USDA Natural Resources Conservation Service

Ecological site F048AY908CO
Mixed Conifer

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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 moderately deep to very deep (20 to 60+ inches). Soil surface textures are loam, very gravelly sandy loam, very stony sandy loam, stony sandy loam, stony loam, very stony loam, very cobbly loam or gravelly fine sandy loam. Subsurface textures can be loamy-skeletal or sometimes fine-loamy. It is usually ustic udic or typic udic and cryic. It is a Mixed Conifer community with subalpine fir, white fir,

and Douglas fir intermixed. The effective precipitation ranges from 20 to 40 inches.

Associated sites

F048AY449CO	**Aspen Woodland** This site is a permanent type aspen stand in Western Colorado. This site is found mostly commonly on mountain slopes, hills, and complex landslides. Soils are moderately deep to very deep (20 to 60+ inches), dark and high in organic matter. Soil surface textures are loam, stony loam, very stony loam, cobbly loam, gravelly loam or very cobbly loam. Subsurface textures can be fine-loamy, loamy-skeletal, clayey-skeletal or fine. It is usually ustic udic and can be frigid or cryic. It is a Aspen – Wood's Rose – Slender Wheatgrass community. It Precipitation ranges from 20 to 30 inches, but on favorable north and east aspect it can be found as low as 18
R048AY228CO	**Mountain Loam** This site occurs mainly alluvial fans, mountain slopes, benches, terraces, or hills. Slopes average between 5 and 10% but can range from 0 to 30%. Soils are moderately deep to deep (20-60 inches) loamy soils derived from residuum from igneous and metamorphic rocks or sandstone and shale; slope alluvium from sandstone and shale, or igneous and metamorphic rocks; colluvium from igneous and metamorphic rocks or sandstone and shale, and/or alluvium from igneous and metamorphic rocks. Soil surface texture are loam, sandy loam or silt loam with loamy subsurface. It is a Mountain Big Sagebrush - Arizona Fescue community. It has a typic ustic moisture regime. The effective precipitation ranges from 16 to 20 inches.
R048AY237CO	**Stony Loam** This site occurs mainly alluvial fans, mountain slopes mountains and valley sides. Slopes is between 0 to 30%. Soils are deep (60 inches or more) loamy soils derived from outwash; till; colluvium from basalt, sandstone or granite and gneiss; and/or alluvium from igneous and metamorphic rocks; or basalt. Soil surface texture are stony to extremely stony loam, cobbly loam; or cobbly to very cobbly sandy loam with loamy-skeletal subsurface. It is a Mountain Big Sagebrush - Bluebunch wheatgrass community. It has a typic ustic moisture regime. The effective precipitation ranges from 16 to 20 inches.
R048AY222CO	**Loamy Park** This site ioccurs on alluvial and colluvial fans, hillsides, plains, sideslopes, terraces, valley sideslopes, and valley bottoms Slopes are from 0 to 30%. Soils are moderately deep to deep (20-60 inches) loamy soils derived from residuum from igneous and metamorphic rocks; alluvium from granite, gneiss, schist, or sandstone and shale. Soil surface texture are sandy loam to loam with loam subsurface. It is an Arizona Fescue – Mountain Muhly community. It has a typic ustic moisture regime. The effective precipitation ranges from 16 to 20 inches.

Similar sites

R048AY443UT	**Mountain Shallow Loam (Mixed Conifer)** This ecological site occurs in the Uintah Basin Section of the Southern Rocky Mountain Provence which extends westward into Utah. Mountains in this area are mostly crustal uplifts that formed in the Cretaceous and Tertiary periods. Alluvial fans at the base of these mountains are recharge zones for local aquifers. This site occurs on shallow to deep soils over limestone or sandstone bedrock. The dry surface layer color is typically brown and the surface soil textures range from very channery fine sandy loams to gravelly loams. These soils are moderately well developed, well drained, and have moderate water holding capacities. Soil temperature regime is frigid and moisture regime is ustic.

Table 1. Dominant plant species

Tree	(1) *Abies lasiocarpa* (2) *Abies concolor*
Shrub	Not specified
Herbaceous	(1) *Carex geyeri* (2) *Elymus trachycaulus*

Physiographic features

This site occurs on mountain slopes from approximately 8,000 to 11,000 feet in elevation.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope
Runoff class	Medium to high
Flooding frequency	None
Ponding frequency	None
Elevation	8,000–11,000 ft
Slope	2–60%

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)	24 in

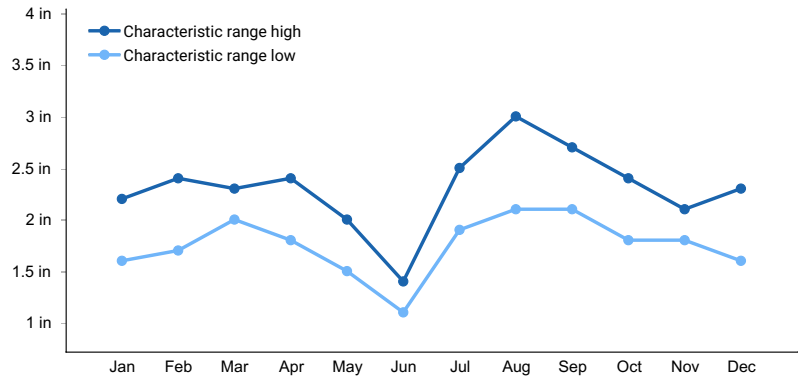


Figure 1. Monthly precipitation range

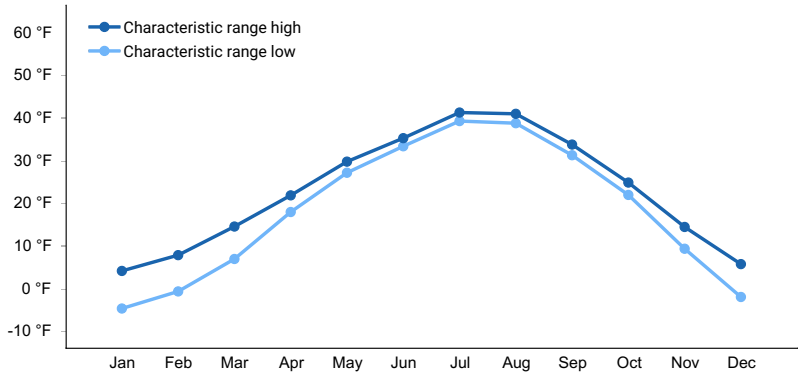


Figure 2. Monthly minimum temperature range

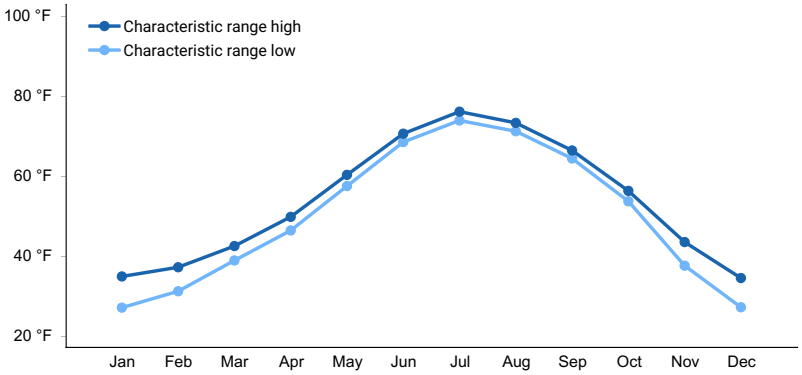


Figure 3. Monthly maximum temperature range

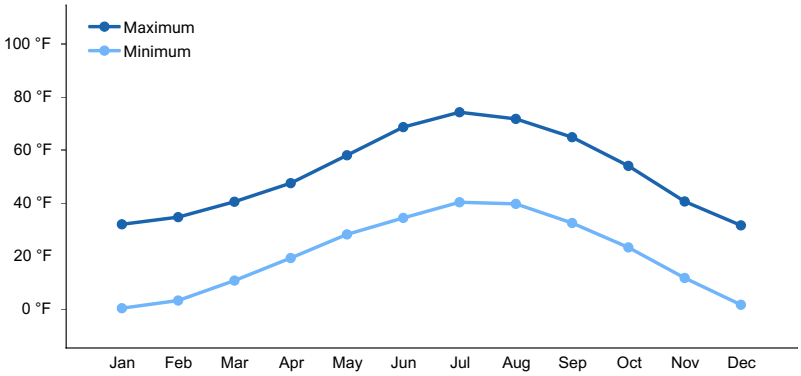


Figure 4. Monthly average minimum and maximum temperature

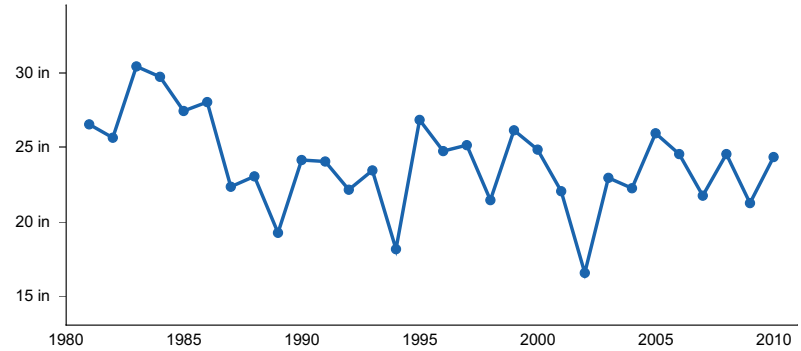


Figure 5. Annual precipitation pattern

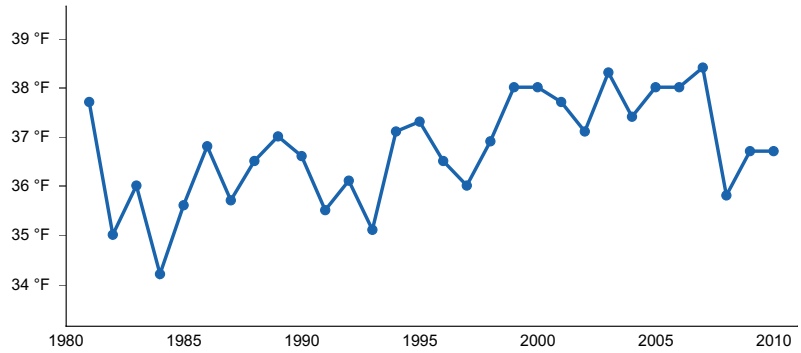


Figure 6. Annual average temperature pattern

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

Soils are moderately deep to very deep (20 to 60+ inches). Subsurface textures can be loamy-skeletal or sometimes fine-loamy. It is usually ustic udic or typic udic and cryic.

Table 4. Representative soil features

Parent material	(1) Residuum–granite (2) Slope alluvium–sandstone and shale (3) Residuum–volcanic rock (4) Colluvium–volcanic rock (5) Colluvium–sandstone (6) Residuum–sandstone (7) Colluvium–gneiss (8) Colluvium–mica schist (9) Colluvium–granite (10) Slope alluvium–granite (11) Outwash–granite (12) Outwash–sandstone
Surface texture	(1) Loam (2) Very gravelly, very stony, stony sandy loam (3) Stony, very stony, very cobbly loam (4) Gravelly fine sandy loam
Family particle size	(1) Loamy-skeletal (2) Fine-loamy
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Soil depth	20–100 in
Surface fragment cover <=3"	1–25%
Surface fragment cover >3"	0–25%
Available water capacity (Depth not specified)	2–5 in
Calcium carbonate equivalent (Depth not specified)	0–1%
Electrical conductivity (Depth not specified)	0–1 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0
Soil reaction (1:1 water) (Depth not specified)	5.6–7.3
Subsurface fragment volume <=3" (Depth not specified)	10–45%
Subsurface fragment volume >3" (Depth not specified)	5–40%

Ecological dynamics

The following State and Transition diagram depicts the most common plant communities found on this ecological site. It does not necessarily depict all the plant communities that can occur, but does show the most prevalent and repeatable. As more data are collected, some of these plant communities may be revised or removed, and new ones added. These descriptions capture the current knowledge and experience at the time of this revision.

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 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 transition between Reference State 1 and State 2 is considered irreversible because of the naturalization of exotic species of both flora and fauna, possible extinction of native species, and climate change. There may have also been accelerated soil erosion.

Community Phase 1.1: 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. The description of the Reference State was determined by NRCS Soil Survey Type Site Location information and familiarity with relict areas where they exist. At the time of European colonization, what would have been observed on these sites would have primarily depended on the time since the last wildfire occurred. If fire had not occurred for about 100 years, a stand of mixed conifers including subalpine fir (*Abies lasiocarpa*), Douglas-fir (*Pseudotsuga menziesii*), and white fir (*Abies concolor*) would have been the dominant species occupying the site (1.1). The particular tree dominants would also sort out based on aspect exposure (Alexander 1985, 1988). The understory would have been relatively sparse under mature trees due to tree competition, overstory shading, and duff accumulation. Wildfire or insect outbreaks on particular tree species (1.1a) would have replaced these stands with a rich diversity of 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 the increasing presence of aspen (*Populus tremuloides*) first as seedlings and saplings (1.4), and later as mature aspen with mixed conifer seedlings (1.5). Ultimately the conifers would have outcompeted aspen, returning the climax vegetation (1.1). Wildfire (1.1a, 1.5b) would have been the primary disturbance factor prior to colonization, although periodic outbreaks of insects destroying particular tree species could reset the successional clock. Early successional stages were shorter in duration.

Community Phase 1.1: mature subalpine fir/ white fir/ Douglas-fir/ sparse understory
This plant community (1.1) would have been characterized by a stand of mature mixed conifers including subalpine fir, Douglas-fir, and white fir, with a sparse understory of Geyer’s sedge (*Carex geyeri*), slender wheatgrass (*Elymus trachycaulus*), and heartleaf arnica (*Arnica cordifolia*).

Community Pathway 1.1a:
Wildfire would have removed the trees, allowing shade-intolerant herbs to flourish briefly.

Community Phase 1.2: herb-dominated
This plant community would have developed within the first 5 years following fire.
Geyer’s sedge, slender wheatgrass, and heartleaf arnica would have been the dominant species, along with many other short-lived herbaceous shade-intolerant species.

Community Pathway 1.2a:
After about 5 years, shrubs would begin to establish in the site.

Community Phase 1.3: shrub-herb co-dominance
Between 5 and 60 years after fire, shrubs and herbs would co-dominate the site. The increasing shrub component would have included mountain snowberry (*Symphoricarpos oreophilus*), creeping barberry (*Mahonia repens*), mallow ninebark (*Physocarpus malvaceus*), and gooseberry currant (*Ribes montigenum*), among others.

Community Pathway 1.3a:
About 60 years after fire, aspen would have become established in the site.

Community Phase 1.4: immature aspen
This plant community would have been dominated by a stand of immature aspen, a seral species, while the conifer species would have begun to establish themselves under other nurse plants. A stand of immature aspen would have existed approximately 60 to 80 years following the last fire.

Community Pathway 1.4a:
Aspen would have continued to mature while the various conifers would have become well established in the understory.

Community Phase 1.5: mature aspen/ mixed conifer
A stand of mature aspen intermixed with mixed conifers and various understory shrubs would have been encountered approximately 80 to 100 years post fire.

Community Pathway 1.5a:
After about 100 years following the last fire, the conifers would become mature, shading out aspen and the shade-intolerant shrub and herb species in the understory.

Community Pathway 1.5b:
Wildfire would have removed the trees, allowing shade-intolerant herbs to flourish briefly.

Transition T1a: from State 1 to State 2 (Reference State to Secondary Forest/ Introduced State)
The simultaneous introduction of exotic species, both plants and animals, and possible extinctions of native flora and fauna, along with climate change, has caused State 1 to transition to State 2. Europeans further altered this vegetation largely through logging, livestock grazing, trapping of beaver, and changing the fire regime. Continued impacts could prevent the recovery toward potential conifer dominance (State 2, various phases). The reversal of these changes (i.e. a return pathway) back to State 1 is not impractical.

State 2: Secondary Forest/ Introduced State
State 2 is similar to State 1 in form and function, with the exception of the presence of non-native plants and animals, possible extinctions of native species, a different climate, and a secondary stand of trees. State 2 is a description of the ecological site following Euro-American settlement. This state can be regarded as the current potential. With the least amount of disturbance or manipulation of the fire regime, a mature stand of subalpine fir, white fir, and Douglas fir with a sparse understory component is expected at this site (2.1). As with the Reference State, time since last wildfire remains the key factor in determining what vegetation will be encountered on these sites. Wildfire, particularly crown fires, or complete harvesting of the forest (2.1b, 2.5b, 2.6a) will replace these stands with a rich diversity of herb-dominated vegetation. (2.2). In the absence of any major disturbance (2.2a, 2.3a, 2.4a, 2.5a), the vegetation will progress into more of a shrub-herb co-dominance (2.3), followed by the increasing presence of aspen, first as seedlings and saplings (2.4), and later as mature aspen with immature conifers (2.5). Ultimately the conifers will outcompete aspen, returning to a semblance of climax vegetation (2.1). In some areas where wildfire has been prevented, the conifers may become over-mature (2.6) and consequently are more susceptible to infestation by insects and pathogens (2.1a). The resiliency of this State can be maintained by moderating human uses of the forest for timber and/or grazing.

Community Phase 2.1: Mature Douglas-fir/ Sparse understory
This plant community (2.1) is characterized by a stand of mature subalpine fir, white fir, and Douglas-fir. A sparse understory of Geyer’s sedge, slender wheatgrass, and heartleaf arnica may be present.

Community Pathway 2.1a:
With fire exclusion, or well over 100 years since last fire, the conifer stand will ultimately deteriorate (become over-mature) and become increasingly susceptible to infestation by insects or other pathogens.

Community Pathway 2.1b:
A stand-replacing wildfire or intensive logging will set the vegetation back to an early seral herb-dominated phase. Logging opens up the forest canopy, allowing shade-intolerant understory herbs and shrubs to flourish for 20 to 30 years.

Community Pathway 2.1c:
The removal of only the mature Douglas-fir will leave only the less desirable true fir species in the overstory.

Community Phase 2.2: herb-dominated
This plant community will develop within the first 5 years following the last fire or complete tree removal. Geyer’s sedge, slender wheatgrass, and heartleaf arnica will be the dominant understory species. A small component of introduced species may be present.

Community Pathway 2.2a:
The combination of heavy season long livestock grazing and fire exclusion will accelerate woody plant (shrub) establishment and diminish the herbaceous understory.

Community Phase 2.3: shrub-herb co-dominance
A plant community co-dominated by shrubs and herbs will develop approximately 5 to 60 years following fire or complete tree removal. A small component of introduced species may be present.

Community Pathway 2.3a:
The combination of heavy season long livestock grazing and fire exclusion will accelerate woody plant establishment and diminish the herbaceous understory.

Community Phase 2.4: immature aspen
Aspen will establish in the site 60 to 80 years after the last fire or complete tree removal.

Community Pathway 2.4a:
The combination of heavy season long livestock grazing and fire exclusion will accelerate woody plant establishment and diminish the understory.

Community Phase 2.5: mature aspen/ mixed conifer
A stand of mature aspen with an intermixed with subalpine fir, white fir, and Douglas-fir will develop approximately 80 to 100 years following fire or complete tree removal.

Community Pathway 2.5a:
The combination of heavy season long livestock grazing and fire exclusion will accelerate woody plant establishment and diminish the understory.

Community Pathway 2.5b:
A stand-replacing wildfire or intensive logging will set the vegetation back to an early seral herb-dominated phase. Logging opens up the forest canopy allowing grasses, herbs, and shrubs to flourish for 20 to 30 years.

Community Pathway 2.5c:
The removal of mature aspen will leave a stand of immature aspen, possibly with a few subalpine fir, white fir, and Douglas-fir in the understory.

Community Phase 2.6: over-mature, blighted mixed conifers/ understory absent
This plant community is the result of fire exclusion for well over 100 years. The Douglas-fir is over-mature and weakened, making it susceptible to infestation by insects or other pathogens.

Community Pathway 2.6a:
A stand-replacing wildfire will set the vegetation back to an early seral herb-dominated phase.

Transition T2a: from State 2 to State 3 (Secondary Forest/ Introduced State to Tertiary Forest/ Degraded State)
The Secondary Forest/ Introduced State will transition to the Tertiary Forest/ Degraded State following a second cycle of timber harvest or a stand replacing wildfire and further impacts from heavy continuous season-long grazing. Logging opens up the forest canopy allowing shade-intolerant species to flourish for 20 to 30 years. Secondary and tertiary disturbances can produce an array of vegetation from degraded temporary meadows to further simplified forests. The approach to this transition is indicated by a loss of species diversity, discontinuous litter and duff coverage, and evidence of accelerated soil erosion. This transition is triggered by excessive human utilization of the most economically desirable parts of the vegetation.

State 3: Tertiary Forest/ Degraded State
State 3 is characterized by tertiary forests in which both the understory vegetation and tree condition have been degraded. Fire suppression accelerates the development of woody plant dominance.

Community Phase 3.1: mature subalpine fir/ white fir/ Douglas-fir/ sparse understory
This plant community (3.1) is characterized by a mixed stand of mature subalpine fir, white fir, and Douglas-fir. A sparse understory of Geyer’s sedge, and slender wheatgrass, heartleaf arnica, and other shade-tolerant plants may be present.

Community Pathway 3.1a:

With fire exclusion, or well over 100 years since last fire, subalpine fir, white fir, and Douglas-fir will ultimately age, lose vigor, and become increasingly susceptible to infestation by insects or other pathogens.

Community Pathway 3.1b:
A stand-replacing wildfire or intensive logging will set the vegetation back to an early seral herb-dominated phase. Logging opens up the forest canopy, allowing shade-intolerant grasses, forbs, and shrubs to flourish for 20 to 30 years.

Community Pathway 3.1c:
The removal of only the mature Douglas-fir will leave only the less desirable true fir species in the overstory.

Community Phase 3.2: herb-dominated
This plant community will develop within the first 5 years following the last fire or complete tree removal. Dominant grasses are Geyer's sedge and slender wheatgrass. A small component of introduced species may be present.

Community Pathway 3.2a:
After about 5 years, shrubs will begin to establish in the site.

Community Phase 3.3: shrub-herb co-dominance
A plant community co-dominated by shrubs and herbs will develop approximately 5 to 60 years after fire or complete tree removal. A small component of introduced species may be present.

Community Pathway 3.3a:
Aspen will become established at the site after 60 to 80 years following the last wildfire or complete tree removal.

Community Phase 3.4: immature aspen
Immature aspen dominate the stand 60 to 80 years following the last fire or complete tree removal.

Community Pathway 3.4a:
Aspen matures and immature conifers become well established in the understory 80 years after the last fire or complete tree removal.

Community Phase 3.5: mature aspen/ Douglas-fir
A stand of mature aspen intermixed with subalpine fir, white fir, and Douglas-fir will develop approximately 80 to 100 years following fire.

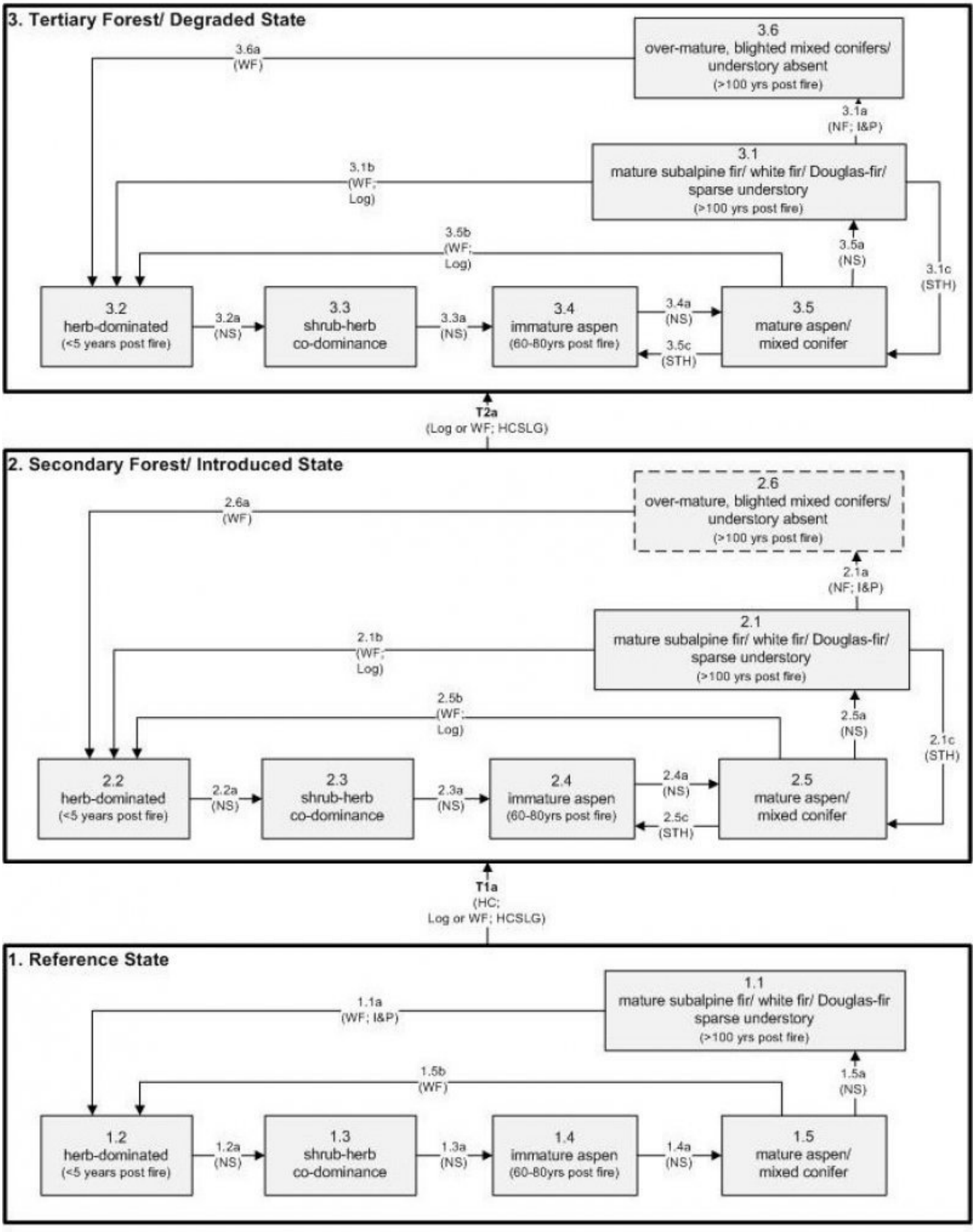
Community Pathway 3.5a:
After about 100 years following the last fire, subalpine fir, white fir, and Douglas-fir will become mature, shading out aspen and the shade-intolerant shrub and herb species in the understory.

Community Pathway 3.5b:
A stand-replacing wildfire or intensive logging will set the vegetation back to an early seral herb-dominated phase. Logging opens up the forest canopy allowing grasses, herbs, and shrubs to dominate for 20 to 30 years. Community Pathway 3.5c:
The removal of mature aspen will leave a stand of immature aspen, possibly with a few subalpine fir, white fir, and Douglas-fir in the understory.

Community Phase 3.6: over-mature, blighted mixed conifers/ understory sparse
This plant community is the result of fire exclusion well over 100 years. The conifers are over-mature and weakened, making them more susceptible to infestation by insects or other pathogens.

Community Pathway 3.6a:
A stand-replacing wildfire will set the vegetation back to an early seral herb-dominated phase.

State and transition model



HC	Historic Change	NF	No Fire
HCSLG	Heavy Continuous Season Long Grazing	NS	Natural Succession
I&P	Insects & Other Pathogens	STH	Selective Timber Harvest
Log	Logging	WF	Wildfire

State 1
Reference State

The total air dry annual production for this site is: 650 lbs/acre in an unfavorable year, 800 lbs/acre in average year and 1,000 lbs./acre for above average year.

Other references

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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	05/02/2024
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):**

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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):**

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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:**
