USDA Natural Resources Conservation Service

Ecological site F043CY514WA
Cryic, Dry-Udic Mountains and Ridges (Subalpine Fir cold dry shrub)

Last updated: 9/08/2023
Accessed: 05/06/2024

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): 043C–Blue and Seven Devils 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

Major land resource area (MLRA): 043C-Blue and Seven Devils Mountains
Modal LRU – 43C01 Cold, Moist Volcanic Highlands

This LRU is composed predominantly of high-elevation mountain slopes, ridges, basins, and mid-elevation mountain slopes and valley walls. Climates are frigid to cryic and xeric to udic. Soils are dominantly loamy Argixerolls, Vitricryands and Vitrixerands. Parent materials are colluvium and residuum from basalt with a volcanic ash cap present on sheltered aspects and positions.

Ecological site concept

This Ecological Site Description occurs mainly on forested backslopes of high elevation mountains, ridges and valley walls. Parent materials are derived from basalt rock mantled by volcanic ash. They are well drained with cryic temperatures and a dry-udic moisture regime. They do not have a water table within 30 inches of the surface during the May-Oct period and have adequate available water holding capacity.

Associated sites

F043CY516WA	**Warm-Cryic, Udic, Loamy, Mountains, and Plateaus, Basalt, Ashy Surface (subalpine fir/cool moist shrub)** warm-cryic, udic, ashy surface, basalt geology.

Similar sites

F043CY516WA	**Warm-Cryic, Udic, Loamy, Mountains, and Plateaus, Basalt, Ashy Surface (subalpine fir/cool moist shrub)** Udic soil moisture regime, warm-cryic soil temperature regime

F043CY517WA	**Warm-Cryic, Udic, Loamy, Mountains, and Uplands, Basalt, Mixed Ash (subalpine fir/cool moist shrub)** Udic soil moisture regime, warm-cryic soil temperature regime
F043CY518WA	**Warm-Cryic, Udic, Loamy, Mountains, Ashy surface (subalpine fir/cool moist shrub)** Udic soil moisture regime, warm-cryic soil temperature regime
F043CY519WA	**Warm-Cryic, Udic, Loamy, Mountains, Mixed Ash (subalpine fir/cool moist shrub)** Udic soil moisture regime, warm-cryic soil temperature regime

Table 1. Dominant plant species

Tree	(1) *Abies lasiocarpa* (2) *Picea engelmannii*
Shrub	(1) *Vaccinium scoparium* (2) *Paxistima myrsinites*
Herbaceous	(1) *Calamagrostis rubescens* (2) *Carex rossii*

Physiographic features

Physiographic Features

This Ecological Site Description occurs mainly on forested backslopes of mountains, ridges and valley walls. Parent materials are derived from basalt rock mantled by volcanic ash.

Landscapes: Mountains, Plateaus
Landforms: Mountain slopes, Plateaus

Elevation:
Total range = 1489 to 1934 m
(4,885 to 6,345 feet)
Central tendency = 1667 to 1785 m
(5,469 to 5,856 feet)

Slope (percent):
Total range = 0 to 55 percent
Central tendency = 10 to 25 percent

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

Flooding:
Frequency: None
Duration: None

Ponding:
Frequency: None
Duration: None

Aspect: 255-30-155
Central Tendency 355-30-130

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope (2) Plateaus or tablelands > Plateau
Flooding frequency	None

Ponding frequency	None
Elevation	5,470–5,855 ft
Slope	10–25%
Water table depth	0 in
Aspect	N, NE, E, SE

Table 3. Representative physiographic features (actual ranges)

Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	4,855–6,345 ft
Slope	0–55%
Water table depth	0 in

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 1,900 feet in the lower river valleys to over 9,300 feet in the higher terrain. The annual precipitation increases from 15 inches in the valleys to over 66 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 = 65 to 75 days
Central tendency = 65 to 70 days

Mean annual precipitation (mm):
Total range = 710 to 1590 mm
(28 to 62 inches)
Central tendency = 895 to 1200 mm
(35 to 47 inches)
MAAT (C)
Total range = 4.4 to 7.0
(40 to 45 F)
Central tendency = 5.1 to 5.9
(41 to 43 F)

Climate stations: none

Table 4. Representative climatic features

Frost-free period (characteristic range)	65-70 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	35-47 in
Frost-free period (actual range)	65-75 days
Freeze-free period (actual range)	
Precipitation total (actual range)	28-62 in
Frost-free period (average)	68 days
Freeze-free period (average)	
Precipitation total (average)	39 in

Influencing water features

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

Flooding:
Frequency: None
Duration: None

Ponding:
Frequency: None
Duration: None

Soil features

Representative Soil Features
This ecological site is associated with the soil component Troutmeadows. The soil component is Typic Vitricryands. These soils have developed in colluvium and/or residuum from basalt with a mantle of tephra.

Parent Materials:
Kind: Tephra (volcanic ash)
Origin: mixed
Kind: residuum and colluvium
Origin: Basalt

Surface Texture: (<2mm fraction)
(1) Ashy Silt Loam

Table 5. Representative soil features

Parent material	(1) Volcanic ash (2) Residuum–basalt (3) Colluvium–basalt
Surface texture	(1) Ashy silt loam
Drainage class	Well drained
Permeability class	Moderate
Depth to restrictive layer	28 in

Soil depth	28 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	11.6 in
Calcium carbonate equivalent (0-60in)	0%
Electrical conductivity (0-60in)	0 mmhos/cm
Sodium adsorption ratio (0-60in)	0
Soil reaction (1:1 water) (0-60in)	6.5
Subsurface fragment volume <=3" (10-60in)	15%
Subsurface fragment volume >3" (10-60in)	8%

Table 6. Representative soil features (actual values)

Drainage class	Well drained
Permeability class	Moderate
Depth to restrictive layer	20–40 in
Soil depth	20–40 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	11.6–16.3 in
Calcium carbonate equivalent (0-60in)	0%
Electrical conductivity (0-60in)	0 mmhos/cm
Sodium adsorption ratio (0-60in)	0
Soil reaction (1:1 water) (0-60in)	5.6–6.5
Subsurface fragment volume <=3" (10-60in)	0–60%
Subsurface fragment volume >3" (10-60in)	0–50%

Ecological dynamics

ECOLOGICAL DYNAMICS OF THE SITE

The subalpine fir cold dry (SF -CDS) ecological site is made up of a singular plant association, Subalpine fir (*Abies lasiocarpa*)/grouse whortleberry (*Vaccinium scoparium*), abbreviated as ABLA/VASC. This plant association is identified in the plant association group as “cold-dry”, and in the broader plant vegetative type group as a “cold upland forest .”

This ecological site occupies the highest forested elevations in MLRA 43C. It is found on all aspects, over a wide variety of slope positions and gradients.

The historic long-term climatic expression of this ecologic site is characterized by cold winters and cool summers,

where frost can occur in any month of the summer season. Snowfall amounts are high, and the accumulated snowpack lingers long into the summer months.

As the global climate continues to warm, these climatic parameters will shift towards dryer and warmer expressions, impacting the basic attributes this ecologic site and changing the nature and structure of the forests in the area.

Engelmann spruce (Picea engelmanii) often dominates post-disturbance stands in mid- to late community development stages, but subalpine fir easily establishes in the understory shade of the mature spruce forest. For these reasons, both subalpine fir and Engelmann spruce (which is a persistent, long lived conifer) are common overstory associates in mature, late seral forests. Although these two species are typically co-dominate in the stand, subalpine fir is considered the climax series.

As a species, subalpine fir is well adapted to long fire free intervals, where fires that do occur are either stand replacement or mixed fire events. Conversely, individual subalpine fir trees rarely survive any type of fire because of the thin bark, shallow rooting structure, and dense branching characteristics which often continue down to the surface of the ground. Needle foliage and crowns are highly flammable, and many older trees contain abundant lichen growth.

Although it is very shade tolerant, subalpine fir is often the pioneer conifer species on harsh sites, and it establishes well in the absence of plant competition under partial sunny conditions.

Engelmann spruce is well adapted to recover rapidly following mixed or stand replacement fire occurrences. It produces abundant seed crops which have good viability and are well dispersed by wind. Engelmann spruce requires mineral soils in order to achieve optimum levels of seedling germination and subsequent establishment, and it will germinate in all light conditions although it does best under shady conditions. Young spruce seedlings growing under full sun exposure will often succumb to the late summer impacts of solar radiation, which results in drought or heat girdling losses.

Engelmann spruce shares many of the same attributes as subalpine fir regarding individual tree susceptibility to wildfire.

Douglas-fir (*Pseudotsuga menziesii*) is a mid-seral component of this ecological site. It generally favors the lower or southerly aspects within the ecological site, as the species is approaching the upper limits of its ecological tolerance (i.e. ecological “amplitude”) to cold. Isolated, very old age individual Douglas-fir remnant trees can be found in parts of this ecological site. In some instances Douglas-fir can be a viable component of mid and late seral stands on more favorable sites.

Lodgepole pine (*Pinus contorta*), limited amounts of western larch (*Larix occidentalis*), and quaking aspen (Populus trichocarpa) are all early seral tree species which can aggressively occupy severely disturbed sites when conditions are favorable. Disturbances (i.e. wildfire or endemic insect outbreaks) initiates the process of lodgepole pine regeneration. Lodgepole pine produces viable seed crops at a relatively early age, and both serotinous and nonserotinous cones are common, allowing regeneration to occur with and without fire. Persistent, self-replacing lodgepole pine stands do not typically occur in the ecologic site due to long fire free interval periods, but when a major wildfire does occur dense stands of lodgepole pine often develop. These stand(s) could persist for 100’s of years in the absence of replacement by mid to late seral conifers, aided by reoccurring stand replacement event(s) which favors lodgepole pine reestablishment. In this case lodgepole begins to act as a dominant seral species, but the more typical route of succession introduces shade tolerant spruce and subalpine fir into the understory of lodgepole pine stands, eventually overtopping and dominating the stand in far less time.

Western larch is an extremely fast growing early seral conifer. It is the most fire adapted conifer in this ecologic site. Mature trees have thick bark, along with high open branches that are very resistant to torching. Western larch will persist into late seral community phases, and will typically survive even the most extreme level of fire, enabling it to seed the emerging post-fire forest communities. Larch establishes well under full sunlight.

In this ecologic site, small aspen stands are scattered among the more extensive spruce-fir stands. Quaking aspen stands are very resistant to fire because of the moist environment in which they occur. However individual aspen trees, smaller sized aspen patches, or stands in close proximity to flammable conifers are killed when wildfires sweep across the larger landscape. Aspen typically responds following fire to produce above ground stems that have sprouted (i.e. “sucker”) from underground roots.

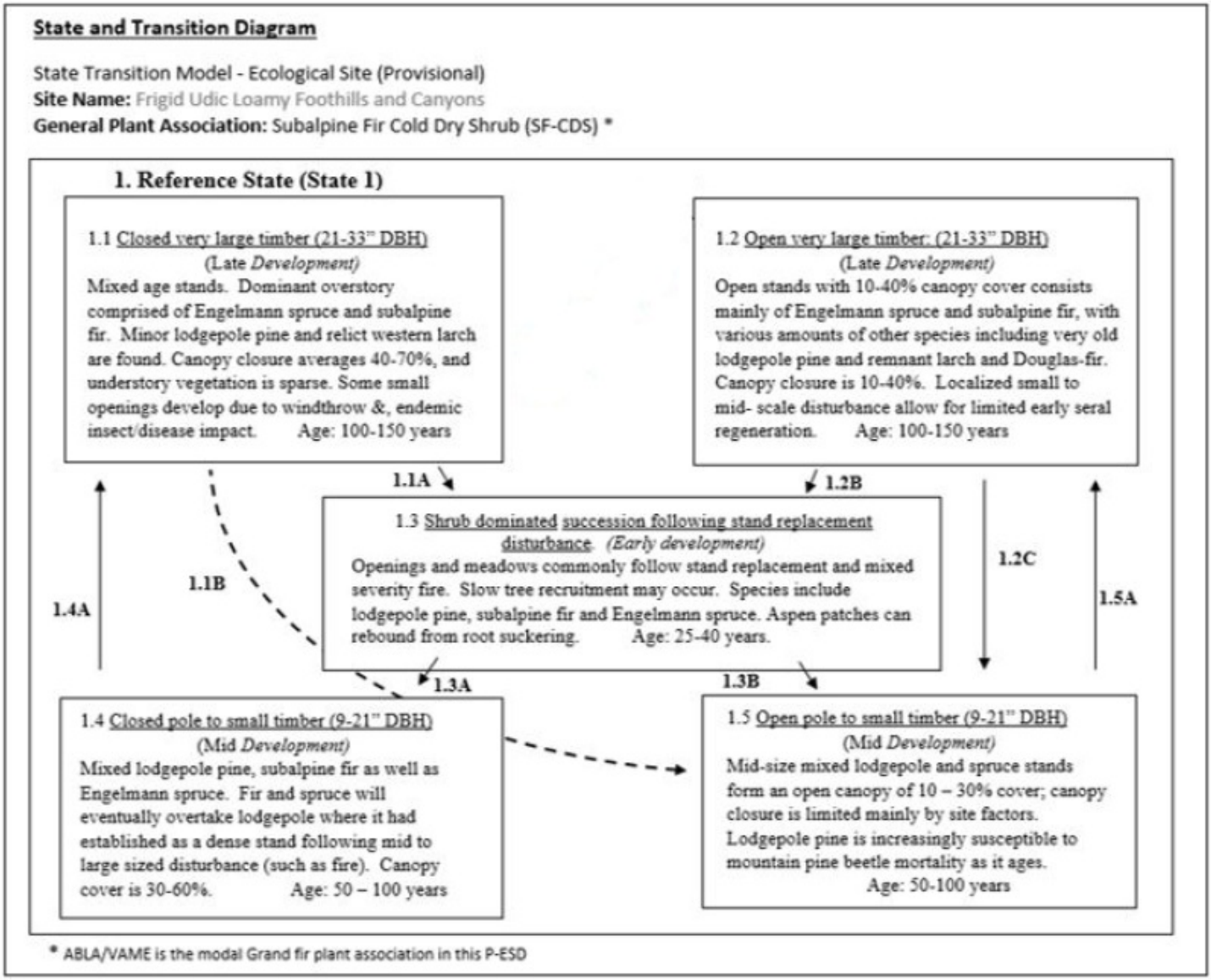
Both lodgepole pine and aspen can quickly establish following catastrophic wildfire events, and at times can be found together in mixed stands. When these two tree species regenerates in significant amounts, they can overtop and outcompete newly emerging Engelmann spruce and subalpine fir seedlings.

Wildfire, in the form of stand replacement and mixed severity events, typically reoccur on an equal 50-50 frequency in the ecologic site over a long period of time. These types of fires also share a common long term “mean fire return interval” (MFRI) of approximately 200 years for both disturbance types, but the overall MFRI for any individual fire event is 125 years. Surface fire is essentially absent from this ecologic site.

In addition to fire disturbance, the SF-CDS ecologic site is also impacted and changed by periodic windthrow, and by significant insect and disease disturbances (typically when these occur at an epidemic rather than an endemic

level).
Other biotic and abiotic disturbance factors for the common conifers of the ecologic site:
• Engelmann Spruce is impacted by spruce and western spruce budworm, wood rotting fungi, broom rusts and windthrow. Armillaria and laminated root disease susceptibility is moderate.
• Subalpine fir is also impacted by spruce and western spruce budworm, as well as by bark beetles (such as fir engraver), non-native balsam aphid, and tussock moth. Anosus root disease and Indian paintbrush fungus affect subalpine fir, and it is also prone to windthrow.
• Western larch is attacked by the dwarf mistletoe parasite. It is also impacted by needlecast and red ring rot, as well as by western spruce budworm and larch casebearer. Larch is not prone to windthrow except in rare instances, and is relatively free of most root disease.
• Douglas-fir suffers from tussock moth and other insect defoliators and dwarf mistletoe, and is susceptible to armillaria and laminated root disease.
• Lodgepole pine is attacked by mountain pine beetle, pine engraver, weevils, mistletoe and various fungi causing stem canker and gall rust. It is moderately susceptible to
armillaria root disease.
Moisture loving understory species occur in the understory of mature forests. Big huckleberry (*Vaccinium membranaceum*) grouse whortleberry, prince's pine (*Chimaphila umbellata*), and heartleaf arnica (Arnica cardifolia) are common.

State and transition model



Plant Community, Transition(s) and Restoration Pathways

Reference State Community Pathways:

(see Appendix 1 for tree-size classes)

1.1 A Stand replacement, or extensive mixed fire, or similar stand impact by insect/disease disturbance.

1.1B Spruce beetle epidemic transition to community phase 1.5.

Epidemic mountain pine beetle eliminate very old lodgepole, regeneration is rapid will maintain Community 1.2.

1.2B Disturbance event transitions the stand back to early development.

1.2C Epidemic insect mortality moves the stand back to mid-development phase.

1.3A Develops in time to *closed*, mid-development phase.

1.3B Develops in time to *open*, mid-development phase.

1.4A Stand grows and develops to *closed*, late development phase.

1.5A Stand grows and develops to *open*, late development phase.

Although climate change and the impacts of a warmer and dryer environment threaten this ecologic site, no transitions or alternative states are described in this ecologic site.

References

Powell, D.C., C.G. Johnson, E.A. Crowe, A. Wells, and D.K. Swanson. 2007. Potential vegetation hierarchy for the Blue Mountains section of northeastern Oregon, southeastern Washington, and west-central Idaho. Gen. Tech. Rep. PNW-GTR-709.. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station., Portland, OR.

Other references

USNVC [United States National Vegetation Classification]. 2020. United States National Vegetation Classification Database, V2.03. Federal Geographic Data Committee, Vegetation Subcommittee, Washington DC. USNVC: http://usnvc.org/

Contributors

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Approval

Kirt Walstad, 9/08/2023

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	05/06/2024
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:**

17. **Perennial plant reproductive capability:**