

Ecological site group EX043AESG02
Dry, Warm, Hill Slopes and Valleys (Ponderosa Pine Dry Shrub and Grass)
***Pinus ponderosa* / *Purshia tridentata* – *Festuca idahoensis* -**
Pseudoroegneria spicata

Last updated: 03/08/2019
Accessed: 11/09/2024

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

Modal LRU: 43A01 - Okanogan Plateau

This LRU is composed predominantly of low to mid-elevation slopes of hills, outwash terraces, alluvial fans and escarpments. The soils tend to be loamy mollisols, entisols and inceptisols with mixed ash surfaces. Till, outwash and some residuum or colluvium from granitic rock are the dominant parent materials. Soil climate is mesic temperature regime and xeric moisture regime with average annual precipitation around 405 mm (16 inches).

Other LRU where occurring: 43A03 - Columbia-Colville Valleys
44A01 - Spokane-Rathdrum Outwash Plains
43A02 - Western Selkirk Highlands

Ecological Site Group Concept:

The data below describes the physiographic, climatic and other parameters for the Ponderosa Pine/ Dry Shrub, Grass ES group as a whole. This vegetation alliance is widespread so a Core Concept for each parameter is also described. See Appendix A for a finer division of the alliance based on selected soil features. The bulk of this ecological site lies along the river valleys and slopes along the Columbia and Spokane Rivers. It's dominated by a cover of bitterbrush with patches of ponderosa pine. Fire disturbance is the key factor in vegetation cover. With short fire intervals a pine/grass savanna exists, longer fire intervals allow bitterbrush and pine to establish and a pine/shrub savanna occurs. Extended fire intervals allow a pine woodland to develop and maintain a forest ecosystem.

Physiographic Features

This ecological site occurs mainly on forested glaciated hill or mountain back slopes, summits and foot slopes. It is found between 1,165 feet and 4,830 feet in elevation on southeast to northwest aspects. Slopes generally range from 15 to 40 percent, but can be found on slopes up to 80 percent.

Landscapes: Mountains, Foothills, Valleys

Landform: Mountain slopes, Hill slopes, Outwash terraces, Escarpments

Elevation

Total range: 355 – 1,470m

(1,165 to 4,830 feet)
Core Concept: 665-990m
(2,180 to 3,245 feet)
Slope (percent): Total range: 0-80
Core Concept: 15-40 Water Table Depth >200 cm
(>80 inches)

Flooding: Frequency: None
Duration: None
Ponding:
Depth (inches): 0
Frequency: none Duration: None

Aspect: Range: 90-205-320
Core Concept: 170-205-280

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 3,500 feet over the Okanogan highlands. North-south ranges of mountains extending into southern British Columbia reach elevations of 4,000 to 5,000 feet within a few miles of the Okanogan River. The annual precipitation increases from 11 inches in the valley to 23 inches over some of the Plateau. Winter season snowfall varies from 30 to 70 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. The few snow survey reports available for elevation above 5,000 feet indicate six to eight feet of snow on the ground the first of April and four to five feet the first of May.

In January, the average maximum temperature is near 30° F and the minimum temperature is 15° F. Minimum temperatures from -10° to -20°F are recorded almost every winter and temperatures ranging from -25° to -42° F have been recorded in the colder valleys. 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 in the colder valleys by the first of September and before mid-October in the warmer areas.(from WRCC: Climate of Washington)

Mean Annual precipitation
Total Range: 260-680 mm
(10 to 27 inches)
Core Concept: 340-475 mm
(13 to 19 inches)

MAAT
Total Range 4.2-10.7 C
(40 to 51 F)
Core Concept: 7.0-8.6 C
(45 to 47 F)

Frost free period (days)

Total range: 90-140
Core Concept: 110-120

Climate Stations: CHIEF JOSEPH SUBSTN, TIMENTWA, Kettle Falls

Soil features

Representative Soil Features

This ecological site group is associated with several soil components. The most soil components can be grouped into three soil subgroups: Vitrandic Haploxerolls, Typic Xeropsamments, Vitrandic Argixerolls. Soils in this ecological site are very deep to moderately deep with available water holding capacities mostly equal to or greater than 6.7 cm (in 100cm). Most of these soils have developed in over till, outwash and residuum and colluvium from granitic rock that has some influence from Mazama tephra. The soils are mostly well-drained to somewhat excessively drained. Surface textures include ashy fine sandy loam, ashy silt loam, stony and/or ashy loam.

Soil series occurring in this ES group:

Bong, Burns creek, Dart, Donovan, Ewall, Georgecreek, Hellgate, Leiko, Northstar, Peka, Setill, Sinlahekin, Skanid, Spokane, Springdale, Thowson, Vanbrunt, Wadams, Whitestone, Winthrop

Parent Materials:

Kind: Volcanic ash, Till, Outwash, Residuum, and Colluvium

Origin: Granite, Rhyolite and Quartzite

Surface Texture: (<2mm fraction)

(1) Ashy Sandy Loam (2) Ashy Loam

Subsurface Texture Groups: Loamy, Sandy Surface Fragments

Appendix A

Examination of map unit components assigned to the Ponderosa Pine Dry Shrub, Grass alliance showed four possible subdivisions of the larger ecological group.

These are:

- 1) Warm Mesic Xeric Loamy Foothills/Mountainsides, ashy surface (Ponderosa Pine Dry Shrub, Grass)
- 2) Warm Mesic Xeric Loamy Foothills/Mountainsides, mixed ash surface (Ponderosa Pine Dry Shrub, Grass)
- 3) Warm Mesic Xeric Loamy Foothills/Mountainsides, low AWC subsoils (Ponderosa Pine Dry Shrub, Grass)
- 4) Warm Mesic Xeric Sandy Hill slopes and Outwash terraces (Ponderosa Pine Dry Shrub, Grass)

A.1 Warm Mesic Xeric Loamy Foothills/Mountainsides, ashy surface (Ponderosa Pine Dry Shrub, Grass)

Most commonly found in LRU 43A01 (Okanogan Plateau). 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, Canyons

Landform: sideslopes, foot slopes, toe slopes

Elevation (m): Total range = 555 to 1135 m

(1,820 to 3,725 feet)

Core Concept = 695 to 870 m

(2,280 to 2,855 feet)

Slope (percent): Total range = 0 to 65 percent
Core Concept = 15 to 35 percent

Water Table Depth (cm):
>200 cm
(>80 inches)

Flooding:
Frequency: None
Duration: None

Ponding:
Frequency: None
Duration: None

Aspect:
115-195-295
Core Concept: 145-195-215

Climatic Features
Frost-free period (days): Total range = 105 to 135 days
Core Concept = 110 to 120 days

Mean annual precipitation (cm): Total range = 370 to 540 mm
(15 to 21 inches)
Core Concept = 430 to 510 mm
(17 to 20 inches)

MAAT (C): Total range = 7.3 to 8.8
(45 to 48 F)
Core Concept = 7.8 to 8.1
(46 to 47 F)

Climate Stations: CHIEF JOSEPH SUBSTN

Representative Soil Features

This ecological subsite is associated with several soil series (e.g. Thowson, Wadams). The soils are Typic Vitrixerands. 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,
Origin: unspecified

Surface Texture:

- (1) Ashy Sandy Loam
- (2) Ashy Coarse Sandy Loam

Fragment content of surface (hard fragments): 0 to 5 percent (median = 2%)

Subsurface Texture Group: Loamy

Fragment content of subsurface (25 to 100cm): 5 to 20 percent (median = 15%)

Most components lack surface fragments

Drainage Class: Well drained

Saturated Hydraulic conductivity: High

Soil Depth: >200 cm

Calcium Carbonate Equivalent (percent): 0

Soil Reaction (1:1 Water): 6.7 to 7.0

Available Water Capacity (total in 100cm): 13.06-14.53cm (median = 13.06cm)

A.2 Warm Mesic Xeric Loamy Foothills/Mountainsides, mixed ash surface (Ponderosa Pine Dry Shrub, Grass)

Most commonly found in LRU 43A03 (Columbia-Colville Valleys). Also found in areas of 43A01, 43A02. 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 = 355 to 1495 m

(1,165 to 4,900 feet)

Core Concept = 685 to 1,010 m

(2,245 to 3,310 feet)

Slope (percent): Total range = 0 to 80 percent

Core Concept = 15 to 40 percent

Water Table Depth (cm) : >200 cm

(>80 inches)

Flooding:

Frequency: None

Duration: None

Ponding:

Frequency: None

Duration: None

Aspect:

70-200-295

Core Concept: 120-200-240

Climatic Features

Frost-free period (days): Total range = 85 to 145 days

Core Concept = 105 to 125 days

Mean annual precipitation (cm): Total range = 265 to 735 mm

(10 to 29 inches)

Core Concept = 335 to 495 mm
(13 to 19 inches)

MAAT (C Total range = 4.4 to 10.3
(40 to 51 F)
Core Concept = 7.0 to 7.9
(45 to 46 F)

Climate Stations: none

Representative Soil Features

This ecological subsite is associated with several soil series (e.g. Bong, Burnscreek, Donavan, Georgecreek, Hellgate, Leiko, Peka, Setill, Sinlahekin, Spokane, Whitestone). The soil components can be grouped into: Vitrandic Haploxerolls, Vitrandic Argixerolls, Pachic Ultic Haploxerolls, and Ultic Haploxerolls. 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
Origin: Granite, volcanic and sedimentary

Surface Texture:

(1) Ashy Loam
(2) Ashy Sandy loam
(3) Ashy Silt loam

Fragment content of surface: 3 to 25 percent (median = 10%)

Subsurface Texture Group: Loamy

Fragment content of subsurface (25 to 100cm): 4 to 70 percent (median = 25%)
Most components lack surface fragments
Drainage Class: Well drained (small areas Somewhat Excessively drained components)
Saturated Hydraulic conductivity: Moderately high to High
Soil Depth: Moderately deep to very deep
Paralithic contacts when present are at 84 to 140cm (median = 112 cm)
Densic contacts when present are at 66 to 124cm (median = 97 cm)
Calcium Carbonate Equivalent (percent): 0 to 5 percent (median = 0%)
Soil Reaction (1:1 Water): 5.5 to 7.4
Available Water Capacity (total in 100cm): 7.40-15.90cm (median = 9.04cm)

A.3 Warm Mesic Xeric Loamy Foothills/Mountainsides, low AWC subsoils (Ponderosa Pine Dry Shrub, Grass)

Most commonly found in LRU 43A01 (Okanogan Plateau). Also found in areas of 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: Foothills, Mountains, Canyons
Landform: sideslopes, foot slopes, summits q

Elevation (m): Total range = 365 to 1475 m
(1,195 to 4,840 feet)
Core Concept = 705 to 1,015 m

(2,310 to 3,330 feet)

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

Core Concept = 15 to 45 percent

Water Table Depth (cm) : >200 cm

(>80 inches)

Flooding:

Frequency: None

Duration: None

Ponding:

Frequency: None

Duration: None

Aspect:

90-208-315

Core Concept: 170-208-280

Climatic Features

Frost-free period (days): Total range = 85 to 150 days

Core Concept = 105 to 125 days

Mean annual precipitation (cm): Total range = 260 to 660 mm

(10 to 26 inches)

Core Concept = 335 to 465 mm

(14 to 18 inches)

MAAT (C Total range = 4.3 to 10.3

(40 to 51 F)

Core Concept = 6.9 to 7.8

(45 to 46 F)

Climate Stations: TIMENTWA

Representative Soil Features

This ecological subsite is associated with several soil series (e.g. Leiko, Northstar, Skanid, Vanbrunt, Whitestone). The soil components are Vitrandic Haploxerolls. These soils have developed in mixed Mazama tephra, loess and other deposits over till, outwash, residuum and colluvium from granite, rhyolite, or quartzite. 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

Origin: Granite, rhyolite, quartzite

Surface Texture: (<2mm fraction)

(1) Ashy Sandy Loam

(2) Ashy Coarse Sandy loam

(3) Ashy Loam

Fragment content of surface: 10 to 38 percent (median = 25%)

Subsurface Texture Group: Loamy

Fragment content of subsurface (25 to 100cm): 10 to 67 percent (median = 50%)

Most components lack surface fragments

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

Saturated Hydraulic conductivity: Moderately High to High

Soil Depth: Shallow to very deep

Lithic contacts – 50-100 cm (median = 64)

Paralithic contacts when present are at 25 to 50cm (median = 46 cm)

Calcium Carbonate Equivalent (percent): 0

Soil Reaction (1:1 Water): 5.5 to 6.7

Available Water Capacity (total in 100cm): 3.71-7.18cm (median = 5.23cm)

A.4 Warm Mesic Xeric Sandy Hill slopes and Outwash terraces (Ponderosa Pine Dry Shrub, Grass)

Most commonly found in LRU 43A03 (Columbia-Colville Valleys). Also found in areas of 43A01, 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

Landform: sideslopes, foot slopes, toe slopes q

Elevation (m): Total range = 365 to 1410 m

(1,195 to 4,625 feet)

Core Concept = 485 to 860 m

(1,590 to 2,820 feet)

Slope (percent): Total range = 0 to 60 percent

Core Concept = 1 to 25 percent

Water Table Depth (cm) : >200 cm

(>80 inches)

Flooding:

Frequency: None

Duration: None

Ponding:

Frequency: None

Duration: None

Aspect:

100-197-300

Core Concept: 115-197-245

Climatic Features

Frost-free period (days): Total range = 95 to 150 days

Core Concept = 110 to 130 days

Mean annual precipitation (cm): Total range = 265 to 635 mm

(10 to 25 inches)
Core Concept = 350 to 465 mm
(14 to 18 inches)

MAAT (C Total range = 4.8 to 10.7
(41 to 51 F)
Core Concept = 7.1 to 8.3
(45 to 47 F)

Climate Stations: Kettle Falls

Representative Soil Features

This ecological subsite is associated with several soil series (e.g. Bong, Dart, Ewall, Springdale, Winthrop). The soil components are Entic Ultic Haploxerolls, Typic Xeropsamments, Vitrandic Haploxerepts, and Vitrandic Haploxerolls. These soils have developed in mixed Mazama tephra, loess and other deposits over till, outwash, residuum and colluvium from granite, rhyolite, or quartzite. 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: outwash and alluvium

Origin: Granite, or unspecified

Surface Texture: (<2mm fraction)

(1) Ashy Sandy Loam

(2) Ashy Coarse Sandy loam

(3) Coarse Sand

(4) Loamy Coarse Sand

(5) Loamy Sand

Fragment content of surface: 4 to 33 percent (median = 6%)

Subsurface Texture Group: Sandy

Fragment content of subsurface (25 to 100cm): 4 to 57 percent (median = 10%)

Most components lack surface fragments

Drainage Class: Somewhat Excessively and Excessively drained

Saturated Hydraulic conductivity: High to Very High

Soil Depth: very deep

Calcium Carbonate Equivalent (percent): 0

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

Available Water Capacity (total in 100cm): 4.50-7.37cm (median = 6.48cm)

Vegetation dynamics

Ecological Dynamics of the Site

This ecological site can be highly variable depending on fire occurrence and severity, and seed source of shrubs and pine. It is mainly located on foothills and side slopes next to the Columbia and Spokane Rivers. Through the ages it has had much human disturbance from Native Americans and from European settlement. Sites can be described as pine/savanna to pine/woodland depending on fire occurrence and occur throughout the landscape. Ponderosa pine and bitterbrush are the main cover species with Idaho fescue and bluebunch wheatgrass inversely proportionate to bitterbrush depending on fire disturbance. Soils will vary from sandy to loamy.

Ponderosa pine/shrub savanna will occur when fire intervals are 20 – 30 years allowing the bitterbrush to dominate the cover with scattered pine clusters. Frequent ground fires every 7-10 years will lead to a ponderosa pine/grass

savanna with the bitterbrush killed by fire and bunchgrasses increasing. When fire occurrence is extended in the pine/shrub savanna pine cover increases with a mosaic of medium density pine stands with bitterbrush in the openings. Mix severity fires maintain this mosaic pine woodland/shrub savanna. In long extended fire periods a multi-story dense ponderosa pine woodland will establish with shrubs and grass in small percentages in the understory.

Relationship to Other Established Classifications:

United States National Vegetation Classification (2008) – A3446 Ponderosa Pine / Shrub Understory Central Rocky Mt. Forest & Woodland Alliance

Washington Natural Heritage Program. Ecosystems of Washington State, A Guide to Identification, Rocchio and Crawford, 2015 – Northern Rocky Mountain Ponderosa Pine Woodland and Savanna

Description of Ecoregions of the United States, USFS PN # 1391, 1995 - M332 Middle Rocky Mountain Steppe–Coniferous Forest -Alpine Meadow Province

Level III and IV Ecoregions of WA, US EPA, June 2010 - 15r Okanogan – Colville Xeric Valleys & Foothills

This ecological site includes the following USDA Forest Service Plant Associations: PIPO/PUTR, PIPO/PUTR-FEID, and PIPO/PUTR-PSSP. (Williams et. al. 1995)

Major Land Resource Area

MLRA 043A

Northern Rocky Mountains

Subclasses

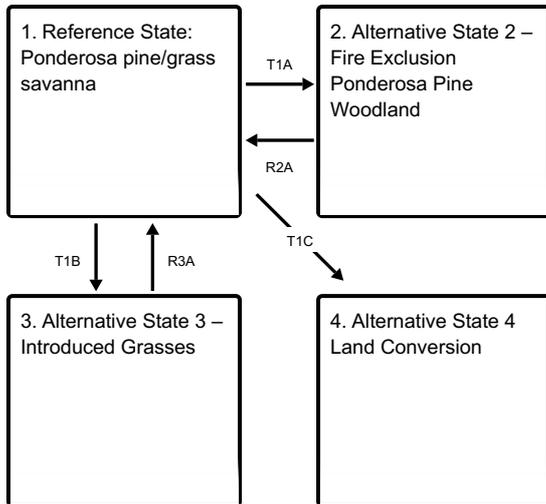
- F043AY505WA–Warm Mesic Xeric Loamy Foothills/Mountainsides, ashy surface (Ponderosa Pine Dry Shrub, Grass) *Pinus ponderosa* / *Purshia tridentata* – *Festuca idahoensis* - *Pseudoroegneria spicata*
- F043AY506WA–Warm Mesic Xeric Loamy Foothills/Mountainsides, mixed ash surface (Ponderosa Pine Dry Shrub, Grass) *Pinus ponderosa* / *Purshia tridentata* – *Festuca idahoensis* - *Pseudoroegneria spicata*
- F043AY507WA–Warm Mesic Xeric Loamy Foothills/Mountainsides, low AWC subsoils (Ponderosa Pine Dry Shrub, Grass) *Pinus ponderosa* / *Purshia tridentata* – *Festuca idahoensis* - *Pseudoroegneria spicata*
- F043AY508WA–Warm Mesic Xeric Sandy Hill slopes and Outwash terraces (Ponderosa Pine Dry Shrub, Grass) *Pinus ponderosa* / *Purshia tridentata* – *Festuca idahoensis* - *Pseudoroegneria spicata*

Stage

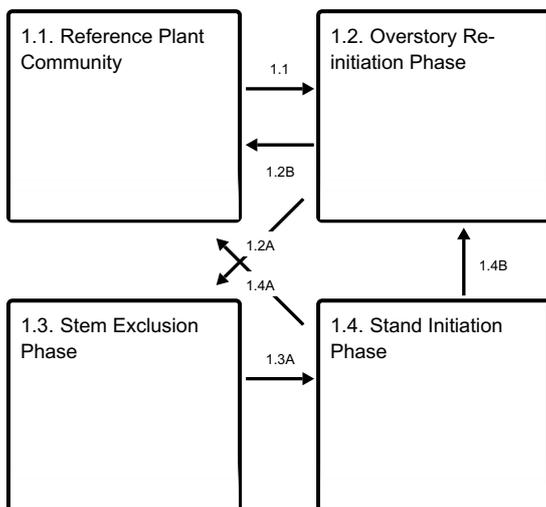
Provisional

State and transition model

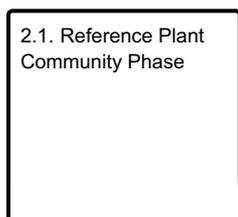
Ecosystem states



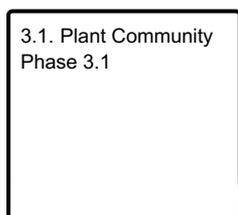
State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities



State 1

Reference State: Ponderosa pine/grass savanna

This state can have highly variable plant cover depending on fire disturbance. With frequent ground fire every 7-10 years the reference plant community will be a pine/grass savanna with bunchgrasses dominating with scattered pine. In variable mixed severity fires a patchy mosaic of pine stands with open areas of bitterbrush will be the norm. With fire exclusion a medium to dense multi-story ponderosa pine woodland will develop creating an alternative state. Past human disturbance has allowed introduced annual and perennial grasses to establish and mix into the natural cover sometimes out competing the native vegetation causing an alternative state. Ponderosa pine is the

only tree species. Antelope bitterbrush is the major shrub species with kinnikinnick, snowbrush ceanothus, spirea, snowberry, and sagebrush in minor amounts depending on location and moisture. Idaho fescue and bluebunch wheatgrass dominate the grass component with varying amount of geyer's sedge, needle and thread grass, blue wildrye, and rough fescue. Forest productivity is measured using site index (SI) and culmination of annual increment (CMAI). Ponderosa pine is the only tree species and site indexes ranges greatly depending on local site characteristics. NRCS forest site index plots taken throughout MLRA 430 shows this variability. Site index ranges from 60 – 107. Average site index for this ecological site will be 75 – 80 feet using Meyers 100 year total age table. Using the average SI CMAI would be 66 cubic feet/acre/year at 40 years of age in a fully stocked stand. Forage production estimates from NRCS Range 5 Plots in Okanogan County in Ponderosa pine / antelope bitterbrush sites are as follows based on overstory tree canopy. Forage production figures are in pounds/acre for all vegetation below 4.5 feet (grass, sedges, forbs, shrubs, tree regeneration): Overstory tree canopy – Forage production 0 – 20% - 800 to 1400 lbs/ac 20 – 40% - 300 to 650 lbs/ac The bulk of the grass production is bluebunch wheatgrass and Idaho fescue. Other grass species include needle and thread grass, prairie junegrass, rough fescue, pine grass and big bluegrass. The most prominent forbs are lupine, basalmroot, pussytoes, hawkweed, and yarrow. The most prominent shrub is bitterbrush. Other shrubs include currant, snowbrush ceanothus, big sagebrush, rabbitbrush, and buckwheat. Tree regeneration included mostly ponderosa pine with an occasional Douglas-fir.

Community 1.1 Reference Plant Community

This phase will be considered the reference plant community with ground fire frequency 7- 15 years maintaining a pine/grass savanna with scattered pine and bitterbrush not killed in ground fire. Idaho fescue and bluebunch wheatgrass will dominate ground cover with pine and shrubs less the 10%.

Community 1.2 Overstory Re-initiation Phase

Suspension of the fire regime allows overstory of bitterbrush and ponderosa pine to reseed and establish. Ground cover of bitterbrush will exceed that of understory bunchgrass. Ponderosa pine stands form a patchy mosaic with bitterbrush. This condition can be maintained with mixed severity fires causing varying degrees of kill to shrubs and trees creating the mosaic shrub/pine clump pattern.

Community 1.3 Stem Exclusion Phase

Dense clumps of ponderosa pine shade out grass and shrubs. Bitterbrush in openings reduce bunchgrass cover.

Community 1.4 Stand Initiation Phase



Figure . Fire has killed bitterbrush and some mature pine. Bunchgrasses increase

Bitterbrush and some pine killed in ground fire. Bunchgrasses increase in cover.

Pathway 1.1

Community 1.1 to 1.2

Fire interval extended 20+ years allowing bitterbrush and ponderosa pine to reestablish.

Pathway 1.2B

Community 1.2 to 1.1

Ground fires reoccur killing shrubs and most of pine seedlings/saplings returning site to pine/grass savanna

Pathway 1.2A

Community 1.2 to 1.3

Reestablished pine stands from dense clumps in between dense bitterbrush cover in openings.

Pathway 1.3A

Community 1.3 to 1.4

Severe fire killing most of pine and bitterbrush.

Pathway 1.4A

Community 1.4 to 1.1

Reoccurring ground fires every 10 years maintain pine/grass savanna

Pathway 1.4B

Community 1.4 to 1.2

Time, fire interval increased allowing pine and bitterbrush to reestablish

State 2

Alternative State 2 – Fire Exclusion Ponderosa Pine Woodland

Fire exclusion for over 50 years allows ponderosa pine stands to dominate cover and form multi-aged medium to dense woodlands. In most cases mixed severity to stand replacing fires will not revert site back to a pine/savanna condition in State 1.

Community 2.1

Reference Plant Community Phase

Medium to dense stands of ponderosa pine. Multi-aged with overstory of 100 year old pine with multi-level overstory and patches of dense seedling to pole stands. Shrub layer is sparse and bunchgrass cover is scattered.

State 3

Alternative State 3 –Introduced Grasses

The plant composition in this state is variable with cool season introduced grasses encroaching from adjacent homesteads and pastures. One annual species of special note that can cause a drastic shift in grass species is cheat grass (*Bromus tectorum*). It invades from overgrazed or heavily disturbed pastures and can out compete the native bunchgrasses changing to a shrub/cheatgrass site.

Community 3.1

Plant Community Phase 3.1

Cool season perennial grasses could include crested wheatgrass, intermediate wheatgrass, and wild rye grass. Annual cool season grasses could include cheatgrass.

State 4

Alternative State 4 Land Conversion

when this ecological site is located near human settlement, it is frequently converted to homesteads, pastures and cropland.

Transition T1A

State 1 to 2

Natural fire regime interval stopped through fire prevention allowing pine to dominate site overtopping bitterbrush. Site converted to forest/woodland condition without the natural reoccurring fire regime.

Transition T1B

State 1 to 3

Introduced non-native grasses invade site over the years of human habitation. Native grasses cannot compete with these grasses especially when heavily grazed for many years.

Transition T1C

State 1 to 4

Site converted to other land uses.

Restoration pathway R2A

State 2 to 1

Heavy overstory thinning followed by reoccurring understory prescribed burning to return to pine/grass savanna state.

Restoration pathway R3A

State 3 to 1

Site preparation followed by native plant reseeding with grazing protection.

Citations

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