USDA Natural Resources
Conservation Service

Ecological site F048AY475UT
Mountain Very Steep Stony Loam (Douglas Fir)

Last updated: 3/05/2024
Accessed: 05/02/2024

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): 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.

Ecological site concept

The soils of this site formed mostly in colluvium over residuum from sandstone and shale. Surface soils are extremely bouldery fine sandy loam, extremely stony loam to very channery loam in texture. Rock fragments may be present on the soil surface and throughout the profile, but make up more than 35 percent of the soil volume. These soils are shallow to deep, well-drained, and have moderately slow to moderate permeability. pH is slightly to moderately 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 ustic and the soil temperature regime is frigid. Precipitation ranges from 16-22 inches annually.

Associated sites

R048AY473UT	**Mountain Very Steep Stony Loam (Shrub)** Often occurs adjacent to this site.

Similar sites

F048AY463UT	**Mountain Very Steep Loam (Douglas Fir)** Similar plant community but has fewer rock fragments in soil profile.

Table 1. Dominant plant species

Tree	(1) *Pseudotsuga menziesii*
Shrub	(1) *Mahonia repens*
Herbaceous	(1) *Poa secunda*

Physiographic features

This site occurs at elevations between 6,000 and 9,500 feet. It is found on hills and mountain slopes with slopes ranging from 50-80 percent. Flooding and ponding do not occur on this site.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Hill
Runoff class	Medium to high
Flooding frequency	None
Ponding frequency	None

Elevation	6,000–9,500 ft
Slope	50–80%
Ponding depth	Not specified
Water table depth	Not specified
Aspect	NE, SE

Climatic features

The climate of this site is dry subhumid and semiarid. It is characterized by cold, snowy winters and warm, dry summers. The average annual precipitation ranges from 16 to 22 inches. July, August, and October are typically the wettest months with June being the driest. The most reliable sources of moisture for plant growth are the snow that accumulates over the winter and spring rains. Summer thunderstorms are intermittent and sporadic in nature, and thus, are not reliable sources of moisture to support vegetative growth on this site.

Table 3. Representative climatic features

Frost-free period (characteristic range)	60-90 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	16-22 in

Influencing water features

Due to its landscape position, this site is not influenced by streams or wetlands.

Soil features

The soils of this site formed mostly in colluvium over residuum from sandstone and shale. Surface soils are extremely bouldery fine sandy loam, extremely stony loam to very channery loam in texture. Rock fragments may be present on the soil surface and throughout the profile, but make up more than 35 percent of the soil volume. These soils are shallow to deep, well-drained, and have moderately slow to moderate permeability. pH is slightly to moderately 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 ustic and the soil temperature regime is frigid. Precipitation ranges from 16-22 inches annually.

Table 4. Representative soil features

Parent material	(1) Colluvium–sandstone and shale (2) Residuum–sandstone and shale
Surface texture	(1) Very channery, extremely stony loam (2) Extremely bouldery fine sandy loam
Family particle size	(1) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	10–60 in
Soil depth	10–60 in
Surface fragment cover <=3"	0–37%
Surface fragment cover >3"	0–57%
Available water capacity (Depth not specified)	2–5 in
Calcium carbonate equivalent (Depth not specified)	1–20%

Electrical conductivity (Depth not specified)	0–4 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0–5
Soil reaction (1:1 water) (Depth not specified)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–50%
Subsurface fragment volume >3" (Depth not specified)	0–40%

Ecological dynamics

It is impossible to determine in any quantitative detail the historic climax plant community (HCPC) for this ecological site because of the lack of direct historical documentation preceding all human influence. In some areas, the earliest reports of dominant plants include the cadastral survey conducted by the General Land Office, which began in the late 19th century for this area (Galatowitsch 1990). However, up to the 1870s the Shoshone Indians, prevalent in northern Utah and neighboring states, grazed horses and set fires to alter the vegetation for their needs (Parson 1996). In the 1860s, Europeans brought cattle and horses to the area, grazing large numbers of them on unfenced parcels year-long (Parson 1996). Itinerant and local sheep flocks followed, largely replacing cattle as the browse component increased.

Below is a State and Transition Model diagram that illustrates 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.

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.

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. The description of the Reference State was determined by NRCS Soil Survey Type Site Location information and familiarity with rangeland relict areas where they exist. At the time of European colonization, what would have been observed on these sites depended primarily on the time since the last wildfire occurred. If the site had not experienced fire for about 100 years, Douglas-fir (*Pseudotsuga menziesii*) would have been the dominant species occupying the site with a sparse understory (1.1) due to tree competition, overstory shading, and duff accumulation. Douglas-fir replaces itself without wildfire and would have been the climax dominant. Wildfire (1.1a) would have replaced these stands with a rich herb-dominated vegetation (1.2). In the absence of any major disturbance (1.2a, 1.3a, 1.4a, 1.5a), the re-sprouting vegetation including quaking aspen (*Populus tremuloides*), bigtooth maple (*Acer grandidentatum*), and/or Gambel oak (*Quercus gambelii*) would have reclaimed the site (1.3), followed by the increasing presence of aspen (*Populus tremuloides*), first as saplings (1.4),

and later as mature aspen with Douglas-fir seedlings (1.5), ultimately to where aspen would have been outcompeted by Douglas-fir returning to the climax vegetation (1.1). Wildfire (1.1a, 1.5b) would have been the primary disturbance factor prior to colonization.

Community Phase 1.1: densely canopied Douglas-fir/ sparse understory
This plant community (1.1) would have been characterized by a stand of mature Douglas-fir with a sparse understory of Geyer's sedge (*Carex geyeri*), bluegrass (Poa spp.), chokecherry (*Prunus virginiana*), Fendler's meadow-rue (*Thalictrum fendleri*), and creeping barberry (*Mahonia repens*).

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 since the last fire, with Geyer's sedge, bluegrass, slender wheatgrass (*Elymus trachycaulus*), heartleaf arnica (*Arnica cordifolia*) and feathery false lily of the valley (*Maianthemum racemosum* ssp. racemosum) being the dominant understory species.

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

Community Phase 1.3: re-sprouting aspen, maple, oak/ herbaceous understory
For a period of about 5 to 60 years post fire, a mixture of re-sprouting shrubs would have been dominant on the site, including, quaking aspen, bigtooth maple, and Gambel oak. Other prominent shrubs would have been mountain snowberry (*Symphoricarpos oreophilus*), chokecherry (*Prunus virginiana*), Saskatoon serviceberry (*Amelanchier alnifolia*), and Oregon boxleaf (*Paxistima myrsinites*), among others. The herbaceous understory would also have been fairly intact.

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

Community Phase 1.4: immature aspen
This plant community would have been dominated by a stand of immature aspen, which is a seral species while Douglas-fir begins to establish itself under other nurse species. A stand of immature aspen would have existed approximately 60 to 80 years since last fire.

Community Pathway 1.4a:
Aspen would have continued to mature while Douglas-fir would have become well established in the understory.

Community Phase 1.5: mature aspen/ Douglas-fir
A stand of mature aspen intermixed with Douglas-fir saplings would have been encountered approximately 80 to 100 years post fire.

Community Pathway 1.5a:
After about 100 years following the last fire, Douglas-fir 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 fur 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 practical.

a. Nature of Forest Community

The overstory tree canopy cover is 30 to 40 percent. Common understory plants are Geyer sedge, wheeler bluegrass, heartleaf arnica, chokecherry, canyon maple, and creeping Oregon grape. Understory composition by air-dry weight is about 25 percent perennial grasses and grasslike plants, 10 percent forbs, and 65 percent shrubs. Understory production ranges from 500 pounds per acre in favorable years to about 100 pounds per acre in unfavorable years. Understory production includes the total annual production of all species within 4 ½ feet of the ground surface.

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 shortly following Euro-American settlement. This state can be regarded as the current potential. With the least amount of disturbance or manipulation of fire regime (Alexander 1985; 1988), a mature stand of 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 would be encountered here. Wildfire, particularly crown fires, or complete harvesting of the forest (2.1b, 2.5b) will replace these stands with a rich 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 saplings (2.4), and later as mature aspen with Douglas-fir (2.5), ultimately to where Douglas-fir will outcompete aspen returning to the climax vegetation (2.1). Because soils on this site are rocky they are considered “self-armoring,” thus making the site resistant to the effects of erosion. Heavy livestock grazing and tree harvests will reduce the stability of this site, while a reduction in livestock use and tree harvests will maintain stability.

Community Phase 2.1: densely canopied Douglas-fir/ sparse understory
This plant community (2.1) is characterized by a stand of mature Douglas-fir with a sparse understory of Geyer’s sedge, and bluegrass may be present.

Community Pathway 2.1a:
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 more understory for 20 to 30 years.

Community Pathway 2.1b:
The removal of only the mature Douglas-fir will allow some aspen to return and the immature Douglas-fir to continue growing.

Community Phase 2.2: herb-dominated
This plant community will develop within the first 5 years since the last fire. Dominant grasses are Geyer’s sedge, bluegrass, and slender wheatgrass with heartleaf arnica and feathery false lily of the valley as common forbs. A small component of introduced species may also 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: re-sprouting aspen, maple, oak/ herbaceous understory
A plant community co-dominated by shrubs and herbs will develop approximately 5 to 60 years post fire. 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 Pathway 2.3b:
Heavy browsing will lead to Phase 2.1, a densely canopied Douglas-fir community with a sparse 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/ Douglas-fir
A stand of mature aspen intermixed with 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 more understory 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 Douglas-fir in the understory.

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 stand replacing wildfire, and further impacts from heavy continuous season-long grazing. Logging opens up the forest canopy allowing shade tolerant understory for 20 to 30 years. Secondary and tertiary disturbances produce an assemblage of vegetation from degraded temporary meadows to further simplified forests. A key indicator of the approach to this transition the presence of dominant trees that have reached the size required for commercial harvest. The trigger is a management decision. The second cycle of cutting typically is a clearcut, where all stems are downed, slash piled and burned.

State 3 Tertiary Forest/ Degraded State
State 3 is characterized by tertiary forests that are further degraded in both understory and remnant tree layers. Active fire suppression speeds up the recovery of dominance by woody plants. Less predictable changes in the vegetation of State 3 will ensue due to global climate changes.

Community Phase 3.1: densely canopied Douglas-fir/ sparse understory
This plant community (3.1) is characterized by a stand of mature Douglas-fir. A sparse understory of Geyer’s sedge and bluegrass may be present.

Community Pathway 3.1a:
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 3.1b:
The removal of only the mature Douglas-fir will allow aspen to return and the immature Douglas-fir to continue growing.

Community Phase 3.2: herb-dominated
This plant community will develop within the first 5 years since the last fire. Dominant grasses are Geyer’s sedge, bluegrass, 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: re-sprouting aspen, maple, oak/ herbaceous understory
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 60-80 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 Douglas-fir become well established in the understory 80 years after the last fire or complete tree removal.

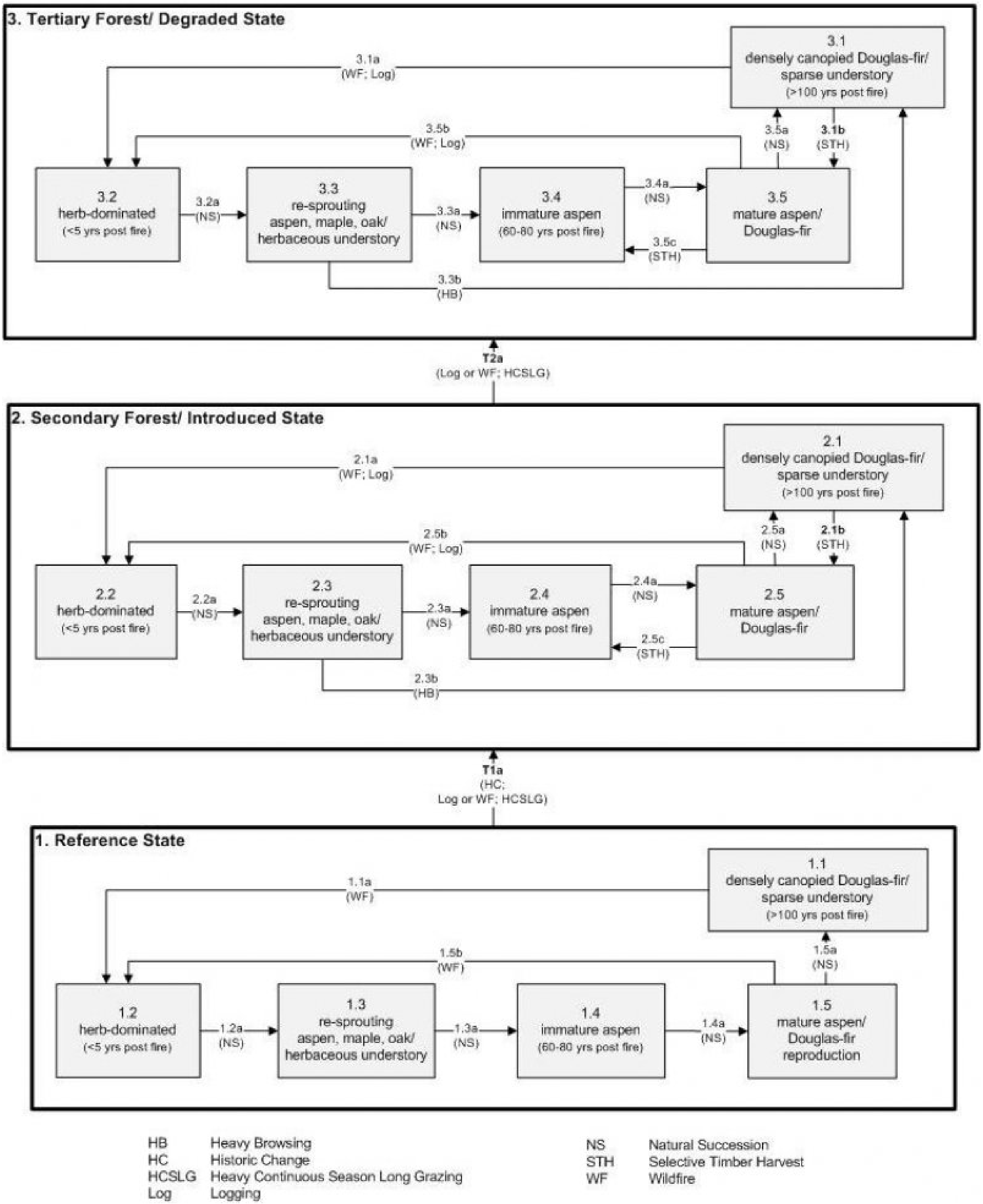
Community Phase 3.5: mature aspen/ Douglas-fir
A stand of mature aspen intermixed with Douglas-fir will develop approximately 80 to 100 years after the last fire or complete tree removal.

Community Pathway 3.5a:
After about 100 years following the last fire, 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 clearcut. Logging opens up the forest canopy allowing more understory 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 Douglas-fir in the understory.

State and transition model



State 1
Reference State

Community 1.1
Reference State

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	75	225	375
Grass/Grasslike	15	45	75
Forb	10	30	50
Total	**100**	**300**	**500**

Additional community tables

Animal community

Livestock Grazing: This site is suited to cattle and sheep grazing during the summer and fall. Livestock will often concentrate on this site taking advantage of the shade and shelter offered by the tree overstory. Many areas are not used because of steep slopes or lack of adequate water. Attentive grazing management is required due to steep slopes and erosion hazards. Harvesting trees under a sound management program can open up the tree canopy to allow increased production of understory species desirable for grazing.

Wildlife species seeking food and cover in this forest site include elk, mule deer, bear, porcupine, snowshoe hare, owl, and woodpecker.

Wood products

6. Silvicultural Practices

a. Douglas-fir seedlings establishment may be improved by shade cards that will protect the trees from intense heat on southern or western aspects and by the presence of litter if it does not prevent the seed from reaching moist soil and does not absorb light rain showers.

b. Prescription burning may be used to reduce competition before replanting a harvested site.

c. Douglas-fir will not regenerate in the shade. Seed tree harvests may be used to regenerate a site with or without prescription burning. Shelter wood cut should be avoided for Douglas-fir regeneration.

d. Harvest cut selectively or in small patches (size dependent upon site conditions) to enhance forage production.

1. Precommercial thinning and improvement cutting – removal of poorly formed, diseased, and low vigor trees of little or no value.

2. Commercial thinning– selectively harvest surplus trees to achieve desired spacing. Save large, healthy, full-crowned trees. Do not select only “high grade” trees during harvest.

e. Pest Control – use necessary and approved control for specific pests or diseases.

f. Fire hazard – fire is usually not a problem in mature grazed stands.

Other information

4. Limitations and Considerations

a. Potential for sheet and rill erosion is moderate to severe depending on slope.

b. Moderate to severe equipment limitations on steeper slopes and on sites having extreme surface stoniness.

c. Proper spacing is the key to a well managed multiple use and multi-product forest.

5. Essential Requirements

a. Adequately protect from uncontrolled burning.

b. Protect soils from accelerated erosion.

c. Apply proper grazing management practices (see management guides)

Table 6. Representative site productivity

Common Name	Symbol	Site Index Low	Site Index High	CMAI Low	CMAI High	Age Of CMAI	Site Index Curve Code	Site Index Curve Basis	Citation
Rocky Mountain Douglas-fir	*PSMEG*	48	50	30	40	–	–	–	

Inventory data references

When available, monitoring data (of various types) were employed to validate more subjective inferences made in this diagram. See the complete files in the office of the State Range Conservationist for more details.

Other references

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Approval

Kirt Walstad, 3/05/2024

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:**
