USDA Natural Resources Conservation Service

Ecological site F048AY915CO
Engelmann Spruce – Whortleberry– Jacob's-Ladder

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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): 048A–Southern Rocky Mountains

MLRA 48A makes up about 45,920 square miles (119,000 square kilometers) and is the southern part of the Rocky Mountains. The Southern Rocky Mountains lies east of the Colorado Plateau, south of the Wyoming Basin, west of the Great Plains, and north of the Rio Grande Rift. It is in western and central Colorado, southeastern Wyoming, eastern Utah, and northern New Mexico. The headwaters of major rivers such as the Colorado, Yampa, Arkansas, Rio Grande, North Platte and South Plate rivers are located here. This MLRA has numerous national forests, including the Medicine Bow National Forest in Wyoming; the Routt, Arapaho, Roosevelt, Pike, San Isabel, White River, Gunnison, Grand Mesa, Uncompahgre, Rio Grande, and San Juan National Forests in Colorado; the Carson National Forest and part of the Santa Fe National Forest in New Mexico. Rocky Mountain National Park also is in this MLRA.

MLRA 48A is the southern Rocky Mountains physiographic region. The Southern Rocky Mountains consist primarily of two belts of strongly sloping to precipitous mountain ranges trending north to south. Several basins, or parks, are between the belts. Some high mesas and plateaus are included. It is characterized by mountain ranges that were uplifted during the Laramide Orogeny and then had periods of glaciation. The ranges include the Sangre de Cristo Mountains, the Laramie Mountains, and the Front Range in the east and the San Juan Mountains and the Sawatch and Park Ranges in the west. The ranges are dissected by many narrow stream valleys having steep gradients. In some areas the upper mountain slopes and broad crests are covered by snowfields and glaciers. Elevation typically ranges from 6,500 to 14,400 feet (1,980 to 4,390 meters) in this area. The part of this MLRA in central Colorado includes the highest point in the Rockies, Mount Elbert, which reaches an elevation of 14,433 feet (4,400 meters). More than 50 peaks in the part of the MLRA in Colorado are at an elevation of more than 14,000 feet (4,270 meters). Many small glacial lakes are in the high mountains.

The mountains in this area were formed mainly by crustal uplifts during the late Cretaceous and early Tertiary periods. This large MLRA can be subdivided into at least 4 large general divisions. First is the Rockies on the east side of this area are called the “Front Range,” which is a fault block that has been tilted up on edge and uplifted and is largely igneous and metamorphic geology. It was tilted up on the east edge, so there is a steep front on the east and the west side is more gently sloping and in the south east there are rocks exposed in the mountains are mostly Precambrian igneous and metamorphic rocks. Second is the tertiary rocks, primarily basalt and andesitic lava flows, tuffs, breccias, and conglomerates, are throughout this area (San Juan Mountains Area). The third division is Northwest part of the MLRA is dominantly sedimentary rock from the cretaceous/tertiary and Permian/ Pennsylvanian periods. The fourth subset is the long and narrow Sangre de Cristos mountains uplifted in the Cenozoic are between the Rio Grande rift and the great plains. Many of the highest mountain ranges were reshaped by glaciation during the Pleistocene. Alluvial fans at the base of the mountains are recharge zones for local basin and valley fill aquifers. They also are important sources of sand and gravel.

The average annual precipitation ranges predominantly from 12 to 63 inches. Summer rainfall commonly occurs as high-intensity, convective thunderstorms. About half of the annual precipitation occurs as snow in winter; this proportion increases with elevation. In the mountains, deep snowpacks accumulate throughout the winter and

generally persist into spring or early summer, depending on elevation. Some permanent snowfields and small glaciers are on the highest mountain peaks. In the valleys at the lower elevations, snowfall is lighter and snowpacks can be intermittent. The average annual temperature is 26 to 54 degrees F (-3 to 12 degrees C). The freeze-free period averages 135 days and ranges from 45 to 230 days, decreasing in length with elevation. The climate of this area is strongly dependent upon elevation; precipitation is greater, and temperatures are cooler at the higher elevations. The plant communities vary with elevation, aspect and change in latitudes due to changing in precipitation kind and timing and temperature.

The dominant soil orders in this MLRA are Mollisols, Alfisols, Inceptisols, and Entisols. The soils in the area dominantly have a frigid or cryic soil temperature regime and an ustic or udic soil moisture regime. Mineralogy is typically mixed, smectitic, or paramicaceous. In areas with granite, gneiss, and schist bedrock, Glossocryalfs (Seitz, Granile, and Leadville series) and Haplocryolls (Rogert series) formed in colluvium on mountain slopes. Dystrocryepts (Leighcan and Mummy series) formed on mountain slopes and summits at the higher elevations. In areas of andesite and rhyolite bedrock, Dystrocryepts (Endlich and Whitecross series) formed in colluvium on mountain slopes. In areas of sedimentary bedrock, Haplustolls (Towave series) formed on mountain slopes at low elevations and with low precipitation. Haplocryolls (Lamphier and Razorba series), Argicryolls (Cochetopa series), and Haplocryalfs (Needleton series) formed in colluvium on mountain slopes at high elevations.

Classification relationships

NRCS:
Major Land Resource Area 48A, Southern Rocky Mountains (United States Department of Agriculture, Natural Resources Conservation Service, 2006).

USFS:
M331F- Southern Parks and Rocky Mountain Range Section Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow

M331G – South Central Highlands Section Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow

M331H – North Central Highlands and Rocky Mountains Section Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow

M331I – North Parks and Ranges Section Southern Rocky Mountain Steppe - Open Woodland - Coniferous Forest - Alpine Meadow

M341B – Tavaputs Plateau Section M341 Nevada-Utah Mountains Semi-Desert - Coniferous Forest - Alpine Meadow (Cleland, et al., 2007).

EPA:
21a – Alpine Zone, 21b – Crystalline Subalpine Forests, 21c – Crystalline Mid-Elevations Forests, 21d -Foothill Shrublands, 21e – Sedimentary Subalpine Forests, 21f – Sedimentary Mid-Elevation Forests, 21g – Volcanic Subalpine Forests, and 21h – Volcanic Mid-Elevation Forests < 21 Southern Rockies < 6.2 Western Cordillera < 6 Northwestern Forested Mountains North American Deserts (Griffith, 2006).

20c – Semiarid Benchlands and Canyonlands and 20e - Escarpements < 20 Colorado Plateau < 10.1 Cold Deserts < 10 North American Deserts (Griffith, 2006).

USGS:
Southern Rocky Mountain Province and the southern part of Unita Basin Section Colorado Plateaus Province

Ecological site concept

This site is found mostly commonly on mountain slopes. Soils are very deep (> 60+ inches). Soil surface textures are cobbly ashy loam, or cobbly ashy silt loam. Subsurface textures are generally loamy-skeletal. It is usually ustic udic or typic udic and cryic. It is a Engelmann Spruce – whortleberry– Jacob's-ladder community. The effective precipitation ranges from 20 to 40 inches.

Associated sites

R048AY250CO	**Subalpine Loam** This site occurs on hills, mountain-slopes, and mountains. Slopes is between 1 to 30%. Soils are deep to very deep (20 to 60+ inches). Soils are derived from colluvium and alluvium from volcanic rock; complex landslide deposits from igneous, metamorphic, and sedimentary rock; and slope alluvium, colluvium, residuum, alluvium or complex landslide deposits from sandstone and shale or shale. Soil surface texture is loam with loamy textured subsurface. It is a mountain big sagebrush – Thurber's Fescue community. It has an ustic udic/typic udic moisture regime and cryic temperature regime. The effective precipitation ranges from 20 to 30 inches.

Similar sites

F048AY918CO	**Spruce-Fir Woodland** This site is found mostly commonly on mountain slopes, complex landslides, and mesas. Soils are moderately deep to very deep (20 to 60+ inches). Soil surface textures are loam, cobbly loam, gravelly loam, very cobbly sandy loam, very gravelly sandy loam, very stony sandy loam, very cobbly fine sandy loam, or stony fine sandy loam. Subsurface textures can be loamy-skeletal, or clayey-skeletal. It is usually ustic udic or typic udic and cryic. It is a Engelmann Spruce – Subalpine Fir – Elk Sedge – Slender Wheatgrass community. The effective precipitation ranges from 20 to 40 inches.
F048AY524UT	**High Mountain Stony Loam (Engelmann Spruce)** The soils of this site formed mostly in alluvium and/or colluvium or till derived from diorite. Surface soils are fine gravelly to cobbly loam in texture. Rock fragments may be present on the soil surface and throughout the profile, and make up more than 50 percent of the soil volume. These soils are deep, well-drained, and have moderate to moderately rapid permeability. pH is very strongly acid to neutral alkaline.. Available water-holding capacity ranges from 2 to 5 inches of water in the upper 60 inches of soil. The soil moisture regime is mostly udic and the soil temperature regime is cryic. Precipitation ranges from 22-35 inches annually.
F048AY532UT	**High Mountain Very Steep Stony Loam (Engelmann Spruce)** The soils of this site formed mostly in colluvium derived from sandstone, shale and siltstone or conglomerate. Surface soils are silt loam, fine sandy loam to loam in texture. Rock fragments may be present on the soil surface and throughout the profile and generally makes up more than 50 percent of the soil volume. These soils are deep to very deep, well-drained, and have moderately slow to moderate permeability. pH is slightly acidic to slightly alkaline. Available water-holding capacity ranges from 4 to 6 inches of water in the upper 60 inches of soil. The soil moisture regime is mostly udic and the soil temperature regime is cryic. Precipitation ranges from 22-35 inches annually.

Table 1. Dominant plant species

Tree	(1) *Picea engelmannii*
Shrub	(1) *Vaccinium myrtillus*
Herbaceous	(1) *Polemonium pulcherrimum*

Physiographic features

This site occurs at upper timberline, often in cirques and other cold sites that retain snow cover late into the summer. This site occurs on all aspects and on moderate to steep slopes.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope
Flooding frequency	None
Ponding frequency	None
Elevation	10,500–11,600 ft
Slope	20–60%

Climatic features

Average annual precipitation is about 20 to 40 inches. Of this, approximately 65-75% falls as snow, and 25-35% falls as rain between middle of June to and the middle of September 1. Summer moisture is mostly from thundershowers in July, August and September. May to June is the driest period of the year with the driest month being June. December thru March is the wettest period and the wettest month is usually January. The average annual total snowfall is 198.5 inches. The snow depth usually ranges from 4 to 35 inches during November thru April. The highest winter snowfall record in this area is 354.5 inches which occurred in 1964-1965. The lowest snowfall record is 68.5 inches during the 1914-1915 winter. The frost-free period typically ranges from 25 to 90 days. The last spring frost is typically the end of June to the middle of July. The first fall frost is the first week of August to the first week of September. Mean daily annual air temperature is about 17.9ºF to 51.5ºF, averaging about 13.6ºF for the winter and 54.9ºF in the summer. Summer high temperatures of 70ºF to mid-70ºF are not unusual. The coldest winter temperature recorded was -47ºF on February 6, 1982 and the warmest winter temperature recorded was 13.6ºF on December 18, 1917. The coldest summer temperature recorded was 15ºF on June 20, 1920 and the warmest was 95 ºF on July 17, 1949. Wide yearly and seasonal fluctuations are common for this climatic zone. Data taken from Western Regional Climate Center (2018) for Crested Butte, Colorado Climate Station.

This zone in MLRA 48 will need to be broken up into at least 7 land resources zones in future projects based on current knowledge of precipitation and temperature patterns.

West Central Zone Stations: use in write up above. Driest month is June and wettest months are December thru March.

Northwest Zone Climate Stations: Marvine Ranch, Pyramid, Vail and Winter Park. Driest month is June and the wettest period is October thru April.

Southwest Zone Climate Stations (Precambrian sedimentary and igneous): Cascade, Electra Lake, Rico, Silverton, Telluride 4 WNW and Trout Lake. This area has driest month as June and the wettest months are July and August.

Southwest Volcanics: Platoro and Rio Grande Reservoir. The driest month is June and the Wettest are August and March.

Northeast (Front Range Igneous and Metamorphic): Allen’s Park 2 NNW, Allen’s Park NNW, Breckenridge, Climax, Jones Pass 2E, and Squaw Mountain. April, May, July and August are the wettest months. February, December, November and October are the driest.

Southeast (Sangre de Cristo Mtns): North Lake – This is the only climate station in this zone. It driest months are December and January with July being the wettest. So, this area receives more summer precipitation than other zones in this climate zone.

Frigid high elevation valleys: Aspen 1 SW, Ouray, Tacoma, Gross Reservoir, Coal Creek Canyon, Steamboat Springs, Marvine, and Buckskin Mtn 1 E. These areas have longer growing seasons by 20 to 40 days over the cryic stations

Table 3. Representative climatic features

Frost-free period (characteristic range)	5-36 days
Freeze-free period (characteristic range)	40-76 days
Precipitation total (characteristic range)	20-40 in
Frost-free period (actual range)	3-46 days
Freeze-free period (actual range)	32-88 days
Precipitation total (actual range)	20-40 in
Frost-free period (average)	19 days
Freeze-free period (average)	56 days

Precipitation total (average)	30 in

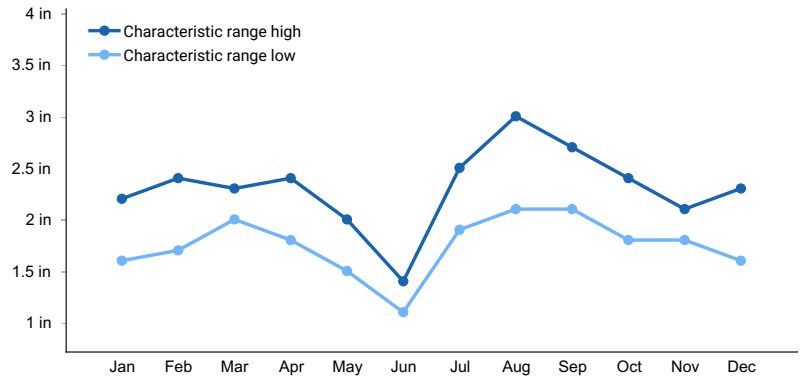


Figure 1. Monthly precipitation range

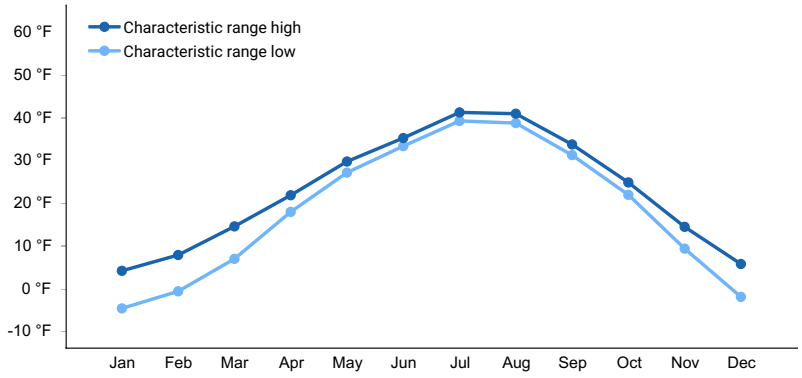


Figure 2. Monthly minimum temperature range

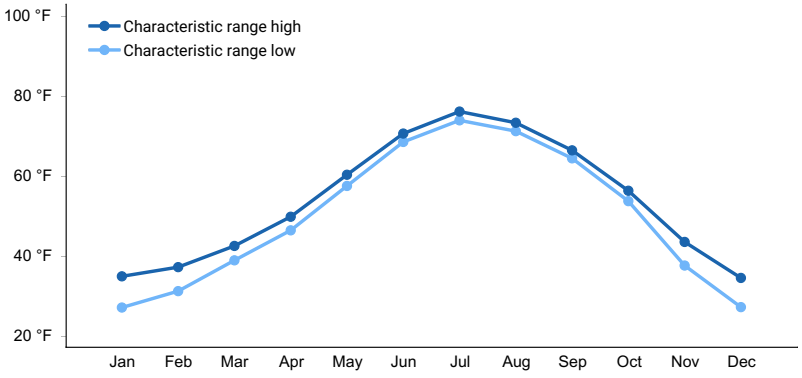


Figure 3. Monthly maximum temperature range

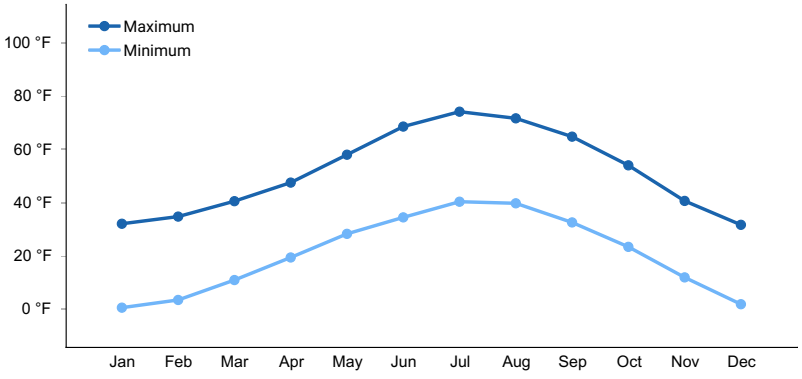


Figure 4. Monthly average minimum and maximum temperature

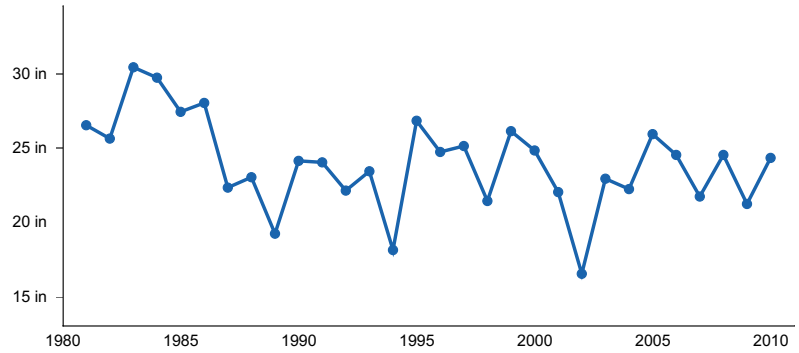


Figure 5. Annual precipitation pattern

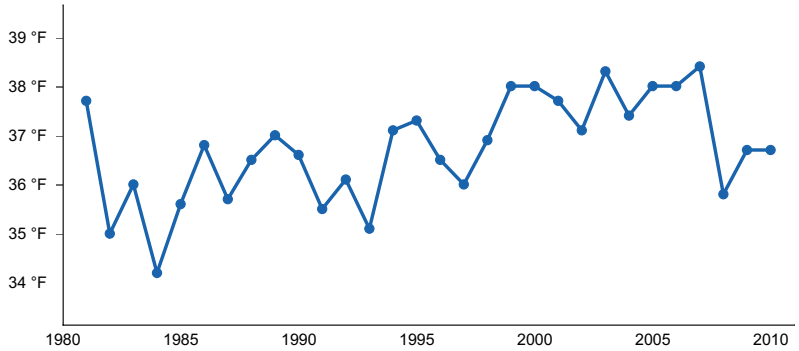


Figure 6. Annual average temperature pattern

Climate stations used

- (1) CLIMAX [USC00051660], Leadville, CO
- (2) CRESTED BUTTE [USC00051959], Crested Butte, CO
- (3) MARVINE RCH [USC00055414], Meeker, CO
- (4) RICO [USC00057017], Cahone, CO
- (5) RIO GRANDE RSVR [USC00057050], Lake City, CO
- (6) SILVERTON [USC00057656], Silverton, CO
- (7) TELLURIDE 4WNW [USC00058204], Telluride, CO
- (8) VAIL [USC00058575], Vail, CO

Influencing water features

None

Soil features

Soil great groups represented in decreasing order of extent are Cryoboralfs, Cryoborolls, and Cryochrepts.

Table 4. Representative soil features

Parent material	(1) Colluvium–volcanic breccia
Surface texture	(1) Cobbly, ashy loam (2) Cobbly, ashy silt loam
Family particle size	(1) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Soil depth	60–100 in
Surface fragment cover <=3"	0–1%

Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	3–4 in
Subsurface fragment volume <=3" (Depth not specified)	15–35%
Subsurface fragment volume >3" (Depth not specified)	20–30%

Ecological dynamics

Below is a State and Transition Model diagram to illustrate the “phases” (common plant communities), and “states” (aggregations of those plant communities) that can occur on the site. Differences between phases and states depend primarily upon observations of a range of disturbance histories in areas where this ESD is represented. These situations include tree harvest, grazing gradients to water sources, fence-line contrasts, patches with differing dates of fire, herbicide treatment, tillage, and kinds and times of timber harvest, etc. Reference State 1 illustrates the common plant communities that probably existed just prior to European settlement.

The major successional pathways within states, (“community pathways”) are indicated by arrows between phases. “Transitions” are indicated by arrows between states. The drivers of these changes are indicated in codes decipherable by referring to the legend at the bottom of the page and by reading the detailed narratives that follow the diagram.

The plant communities shown in this State and Transition Model may not represent every possibility but are probably the most prevalent and recurring plant communities. As more monitoring data are collected, some phases or states may be revised, removed, and/or new ones may be added. None of these plant communities should necessarily be thought of as “Desired Plant Communities.” According to the USDA NRCS National Range & Pasture Handbook (USDA-NRCS 2003), Desired Plant Communities (DPC’s) will be determined by the decision-makers and will meet minimum quality criteria established by the NRCS. The main purpose for including descriptions of a plant community is to capture the current knowledge at the time of this revision.

This site provides poor grazing for livestock because of the short growing season, limited numbers of forage species, and low productivity resulting from shade associated with the generally continuous tree canopy. However, it does provide valuable summer range for big game.

State 1 Reference State
The Reference State is a description of this ecological site just prior to Euro-American settlement but long after the arrival of Native Americans. At the time of European colonization, what would have been observed on these sites would have primarily depended on the time elapsed since the last wildfire occurred. Had the site been relatively undisturbed (i.e. without fire) for approximately 400 years or longer, the late seral climax of and Engelmann spruce dominate forest would have been found (1.1). The understory would have been relatively sparse due to tree competition, overstory shading, and duff accumulation. Wildfire (1.1a) would have replaced these stands with diverse herb-dominated vegetation (1.2). In the absence of any major disturbance (1.2a, 1.3a, 1.4a, 1.5a), the vegetation would have progressed into more of a shrub-herb co-dominance (1.3), followed by aspen (*Populus tremuloides*) (1.4), then would have become a mature stand of subalpine fir (*Abies lasiocarpa*) (1.5). Ultimately the site would have been reinvaded by Engelmann spruce (1.1). Wildfire (1.1a, 1.5b) would have been the primary disturbance factor prior to colonization. Livestock grazing and fire exclusion can accelerate natural succession of woody species.

Community Phase 1.1: Mature Engelman Spruce
Engelmann spruce co-dominate the climax overstory; few stands exhibit Engelmann spruce dominance over subalpine fir. Douglas fir and aspen occur as seral trees in some stands. The understory would be sparse consisting of shade-tolerant herbs such as heartleaf arnica, Geyer’s sedge, slender wheatgrass, and spike trisetum. This community would have existed approximately 400 years post fire.

Community Pathway 1.1a:
A stand-replacing wildfire or intensive logging will set the vegetation back to an early seral herb-dominated phase. Logging opens the forest canopy, allowing shrubs and herbs to flourish for 20 to 30 years.

Community Phase 1.2: herb-dominated meadow
This plant community will develop within the first 5 years following the last fire or complete tree removal. This would have been dominated by shade-intolerant forbs and grasses.

Community Pathway 1.2a:
After about 5 years, shrubs will establish, and the understory will diminish due to natural succession. Heavy season-long livestock grazing will accelerate woody plant recovery and diminish the understory.

Community Phase 1.3: shrub-herb
Between 5 and 30 years after fire, shrubs and herbs would co-dominate the site. The increasing shrub component would have included common juniper (*Juniperus communis*), whortleberry (*Vaccinium myrtillus*), gooseberry currant (*Ribes montigenum*), and Oregon boxleaf (*Paxistima myrsinites*). Geyer's sedge, spike trisetum, heartleaf arnica, and meadow-rue would have been beginning to be present in the understory.

Community Pathway 1.3a:
Woody plant recovery continue to occur due to natural succession. Heavy season-long sheep grazing, deer and elk grazing, and fire exclusion will accelerate woody plant recovery and diminish the understory. About 30 years after fire, aspen would have become established in the site.

Community Phase 1.4: aspen
This plant community would have been dominated by aspen, a seral species. Understorys are forb-rich beneath early successional aspen canopies. Subalpine fir would have been present only as an understory species at this time. Aspen would have dominated these sites for approximately 30 to 100 years following the last fire. The understory would have had a mixture of shrubs and herbaceous species.

Community Pathway 1.4a:
With approximately another century without fire, subalpine fir would have out competed the aspen to become the dominant overstory species at the site. Heavy season-long livestock grazing, and fire exclusion will accelerate woody plant recovery and diminish the understory.

Community Phase 1.5: mixed age subalpine fir
A stand of mature aspen with an inter-mixing of subalpine fir, and Engelmann spruce will develop approximately 100 to 400 years following fire or complete tree removal. Only shade-tolerant understory species would have been present. During this time, Engelmann spruce would become established in the understory.

Community Pathway 1.5a:
After approximately 400 years following the last wildfire, Engelmann spruce would have out-competed subalpine fir to become the dominant overstory species at the site. Fire exclusion will accelerate woody plant recovery and diminish the understory.

Community Pathway 1.5b:
A stand-replacing wildfire or intensive logging will set the vegetation back to an early seral shade-intolerant herb-dominated phase. Logging opens up the forest canopy allowing shrubs and herbs to flourish for 20 to 30 years.

Transition T1a: from State 1 to State 2
Sites that have had the most intense logging pressure have also had greatest degree of forest soil erosion and soil compaction. Once the forest reaches a certain level of degradation, managers often decide to focus on favoring one tree, usually lodgepole pine because of its greater growth rate and merchantability. This requires a clear cut and slash disposal followed by planting.

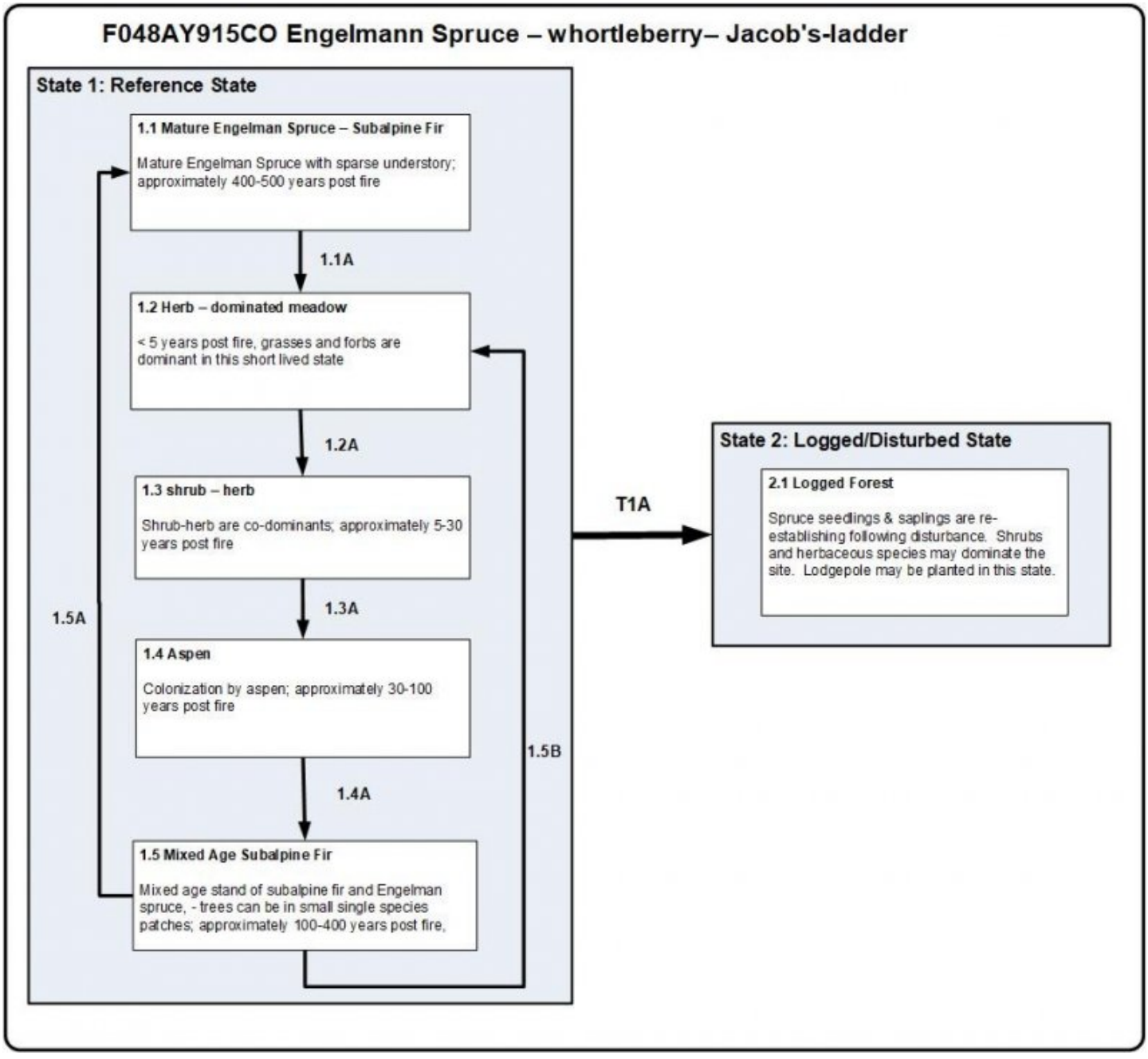
A less costly alternative compared to logging/slashing/replanting is to defer logging and control livestock grazing to allow whatever self-regenerating trees that occur on the site to recover. This process could, however, be thwarted by heavy game usage (i.e. elk utilization of aspen, or snowshoe hare utilization of subalpine fir).

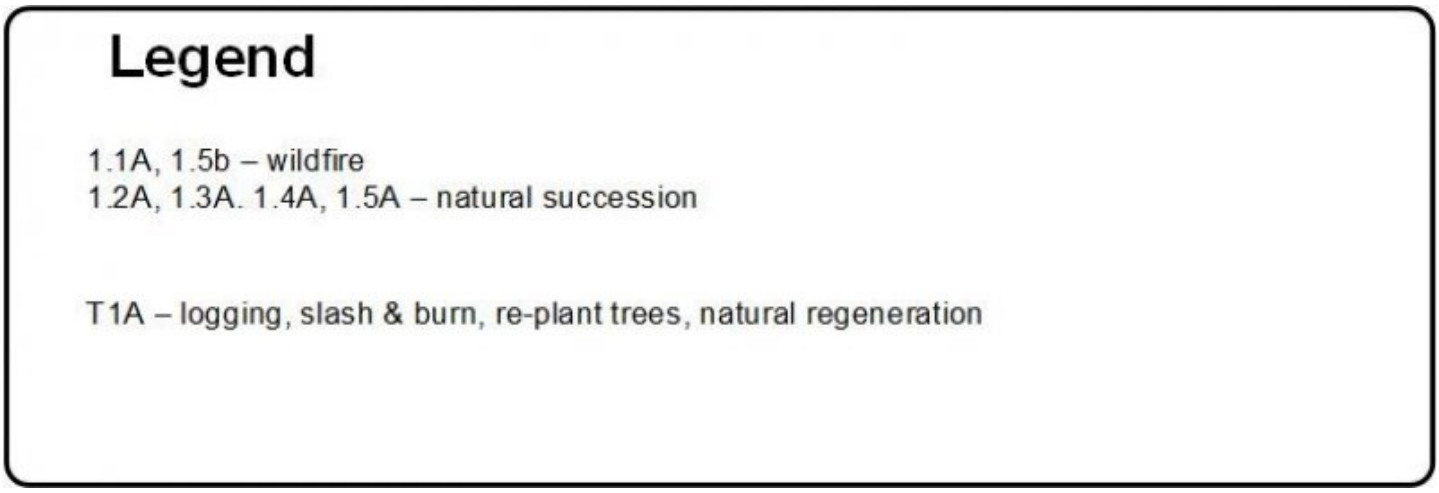
State 2: Logged Forest
This state is forest plantation with trees like lodgepole pine planted specifically to replace previously degraded forests and to increase productivity of the site for economic profitability. Subsequent harvests and replanting will

take place at maximum wood accumulation. Thinning to reduce insect or pathogen outbreaks will help maintain the resiliency of this State. Conversely, no management action may reduce the resiliency of this State.

With the large spruce trees being targeted during the first rounds of logging, what was left of these trees was minimal to none. Instead, sites that would have been dominated by Engelmann spruce became more often dominated by subalpine fir with only a scattering of Engelmann spruce (1.1). Logging effects, along with associated mechanical and fire disturbances, open the canopy and allow for the expansion of the herbaceous understory.

State and transition model





State 1
Reference State

Engelmann Spruce/whortleberry/Jacobs Ladder

Community 1.1
Engelmann Spruce/Myrtle Blueberry/Jacobs Ladder

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	110	225	380
Forb	70	125	195
Grass/Grasslike	120	125	150
Total	**300**	**475**	**725**

Community 1.2
Reference Plant Community

At the highest elevations, Engelmann spruce dominates the overstory, while at slightly lower elevations both Engelmann spruce and subalpine fir can be found, the latter often less commonly as mature trees. Bristlecone pine is sometimes present as a seral tree near the timberline. This site is above the elevation limits of aspen. The undergrowth is characterized by whortleberry ranging in cover from 5% to 95%, and such cold indicator species as *Senecio amplectens* (showy alpine ragwort), *Luzula parviflora* (small flowered woodrush), and Polemonium Pulcherrimum (dry Jacobs ladder). The presence of *Erigeron eximius* (sprucefir fleabane) indicates warmer situations within this ecological site. This site joins the alpine sites on the upper end. Where it gets drier it can join the bristlecone pine/Thurber fescue site. This site is most often bonded with the subalpine fir/whortleberry site on the lower end. This site is generally restricted to the coldest extremes of forest growth. Tundra species commonly present include *Geum rossii* (ross' avens), Bistorta vivipara (alpine bistort), Dischampsia caespitosa (tufted hairgrass), *Sibbaldia procumbens* (creeping sibbaldia), and *Trifolium dasyphyllum* (alpine clover). Snowfall and snow accumulation surpass that of all other habitat types. Whortleberry and Jacobs ladder both increase in frequency with an increase in snowpack duration.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Grasses**			100–200	
	fringed brome	BRCI2	*Bromus ciliatus*	25–50	–
	Ross' sedge	CARO5	*Carex rossii*	20–35	–
	smallflowered woodrush	LUPA4	*Luzula parviflora*	15–25	–
	spike trisetum	TRSP2	*Trisetum spicatum*	10–15	–
	Thurber's fescue	FETH	*Festuca thurberi*	10–15	–
	southwestern showy sedge	CABE3	*Carex bella*	10–15	–
Forb					
2	**Forbs**			75–175	
	Jacob's-ladder	POPU3	*Polemonium pulcherrimum*	25–50	–
	alpine false springparsley	PSMO	*Pseudocymopterus montanus*	15–25	–
	showy alpine ragwort	SEAM	*Senecio amplectens*	15–25	–
	Virginia strawberry	FRVIG2	*Fragaria virginiana ssp. glauca*	10–15	–
	tall fringed bluebells	MECI3	*Mertensia ciliata*	10–15	–
	sickletop lousewort	PERA	*Pedicularis racemosa*	10–15	–
Shrub/Vine					
3	**Shrubs**			125–325	
	whortleberry	VAMY2	*Vaccinium myrtillus*	125–225	–
	sidebells wintergreen	ORSE	*Orthilia secunda*	5–10	–
	gooseberry currant	RIMO2	*Ribes montigenum*	5–10	–

Other references

Chapman, S.S., G.E. Griffith, J.M. Omernik, A.B. Price, J. Freeouf, and D.L. Schrupp. 2006. Ecoregions of Colorado. (2-sided color poster with map, descriptive text, summary tables, and photographs). U.S. Geological Survey, Reston, VA. Scale 1:1,200,000.

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Approval

Kirt Walstad, 3/05/2024

Acknowledgments

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--Site Development and Testing Plan--:

Future work to validate and further refine the information in this Provisional Ecological Site Description is necessary. This will include field activities to collect low-, medium-, and high-intensity sampling, soil correlations, and analysis of that data.

Additional information and data is required to refine the Plant Production and Annual Production tables for this ecological site. The extent of MLRA 48A must be further investigated.

Field testing of the information contained in this Provisional ESD is required. As this ESD is moved to the Approved ESD level, reviews from the technical team, quality control, quality assurance, and peers will be conducted.

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	05/10/2025
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):**

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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:**
