USDA Natural Resources Conservation Service

Ecological site F043AY555ID
Acidic Grand Fir Mosaic 30-45" PZ Frigid Clearwater Mountains

Last updated: 4/09/2025
Accessed: 04/14/2026

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

Modal LRU – 43A10 - Clearwater Mountains

This LRU is composed predominantly of mid and high elevation valley walls, mountain slopes and ridges. The soils tend to be loamy andisols and inceptisols with ashy surfaces. Residuum and colluvium from metamorphics, and granitics are the dominant parent materials. Soil climate is a cryic or frigid temperature regime and udic moisture regime with average annual precipitation around 1300 mm (51 inches).

Others where occurring – 43A11 Bitterroot Metasedimentary Zone

Classification relationships

Relationship to Other Established Classifications:
United States National Vegetation Classification (2008) – A3362 Grand fir – Douglas-fir Central Rocky Mt. Forest and 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.

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 -15w Western Selkirk Maritime Forest. 15y Selkirk Mountains. 15u Inland Maritime Foothills and Valleys.
This ecological site includes or occurs near the following USDA Forest Service Plant Associations: ABGR/ASCA, ABGR/SETR, THPL/ASCA, TSME/STAM, ABLA/STAM (Forest Habitat Types of N. Idaho, A Second Approximation, USFS Revised 1991).

Ecological site concept

Grand Fir Mosaic habitats occur in upland forests above tributaries of the Clearwater River in northern Idaho. The Grand Fir Mosaic derives its name from *Abies grandis* (grand fir), the dominant conifer, and the mosaic of sizes and shapes of natural nonforested openings. Alnus sinuata (Sitka alder), *Pteridium aquilinum* (bracken fem), Rudbeckia occidentalis (western coneflower), or Menziesia ferruginea (fools huckleberry) are the dominant species found in these natural openings. The number of conifer species in the Grand Fir Mosaic is limited when compared to adjacent forest habitats. Key identifying characteristics include presence of Actaea rubra and/or *Synthyris platycarpa*; *Pteridium aquilinum* glades that are quite old (few trees, little woody vegetation except patches of Menziesii ferruginea, Alnus sinuata, Sambucus racemosa, and/or *Acer glabrum*).: *Pinus contorta* is absent or rare.; In areas where the forest canopy has been removed, such as from harvesting, there is rapid invasion by *Pteridium aquilinum*, and *Rudbeckia occidentalis* (Ferguson and Johnson 1996).Soils are cool, moist, and well drained. They are loamy textured and very deep with moderate to high available water capacity. In glade areas they will have high organic matter content and dark color in the surface layers.

Table 1. Dominant plant species

Tree	(1) *Abies grandis* (2) *Picea engelmannii*
Shrub	(1) *Acer glabrum* (2) *Amelanchier alnifolia*
Herbaceous	Not specified

Physiographic features

Physiographic Features
This ecological site occurs mainly on forested slopes of mountains. Parent materials are mostly residuum and colluvium derived from granitic or metamorphic mantled by volcanic ash and loess.

Landscapes: Mountains
Landforms: Mountain slopes

Elevation:
Total range = 1005 to 1755 m
(3,295 to 5,755 feet)
Central tendency = 1285 to 1475 m
(4,215 to 4,840 feet)

Slope (percent):
Total range = 0 to 85 percent
Central tendency = 20 to 50 percent

Aspect: none dominant

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope
Flooding frequency	None
Ponding frequency	None
Elevation	4,215–4,840 ft
Slope	20–50%
Water table depth	80 in
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Flooding frequency	None
Ponding frequency	None
Elevation	3,295–5,755 ft
Slope	0–85%
Water table depth	80 in

Climatic features

Climatic Features

The climate of this portion of the MLRA is controlled by a combination of large-scale and small-scale factors. The large-scale factors include latitude, relative position on the North American continent, prevailing hemispheric wind patterns, and extensive mountain barriers. Small-scale or local factors include the topographic setting and position (valley, slope, or ridge location), as well as orientation or aspect, and vegetative cover. Broadly, the climate is transitional between a northern Pacific coastal type and a continental type. The Pacific influence is noted particularly by the late autumn and winter maximum in cloudiness and precipitation and in the relatively moderate average winter temperatures, compared with areas east of the Rocky Mountains. Summer is characteristically sunny and dry, though July and August are the only distinct summer months. July and August are thus also the peak fire-danger months. Annual precipitation (rain and melted snow) averages as little as 10 inches at the lowest canyon floors; over 100 inches at the highest elevations. Wettest months are normally November, December, and January. Close to 60 percent of the annual total occurs during the period November through March. A slight, secondary peak in precipitation normally appears in May and June, followed by a sharp decrease in July. Snowfall accounts for more than 50 percent of the total precipitation at elevations above 4,800 ft. Snow cover usually persists in the mid elevation valleys from early December through the end of March. High-elevation snowpack reaches a depth of 5 ft or more in March and April and may linger into June. The main season of lightning (or thunderstorm) activity extends from late May through August. Storms occur on an average of 3 or 4 days each in June, July, and August. Monthly mean temperatures in populated valley locations range from 24 F (-4 C) in January to 65 F (18 C) in July; these are midpoint values between the average daily maximum and minimum temperatures. The annual mean is 43 F (6 C). A large diurnal range occurs in summer. Extreme temperatures have been as high as 103" to 105" F (about 40" C) and as low as -36" F (-38" C). Temperature inversions are commonplace, particularly on the clear summer and early autumn nights. The frost-free season, defined as the period with minimum temperatures staying above 32" F (0" C), varies widely with elevation and topographic position. The season is generally longer at lower elevation locations and on slope positions in the "thermal belt" around 3,500 ft. The season is shorter in positions affected by cold air drainage and slopes above the “thermal belt” at elevations >5,500 ft. Relative humidity is usually high throughout the day in late autumn and winter, averaging 70 to 80 percent or higher in midafternoon. In July and August, afternoon values average near 35 percent in the mid elevation valleys and 45 percent at 5,500 ft. Summer nighttime humidity in these valleys typically recovers to over 90 or 95 percent by dawn. On the slopes above the temperature inversion, at the same time, humidity may average only 50 to 60 percent. Winds have a prevailing (most frequent) direction from the southwest during all or most of the year. Local terrain effects modify the larger-scale wind that occurs in the adjacent free atmosphere. A nighttime drainage effect is common. Sunshine duration is at a minimum in December, when it may average only 20 percent of the maximum possible. July has close to 80 percent of the maximum possible.
(from Finklin, A. 1983. Climate of Priest River Experimental Forest, Northern Idaho.GTR-INT-159)

Frost-free period (days):
Total range = 40 to 90 days
Central tendency = 50 to 65 days

Mean annual precipitation (cm):
Total range = 920 to 1725 mm
(36 to 68 inches)
Central tendency = 1225 to 1425 mm
(48 to 56 inches)
MAAT (C)
Total range = 4.2 to 7.8
(40 to 46 F)
Central tendency = 5.6 to 6.4
(42 to 44 F)

Climate stations: none

Influencing water features

Water Table Depth: >80 inches

Flooding:
Frequency: None
Duration: None

Ponding:
Frequency: None
Duration: None

Soil features

Representative Soil Features

This ecological site is associated with several soil components (e.g. Typic Vitrandepts, Eutric Glossoboralfs, Longbar, Bigtalk, and Humic Udivitrands). The soil components are Typic Udivitrands, Alfic Udivitrands, Typic Hapludolls, Humic Udivitrands, and Typic Eutrudepts. These soils have developed in thick Mazama tephra deposits (often highly mixed with loess) over several other parent materials. These parent materials are dominantly: residuum and colluvium derived from granitic or metamorphic rock.

Typically, silicon and aluminum contained in volcanic ash weather to form various combinations of allophane and imogolite, which are noncrystalline hydrous aluminosilicates. Soils dominated by allophane and imogolite in the clay-size fraction are

referred to as allophanic soils. They are characterized by moderately-to-slightly acid pH and low aluminum availability. Under certain conditions, such as non-forested openings (glades) in the GFM, aluminum-humus complexes are preferentially formed instead of allophane and imogolite. This process gives rise to non-allophanic soils. Soils of the GFM have non-allophanic characteristics reflected in low seasonal pH, high water availability in most years, high organic matter inputs from forb communities and a source of aluminum from the weathered volcanic ash. Allophanic and non-allophanic soils exist side by side in the GFM.

Table 4. Representative soil features

Parent material	(1) Volcanic ash (2) Colluvium–granite (3) Colluvium–metamorphic rock (4) Residuum–granite (5) Residuum–metamorphic rock
Surface texture	(1) Ashy silt loam (2) Loam
Drainage class	Well drained
Permeability class	Moderate
Depth to restrictive layer	80 in
Surface fragment cover >3"	0%
Available water capacity (0-40in)	6.1 in
Calcium carbonate equivalent (0-60in)	0%
Electrical conductivity (0-60in)	0 mmhos/cm
Soil reaction (1:1 water) (0-60in)	5.8
Subsurface fragment volume <=3" (10-60in)	5%
Subsurface fragment volume >3" (10-60in)	0%

Table 5. Representative soil features (actual values)

Drainage class	Well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	80 in
Surface fragment cover >3"	0%

Available water capacity (0-40in)	4.7–6.9 in
Calcium carbonate equivalent (0-60in)	0%
Electrical conductivity (0-60in)	0 mmhos/cm
Soil reaction (1:1 water) (0-60in)	5.1–7.3
Subsurface fragment volume <=3" (10-60in)	0–40%
Subsurface fragment volume >3" (10-60in)	0–36%

Ecological dynamics

Ecological Dynamics of the Site

Grand Fir Mosaic habitats are found in upland forests that form drainages of the Clearwater River in northern Idaho and in the Blue Mountains of northeastern Oregon. The Grand Fir Mosaic (GFM) is named for the dominant conifer, grand fir (*Abies grandis*), and the variety of sizes and shapes of natural openings in the forest canopy (Ferguson and Johnson 1996). Dominant species in natural openings are Sitka alder (Alnus sinuata), bracken fern (*Pteridium aquilinum*), and fool's huckleberry (*Menziesia ferruginea*). The bulk of this ecological site occurs in the Clearwater River drainage.

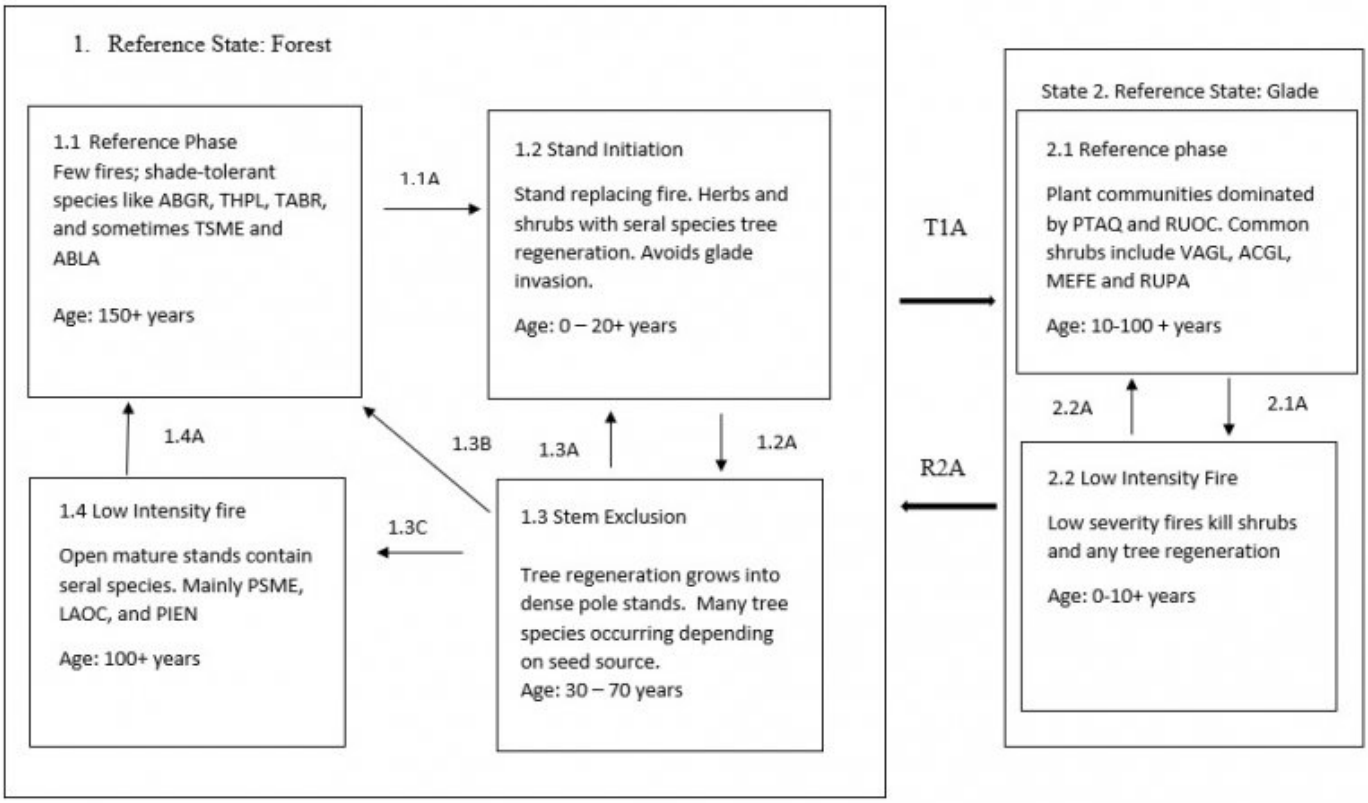
The species composition of conifers in the GFM differs from non-Mosaic habitats (Ferguson and Johnson 1996). Grand fir is found most often, followed by Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), and Douglas-fir (*Pseudotsuga menziesii* var. glauca). Western white pine (*Pinus monticola*) and western larch (*Larix occidentalis*.) are found infrequently in northern Idaho. Elevations in the GFM are generally too high for ponderosa pine (*Pinus ponderosa*). Western redcedar (*Thuja plicata*) and mountain hemlock (*Tsuga mertensiana*) are found in certain parts of the GFM in Idaho. Of special note is the absence of lodgepole pine (*Pinus contorta*), which is found in higher and lower elevation forests adjacent to the GFM, but rarely in the GFM.

Key understory species include Douglas maple, serviceberry, twinflower, thimbleberry, pacific yew, mountain ash, common snowberry, wood rose, sitka alder, queencup beadlily, wild ginger, Idaho goldthread, western meadowrue, pathfinder, Hooker fairybells, mountain arnica, western coneflower, Canada violet, Ladyfern, bracken fern, Columbia brome, Ross sedge and tall trisetum.

State and transition model

State and Transition Diagram

Ecological Site
Cool-Frigid, Moist-Udic Loamy Mountains (Grand Fir Mosaic)



State 1
Reference

These are climax plant communities that persist within a matrix of overmature grand fir (*Abies grandis*) and western redcedar (*Thuja plicata*) forests and tree islands. There are few wildfires, so natural succession has reduced the occurrence of seral conifers such as lodgepole pine (*Pinus contorta*), Douglas-fir (*Pseudotsuga menziesii*), western white pine (*Pinus monticola*), and western larch (*Larix occidentalis*). Late successional, shade-tolerant species like grand fir, western redcedar, Pacific yew (*Taxus brevifolia*), and sometimes mountain hemlock (*Tsuga mertensiana*) and subalpine fir (*Abies lasiocarpa*), are common along with mid-successional Engelmann spruce (*Picea engelmannii*). Regeneration of conifers in forest canopy openings is a slow and unreliable process in these low pH volcanic ash-cap soils that have abundant populations of pocket gophers (Thomomys talpoides). Disjunct and rare plant species occur in and near these forests, including evergreen synthyris (*Synthyris platycarpa*), Oregon bluebell (*Mertensia bella*), Dasynotus (*Dasynotus daubenmirei*), and Case's corydalis (*Corydalis caseana*). Reoccurring severe fires in the can cause expansion of the glades into formerly forested areas. Fire exclusion for long periods allows the forest composition to move to late successional, shade-tolerant species like grand fir, western redcedar, Pacific yew (*Taxus brevifolia*), and sometimes mountain hemlock (*Tsuga mertensiana*) and subalpine fir

(*Abies lasiocarpa*). However, succession does not lead to a reduction in size of glade areas

Community 1.1
Reference

Late successional, shade-tolerant species like grand fir, western redcedar, Pacific yew (*Taxus brevifolia*), and sometimes mountain hemlock (*Tsuga mertensiana*) and subalpine fir (*Abies lasiocarpa*), are common along with mid-successional Engelmann spruce (*Picea engelmannii*) and Douglas-fir (*Pseudotsuga menziesii* var. glauca). Western white pine (*Pinus monticola*) and western larch (*Larix occidentalis*.) are found infrequently. Regeneration of conifers in forest canopy openings is slow and unreliable.

Dominant plant species

- grand fir (*Abies grandis*), tree
- western redcedar (*Thuja plicata*), tree
- Engelmann spruce (*Picea engelmannii*), tree

- Rocky Mountain Douglas-fir (*Pseudotsuga menziesii var. glauca*), tree
- Rocky Mountain maple (*Acer glabrum*), shrub
- Saskatoon serviceberry (*Amelanchier alnifolia*), shrub
- Oregon boxleaf (*Paxistima myrsinites*), shrub
- white spirea (*Spiraea betulifolia*), shrub
- thinleaf huckleberry (*Vaccinium membranaceum*), shrub
- Scouler's willow (*Salix scouleriana*), shrub
- Utah honeysuckle (*Lonicera utahensis*), shrub
- Greene's mountain ash (*Sorbus scopulina*), shrub
- red elderberry (*Sambucus racemosa*), shrub
- Pacific yew (*Taxus brevifolia*), shrub
- Columbia brome (*Bromus vulgaris*), grass
- Ross' sedge (*Carex rossii*), grass
- tall trisetum (*Trisetum canescens*), grass
- American trailplant (*Adenocaulon bicolor*), other herbaceous
- starry false lily of the valley (*Maianthemum stellatum*), other herbaceous
- bride's bonnet (*Clintonia uniflora*), other herbaceous
- western meadow-rue (*Thalictrum occidentale*), other herbaceous
- British Columbia wildginger (*Asarum caudatum*), other herbaceous
- Idaho goldthread (*Coptis occidentalis*), other herbaceous
- Oregon drops of gold (*Prosartes hookeri var. oregana*), other herbaceous
- mountain arnica (*Arnica montana*), other herbaceous
- western coneflower (*Rudbeckia occidentalis*), other herbaceous
- Canadian white violet (*Viola canadensis*), other herbaceous

Community 1.2
Stand Initiation

Herbs and shrubs reestablish on site. Ceanothus species can dominate if fire caused soil degradation. Tree regeneration can be mixed or dominated by western larch and lodgepole pine. Ponderosa pine and Douglas-fir can also be present. White pine was a

major factor in regeneration before the blister rust reduced its significance. Site is in danger of glade assemblage invasion.

Community 1.3
Stem Exclusion

Dense stands of mixed seral species or dominated be larch or lodgepole pine. Douglas-fir, ponderosa pine, and western white pine can be in the stand.

Community 1.4
Low Severity Fires

Low severity fires create an open stand of mature Douglas-fir, Western larch, ponderosa pine, and lodgepole pine. Due to low fire frequency this phase is rare.

Pathway 1.1A
Community 1.1 to 1.2

Reference **Stand Initiation**

Stand replacing fire back to the herbs and shrub stage. Regeneration dependent on seed source and brush competition.

Pathway 1.2A
Community 1.2 to 1.3

Stand Initiation

Stem Exclusion

Tree regeneration grows into dense pole stand. Species can be mixed or dominated by larch or more rarely lodgepole pine.

Pathway 1.3B
Community 1.3 to 1.1

Stem Exclusion

Reference

Mixed severity fires create patchy mosaic as in reference plant community phase 1.1.

Pathway 1.3A
Community 1.3 to 1.2

Stem Exclusion

Stand Initiation

Stand replacing fire.

Pathway 1.3C
Community 1.3 to 1.4

Frequent low severity fires create open pole stands.

Pathway 1.4A
Community 1.4 to 1.1

Fire interval lengthens, and tree regeneration becomes established. Mixed severity fires create patchy mosaic of seral species and grand fir.

State 2

Glade

Figure 1. Reference State 2 (Glade) in foreground with Reference State 1 (Forest islands) in background. (From Ferguson and Johnson. 1996.)

Severe fires or other historic disturbance creates glade openings. Successional plant communities in the GFM are dominated by bracken fern and western coneflower. Bracken fern is usually present in low densities under forest canopies, but rapidly expands following disturbance. Once established these communities are very persistent. They appear to be maintained by a combination of allelopathy, pocket gopher activity and changes in soil minerology and chemistry due to increased organic matter contribution

Community 2.1
Reference

Site biomass is dominated by Western coneflower (*Rudbeckia occidentalis*), Bracken fern (*Pteridium aquilinum*). Shrubs are present as scattered patches. Most frequent shrub species are: Douglas maple (*Acer glabrum* Douglasii), Blue huckleberry (Vaccinium globulare), Mock azalea (*Menziesia ferruginea*), and Thimbleberry (*Rubus parviflorus*). Most frequent forb species are: Starry solomonplume (Smilacina stellata), Queencup beadlily (*Clintonia uniflora*), Wild ginger (*Asarum caudatum*), and Idaho goldthread (*Coptis occidentalis*). Most frequent graminoids are: Columbia brome (*Bromus vulgaris*), and Ross sedge (Carex rosii).

Dominant plant species

- Rocky Mountain maple (*Acer glabrum*), shrub
- thinleaf huckleberry (*Vaccinium membranaceum*), shrub
- rusty menziesia (*Menziesia ferruginea*), shrub
- thimbleberry (*Rubus parviflorus*), shrub
- Columbia brome (*Bromus vulgaris*), grass
- Ross' sedge (*Carex rossii*), grass
- western brackenfern (*Pteridium aquilinum*), other herbaceous

- western coneflower (*Rudbeckia occidentalis*), other herbaceous
- starry false lily of the valley (*Maianthemum stellatum*), other herbaceous
- bride's bonnet (*Clintonia uniflora*), other herbaceous
- British Columbia wildginger (*Asarum caudatum*), other herbaceous

Community 2.2
Disturbance

Site is forb dominated with shrubs reduced or eliminated and coniferous regeneration killed. Temporary occupation of significant portions of the site by early successional forbs such as fireweed (*Chamerion angustifolium*) may occur.

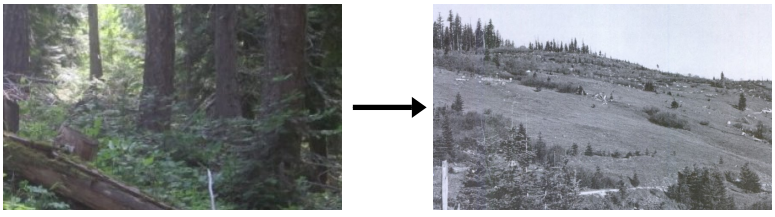
Pathway 2.1A
Community 2.1 to 2.2

Low severity fires kill some shrubs and any tree regeneration. Roots of coneflower and bracken fern are often able to survive to resprout. Any shrubs present are burned back but also may be prepared to sprout from root collars if fire severity is low enough.

Pathway 2.2A
Community 2.2 to 2.1

Time and regrowth allows restoration of pre-disturbance glade community.

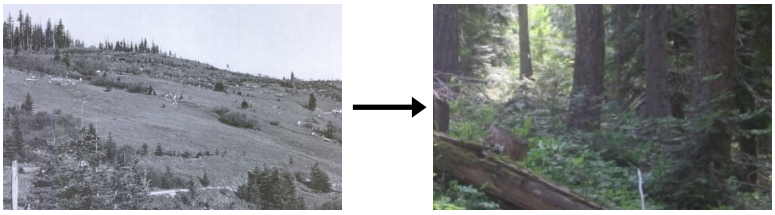
Transition T1A
State 1 to 2



Reference **Glade**

Severe burns kill regeneration and allow for invasion and expansion of glade assemblage species. Presence of bracken fern and other glade species in pre-fire understory provides opportunity for rapid site colonization. Pocket gopher activity increases with proliferation of bracken fern.

Restoration pathway R2A
State 2 to 1



Glade Reference

Careful site selection with fire control and forb suppression allow tree regeneration to establish. This is very difficult to accomplish.

Additional community tables

References

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Smith and Fischer. 1997. Fire Ecology of the Forest Habitat Types of Northern Idaho.

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	12/18/2020
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:

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

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

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

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:**