

Ecological site F043AY520WA Warm-Cryic, Moist-Xeric, Loamy, Ashy Mountain Slopes (Subalpine Fir Cool Shrub, low elevation)

Last updated: 3/11/2025

Accessed: 05/13/2025

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 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 – 43A02 - Western Selkirk Highlands

This LRU is composed predominantly of mid elevation valley walls, foothills, mountain slopes and ridges. The soils tend to be loamy andisolss and inceptisols with ashy surfaces. Residuum and colluvium from metamorphics, till and outwash are the dominant parent materials. Soil climate is a cryic or frigid temperature regime and xeric moisture regime with average annual precipitation around 660 mm (26 inches).

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

Classification relationships

Relationship to Other Established Classifications:

United States National Vegetation Classification (2008) – A3614 *Abies lasiocarpa* – *Picea engelmannii* Rocky Mountain Forest & Woodland Alliance

Washington Natural Heritage Program. Ecosystems of Washington State, A Guide to Identification, Rocchio and Crawford, 2015 – Subalpine – Montane Mesic 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 – 15r Okanogan-Colville Xeric Valleys and Foothills, 15w Western Selkirk Maritime Forest, 15x Okanogan Highland Dry Forest, 15y Selkirk Mountains.

This ecological site includes the following USDA Forest Service Plant Association: ABLA/VACA, ABLA/LIBO, and ABLA/COCA, (Williams et. al. 1995) and ABLA/LIBO, ABLA/PAMY (Williams, Lillybridge, 1983)

Ecological site concept

Ecological Site Concept:

This ESD is distinguished by an overstory of subalpine fir and an understory shrub component of huckleberry. It occurs on lower slopes of loamy foothills, mountainsides, and terraces that are affected by cold air drainage. Depth to a water table is > 30 inches during the April to Oct period and AWC is >3 inches cumulative to a depth of 40 inches. This ESD fits into the National Vegetation Classification's Subalpine Fir - Engelmann Spruce Rocky Mountain Moist Forest Alliance and Washington State Natural Heritage Program's Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest.

Table 1. Dominant plant species

Tree	(1) <i>Abies lasiocarpa</i> (2) <i>Picea engelmannii</i>
Shrub	(1) <i>Vaccinium cespitosum</i> (2) <i>Cornus canadensis</i>
Herbaceous	(1) <i>Calamagrostis rubescens</i>

Physiographic features

Physiographic Features

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

Landscapes: Mountains, Foothills

Landform: Mountain slope, Hill slope, Outwash Terraces, Moraines, Drainageways

Elevation:

Total range = 700 to 2095 m

(2,295 to 6,870 feet)

Central tendency = 1220 to 1570 m

(4,000 to 5,150 feet)

Slope (percent):

Total range = 0 to 80 percent

Central tendency = 20 to 45 percent

Water Table Depth:

30 to >200cm

(12 to >80 inches)

Flooding:

Frequency:

Occasional to None

Duration:

Brief to None

Ponding:

Frequency:

None

Duration:

None

Runoff Class:

Low to Very high

Aspect:

Full range: 225-20-175

Central tendency: 285-20-75

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope (2) Foothills > Hillslope (3) Foothills > Outwash terrace (4) Mountains > Moraine (5) Mountains > Drainageway
Flooding frequency	None
Ponding frequency	None
Elevation	1,219–1,570 m
Slope	20–45%
Water table depth	0 cm
Aspect	W, NW, N, NE, E

Table 3. Representative physiographic features (actual ranges)

Flooding frequency	Occasional to none
Ponding frequency	None
Elevation	700–2,094 m
Slope	0–80%
Water table depth	30–0 cm

Climatic features

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 1,500 feet in the lower river valleys to 7,100 feet on the highest peaks. The annual precipitation increases from 17 inches in the valley to 40 inches over the higher mountains. 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 = 75 to 115 days

Central tendency = 90 to 105 days

Mean annual precipitation (cm):

Total range = 280 to 1980 mm

(11 to 78 inches)

Central tendency = 590 to 1145mm

(23 to 45 inches)

MAAT (C)

Total range = 1.8 to 8.5

(35 to 47 F)

Central tendency = 4.2 to 5.9

(39 to 43 F)

Climate Stations:

Bonapart Stake

Influencing water features

Soil features

Representative Soil Features

This ecological site group is associated with several soil components. Most soil components can be grouped into six soil subgroups: Xeric Vitricryands, Haploxerandic Haplocryepts, Andic Dystrocryepts, Typic Haplocryands, Typic Vitricryands, and Vitriixerandic Haplocryepts. Most of these soils have developed in Mazama tephra deposits over till, outwash and residuum and colluvium from granitic and metamorphic rock. These tephra (ash) 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 moderately deep (densic contact) 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, though some poorly drained soils do occur. Surface textures include ashy silt loam, ashy loam, and ashy fine sandy loam.

Parent Materials:

Kind: Tephra (volcanic ash)

Origin: mixed

Kind: residuum, colluvium , alluvium

Origin: Granite, Metamorphic, Metasedimentary rock

Surface Texture:

(1)Ashy silt loam

(2) Ashy loam

(3) Ashy fine sandy loam

Subsurface Texture Group: Loamy

Surface Fragments: None

Drainage Class: Poorly to Well Drained

Permeability Class: Very Slow To Moderately rapid

Electrical Conductivity (mmhos/cm): 0-0-0

Sodium Absorption Ratio: 0-0-0

Calcium Carbonate Equivalent (percent): 0-0-10

Soil Reaction (1:1 Water): 5.3-6.3-7.9

Soil Reaction (0.01M CaCl₂): NA

Available Water Capacity (inches):

3.4-6.2-10.9

(8.7-15.6-27.8cm)

Table 4. Representative soil features

Parent material	(1) Volcanic ash (2) Alluvium (3) Colluvium–granite (4) Colluvium–metamorphic rock (5) Colluvium–metasedimentary rock
Surface texture	(1) Ashy loam (2) Ashy sandy loam
Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Available water capacity (0-101.6cm)	39.62 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Soil reaction (1:1 water) (0-101.6cm)	6.3

Table 5. Representative soil features (actual values)

Drainage class	Poorly drained to well drained
Permeability class	Very slow to moderately rapid
Available water capacity (0-101.6cm)	22.1–70.61 cm

Calcium carbonate equivalent (0-101.6cm)	0–10%
Soil reaction (1:1 water) (0-101.6cm)	5.3–7.9

Ecological dynamics

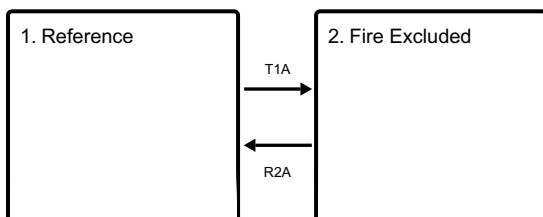
Ecological Dynamics of the Site

The three main US Forest Service plant associations (PA) incorporated into this ecological site all are located on benches/terraces, and toe slopes. Often they are near riparian areas. They can occur at lower elevations as ecotypes of their higher elevation sites due to cold air drainage and/or frosty conditions. The ABLA/COCA13 (Subalpine fir (ABLA)/bunchberry dogwood) PA is moister than ABLA/LIBO3 (ABLA/twinflower or ABLA/VACE (ABLA/dwarf huckleberry) and capable of having more Engelmann spruce in the overstory and understory. In the ABLA/LIBO3 and ABLA/VACE Pas, subalpine fir will have higher presence in the overstory and understory with fire exclusion. Many stands are in early to mid-seral condition with Douglas-fir (PSME), western larch (LAOC), and lodgepole pine (PICO) as the main overstory component. Subalpine fir (ABLA) and Engelmann spruce (PIEN) can be present in the understory.

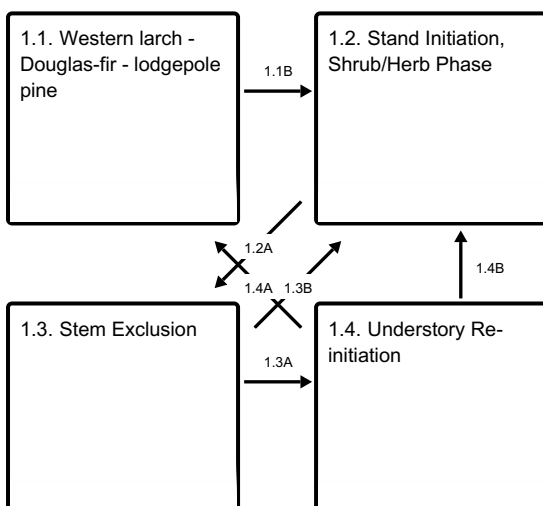
Most of this site is located west of the Columbia river in the Western Selkirk Mts. LRU, however will occur in the east when right conditions apply. A plant association which is similar and could be found at lower elevations would be the ABLA/LIBO PA in the Okanogan Highlands LRU. Also, at lower elevation in the Okanogan Highlands is the ABLA/PAMY (ABLA/pachistima) PA, however, this PA can be found on mid to lower north slopes on deeper soils with good tree productivity. It does not have a cold air drainage (frost) concern.

State and transition model

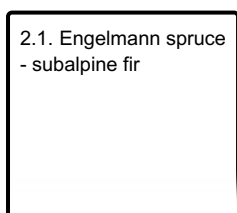
Ecosystem states



State 1 submodel, plant communities



State 2 submodel, plant communities



State 1

Reference

In the reference condition the early to mid-seral species condition is the norm with mixed severity fire keeping a mosaic of western larch, Douglas-fir, and lodgepole pine in the overstory over scattered regeneration of subalpine fir, Engelmann spruce, and Douglas-fir. Stand replacing fires can be composed of solid lodgepole pine regeneration or a mix of western larch, Douglas-fir, and lodgepole. As seral stands mature subalpine fir and Engelmann spruce will establish in the understory. Sites with fire exclusion for extended periods will have subalpine fir and Engelmann spruce in the overstory and understory. Engelmann spruce sometimes can dominate the overstory on the moister sites. Key understory shrubs include bunchberry dogwood, twinflower, dwarf huckleberry, snowberry, western prince's pine, Utah honeysuckle, spirea, and pachistima. Key herbs include pinegrass, western rattlesnake plantain, and queencup beadlily

Community 1.1

Western larch - Douglas-fir - lodgepole pine

Overstory dominated by western larch, Douglas-fir, and lodgepole pine. There may be an occasional subalpine fir and Engelmann spruce in the overstory. Understory will have subalpine fir and Engelmann spruce where ground fires have been absent. Understory dominated by shrubs and pinegrass. Mixed severity fires maintain this plant community in a mosaic with overstory seral species and understories of shrubs and mixed species regeneration. In the moister portions of this site Engelmann spruce can dominate with subalpine fir as minor stand component. Plant Community Pathway 1.1A Reference plant community maintained by reoccurring mixed severity fires keeping a mix of mature seral species with shrub/tree regeneration gaps. 1.1A is not a pathway from one community phase to another but an indicator of a disturbance dependent community phase. The community phase usually remains stable until the disturbance regime or return-cycle is disrupted.

Dominant plant species

- western larch (*Larix occidentalis*), tree
- Rocky Mountain Douglas-fir (*Pseudotsuga menziesii* var. *glauca*), tree
- lodgepole pine (*Pinus contorta* var. *latifolia*), tree
- Engelmann spruce (*Picea engelmannii*), tree
- subalpine fir (*Abies lasiocarpa*), tree
- longtube twinflower (*Linnaea borealis* ssp. *longiflora*), shrub
- Oregon boxleaf (*Paxistima myrsinites*), shrub
- kinnikinnick (*Arctostaphylos uva-ursi*), shrub
- Saskatoon serviceberry (*Amelanchier alnifolia*), shrub
- pipsissewa (*Chimaphila umbellata*), shrub
- hollyleaved barberry (*Mahonia aquifolium*), shrub
- dwarf bilberry (*Vaccinium cespitosum*), shrub
- Utah honeysuckle (*Lonicera utahensis*), shrub
- white spirea (*Spiraea betulifolia*), shrub
- bunchberry dogwood (*Cornus canadensis*), shrub
- pinegrass (*Calamagrostis rubescens*), grass
- white hawkweed (*Hieracium albiflorum*), other herbaceous
- strawberry (*Fragaria*), other herbaceous
- northwestern sedge (*Carex concinnoides*), other herbaceous
- western rattlesnake plantain (*Goodyera oblongifolia*), other herbaceous
- bride's bonnet (*Clintonia uniflora*), other herbaceous
- starry false lily of the valley (*Maianthemum stellatum*), other herbaceous

Community 1.2

Stand Initiation, Shrub/Herb Phase

Stand replacing fires convert site back to shrub/herb phase with tree regeneration dependent on seed source and fire severity. Dense stands of lodgepole pine can be present if sufficient seed was available in the ground. Western larch can also establish quickly with sufficient seed source and bare soil. Mixed species stand could develop with all seral species present including Douglas-fir, larch, and lodgepole. Shrubs will re-sprout and compete with tree

seedlings.

Dominant plant species

- lodgepole pine (*Pinus contorta* var. *latifolia*), tree
- western larch (*Larix occidentalis*), tree
- Rocky Mountain Douglas-fir (*Pseudotsuga menziesii* var. *glauca*), tree

Community 1.3

Stem Exclusion

Dense stands of mixed or single tree species will develop and start to compete for space and nutrients.

Community 1.4

Understory Re-initiation

As stands mature mortality gaps occur from stand competition and insects create areas for understory release. Shrubs and herbs increase along with tree regeneration.

Pathway 1.1B

Community 1.1 to 1.2

Stand replacing fire back to shrub/herb phase

Pathway 1.2A

Community 1.2 to 1.3

Time. Mixed or single seral species tree regeneration move out of the seedling/sapling phase into dense pole stands.

Pathway 1.3B

Community 1.3 to 1.2

Stand replacing fire back to the shrub/herb phase.

Pathway 1.3A

Community 1.3 to 1.4

Stands move out of the pole stage through competition opening up canopy gaps for understory shrubs and herbs to increase. Tree regeneration will include shade tolerant subalpine fir and Engelmann spruce.

Pathway 1.4A

Community 1.4 to 1.1

Stands mature into mixed stand of seral species with some subalpine fir or Engelmann spruce in overstory and understory.

Pathway 1.4B

Community 1.4 to 1.2

Stand replacing fire converts site back to the shrub/herb phase.

State 2

Fire Excluded

All aged mature stands of PIEN and ABLA.

Community 2.1

Engelmann spruce - subalpine fir

All aged mature stands of PIEN and ABLA. ABLA and PIEN in understory AGE: 100+ years

Transition T1A

State 1 to 2

Fire exclusion for 100+ years create climax plant SAF/ES plant community

Restoration pathway R2A

State 2 to 1

Management with overstory removal and prescribed fire

Additional community tables

Other information

Overall this site is productive for tree species listed, however, cool air drainage and frosty conditions can create concerns for regeneration and optimum growth. Site indexes are measured on 50 year and 100 year tables based on Breast Height Age (BA) or Total Age (TA). CMAI indicates the sites ability to produce wood at a certain age of a stand's maximum annual growth measured in cubic feet per acre.

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
lodgepole pine	PICOL	75	94	57	100	100	—	—	
subalpine fir	ABLA	90	95	86	100	90	—	—	
Engelmann spruce	PIEN	90	106	43	91	85	—	—	
western larch	LAOC	60	68	57	86	—	—	—	
Rocky Mountain Douglas-fir	PSMEG	52	60	72	86	128	—	—	
Rocky Mountain Douglas-fir	PSMEG	64	79	43	72	101	—	—	

References

. 1998. NRCS National Forestry Manual.

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

Williams, C.K., B.F. Kelley, B.G. Smith, and T.R. Lillybridge. October, 1995. Forested Plant Associations of the Colville National Forest.

Williams, C.K. and T.R. Lillybridge. 1983. Forested Plant Associations of the Okanogan National Forest R6-Ecol-132b-1983.

Approval

Kirt Walstad, 3/11/2025

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):**

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:**
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17. **Perennial plant reproductive capability:**
-