Ecological site F043AY558ID
Frigid, Udic, Unglaciated, Loamy, Hills and Mountains, Metasedimentary (western hemlock/moist herb) Western hemlock/Brides bonnet-wild ginger

Last updated: 10/14/2020
Accessed: 05/18/2024

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): 043A–Northern Rocky Mountains

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Description of MLRAs can be found in: United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

Available electronically at: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_053624#handbook

LRU notes

Found in LRU 43A11 (Bitterroot Metasedimentary Zone). Also found in 43A09 (Western Bitterroot Foothills). Climate parameters were obtained from PRISM and other models for the area. Landscape descriptors are derived from USGS DEM products and their derivatives.

Classification relationships

Relationship to Other Established Classifications:

United States National Vegetation Classification (2008), A3612 Western Hemlock – Western Redcedar Cool-Mesic Central Rocky Mountain Forest & Woodland Alliance.

Washington Natural Heritage Program. Ecosystems of Washington State, A Guide to Identification, Rocchio and Crawford, 2015 - Northern Rocky Mt. Mesic Montane Mixed Conifer Forest (Cedar-Hemlock)

Description of Ecoregions of the United States, USFS PN # 1391, 1995 - M333 Northern Rocky Mt. Forest-Steppe-Coniferous Forest-Alpine Meadow Province
Level III and IV Ecoregions of WA, US EPA, June 2010 – 15y Selkirk Mountains, 15w Western Selkirk Maritime Forest.
This ecological site includes the following USDA Forest Service Plant Associations Western Hemlock Series: TSHE/CLUN, TSHE/ASCA. (Williams et. al. 1995)

Ecological site concept

This ecological site is the most productive in terms of forest production and biodiversity. It can be highly dynamic in forest succession depending on seed source, degree of disturbance, and shrub completion. Western larch has

taken over the role of early successor since the western white pine blister rust epidemic. A whole range of tree species can be found through forest succession. Eventually, without major disturbance stands of Douglas-fir, larch, grand fir and white pine are overtaken by western hemlock and western redcedar. These cedar-hemlock stands will perpetuate until a major stand replacing fire occurs. These soils have developed in volcanic ash over colluvium and residuum from metasedimentary rock. The soils are very deep and have adequate available water capacity to a depth of 40 inches. The soils are moderately well or well drained. While some soils have a perched water table, they do not have a water table within 30 inches of the surface during the May-Dec period.

Table 1. Dominant plant species

Tree	(1) *Tsuga heterophylla* (2) *Thuja plicata*
Shrub	(1) *Lonicera utahensis* (2) *Rosa gymnocarpa*
Herbaceous	(1) *Clintonia uniflora* (2) *Asarum caudatum*

Physiographic features

Physiographic Features
Landscapes: Mountains, Foothills
Landform: hillslopes, mountain slopes, escarpments, ridges

Elevation (m): Total range = 650 to 1720 m
(2,130 to 5,640 feet)
Central tendency = 970 to 1270m
(3,180 to 4,165 feet)

Slope (percent): Total range = 0 to 100 percent
Central tendency = 30 to 55 percent

Aspect: Total range: 235-15-170
Central tendency: 300-15-65

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope (2) Foothills > Hillslope (3) Foothills > Ridge (4) Foothills > Escarpment
Flooding frequency	None
Ponding frequency	None
Elevation	969–1,269 m
Slope	30–55%
Water table depth	203 cm
Aspect	NW, N, NE, E

Table 3. Representative physiographic features (actual ranges)

Flooding frequency	None
Ponding frequency	None
Elevation	649–1,719 m
Slope	0–100%
Water table depth	30–203 cm

Climatic features

Climatic Features
Frost-free period (days): Total range = 75 to 130 days
Central tendency = 95 to 110 days

Mean annual precipitation (cm): Total range = 570 to 1620 mm
(22 to 64 inches)
Central tendency = 965 to 1225 mm
(38 to 48 inches)

MAAT (C): Total range = 4.0 to 8.8
(39 to 48 F)
Central tendency = 5.8 to 7.0
(42 to 45 F)

Climate Stations: none

Influencing water features

Water Table Depth: 12 to >80 inches during Feb-Apr (median = >80 inches)
>80 inches during May-Jan
Flooding:
Frequency: None
Duration: None

Ponding:
Frequency: None
Duration: None

Soil features

Representative Soil Features

This ecological subsite is associated with several soil series (e.g. Honeyjones, Hugus, Huckle, Flewsie, Hobo, Hubub, Disalto, Secunda, and Chesley). The soils are Typic Udivitrands, Alfic Udivitrands, Oxyaquic Udivitrands, and Andic Dystrudepts. These soils have developed in thick (>7 inches) volcanic ash over colluvium and residuum from metasedimentary rock. The soils are deep and very deep and have adequate available water capacity to a depth of 40 inches. The soils are moderately well or well drained. While some soils have a perched water table, they do not have a water table within 30 inches of the surface during the May-Dec period.

Table 4. Representative soil features

Parent material	(1) Volcanic ash (2) Colluvium–metasedimentary rock (3) Colluvium–quartzite (4) Residuum–metasedimentary rock (5) Residuum–quartzite
Surface texture	(1) Ashy silt loam (2) Gravelly, ashy silt loam
Drainage class	Well drained
Permeability class	Moderate
Depth to restrictive layer	203 cm
Surface fragment cover >3"	0%

Available water capacity (0-101.6cm)	12.7 cm
Calcium carbonate equivalent (0-152.4cm)	0%
Electrical conductivity (0-152.4cm)	0 mmhos/cm
Soil reaction (1:1 water) (0-152.4cm)	6.1
Subsurface fragment volume <=3" (25.4-152.4cm)	15%
Subsurface fragment volume >3" (25.4-152.4cm)	0%

Table 5. Representative soil features (actual values)

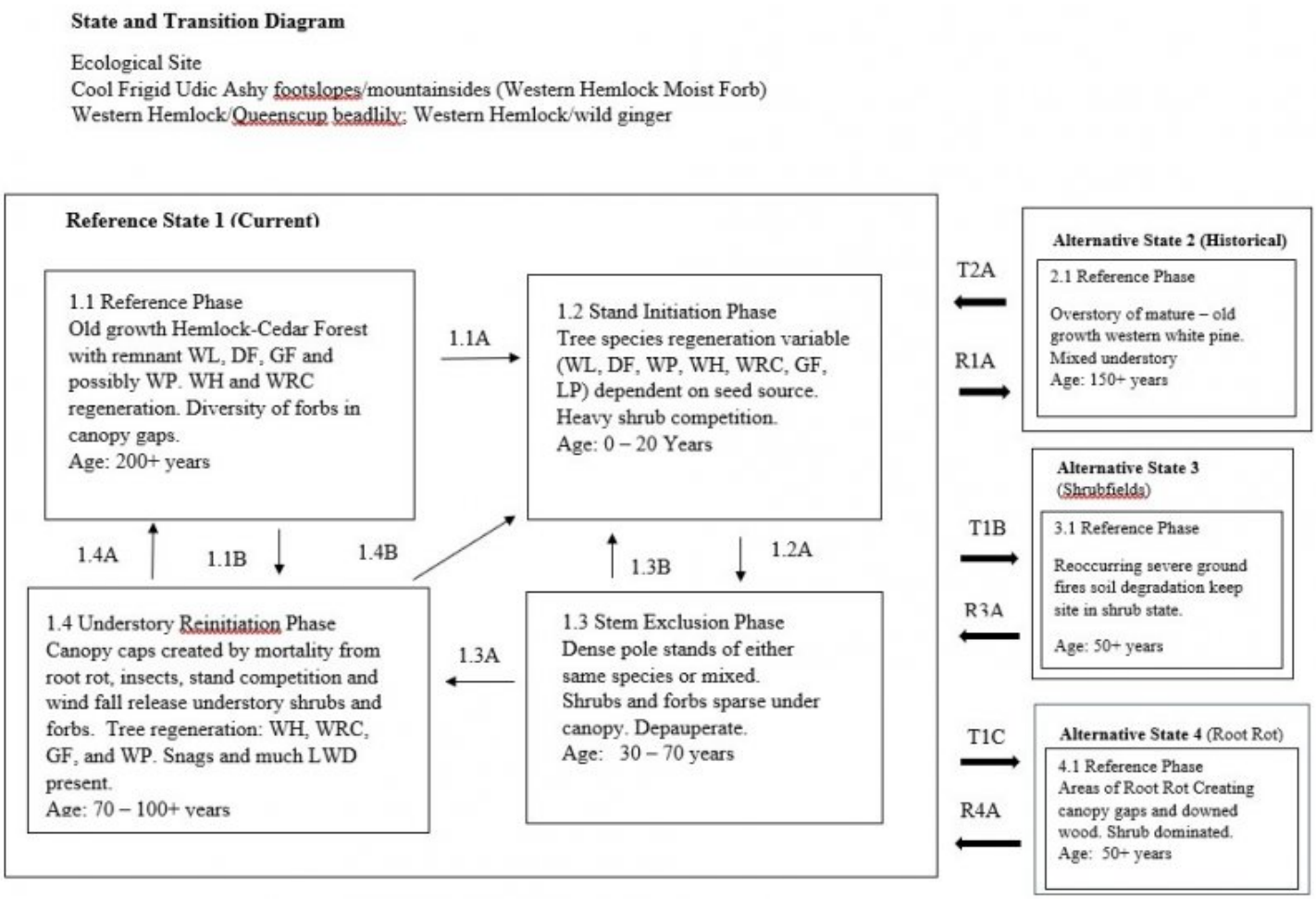
Drainage class	Moderately well drained to well drained
Permeability class	Slow to moderately rapid
Depth to restrictive layer	102–203 cm
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	9.65–26.92 cm
Calcium carbonate equivalent (0-152.4cm)	0%
Electrical conductivity (0-152.4cm)	0 mmhos/cm
Soil reaction (1:1 water) (0-152.4cm)	5.4–7.3
Subsurface fragment volume <=3" (25.4-152.4cm)	0–75%
Subsurface fragment volume >3" (25.4-152.4cm)	0–65%

Ecological dynamics

Ecological Dynamics of the Site
This site occurs most commonly on north slopes, cool benches, and dissected drainages in Northern Idaho and NE Washington. The depth of volcanic ash in the soil along with high precipitation makes this site highly productive. It is recognized by USFS Forest Habitat Types of Northern Idaho as the Western hemlock / Queenscup beadlily and Western hemlock / Wild Ginger habitat types. The WH/beadlilly habitat type is the most prolific and occurs on all aspects. The wild ginger type occurs on moister landscapes, usually on toe slopes or drainage areas. The cooler portions of this site occur at higher elevation lack western redcedar and have rusty menziesia as key shrub indicator.
This site has the highest ecological dynamics depending on type and degree of disturbance, and tree species seed source. Western hemlock and western redcedar will eventually dominate the overstory without major fire disturbance. Grand fir, Douglas-fir, western white pine, and western larch could be present in varying amounts. Understory reproduction and 2nd level overstory will be dominated by western hemlock and western redcedar due to their high degree of shade tolerance. There will be a large component of downed wood caused by windthrow, seral species die-out, and insect and disease mortality. Paper birch is a key deciduous tree species in this hemlock-cedar ecological site. It can be a prominent understory component in early to mature stands and eventually dies out in the late climax forest.
Fire frequency in these stands occurs in long intervals of 150+ years. Due to the large volume of wood, stand replacing fires were the norm leaving the site naturally reforested by western white pine. After the white pine blister rust epidemic western larch, Douglas-fir, and in drier areas ponderosa pine gets established depending on seed source and competing shrub species. Grand fir, western hemlock, and western redcedar will also reestablish on the

site through time. Lodgepole pine can be present and prevalent on sites after fire.
Ceanothus, alder species, and Douglas maple can reestablish quickly on these burnt sites slowing down natural reforestation. Reoccurring severe fires causing soil degradation can keep the site in a shrub dominated condition for long periods. Western larch is not as hardy as western white pine in competing with the brush species through natural regeneration. Larch needs to immediately establish on bare soil without much competition. The loss of the dominant white pine component again has caused a higher occurrence of Douglas-fir, grand fir, western hemlock, and western redcedar in developing stands.
The understory vegetation can be very rich in areas receiving enough sunlight. Key species include Queenscup beadlily, hooker fairybells, starry Solomon seal, wintergreen, huckleberry spp., and sword fern.

State and transition model



State 1
Reference State

This state results in an old growth western hemlock and western redcedar forest. Fire return intervals are far apart due to its moist environment. It is highly dynamic in its seral stages after major disturbance with many tree species capable of establishing and growing to mature age. Western white pine used to be a dominant tree in this state establishing after a severe fire and be a major overstory component in the mature to old growth phase, however, the white pine blister rust epidemic in the 1930s reduced it to a minor component in stand composition of current forests. White pine stabilized the site for long periods due to its disease and insect resistance. Currently Western Larch, Douglas-fir, Grand fir, cedar, and hemlock have taken its place in early stand establishment through the mature and old growth phases. This has led to more root rot in mature stands with Douglas-fir, Grand fir, cedar, and hemlock. Eventually, western hemlock and western redcedar dominate regeneration in mature stands and a hemlock-cedar forest develops without major disturbance. This state can be floristically rich with shrubs and herbs when canopy gaps are created. Major shrub species include big huckleberry, twinflower, pachistima, prince's pine, pyrola, honeysuckle, and rose. Herbs include queencup beadlily, violet, western rattlesnake plantain, wild ginger, sword fern, Hooker fairybells, and twisted stalk. A key understory tree species in this ecological site is paper birch. It is usually more prominent early to middle seral stages and notable snags present in mature to old growth phases. Another key seral species descriptive of this ecological site is Sitka alder. It is present during the stand initiation phase located in moisture receiving areas. Redstem and snowbrush ceanothus species can be prominent in fire disturbed areas. Black cottonwood is also prominent seral species and usually died out by the mature forest phase.

Community 1.1
Reference

Old growth stands of western hemlock and western redcedar 200+ years old. Grand fir, Douglas-fir, and western larch may be present in the overstory. Second level overstory mostly western hemlock, western redcedar. . Natural regeneration mostly western hemlock and some western redcedar, some grand fir, Douglas-fir, and white pine possible. Canopy openings from windthrow or root rot advance understory forb/shrub vegetation, and hemlock and cedar regeneration. Large volume of down and dead wood. Without major disturbance this community phase will perpetuate itself with hemlock and cedar.

Dominant plant species

- western hemlock (*Tsuga heterophylla*), tree
- western redcedar (*Thuja plicata*), tree
- grand fir (*Abies grandis*), tree
- Rocky Mountain Douglas-fir (*Pseudotsuga menziesii var. glauca*), tree
- western larch (*Larix occidentalis*), tree
- western white pine (*Pinus monticola*), tree
- thinleaf huckleberry (*Vaccinium membranaceum*), shrub
- longtube twinflower (*Linnaea borealis ssp. longiflora*), shrub
- Oregon boxleaf (*Paxistima myrsinites*), shrub
- pipsissewa (*Chimaphila umbellata*), shrub
- wintergreen (*Pyrola*), shrub
- Utah honeysuckle (*Lonicera utahensis*), shrub
- dwarf rose (*Rosa gymnocarpa*), shrub
- bride's bonnet (*Clintonia uniflora*), other herbaceous

- darkwoods violet (*Viola orbiculata*), other herbaceous
- western rattlesnake plantain (*Goodyera oblongifolia*), other herbaceous
- western swordfern (*Polystichum munitum*), other herbaceous
- Canadian wildginger (*Asarum canadense*), other herbaceous
- Oregon drops of gold (*Prosartes hookeri var. oregana*), other herbaceous
- claspleaf twistedstalk (*Streptopus amplexifolius*), other herbaceous

Community 1.2
Stand Initiation

Stand replacing fire creates seedbed for natural regeneration. Natural regeneration species composition depends on available seed source and level of disturbance. Western white pine can no longer dominate natural regeneration due to blister rust. Western larch has taken over to a lesser degree and can dominate natural regeneration after hot burns exposing mineral soil and good seed dispersal years. Otherwise mixed species natural regeneration will occur with the whole tree species mix of this ecological site occurring. Severe disturbance can advance shrub competition from ceanothus species, alder, willow, snowberry, and ribes spp. which deter natural regeneration. Paper birch and black cottonwood can also be present in this early stage.

Dominant plant species

- western larch (*Larix occidentalis*), tree
- Rocky Mountain Douglas-fir (*Pseudotsuga menziesii var. glauca*), tree
- grand fir (*Abies grandis*), tree
- ponderosa pine (*Pinus ponderosa*), tree
- western white pine (*Pinus monticola*), tree
- paper birch (*Betula papyrifera*), tree
- black cottonwood (*Populus balsamifera ssp. trichocarpa*), tree
- ceanothus (*Ceanothus*), shrub
- Sitka alder (*Alnus viridis ssp. sinuata*), shrub
- Scouler's willow (*Salix scouleriana*), shrub
- common snowberry (*Symphoricarpos albus*), shrub
- currant (*Ribes*), shrub

Community 1.3
Stem Exclusion

Dense pole to early mature stands 20 to 100 years old. Stand composition depending on natural regeneration. Stands could be consist of mainly western hemlock and western redcedar, solid stands of western larch, or a mix of western larch, western white pine, Douglas-fir, and grand fir. Western hemlock and western redcedar may be present in understory of these mixed stands. Due to high moisture and ash depth in soils sites can carry high stand densities. Understory vegetation is depauperate.

Dominant plant species

- grand fir (*Abies grandis*), tree
- Rocky Mountain Douglas-fir (*Pseudotsuga menziesii var. glauca*), tree
- western larch (*Larix occidentalis*), tree
- western white pine (*Pinus monticola*), tree
- western redcedar (*Thuja plicata*), tree
- western hemlock (*Tsuga heterophylla*), tree
- pipsissewa (*Chimaphila umbellata*), shrub
- bride's bonnet (*Clintonia uniflora*), other herbaceous
- Canadian wildginger (*Asarum canadense*), other herbaceous

Community 1.4
Understory Reinitiation

Canopy gaps for overstory mortality allow understory shrubs and herbs to increase. Stand competition, Armillaria root rot, bark beetles, and defoliators causes mortality in hemlock, grand fir and Douglas-fir. Western redcedar and western hemlock dominate regeneration. Overstory dominated by cedar and hemlock, however, western larch, Douglas-fir, and grand fir can compose of good percentage of the overstory depending on initial stand establishment. Snags and downed wood scattered throughout stand.

Dominant plant species

- western redcedar (*Thuja plicata*), tree

- western hemlock (*Tsuga heterophylla*), tree
- grand fir (*Abies grandis*), tree
- western larch (*Larix occidentalis*), tree
- Oregon boxleaf (*Paxistima myrsinites*), shrub
- pipsissewa (*Chimaphila umbellata*), shrub
- longtube twinflower (*Linnaea borealis ssp. longiflora*), shrub
- bride's bonnet (*Clintonia uniflora*), other herbaceous
- Canadian wildginger (*Asarum canadense*), other herbaceous
- Oregon drops of gold (*Prosartes hookeri var. oregana*), other herbaceous

Pathway 1.1A
Community 1.1 to 1.2

Reference

Stand Initiation

Stand Replacing Fire

Pathway 1.1B
Community 1.1 to 1.4

Reference

Understory Reinitiation

Canopy caps open form due to overstory mortality – root rot, insects, windthrow, and mixed severity fires (infrequent)

Pathway 1.2A
Community 1.2 to 1.3

Stand Initiation

Stem Exclusion

– Time. Tree regeneration grows into dense pole stands

Pathway 1.3B
Community 1.3 to 1.2

Stem Exclusion

Stand Initiation

Stand replacing fire

Pathway 1.3A

Community 1.3 to 1.4

Stem Exclusion

Understory Reinitiation

Time. Crown competition from dense pole to early mature stands, root rot, insect mortality, and wind fall create canopy gaps

Pathway 1.4A
Community 1.4 to 1.1

Understory Reinitiation

Reference

Time. Stand matures and stabilizes until severe disturbance.

Pathway 1.4B
Community 1.4 to 1.2

Understory Reinitiation

Stand Initiation

Stand replacing fire

State 2
Historical – White Pine

Before the 1910 outbreak of western white pine blister rust N. Idaho and parts of NE WA were covered with white pine stands from pole to old growth stages. Severe fires over large acreages allowed white pine to establish and dominate the area. Mature to old growth stands of pine stabilized the area due to its root rot and insect resistance. A mixed understory of shrubs and forbs existed due to sufficient light coming through the white pine canopy. Cedar and hemlock regeneration would also have been present. Large fires again would allow the white pine to establish and the cycle would start again. The blister rust epidemic basically wiped out the white pine and eliminated this stable forest cycle. In its place Douglas-fir, grand fir, western larch, cedar, and hemlock increased in abundance

through the growth stages. More root rot and insect mortality are now present in the stands. In addition, more cedar-hemlock stands reach old stages without a white pine component. To address the white pine blister rust problem cooperative forestry organizations developed a blister rust resistant white pine that has been planted on hemlock and cedar sites. White pine can now be seen growing on these harvested areas.

Community 2.1
Reference

Mature to old growth stands of western white pine over a mixed understory of shrubs and forbs. Cedar and hemlock regeneration could be present. Douglas-fir, western larch, and grand fir could be present in the main white pine overstory.

Dominant plant species

- western white pine (*Pinus monticola*), tree
- western hemlock (*Tsuga heterophylla*), tree
- western redcedar (*Thuja plicata*), tree
- grand fir (*Abies grandis*), tree
- Rocky Mountain Douglas-fir (*Pseudotsuga menziesii var. glauca*), tree
- pipsissewa (*Chimaphila umbellata*), shrub
- longtube twinflower (*Linnaea borealis ssp. longiflora*), shrub
- Utah honeysuckle (*Lonicera utahensis*), shrub
- bride's bonnet (*Clintonia uniflora*), other herbaceous
- Canadian wildginger (*Asarum canadense*), other herbaceous

State 3
Shrubfields

Multiple severe fires keep site in a shrub field state.

Community 3.1
Reference

Major shrubs like ceanothus spp., Douglas maple, alder, snowberry, serviceberry, scouler willow, buffalo berry, and huckleberry will dominate site for long periods. Tree regeneration very slow depending on fire and soil degradation

Dominant plant species

- ceanothus (*Ceanothus*), shrub
- Rocky Mountain maple (*Acer glabrum*), shrub
- Sitka alder (*Alnus viridis ssp. sinuata*), shrub
- common snowberry (*Symphoricarpos albus*), shrub
- Saskatoon serviceberry (*Amelanchier alnifolia*), shrub
- Scouler's willow (*Salix scouleriana*), shrub

- russet buffaloberry (*Shepherdia canadensis*), shrub
- thinleaf huckleberry (*Vaccinium membranaceum*), shrub

State 4
Root Rot

With the increased abundance of Douglas-fir, grand fir, and hemlock in stand development since the white pine bister rust epidemic Armillaria root rot has increased creating pockets to large areas of shrub/small deciduous trees. These root rot areas can exist for long periods until resistant species establish. In areas with metasedimentary parent material this situation is amplified. Species resistant to Armillaria include western larch, white pine, and western redcedar (after seedling stage).

Community 4.1
Reference

Shrub and small deciduous tree dominated areas created from root rot mortality in Douglas-fir, grand fir, and western hemlock. Much downed wood.

Dominant plant species

- western redcedar (*Thuja plicata*), tree
- western larch (*Larix occidentalis*), tree
- western white pine (*Pinus monticola*), tree

Transition R1A
State 1 to 2

Reference State

Historical – White Pine

To return to the historical state of white pine dominant late seral forests landscape level planting of blister rust resistant white pine after large stand replacing fires or clearcut regeneration harvests

Transition T1B
State 1 to 3

Reference State

Shrubfields

Severe fire causing soil degradation or reoccurring fires in stand initiation phase keep state in a shrub state.

Transition T1C
State 1 to 4

Reference State

Root Rot

Root rot, mainly Armillaria, killing hemlock, Douglas-fir, and grand fir creates small to large areas dominated by shrubs or small deciduous trees.

Restoration pathway T2A
State 2 to 1

Historical – White Pine

Reference State

White pine blister rust eliminated white pine as a long term overstory dominant moving to cedar-hemlock forest

Restoration pathway R3A
State 3 to 1

Shrubfields

Reference State

Site by site analysis to determine feasibility of tree planting.

Restoration pathway R4A
State 4 to 1

Root Rot

Reference State

Where feasible, planting blister rust resistant white pine, western larch, and western redcedar in root rot pockets.

Additional community tables

Wood products

sawtimber, pulp, cedar shakes and posts

Other products

Mushrooms, cedar boughs

Table 6. Representative site productivity

Common Name	Symbol	Site Index Low	Site Index High	CMAI Low	CMAI High	Age Of CMAI	Site Index Curve Code	Site Index Curve Basis	Citation
western white pine	*PIMO3*	60	93	118	180	100	–	–	
grand fir	*ABGR*	60	98	76	149	100	–	–	
western larch	*LAOC*	56	85	74	132	70	–	–	
Rocky Mountain Douglas-fir	*PSMEG*	72	85	83	116	110	–	–	
Rocky Mountain Douglas-fir	*PSMEG*	66	100	71	97	90	–	–	

References

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Approval

Curtis Talbot, 10/14/2020

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	05/18/2024
Approved by	Curtis Talbot
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

   _____

2. **Presence of water flow patterns:**

   _____

3. **Number and height of erosional pedestals or terracettes:**

   _____

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

   _____

5. **Number of gullies and erosion associated with gullies:**

   _____

6. **Extent of wind scoured, blowouts and/or depositional areas:**

   _____

7. **Amount of litter movement (describe size and distance expected to travel):**

   _____

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

   _____

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

14. **Average percent litter cover (%) and depth (in):**

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

17. **Perennial plant reproductive capability:**