

Ecological site group EX043AESG05

Warm-Frigid, Xeric Hill and Mountain Slopes (Douglas-Fir Warm Dry Shrub)

Pseudotsuga menziesii / *Physocarpus malvaceus* - *Symphoricarpos albus*

Last updated: 03/13/2019
Accessed: 04/24/2024

Key Characteristics

None specified

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.

Physiography

Major Land Resource Area: 43A Northern Rocky Mountains and Foothills

Modal LRU – 43A03 - Columbia-Colville Valleys

This LRU is composed predominantly of low elevation valley floors and the slopes of foothills or low mountains adjacent to the Columbia and Colville rivers. The soils tend to be loamy mollisols and inceptisols with mixed or thin ash surfaces. Till and outwash are the dominant parent materials. Soil climate is a mesic or frigid temperature regime and xeric moisture regime with average annual precipitation around 495 mm (19 inches).

Others where occurring – 43A01 - Okanogan Plateau
43A02 - Western Selkirk Highlands
43A04 - Selkirk Mountains

Ecological Site Concept:

The data below describes the physiographic, climatic and other parameters for the Douglas-fir/warm, dry shrub ES group as a whole. This vegetation alliance is widespread so a central tendency for each parameter is also described. See Appendix A for a finer division of the alliance based on selected soil features.

This ESD is distinguished by an overstory of ponderosa pine and Douglas-fir and an understory shrub component of ninebark, oceanspray, and snowberry. It occurs on foothills, mountainsides, and flat terraces. Pre European frequent low intensity fire created open ponderosa stands with grass/herbaceous understory, mainly pinegrass. With fire suppression and management use stands currently have high density with multiple overstories of ponderosa pine and Douglas-fir. With infrequent fire shrubs will dominate the understory. This ESD fits into the National Vegetation Standard's Central Rocky Mt. Ponderosa Pine – Douglas-fir Dry shrub alliance and Washington State's Natural Heritage Program's Northern Rocky Mt. Dry Mesic Montane Mixed Conifer Forest.

Physiographic Features

This ecological site group occurs mainly on low to mid elevation slopes of glaciated mountains and foothills. It is found predominantly on sideslopes and foot slopes. The parent material is volcanic ash or mixed volcanic ash and loess over till, loamy outwash or residuum and colluvium from mainly granitic and metasedimentary rock.

Landscapes: Mountains, Foothills, Valleys

Landform: Mountain slope, Hill slope, Outwash Terraces

Elevation:

Total range = 290 to 1585 m

(950 to 5,200 feet)

Central tendency = 705 to 1150 m

(2,300 to 3,770 feet)

Slope (percent):

Total range = 0 to 80 percent

Central tendency = 8 to 45 percent

Water Table Depth:

60 cm to >200 cm

(24 to >80 inches)

Flooding:

Frequency:

None

Duration:

None

Ponding:

Frequency:

None

Duration:

None

Runoff Class:

Low to Very high

Aspect:

290-30-160 in 43A01, 43A02, 43A03

115-240-318 in 43A04

Appendix A

Examination of map unit components assigned to the Douglas-fir/shrub alliance showed three possible subdivisions of the larger ecological group.

These are:

- 1) Warm Frigid Xeric Loamy Foothills/Mountainsides, ashy surface (Douglas-Fir Warm Dry Shrub)
- 2) Warm Frigid Xeric Loamy Foothills/Mountainsides, mixed ash surface (Douglas-Fir Warm Dry Shrub)
- 3) Warm Frigid Xeric Loamy Foothills/Mountainsides, low AWC subsoils (Douglas-Fir Warm Dry Shrub)

A.1 Warm Frigid Xeric Ashy Slopes, ashy surface (Douglas-Fir Warm Dry Shrub)

Most commonly found in LRU 43A02 (Western Selkirk Mountains). Also found in adjacent areas of 43A01 and 43A03. Climate parameters were obtained from PRISM and other models for the area. Landscape descriptors are

derived from USGS DEM products and their derivatives.

Physiographic Features

Landscapes: Mountains, Foothills

Landform: sideslopes, foot slopes, lake terraces, outwash terraces

Elevation (m): Total range = 395 to 1680 m

(1,290 to 5,510 feet)

Central tendency = 875 to 1195 m

(2,870 to 3,920 feet)

Slope (percent): Total range = 0 to 85 percent

Central tendency = 15 to 45 percent

Water Table Depth (cm):

66 cm to >200 cm (median = >200cm)

(26 to >80 inches; median = >80 inches)

Flooding:

Frequency: None

Duration: None

Ponding:

Frequency: None

Duration: None

Aspect:

290-30-160

Climatic Features

Frost-free period (days): Total range = 75 to 130 days

Central tendency = 95 to 110 days

Mean annual precipitation (cm): Total range = 265 to 985 mm

(10 to 39 inches)

Central tendency = 445 to 665 mm

(17 to 26 inches)

MAAT (C): Total range = 3.3 to 9.8

(38 to 50 F)

Central tendency = 5.7 to 7.3

(42 to 45 F)

Climate Stations: Boundary Dam, Chewelah

Representative Soil Features

This ecological subsite is associated with several soil series (e.g. Inkler, Nevine, Oxerine, Scrabblers and Eloika). The soil components can be grouped into: Typic Vitrixerands, and Andic Haploxerepts. These soils have developed in Mazama tephra deposits over till, glaciolacustrine material, outwash and residuum and colluvium from granitic and metasedimentary rock. The tephra layers are important for forest productivity in that they retain large amounts

of water compared to other parent materials, have high cation exchange capacity and high availability of organically bound plant nutrients. The soils range from moderately deep to very deep and have adequate available water capacity to a depth of 1 m. The soils are mostly well-drained.

Parent Materials:

Kind: Tephra (volcanic ash)

Origin: mixed

Kind: till, residuum and colluvium, outwash and glaciolacustrine material

Origin: Granite, Metasedimentary rock

Surface Texture:

(1) Ashy Fine sandy loam

(2) Ashy Silt loam

(3) Ashy Loam

Fragment content of surface: 0 to 16 percent (median = 0%)

Subsurface Texture Group: Loamy

Fragment content of subsurface (25 to 100cm): 0 to 60 percent (median = 38%)

Most components lack surface fragments

Drainage Class: Well drained (2% Moderately Well drained components)

Saturated Hydraulic conductivity: Moderately high to High

Soil Depth: 96% of components have no restriction within 150 cm

Lithic contacts when present are at 60 to 145cm (median = 75cm)

Paralithic contacts when present are at 65 to 115cm (median = 65 cm)

Densic contacts when present are at 50 to 180cm (median = 95 cm)

Calcium Carbonate Equivalent (percent): 0

Soil Reaction (1:1 Water): 6.1 to 7.3

Available Water Capacity (total in 100cm): 8.15-19.88cm (median = 11.98cm)

A.2 Warm Frigid Xeric Ashy Slopes, mixed ash surface (Douglas-Fir Warm Dry Shrub)

Most commonly found in LRU 43A03 (Columbia-Colville Valleys). Also found in adjacent areas of 43A01, 43A02 and 44A01. Climate parameters were obtained from PRISM and other models for the area. Landscape descriptors are derived from USGS DEM products and their derivatives.

Physiographic Features

Landscapes: Foothills, Valleys, Mountains

Landform: sideslopes, foot slopes, lake terraces, outwash terraces

Elevation (m): Total range = 290 to 1510 m

(950 to 4,950 feet)

Central tendency = 635 to 985 m

(2,080 to 3,230 feet)

Slope (percent): Total range = 0 to 75 percent

Central tendency = 6 to 35 percent

Water Table Depth (cm): 75 cm to >200 cm (median = >200cm)

(30 to >80 inches; median = >80 inches)

Flooding:

Frequency: None

Duration: None

Ponding:
Frequency: None
Duration: None

Aspect:
290-30-160

Climatic Features
Frost-free period (days): Total range = 80 to 135 days
Central tendency = 105 to 125 days

Mean annual precipitation (cm): Total range = 265 to 940 mm
(10 to 37 inches)
Central tendency = 430 to 635 mm
(17 to 25 inches)

MAAT (C Total range = 4.1 to 11.0
(39 to 52 F)
Central tendency = 6.7 to 8.4
(44 to 47 F)

Climate Stations: Nespelem, Stockdill Ranch

Representative Soil Features

This ecological subsite is associated with several soil series (e.g. Kaniksu, Stapaloo, Kootenai, Torboy, Spokane, Republic, Scoap, Garrison, Cedonia, Wishbone). The soil components can be grouped into: Vitrandic Haploxerolls, Vitrandic Haploxerepts, Vitrandic Haploxerafls, Lamellic Haploxerafls, and Vitrandic Palexerafls. These soils have developed in mixed Mazama tephra, loess and other deposits over till, outwash, residuum and colluvium from granitic and metasedimentary rock, and glaciolacustrine material. The soils range from moderately deep to very deep and have adequate available water capacity to a depth of 1 m. The soils are mostly well-drained (~90% by area).

Parent Materials:
Kind: Tephra (volcanic ash) mixed with loess and other material
Origin: mixed
Kind: till, residuum and colluvium, outwash and alluvium, and glaciolacustrine material
Origin: Granite, Metasedimentary rock

Surface Texture:
(1) Ashy Loam
(2) Ashy Silt loam
(3) Ashy Sandy loam
(4) Ashy Fine sandy loam

Fragment content of surface: 0 to 34 percent (median = 10%)

Subsurface Texture Group: Loamy
Fragment content of subsurface (25 to 100cm): 0 to 45 percent (median = 24%)
Most components lack surface fragments

Drainage Class: Well drained (small areas of Moderately Well drained and Somewhat Excessively drained components)

Saturated Hydraulic conductivity: Moderately high to High

Soil Depth: 84% of components have no restriction within 150 cm

Lithic contacts when present are at 50 to 115cm (median = 62cm)

Paralithic contacts when present are at 65 to 145cm (median = 80 cm)

Densic contacts when present are at 80 to 125cm (median = 102 cm)

Calcium Carbonate Equivalent (percent): 0 to 15 percent (median = 0%)

Soil Reaction (1:1 Water): 6.1 to 8.4

Available Water Capacity (total in 100cm): 7.51-20.88cm (median = 12.83cm)

A.3 Warm Frigid Xeric Ashy Slopes, low AWC subsoils (Douglas-Fir Warm Dry Shrub)

Most commonly found in LRU 43A03 (Columbia-Colville Valleys). Also found in adjacent areas of 43A01, 43A02, 43A04 and 44A02. Climate parameters were obtained from PRISM and other models for the area. Landscape descriptors are derived from USGS DEM products and their derivatives.

Physiographic Features

Landscapes: Foothills, Mountains

Landform: sideslopes, summits

Elevation (m): Total range = 390 to 1495 m
(1,280 to 4,900 feet)

Central tendency = 725 to 1035 m
(2,380 to 3,390 feet)

Slope (percent): Total range = 0 to 90 percent
Central tendency = 20 to 45 percent

Water Table Depth (cm): >200 cm

Flooding:

Frequency: None

Duration: None

Ponding:

Frequency: None

Duration: None

Aspect:

68-180-293

Climatic Features

Frost-free period (days): Total range = 105 to 140 days

Central tendency = 105 to 115 days

Mean annual precipitation (cm): Total range = 265 to 1160 mm
(10 to 47 inches)

Central tendency = 490 to 760 mm
(19 to 30 inches)

MAAT (C): Total range = 4.3 to 10.2
(40 to 50 F)

Central tendency = 6.5 to 8.0
(44 to 46 F)

Climate Stations: Newport

Representative Soil Features

This ecological subsite is associated with several soil series (e.g. Treble, Thout, Oxerine, Raisio, and Mineral). The soil components can be grouped into: Vitrandic Haploxerolls, Vitrandic Haploxerepts, Vitrandic Dystroxerepts and Andic Haploxerepts. These soils have developed in mixed Mazama tephra, loess and other deposits over till, and/or residuum and colluvium from granitic and metasedimentary rock. The soils range from moderately deep to very deep and have low available water capacity to a depth of 1 m. The soils are mostly well-drained (~90% by area).

Parent Materials:

Kind: Tephra (volcanic ash) mixed with loess and other material

Origin: mixed

Kind: residuum and colluvium, and/or till

Origin: Granite, Metasedimentary rock

Surface Texture:

(1) Ashy Sandy loam

(2) Ashy Silt loam

(3) Ashy Very fine sandy loam

Fragment content of surface: 22 to 61 percent (median = 27%)

Subsurface Texture Group: Loamy

Fragment content of subsurface (25 to 100cm): 38 to 80 percent (median = 55%)

Surface Fragments: about 10% of components have a stony or bouldery surface

Drainage Class: Well drained

Saturated Hydraulic conductivity: Moderately high to High

Soil Depth: ~35% of components have no restriction within 150 cm

Lithic contacts when present are at 25 to 90cm (median = 60cm)

Paralithic contacts when present are at 40 to 65cm (median = 53 cm)

Densic contacts when present are at 40 to 65cm (median = 53 cm)

Calcium Carbonate Equivalent (percent): 0

Soil Reaction (1:1 Water): 6.1 to 7.8

Available Water Capacity (total in 100cm): 5.68-7.64cm (median = 6.24cm)

Climate

Climatic Features

During the spring and summer, a circulation of air around a high-pressure center brings a prevailing westerly and northwesterly flow of comparatively dry, cool and stable air into the region. As the air moves inland, it becomes warmer and drier which results in a dry season beginning in the late spring and reaching a peak in mid-summer. In the fall and winter, a circulation of air around two pressure centers over the ocean brings a prevailing southwesterly and westerly flow of air into the Pacific Northwest. This air from over the ocean is moist and near the temperature of the water. Condensation occurs as the air moves inland over the cooler land and rises along the windward slopes of the mountains or highlands. This results in a wet season beginning in October, reaching a peak in winter, then gradually decreasing in the spring.

The elevation within the LRU varies from approximately 1,000 feet in the lower river valleys to 3,400 feet over the higher terrain. The annual precipitation increases from 18 inches in the valley to 24 inches over the higher foothills. Winter season snowfall varies from 30 to 50 inches. Both rainfall and snowfall increase in the higher elevations. Snow can be expected after the first of November and to remain on the ground from the first of December until

March or April.

In January, the average maximum temperature is near 31° F and the minimum temperature is 18° F. Minimum temperatures from -10° to -20°F are recorded almost every winter and temperatures ranging to -30° F have been recorded. In July, the average maximum temperature is 85° to 90° and the minimum temperature 45° to 50° F. Maximum temperatures reach 100° F on a few afternoons each summer and temperatures between 105° to 110° F have been recorded. Temperatures in the mountains decrease three to five degrees Fahrenheit with each 1,000 feet increase in elevation. The average date of the last freezing temperatures can be expected by mid-May and before mid-October in the warmer areas.

(Compiled from WRCC: Climate of Washington and available station data)

Frost-free period (days):

Total range = 80 to 130 days

Central tendency = 100 to 120 days

Mean annual precipitation (cm):

Total range = 265 to 985 mm

(10 to 39 inches)

Central tendency = 410 to 700 mm

(16 to 28 inches)

MAAT (C)

Total range = 3.8 to 10.3

(39 to 51 F)

Central tendency = 6.0 to 8.1

(43 to 47 F)

Climate Stations:

Boundary Dam, Chewelah, Nespelem, Stockdill Ranch, Newport

Soil features

Representative Soil Features

This ecological site group is associated with several soil components. The soil components can be grouped into four soil subgroups: Typic Vitrixerands, Vitrandic Haploxerepts, Vitrandic Dystroxerepts, Vitrandic Haploxerolls, and Andic Haploxerepts. Most of these soils have developed in Mazama tephra deposits over till, outwash and residuum and colluvium from granitic and metasedimentary rock. These tephra layers are important for forest productivity in that they retain large amounts of water compared to other parent materials, have high cation exchange capacity and high availability of organically bound plant nutrients. Minor amounts of soil are formed in lacustrine deposits. The soils range from shallow (lithic bedrock) to very deep. Many of these soils have dense till layers at a depth of 20 to 40 inches and have a low available water holding capacity and slow to very slow permeability in the till layers. The soils are mostly moderately well drained to well-drained. Surface textures include ashy fine sandy loam, gravelly ashy sandy loam, stony and/or very stony ashy sandy loam. See appendix A for a discussion of different subdivisions of the Douglas-fir/shrub alliance based on differences in soils features.

Parent Materials:

Kind: Tephra (volcanic ash)

Origin: mixed

Kind: residuum and colluvium

Origin: Granite, Metasedimentary rock

Surface Texture:

(1) Ashy Fine sandy loam

(2) Sandy loam

Subsurface Texture Group: Loamy

Drainage Class: Moderately well drained To Somewhat excessively drained

Permeability Class: Impermeable To Moderately rapid

Vegetation dynamics

Ecological Dynamics of the Site

The reference state occurred before European settlement when frequent low intensity fires created open stands of large ponderosa pine with a grass dominated understory of pinegrass. Patches of Douglas-fir regeneration will be present. On the lower foothills this ecological site occurs on north and east slopes. On upper mountainous terrain it will occur on southern and western aspects. The model soil characteristics will be loamy over till or mixed colluvium. Sites escaping frequent fire will have a patchy mosaic of older large trees with patches of regeneration, pole stands of ponderosa pine and Douglas-fir, and a mixture of shrubs, grasses and forbs. Bark beetle and root disease mortality will create snags and woody debris. Severe stand replacing fires can result in ceanothus shrub fields dominating for several years until natural regeneration of pine and Douglas-fir reclaim the site. In other less severe burned areas, grass and sedge species will dominate along with sprouting shrubs like ninebark, oceanspray, and snowberry. This ecological site is similar to the Douglas-fir – Ponderosa pine – Western Larch / pinegrass ecological site (Douglas-fir Cool Dry Grass), however the presence of western larch is rare on the model site. This site being warmer and not adequate for larch growth. The Douglas-fir Cool Dry Grass ecological site climate is cooler located at higher elevations allowing western larch to become a prominent stand component in mature stands.

Lack of fire or fire exclusion crosses a threshold and the site goes to another state. State 2 results in homogenous multi-storied stands of ponderosa pine and Douglas-fir with dense understories of regeneration and/or shrubs. Snags and wood debris are lacking. These stands are highly susceptible to stand replacing fires. Much of the acreage of this ecological site is in this condition. Timber stand improvement and fuel removal treatments along with prescribed fire can restore this site to a more open patchy landscape more resistant to severe fire.

In Alternative State 3 severe fire has damaged soil nutrient capacity with shrub fields of ceanothus species dominating the site for 50+ years. This condition more commonly occurring on south and west facing slopes. Restoration activities must be scrutinized on a site by site basis.

In Alternative State 4 some of the lower landscape portions of this ecological site have been converted to introduced grass pastures or annual cropland. Restoring this site to the reference state takes major inputs in site preparation, tree planting, vegetation control, fuels management and other silvicultural treatments.

Major Land Resource Area

MLRA 043A

Northern Rocky Mountains

Subclasses

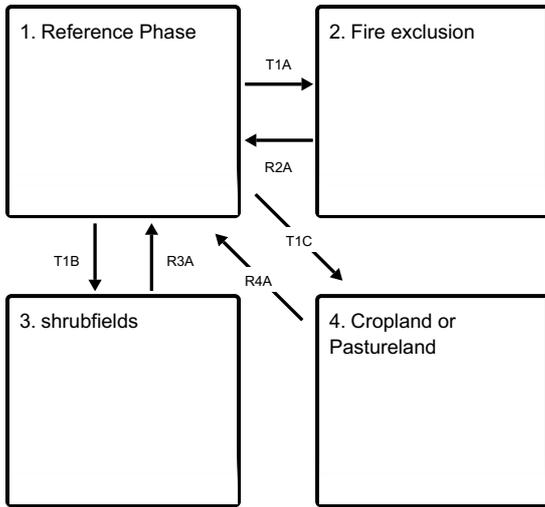
- F043AY517WA–Warm-Frigid, Xeric, Loamy Foothills/Mountainsides, ashy surface (Douglas-Fir/Warm Dry Shrub)
Pseudotsuga menziesii / Physocarpus malvaceus - Symphoricarpos albus
- F043AY518WA–Warm-Frigid, Xeric, Loamy Slopes, mixed ash surface (Douglas-Fir/Warm Dry Shrub)
Pseudotsuga menziesii / Physocarpus malvaceus - Symphoricarpos albus
- F043AY519WA–Warm-Frigid, Xeric, Loamy Slopes, low AWC subsoils (Douglas-Fir/Warm Dry Shrub)
Pseudotsuga menziesii / Physocarpus malvaceus - Symphoricarpos albus

Stage

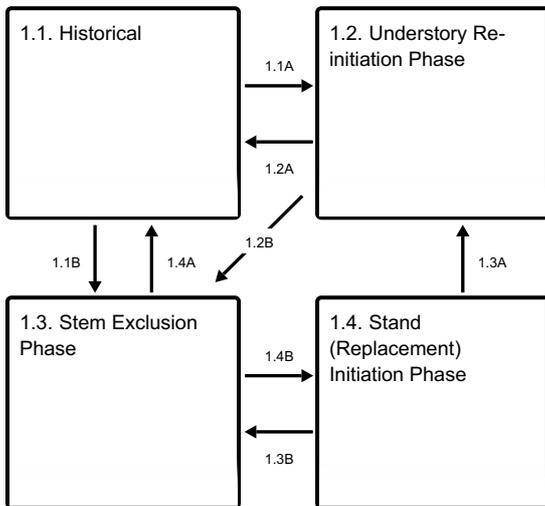
Provisional

State and transition model

Ecosystem states



State 1 submodel, plant communities



State 1 Reference Phase

This state recognizes two forest habitat types Douglas-fir/ninebark and Douglas-fir/snowberry. They occur in close proximity and react similarly. Douglas-fir/snowberry will occur at lower landscapes and sometimes in a moister environment, snowberry being the prominent understory shrub. Ninebark and oceanspray dominate the understory of the modal Douglas-fir/ninebark habitat type. Pinegrass is the dominant grass. They occur on foothills on northern aspects at lower elevations under 3000 feet and on eastern and western aspects on mountain sides over 3000 feet. Western larch is not present on the modal soils of this state. Western larch can occur on the moister Douglas-fir/ninebark/twinflower habitat type phase and wetter Douglas-fir/snowberry sites. Wartberry fairybells and russet buffaloberry are more constant on the on the moister Douglas-fir/ninebark/twinflower site. With frequent low severity ground fires stand develops into an open stand of mostly large ponderosa pine with scattered ponderosa pine and some Douglas-fir regeneration with shrub patches mixed with grasses, mainly pinegrass, elk sedge, Columbia brome, and bluebunch wheatgrass.

Dominant plant species

- ponderosa pine (*Pinus ponderosa*), tree
- Rocky Mountain Douglas-fir (*Pseudotsuga menziesii* var. *glauca*), tree
- western larch (*Larix occidentalis*), tree
- Saskatoon serviceberry (*Amelanchier alnifolia*), shrub
- hollyleaved barberry (*Mahonia aquifolium*), shrub
- oceanspray (*Holodiscus discolor*), shrub
- mallow ninebark (*Physocarpus malvaceus*), shrub
- dwarf rose (*Rosa gymnocarpa*), shrub
- common snowberry (*Symphoricarpos albus*), shrub

- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass
- Columbia brome (*Bromus vulgaris*), grass
- pinegrass (*Calamagrostis rubescens*), grass
- blue wildrye (*Elymus glaucus*), grass

Community 1.1

Historical



Figure . Reference plant community

This phase would be considered the historical plant community. Frequent low severity fires create an open stand of mostly large diameter 100+ year old ponderosa pine with some Douglas-fir. Tree regeneration is patchy consisting mainly of ponderosa pine with some Douglas-fir. Understory vegetation is a mix of shrubs, forbs and grasses. This phase perpetuates itself with reoccurring low intensity fires with some of the pine and fir regeneration surviving to mature stage.

Dominant plant species

- ponderosa pine (*Pinus ponderosa*), tree
- Rocky Mountain Douglas-fir (*Pseudotsuga menziesii var. glauca*), tree
- western larch (*Larix occidentalis*), tree
- Saskatoon serviceberry (*Amelanchier alnifolia*), shrub
- hollyleaved barberry (*Mahonia aquifolium*), shrub
- oceanspray (*Holodiscus discolor*), shrub
- mallow ninebark (*Physocarpus malvaceus*), shrub
- dwarf rose (*Rosa gymnocarpa*), shrub
- common snowberry (*Symphoricarpos albus*), shrub
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass
- Columbia brome (*Bromus vulgaris*), grass
- pinegrass (*Calamagrostis rubescens*), grass
- blue wildrye (*Elymus glaucus*), grass

Community 1.2

Understory Re-initiation Phase



Figure 1. Understory Re-initiation Phase

Without frequent low severity fire this plant community develops into an all aged stand of Douglas-fir and ponderosa pine with scattered remnants of old ponderosa pine. Two to three tree canopy levels can develop with an understory of ninebark, oceanspray and/or snowberry. Canopy openings can develop from windthrow or root rot pockets creating openings for Douglas-fir regeneration or shrubs. Stand is susceptible to stand replacing fires due to large fuel load and ladder fuels. Mixed severity fires will produce a mosaic of patchy large older trees with open areas of regeneration and/or dense shrubs or grass.

Community 1.3 Stem Exclusion Phase



Figure 2. Stem Exclusion Phase

Overstory structure consists of dense one story pole stands of Douglas-fir and ponderosa pine 30-70 years old. Dense stocking creates high fire hazard and stress conditions for bark beetle attack. Armillaria root rot pockets can be present in Douglas-fir.

Community 1.4 Stand (Replacement) Initiation Phase



Figure 3. Stand (Replacement) Initiation Phase

Stand replacing fires or lack of reforestation after harvest, can create dense shrub fields mixed with grass. After severe fires *Ceanothus velutinus*, shiny leaf ceanothus, can dominate the site and limit tree regeneration if soil duff is destroyed and surface textures are damaged. This may cause this phase to go to Alternative State 3. Natural regeneration is variable depending on fire severity. Scouler willow can also be prevalent along with pinegrass and elk sedge. In low intensity or mixed severity fires Ponderosa pine and Douglas-fir will eventually occupy the site. Future ground fires will create a patchy landscape of tree clusters and shrub/grass areas.

**Pathway 1.1A
Community 1.1 to 1.2**



Historical



Understory Re-initiation Phase

Fire return interval extended allowing regeneration to grow and mature. Stand mortality start to occur.

**Pathway 1.1B
Community 1.1 to 1.3**



Historical



Stem Exclusion Phase

Stand replacement disturbance. Severe Fire or insect mortality killing large pine/fir.

**Pathway 1.2A
Community 1.2 to 1.1**



Understory Re-initiation Phase



Historical

Frequent mixed and low severity ground fires kill regeneration some large trees creating patchy open stands

Pathway 1.2B

Community 1.2 to 1.3



Understory Re-initiation Phase



Stem Exclusion Phase

Stand replacement disturbance. Severe Fire or insect mortality killing large pine/fir

Pathway 1.4A Community 1.3 to 1.1



Stem Exclusion Phase



Historical

Time. Low severity ground fires every 10-20 years to create patchy open grown ponderosa pine and Douglas-fir with grass dominant

Pathway 1.4B Community 1.3 to 1.4



Stem Exclusion Phase



Stand (Replacement) Initiation Phase

Time with fire return interval extended to allow natural tree regeneration to grow into dense pole stands

Pathway 1.3A Community 1.4 to 1.2



Stand (Replacement) Initiation Phase



Understory Re-initiation Phase

Time and localized disturbance. Stand competition mortality and insect/disease mortality creating gaps for understory development and tree regeneration

Pathway 1.3B Community 1.4 to 1.3



Stand (Replacement) Initiation Phase



Stem Exclusion Phase

Stand replacement disturbance. Severe fire back to grass/shrub stage with periodic natural tree regeneration

State 2
Fire exclusion

State 3
shrubfields

State 4
Cropland or Pastureland

Forest converted to cropland or pastureland

Transition T1A
State 1 to 2

Fire exclusion over long periods allowing stands to grow into homogenous multi-storied stands

Transition T1B
State 1 to 3

Shrubfields caused by severe fire and soil degradation

Transition T1C
State 1 to 4

Forest stands converted to cropland or pastureland

Restoration pathway R2A
State 2 to 1

Forest stands restored by overstory thinning, ground and ladder fuels reduction, prescribed fire and seeding of native grasses and forbs.

Restoration pathway R3A
State 3 to 1

Careful selection of sites to determine if tree planting success is warranted.

Restoration pathway R4A
State 4 to 1

Afforestation through planting of native trees /shrubs and seeding of native grasses and forbs, treatment of invasive plants and Time.

Citations

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