USDA Natural Resources Conservation Service

Ecological site F047XA532UT
High Mountain Stony Loam (Douglas-fir)

Last updated: 9/19/2019
Accessed: 05/21/2025

General information

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

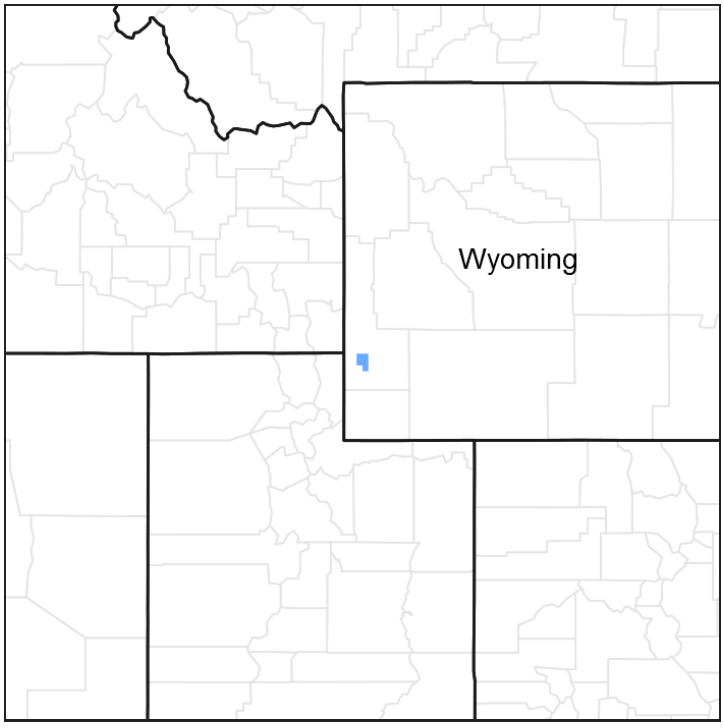

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 047X–Wasatch and Uinta Mountains

MLRA 47 occurs in Utah (86 percent), Wyoming (8 percent), Colorado (4 percent), and Idaho (2 percent). It encompasses approximately 23,825 square miles (61,740 square

kilometers). The northern half of this area is in the Middle Rocky Mountains Province of the Rocky Mountain System. The southern half is in the High Plateaus of the Utah Section of the Colorado Plateaus Province of the Intermontane Plateaus. Parts of the western edge of this MLRA are in the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. The MLRA includes the Wasatch Mountains, which trend north and south, and the Unita Mountains, which trend east and west. The steeply sloping, precipitous Wasatch Mountains have narrow crests and deep valleys. Active faulting and erosion are a dominant force in controlling the geomorphology of the area. The Uinta Mountains have a broad, gently arching, elongated shape. Structurally, they consist of a broadly folded anticline that has an erosion-resistant quartzite core. The Wasatch and Uinta Mountains have an elevation of 4,900 to about 13,500 feet (1,495 to 4,115 meters). The mountains in this area are primarily fault blocks that have been tilted up. Alluvial fans at the base of the mountains are recharge zones for the basin fill aquifers. An ancient shoreline of historic Bonneville Lake is evident on the footslopes along the western edge of the area. Rocks exposed in the mountains are mostly Mesozoic and Paleozoic sediments, but Precambrian rocks are exposed in the Uinta Mountains. The Uinta Mountains are one of the few ranges in the United States that are oriented west to east. The southern Wasatch Mountains consist of Tertiary volcanic rocks occurring as extrusive lava and intrusive crystalline rocks.

The average precipitation is from 8 to 16 inches (203 to 406 mm) in the valleys and can range up to 73 inches (1854 mm) in the mountains. In the northern and western portions of the MLRA, peak precipitation occurs in the winter months. The southern and eastern portions have a greater incidence of high-intensity summer thunderstorms; hence, a significant amount of precipitation occurs during the summer months. The average annual temperature is 30 to 50 degrees F (-1 to 15 C). The freeze-free period averages 140 days and ranges from 60 to 220 days, generally decreasing in length with elevation.

The dominant soil orders in this MLRA are Aridisols, Entisols, Inceptisols, and Mollisols. The lower elevations are dominated by a frigid temperature regime, while the higher elevations experience cryic temperature regimes. Mesic temperature regimes come in on the lower elevations and south facing slopes in the southern portion of this MLRA. The soil moisture regime is typically xeric in the northern part of the MLRA, but grades to ustic in the extreme eastern and southern parts. The minerology is generally mixed and the soils are very shallow to very deep, generally well drained, and loamy or loamy –skeletal.

Ecological site concept

The soils of this site formed in colluvium, alluvium, and residuum derived from various sedimentary and igneous rocks. They are well drained and can be shallow, but are predominately moderately deep to deep. Rock fragments may or may not be present on the soil surface, but make up more than 35 percent of the soil profile by volume. Twigs, pine needles and other litter may cover the surface of the mineral soil. Available water-holding capacity ranges from 3 to 4 inches in the upper 40 inches of soil. Permeability is moderately slow to moderate. The soil moisture regime can be xeric but is predominately udic and the soil temperature regime can be frigid but is predominately cryic.

This site occurs on predominantly north-facing mountain slopes at elevations between 5,800 and 10,200 feet. At higher elevations this site is found on all aspects. Slopes are moderately steep to very steep ranging from 30 to 70 percent. Runoff is high to very high and flooding and ponding do not occur on this site.

Similar sites

F047XA512UT	**High Mountain Loam (Douglas-fir)** This site is also dominated by Douglas fir, but the soil has less than 35 percent rock fragments by volume.

Table 1. Dominant plant species

Tree	(1) *Pseudotsuga menziesii*
Shrub	(1) *Mahonia*
Herbaceous	(1) *Bromus*

Physiographic features

This site occurs on predominantly north-facing mountain slopes at elevations between 5,800 and 10,200 feet. At higher elevations this site is found on all aspects. Slopes are moderately steep to very steep ranging from 30 to 70 percent. Runoff is medium to high and flooding and ponding do not occur on this site.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Mountain
Flooding frequency	None
Ponding frequency	None
Elevation	1,768–3,109 m
Slope	30–70%
Aspect	NW, N, NE

Climatic features

The climate of this site is characterized by cold snowy winters and cool dry summers. Annual precipitation ranges from 28 to 32 inches with most of the precipitation falling as winter snow or spring rain. Timing of precipitation is 60 - 65 percent during the plant dormant period (October to March). As precipitation decreases and temperature increases in July and August, plant growth is reduced for all species and some herbaceous species go into dormancy.

Table 3. Representative climatic features

Frost-free period (average)	70 days
Freeze-free period (average)	96 days
Precipitation total (average)	813 mm

Influencing water features

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

Soil features

The soils of this site formed in colluvium, alluvium, and residuum derived from various sedimentary and igneous rocks. They are well drained and can be shallow but are predominately moderately deep to deep. Rock fragments may or may not be present on the soil surface, but make up more than 35 percent of the soil profile by volume. Twigs, pine needles and other litter may cover the surface of the mineral soil. Available water-holding capacity ranges from 3 to 4 inches in the upper 40 inches of soil. Permeability is moderately slow to moderate. The soil moisture regime can be xeric but is predominately udic and the soil temperature regime can be frigid but is predominately cryic.

Table 4. Representative soil features

Parent material	(1) Colluvium–sedimentary rock (2) Slope alluvium–sedimentary rock (3) Till–sedimentary rock
Surface texture	(1) Gravelly loam (2) Loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	51–152 cm
Soil depth	51–152 cm
Surface fragment cover <=3"	0–15%
Surface fragment cover >3"	0–10%
Available water capacity (0-101.6cm)	7.62–10.16 cm
Calcium carbonate equivalent (0-101.6cm)	0%

Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	6.1–7.3
Subsurface fragment volume <=3" (Depth not specified)	15–25%
Subsurface fragment volume >3" (Depth not specified)	15–25%

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 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.

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.

State and transition model

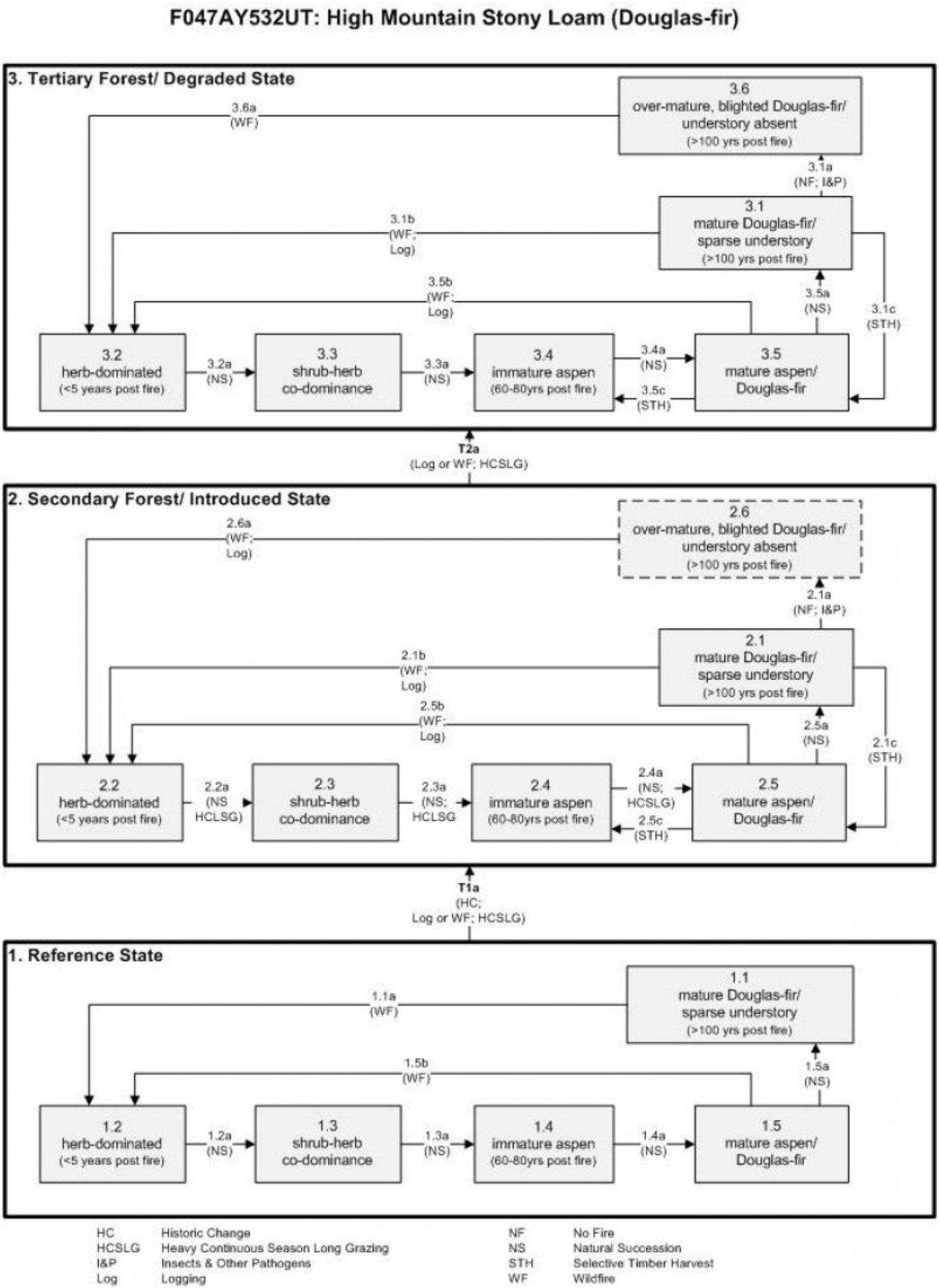

Figure 4. State and Transition Model

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 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, Douglas-fir (*Pseudotsuga menziesii*) would have been the dominant species occupying the site, with a sparse shade-tolerant understory (1.1) due to tree competition, overstory shading, and duff accumulation. Douglas-fir replaces itself without wildfire and was the climatic climax. Wildfire (1.1a) would have temporarily 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 first 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 Douglas-fir seedlings (1.5). Ultimately Douglas-fir would have outcompeted aspen, returning to the climax vegetation (1.1). Wildfire (1.1a, 1.5b) would have been the primary disturbance factor prior to colonization. Early successional stages were shorter in duration. A more complete list of species by lifeform for the Reference State is available in the accompanying tables in the “Plant Community Composition by Weight and Percentage” section of this document.

Community 1.1
Reference State

Community Phase 1.1: mature Douglas-fir/ diminished 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.), and shade tolerant herbs. 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, bluegrass, slender wheatgrass (*Elymus trachycaulus*), would have been the dominant species, along with shade intolerant herbs. 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*), chokecherry (*Prunus virginiana*), Saskatoon serviceberry (*Amelanchier alnifolia*), and Oregon boxleaf (*Paxistima myrsinites*), among others. 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, a seral species, while Douglas-fir begun to establish itself under other nurse species. 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 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, fuel wood harvest, 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 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. b. Productivity Rating of Major Understory Species: Productivity Rating Index: This rating provides an index to the relative importance of species in the understory community as affected by overstory canopy cover.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	73	219	364
Grass/Grasslike	28	84	140
Forb	11	34	56
Total	**112**	**337**	**560**

State 2
Secondary Forest/ Introduced State

Community 2.1
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 the fire regime, a mature stand of Douglas-fir with a sparse understory component is expected at this site (2.1) (Alexander 1985, 1988). 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 develop further 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 Douglas-fir (2.5). Ultimately Douglas-fir will out-compete aspen, returning the site to the climax vegetation (2.1). In some areas where wildfire has been prevented, Douglas-fir trees may become over-mature (2.6) and consequently are more susceptible to infestation by insects and other 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 Douglas-fir with a sparse understory of Geyer's sedge and bluegrass. Shade-tolerant forbs may also be present. Community Pathway 2.1a: With fire exclusion, or well over 100 years since last fire, a Douglas-fir 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 herbs and shrubs to flourish for 20 to 30 years. Community Pathway 2.1c: 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 following the last fire or complete tree removal. Dominant grasses are Geyer's sedge, bluegrass, slender wheatgrass; shade-intolerant forbs are also present. A small component of introduced species, and many annuals, 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/ 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 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 Douglas-fir in the understory. Community Phase 2.6: over-mature, blighted Douglas-fir/ 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 (from 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

Community 3.1
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 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, bluegrass, and shade-tolerant forbs may be present. Community Pathway 3.1a: With fire exclusion, or well over 100 years since last fire, a Douglas-fir stand will ultimately deteriorate 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 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 following the last fire or complete tree removal. Dominant grasses are Geyer’s sedge, bluegrass, and slender wheatgrass. Shade intolerant forbs will also be present. 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 60-80 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 following fire. 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. Logging opens up the forest canopy, allowing grasses, herbs, and shrubs to dominate for 20 -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. Community Phase 3.6: over-mature, blighted Douglas-fir/ 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 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.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Shrubs**			73–364	
Grass/Grasslike					
0	**Grasses**			112–560	
Forb					
0	**Forbs**			11–56	

Animal community

a. 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.

b. Initial Stocking Rates

Stocking rates vary in accordance with such factors as kind and class of grazing animal, season of use, and fluctuation in climate. Actual use records for individual sites, together

with a determination of the degree to which the sites have been grazed and an evaluation of trend in site condition, offer the most reliable basis for developing initial stocking rates.

Selection of initial stocking rates for given grazed units is a planning decision. This decision should be made only after careful consideration of the total resources available, evaluation of alternatives for use and treatment, and establishment of objectives by the decisionmaker.

2. Wildlife
b. List of Potential Species Present

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

Recreational uses

This site has aesthetic values and can be suitable for camping when slopes are gentle. Hunting is difficult on this site due to the dense tree canopy, though big game regularly use this site in the fall.

Wood products

6. Silvicultural Practices

a. Douglas-fir seedling 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 to mature for the final harvest cut. Do not select only “high grade” trees during thinning.

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. Install firebreaks or firelines as necessary.

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 7. 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*	41	51	30	40	–	–	–	

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Contributors

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Approval

Scott Woodall, 9/19/2019

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	
Approved by	
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:**
