of SIL-39. Full stocking, and the Upper limit of the management zone (UZ) and the lower limit of the management zone (LZ) are calculated from Table 1 of the same publication. (shown on the next page) * The site index of 75 given for Meyer is from Table 3 in the Umatilla NF Stocking Levels publication. **The SI value of 83 is also from that table, using a conversion factor of the SI for Meyer multiplied by 1.1 to derive a comparable Barrett SI. ***The SI for Douglas-fir is from site index curves used in R6-ECOL-TP-225A-86 and carried forward into Cochran (1994) Stand Density Index (SDI), Max SD, Full Stocking, UZ and LZ are best defined by Powell in the referenced white papers. Dominant and Indicator Species of the ESD: PLANT LIST—Douglas-fir Warm Dry Grass Source: R6-ERW-TP-036-92 and USFS FEIS Trees: Species Name Scientific Name ADP Code Ecological Interpretation Western larch *Larix occidentalis* LAOC Early Seral Douglas-fir *Pseudotsuga menziesii* PSME Mid Seral Ponderosa pine *Pinus ponderosa* PIPO Early Seral, dominant fire-maintained conifer Lodgepole pine *Pinus contorta* PICOL Early seral (minor seral) Shrubs: Species Name Scientific Name ADP Code Ecological Interpretation Pinemat manzanita *Arctostaphylos nevadensis* ARNE Susceptible to fire kill, resprouts easily Creeping Oregon grape Berberis repens BERE Sprouts from surviving rhizomes following fire Oregon boxwood Pachistima Myrsinites PAMY Moderately resistant to fire-kill Baldhip rose *Rosa gymnocarpa* ROGY Sprouts from surviving root crowns Birchleaf spirea Spirea betulifolia SPBE Resistant to fire, increases Common snowberry *Symphoricarpos albus* SYAL Maintains pre-fire frequency/coverage PLANT LIST—Douglas-fir Warm Dry Grass continued Forbs: Species Name Scientific Name ADP Code Ecological Interpretation Common Yarrow *Achillea millefolium* lanulosa ACMIL Reduced by fires; sprouts from shallow rhizomes Heartleaf Arnica *Arnica cordifolia* ARCO Susceptible to fire-kill Broadpetal Strawberry *Fragaria virginiana* platypetals FRVIP Susceptible to fire-kill, may survive cool burns Hawkweed *Hieracium albiflorum* HIAL2 Regenerates from seed, offsite colonizer Tailcup Lupine *Lupinus caudatus* LUCA Little impact from most fires Grasses: Species Name Scientific Name ADP Code Ecological Interpretation Pinegrass Carex rubescens CARU Moderately resistant to fire kill: rhizomatous, may invade Northwestern sedge *Carex concinnoides* CACO Likely sprouts from rhizomes Elk sedge *Carex geyeri* CAGE Seeds and rhizomes, may increase or invade Western fescue *Festuca occidentalis* FEOC Usually decreases other than cool, wet burns Wheeler's Bluegrass *Poa nervosa* PONE Resistant, early maturation, little litter Herbage and Forage Estimations: The total herbage production for the modal PSME/CARU plant association (measured from sample plots used to support the "Plant Associations of the Blue and Ochoco Mountains" publication) ranged from 228 to 645 pounds/acre, air dried. The average value for the 18 samples plots is 382 pounds/acre, air dried. Information collected during the development of the "Plant Associations of the Wallow-Snake Providence" indicate that the PSME/CARU plant association produced varying amounts of understory herbage/forage production depending on the seral stage of the site. Those production estimations are as follows: Late Seral Mid Seral Early Seral n=2 n=7 n=8 Herbage Production (lbs./acre dry weight) TOTAL Herbage Range and mean 170-425 (300) 250-1,300 (705) 330-8,000 (475) CARU Range and mean 60-200 (130) 200-1,100 (605) 100-600 (290) Total herbage production, and especially forage production, varies significantly depending on canopy coverage, seral stage, forage condition, and the recent fire occurrence(s) on any given site. These factors are compounded by the annual production variance(s) attributed to precipitation and temperature fluctuations.

Community 1.1
Mature Ponderosa pine (Reference Plant Community)

Douglas-fir/pinegrass plant association
Pseudotsuga menziesii/Calamagrostis rubescens
(PSME/CARU) (CDG1 21)

60. North of Rattlesnake Creek, Snake River Canyon Plot 761
(Hells Canyon NRA)

Photo from R-6-ECOL-TP-225A-86, "Plant Associations of the Wallowa-Snake Province" page 332.

This photo represents a mature stand of the PSME/CARU ecological site with an understory of almost pure pinegrass.

This mid to late-seral plant community is the dominant representation of the pre-European historic reference state which is sustained by plant adaptations to naturally occurring and frequent non-lethal fires. It is typically uneven aged with older Ponderosa pine in the overstory, along with mature Douglas-fir and scattered western larch. Reproduction varies with disturbance history.

Community 1.2
Post Disturbance Regeneration Phase

This photo shows a
"patch" opening w
larger (and older)

Patch openings ser
break up crown co
increase wildlife h
diversity, and prov
openings for the re
of sun-loving conif
(under suitable mi
seedbed conditions

Pine seedlings and saplings establish in small-size patch openings created from disturbance events (fire and disease or insect outbreaks, occurring in both endemic or epidemic outbreaks) that reduced or eliminated portions of the overstory canopy layer. Douglas-fir and limited western larch will also establish. Seedling recruitment commonly comes from seed production in the years following the event, but also from viable banked seed that was on the ground before the disturbance occurred or from surviving regeneration that pre-dated the disturbance. Favorable weather conditions are necessary for seedlings to establish and develop. Limitations of seed dispersal distance from seed trees (these are heavy seeds) seriously hinder recruitment in larger patch sizes (this is a frequently occurring disturbance). Ponderosa pine seedlings will become established underneath overstory Ponderosa pine canopy layers, but their development and successional pathway will be impacted by the competition and shade relationships of the overstory stand. (Ponderosa pine is a "shade intolerant" tree species. This is a silvicultural term which means that the tree species is best adapted to growing in open sites or very low levels of overstory shade – Ponderosa pine is a "sun loving" conifer species). Douglas-fir develops in the open on more moist expressions of the ecological site, and in the understory on dryer portions (depending as well on the availability of seed source). Scattered larch and minor grand fir can be found across the landscape.

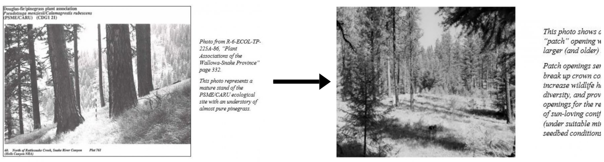
Community 1.3
Mid –Development, Closed Phase – Plant Community

The stand reaches the size class(s) of poles to small sawtimber size individuals (5 to 20 inches DBH). At this stage, Ponderosa pine is well suited to survive low intensity surface fire. Douglas-fir will achieve similar resistance as bark thickens but will retain lower branches which act as ladder fuels and increase the probability of mortality in the event of a surface fire (or more lethal event). Western larch, where found, will act in a similar fashion as Ponderosa pine in terms of surface fire resistance in the juvenile growth stage. The canopy will begin to close and understory early seral shrub cover, if present, begins to decline as tree canopy cover approaches 50 percent. In the transition phase between the sapling and pole-size class, understory fires begin to facilitate a beneficial "thinning" effect in dense stocking conditions (i.e., some trees succumb to the fire while others survive). In other instances, the stand will exhibit clumpy attributes, and increased intraspecific stand stress will occur as the stand ages, which is the beginning of the stem exclusion phase of stand development. Reoccurring ground fire near the middle and later stages of this phase can provide beneficial self-pruning of the lower limbs of individual trees, which reduces the subsequent ladder fuel risk for those trees.

Community 1.4
Late –Development, Closed Phase

Over a longer period of time an older stand has developed as described in Community Pathway 1.1A. Along the way, large individual Ponderosa pine, Douglas-fir and western larch has succumbed to various disturbance agents such as pine beetle(s), lightning strikes, wind breakage, leading to mortality and other agents are described previously. The density of trees has continuously been reduced. At the same time, tree diameter(s) have continued to expand as stocking or density stressors continue to influence the stand. Persistent snags and the development of down wood is at an optimum level. Beneath the dominant and co-dominant overstory layer, a limited expression of younger cohorts of Ponderosa pine, larch and Douglas-fir can exist. A limited amount of grand fir may be encountered. This phase will exhibit the characteristics of an "old growth" stand as it progresses and remains intact over time.

Pathway 1.1A
Community 1.1 to 1.2



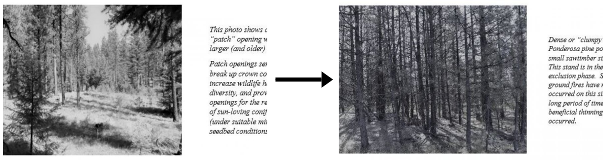
Mature Ponderosa pine (Reference Plant Community) **Post Disturbance Regeneration Phase**

Community Phase Pathway 1.1A This stage is sustained by frequently occurring, non-lethal surface fires which limited mid-seral understory seedling development and maintained a park-like structure, while preventing excessive fuel buildup The frequency and stable nature of the non-lethal fire episodes are cyclical. Fine scale patch openings develop from disturbance events. Causes of overstory mortality include "mixed" stand replacement fire events, and single tree to cluster mortality of mature pine, Douglas-fir, or larch trees that have succumbed to incidences such as beetle kill, mistletoe, windthrow, and storm damage.

Pathway 1.1B
Community 1.1 to 1.4

With time and the absence of major disturbance events, the stand develops into a mature and over-mature cohort. Tree size is large, and density is low. The threat of mountain pine beetle and other species bark beetles increases, and individual trees within the canopy are at greater risk of insect and disease mortality which in turn create gaps in the overstory. On poorer quality sites the incidence of root disease on Douglas-fir may increase. Snags and large organic debris on the surface increase. Additional sunlight will reach the surface and impact the vegetation at that location.

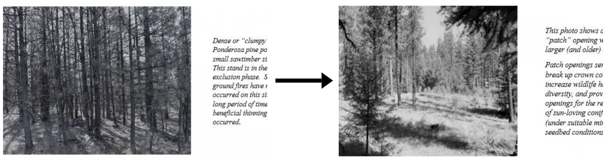
Pathway 1.2A
Community 1.2 to 1.3



Post Disturbance Regeneration Phase — **Mid –Development, Closed Phase – Plant Community**

Community Phase Pathway 1.2A Ground fires eliminate virtually all the young reproduction, setting back the development of the stand to the regeneration (or "initiation") phase. Douglas-fir is susceptible to surface fire mortality to a longer age and development stage than Ponderosa pine in this development phase. The process of seedling establishment is again dependent on cone and seed production, coupled with favorable weather, until an ecologic threshold stocking level of Ponderosa pine and associated conifer seedlings is achieved. The threshold level is possibly about 100 viable seedlings (able to survive to the sapling stage) per acre for most of this ecological site. This can be a short-term and repetitive process until the later sapling to pole stage is reached. The stand develops relatively intact and grows from seedling/sapling to pole/small sawtimer size classes.

Pathway 1.3A
Community 1.3 to 1.2



Mid –Development, Closed Phase – Plant Community — **Post Disturbance Regeneration Phase**

Community Phase Pathway 1.3 A Fires occur which are severe enough to eliminate most of all Ponderosa pine size classes, and again sets back the development of the site to the regeneration phase. The stand develops to the mature phase. Stands have thinned as size classes increased, primarily from the natural exclusion processes as well as from stress induced bark beetle mortality (chiefly mountain pine beetle).

Pathway 1.4A
Community 1.4 to 1.2

A fire event severe enough to eliminate the majority of the overstory, or less severe "mixed" severity fires which creates random patch openings, occurs. The stand or impacted patch areas within the overall stand are set back to the conditions in Plant Community 1.2, in which necessary seed source/seed establishment components must be present in order to achieve adequate conifer (mainly Ponderosa pine) regeneration.

State 2
Long-term Fire Exclusion

Since the arrival of Euro-American settlers to the region in the late 1880's, the character and function of these forests have changed. Logging, grazing, conversion to other uses, and fire exclusion have impacted the natural processes of this fire-dependent ecosystem. Depending on the severity and degree of impact, alternative states (which function outside of the parameters of the reference state), have developed. These states include the following: Conditions favorable to the development of this alternative state began to occur within the Reference State around the turn of the twentieth century. The impacts of fire exclusion, a management goal of post-European settlers, allowed many stands to progress without the natural occurrence of any fire, especially the frequent surface fires. The ecologic benefits of low intensity fires were lost. Fire suppression shifted the age expression and density of the younger stands, and changed the composition of understory vegetation, leading to reduced spatial variation. Fuel levels and fuel stratum layers increased, shifting the fire regime/condition class toward a greater likelihood of mixed and stand replacement fire events

Community 2.1
Long-term Fire Exclusion

These historic photos are from the USFS Lick Creek Experimental Forest in the Bitterroot valley of Montana. These photos document the change in forest structure resulting from long term fire exclusion. *This site is on a very similar ecologic site to this warm, dry grass Douglas-fir ESD. (Photo point 10, PSME/CARU-PIPO, W. Montana HT: RMRS-GTR-23)*

Upper left, from 1909 - This photo was taken immediately after a light selection harvest of mature overstory Ponderosa pine had occurred. The understory vegetation reflects the impacts and results from the historic frequent surface fire regime: **Upper right, from 1938** – Additional harvest of some of the pines in the foreground has occurred in the 30-year interim period. The stand has had total fire exclusion during that time. PP and DF regeneration is robust. **Lower left, from 1958** – Further growth and development of PP and DF in the continued absence of naturally occurring wildfire. **Lower right, from 1989** – (Pre-commercial thinning occurred in 1969, not shown). The stand has continued to grow and mature with the subsequent development of excessive fuels at all levels (i.e. surface, ladder, crown).

Conditions favorable to the development of this plant community began to occur within the Reference State around the turn of the twentieth century. The impacts of fire exclusion, a management goal of post-European settlers, allowed many stands to progress without the natural occurrence of any fire, especially the frequent surface fires. The ecological benefits of low intensity fires were lost. Fire suppression shifted the age expression and density of the younger stands, and changed the composition of understory vegetation, leading to reduced spatial variation. Fuel levels and fuel stratum layers increased, shifting the fire regime or condition class toward a greater likelihood of mixed and stand replacement fire events.

State 3
Stand Replacement Fire

This state represents conditions immediately following a catastrophic wildfire, the most severe impacts would be from those fires originating in Alternative State 2 due to the build-up of excessive levels of fuels. Long-term detrimental impacts to wildlife, hydrology and soil quality begin immediately due to the extremely severe intensity of the catastrophic burn. Microbial populations, organic matter levels, and other elements of the native soil resources are negatively impacted. Soil quality is slow to respond to pre-fire levels. Natural recovery of viable forest structure will be very long after these large-scale events. However, the number of wildlife snags may increase in the short-term following the fire.

Community 3.1
Stand Replacement Fire

This plant community represents conditions immediately following a catastrophic wildfire, the most severe impacts would be from those fires originating in Alternative State 2 due to the build-up of excessive levels of fuels. Long-term detrimental impacts to wildlife, hydrology and soil quality begin immediately due to the extremely severe intensity of the catastrophic burn. Microbial populations, organic matter levels, and other elements of the native soil resources are negatively impacted. Soil quality is slow to respond to pre-fire levels. Natural recovery of viable forest structure will be very long after these large-scale events. However, the number of wildlife snags may increase in the short-term following the fire.

State 4
Introduced grasses and noxious weeds

This state developed with the introduction and invasion of introduced grasses and noxious weeds, most notably cheatgrass. These conditions were likely to develop on areas which were near developed farm and pasture lands, and other converted lands or abandoned agricultural land.

Community 4.1
Introduced grasses and noxious weeds

This plant community developed with the introduction and invasion of introduced grasses and noxious weeds, most notably cheatgrass. These conditions were likely to develop on areas which were near developed farm and pasture lands, and other converted lands or abandoned agricultural land.

State 5
Conversion to Agriculture

This state is the usual result of human intervention following a very intensive or total harvest, or outright conversion of the forest, followed by stump removal and the elimination of all other native forest vegetation. Cultivation followed. These sites were often referred to as “cut over farmlands”. In this state virtually all the natural forest functions were eliminated by the conversion to agricultural lands (this includes annually tilled crops as well as hay and pasture).

Community 5.1
Conversion to Agriculture

This plant community is the usual result of human intervention following a very intensive or total harvest, or outright conversion of the forest, followed by stump removal and the elimination of all other native forest vegetation. Cultivation followed. These sites were often referred to as “cut over farmlands”. In this state virtually all the natural forest functions were eliminated by the converted use to agricultural lands (this includes annually tilled crops as well as hay and pasture).

Transition T1A
State 1 to 2

Long-term fire exclusion (50 to 100 plus) years, resulting in Alternative State 2.

Transition T1B
State 1 to 3

A widespread catastrophic (also referred to as “stand replacing”) fire event occurs as a natural (but relatively rare) event in any phase within the Reference State. Approximately three quarters or more of the cone producing age conifer species are virtually eliminated across all age and size classes, potentially leading to a long-term deficiency of seed source(s) necessary for the re-establishment of the early seral Ponderosa pine and mid and late seral species (resulting in the development of Alternative State 3).

Transition T1C
State 1 to 4

Introduced cool-season grasses invading sites near homesteads, pastureland, and other converted land. This includes cheatgrass invasion of overgrazed sites, as well as other excessive disturbance(s) of the native vegetation resulting in Alternative State 4.

Transition T1D
State 1 to 5

Site converted to annual cropland, pasture, or hayland leading to Alternative State 5.

Restoration pathway R2A
State 2 to 1

Common fuel reduction practices (low thinning, pruning, etc.) is applied. Restoration practices that reduce excessive fuels and reduce overstory crown bulk density, as well as the treatment of overstocked clumpy areas, restore this state to the reference condition. Tree planting in larger un-stocked areas where Ponderosa pine and other native seed sources are absent, as well as the introduction of prescribed burning, can contribute to increased resiliency and a return to natural ecologic integrity.

Transition T2A
State 2 to 3

Wide spread catastrophic fire occurs, similar to that of T1B, but the likelihood, intensity and impact of the wildfire event is much greater in scope due to the unnatural buildup of fuels in Alternative State 2, this occurrence also results in the development of Alternative State 3, but with greater impact to the site than in T1B.

Restoration pathway R3A
State 3 to 1

Reforestation (e.g. The planting of Ponderosa pine, Douglas-fir) is applied in the aftermath of a catastrophic, stand replacing fire. Native fire adapted understory species rebound naturally. Ponderosa pine and lesser amounts of Douglas-fir are planted on extensive burned over areas (reforestation) to overcome the lack of adequate seed source from surviving Ponderosa pine, larch, or Douglas-fir of any size or age class. (It is likely that persistent brush or grass/brush cover could exist for an extended period of time years if left un-planted).

Restoration pathway R4A
State 4 to 1

Site preparation and reseeding with native forest vegetation is applied followed by grazing protection on sites that have been converted to non-forest land use(s) for a long period of time (this process is referred to as afforestation). Practices that enable the site to revert to native understory species, for example tree (and/or native species) plantings in properly prepared seedbed conditions, have the potential to restore the function of native Ponderosa pine communities on sites that were converted to agriculture uses in this ecological site (afforestation).

Transition T4B
State 4 to 5

Practices are applied which eliminate unwanted weeds and invasive species, followed by the application of sound agronomic practices or by applying pasture/hayland management. Returns to Alternative State 5, and not to the Reference State. Areas that were converted to cropland and other agricultural uses and have reverted to undesirable or noxious weeds or other invasive species, are properly treated in order to re-establish viable cropland, pasture or hayland.

Restoration pathway R5A
State 5 to 1

Poor management or abandonment leads to weed invasion, often with noxious species resulting in Alternative State 4. This route is more common than T1C.

Restoration pathway R5B
State 5 to 4

Site preparation and reseeding with native forest vegetation is applied followed by grazing protection on sites that have been converted to non-forest land use(s) for a long period of time (this process is referred to as afforestation). Afforestation efforts like those described in Restoration Pathway 4A are needed in order to restore these areas to forest conditions described in the Reference State.

Additional community tables

Other information

Appendix 1
Tree-Size Class

Tree size classes are based on the diameter measurement taken at the “Diameter Breast Height” (abbreviated as DBH). DBH is the diameter of a tree (the bole) measured at 4.5 feet above ground, on the uphill side if on sloping ground. It is a measurement of the outside of the tree bark. The DBH is given in inches.

The following Tree size class(s) are referred to in this ecological site:

Class Name DBH Range
Seedling 0-1”
Sapling 1-5”
Pole 5-9”
Sawtimber: > 9”
 Small Sawtimber 9-16”
 Large Sawtimber 16-21”
 Very Large Sawtimber > 21”
Note: Some classification systems denote “mature and over mature” at 20 to 30” DBH and larger.
This system is likely derived from an economic production basis rather than on forest health size/age thresholds.

Inventory data references

Data was collected from forestry references, and vegetative experience from within the NRCS field professionals.

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Approval

Kirt Walstad, 11/21/2023

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	05/12/2025
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):**

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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:

---

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:**
