

Ecological site group R006XG115WA

Shallow stony, 6000-7600 feet

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Key Characteristics

None specified

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.

Physiography

Hierarchical Classification

Major Land Resource Area (MLRA): 6 – Cascade Mountains, East Slope

Land Resource Unit (LRU) – Common Resource Areas (CRA):

- 6.1 – North Cascades Subalpine/Alpine
- 6.2 – Pasayten/Sawtooth Highlands
- 6.3 – Okanogan Pine/Fir Hills
- 6.4 – Chelan Tephra Hills
- 6.5 – Chiwaukum Hills and Lowlands

Site Concept Narrative:

For MLRA 6 four ecological site descriptions (ESD) use Shallow Stony in the name:

1. Shallow stony, prairie for the prairies
2. Shallow stony, 2,800 - 4,000 feet
3. Shallow stony, 4,000 – 6,000 feet
4. Shallow stony, 6,000 – 7,600 feet

The ESD below is for Shallow Stony, 6000-7600 feet.

Diagnostics:

More than 80% of the landscape of MLRA 6 is forest. This site stands out because of a lack of trees.

Shallow Stony, 6,000 – 7,600 feet is an upland site at higher elevations of MLRA 6 in the 25-35” precipitation zone. Soils are both shallow (10-20” deep) and stony to extremely stony. Soils have a stony or cobbly surface and rock fragments (35% or more) throughout the profile. Soil textures loam, silt loam and clay loam are most common. The soil surface is mostly bare soil, soil biotic crust or rock.

Shallow Stony, 6,000 – 7,600 feet is a sparsely vegetated grassland-forb site. Not one or two species dominates this site. Instead, dominance is shared by a complex of species including native forbs, prairie junegrass, and grass-like species (sedges & rushes). Mountain big sagebrush has a minor role on this site.

Principle Vegetative Drivers:

The soil (shallow soil depth and stones throughout the profile) and the high elevation (6000-7600 feet) drive the vegetative expression of this site. The soil depth limits deep-rooted species, plus the soil depth and stones limit the water holding capacity in the profile. Thus, plant production is quite limited for Shallow Stony, 6,000 – 7,600 feet sites. The elevation plays an important role in the diversity and composition of species.

Influencing Water Features:

A plant's ability to grow on a site and overall plant production is determined by soil-water-plant relationships

1. Whether rain and melting snow runs off-site or infiltrates into the soil
2. Whether soil condition remain aerobic or become saturated and become anaerobic
3. Water drainage and how quickly the soil reaches wilting point

With adequate cover of live plants and litter, there are no restrictions on this ecological site with water infiltrating into the soil. In some years Shallow Stony sites can become saturated due to the shallow soil depth, but with good drainage would remain anaerobic for only a short period of time. This site has an extremely restricted water holding capacity, so plant production is quite limited.

Physiography of MLRA 6:

Most of MLRA 6 is in the Northern and Middle Cascade Mountains. This mountainous area consists of sharp alpine summits with some higher volcanic cones to the west, and lower lying foothills to the east. Strongly sloping mountains and U-shaped valleys are dominant in the north, with eroded basalt plateaus more typical in the south. The East Slope of the Cascades is a transitional area between the moist, rugged Cascade Mountains to the west and the drier, lower lying Columbia Basalt Plateau to the east. MLRA 6 has some of the landforms typical of both mountains and plateaus.

Physiographic Division: Pacific Mountains

Physiographic Province: Cascade-Sierra Mountains

Physiographic Sections: Northern Cascade and Middle Cascade Mountains

Landscapes: Mountains

Landform: Side-slopes, shoulders, summits, benches

Elevation: Dominantly 5,000 to 7,800 feet

Central tendency: 6,000 to 7,600 feet

Slope: Total range: 15 to 90 percent

Central tendency: 30 to 50 percent

Aspect: Dominantly occurs on southerly aspect, but may occur on all aspects

Geology:

MLRA 6 consists of Pre-Cretaceous metamorphic rocks cut by younger igneous intrusives. Tilted blocks of marine shale, carbonate, and other sediments occur in the far north, and some younger continental, river-laid sediments occur around Leavenworth, WA. Columbia River basalt is dominant in the southern portion of the state. Alpine glaciation has left remnants of glacial till, debris, and outwash in the northern part of this MLRA.

Climate

The climate across MLRA 6 is characterized by moderately cold, wet winters, and hot, dry summers, with limited precipitation due to the rain shadow effect of the Cascades. The average annual precipitation for most of the East Slope of the Cascades is 16-50 inches. Seventy-five to eighty percent of the precipitation comes late October through March as a mixture of rain and snow. The lowest precipitation occurs along the eastern edge, then increasing with rising elevation to the west. Most of the rainfall occurs as low-intensity, Pacific frontal storms during the winter, spring and fall. Rain turns to snow at the higher elevations. All areas receive snow in winter. Summers are relatively dry. The East Slopes experience greater temperature extremes and receive less precipitation than the west side of the Cascades. The shortest freeze-free periods occur along the western edge and the northern end of this MLRA, which are mountainous. The longest freeze-free periods occur along the Columbia River Gorge. First snow generally occurs by September first. Then there is a series of snowstorms that melt off until late October when snow no longer melts.

Mean Annual Precipitation:

Range: 25-60 inches

Central tendency: 25 – 40 inches
Soil moisture regime is xeric

Mean Annual Air Temperature:
Range: 35 to 43 degrees
Central tendency: 38 to 41 degrees
Soil temperature regime is cryic

Frost-free Period (days):
Total range: 50 to 90
Central tendency: 60 to 80
The growing season is early June to early August.

Soil features

Edaphic:
Shallow Stony, 6,000 – 7,600 feet ecological site commonly occurs with Very Shallow, Stony south aspect, 6,000 – 7,600 feet and subalpine fir forest ecological sites.

Representative Soil Features:

This ecological site components are dominantly Lithic and Vitrixerandic taxonomic subgroup of Humicrypts great group of the Inceptisols. Soils are dominantly shallow. Average available water capacity of about 1.5 inches (3.8 cm) in the 0 to 40 inches (0-100 cm) depth range.

Soil parent material is dominantly mixed volcanic ash in the upper part of the soil over colluvium and residuum.

The associated soils are Burget, Milling, Shermount, Lithic Dystrocrypts and similar soils.

Dominate soil surface is stony ashy coarse sandy loam to channery ashy loam.

Dominant particle-size class is loamy-skeletal or loamy

Fragments on surface horizon > 3 inches (% Volume):

Minimum: 0
Maximum: 2
Average: 0

Fragments within surface horizon > 3 inches (% Volume):

Minimum: 0
Maximum: 30
Average: 15

Fragments within surface horizon ≤ 3 inches (% Volume):

Minimum: 5
Maximum: 30
Average: 15

Subsurface fragments > 3 inches (% Volume):

Minimum: 10
Maximum: 50
Average: 25

Subsurface fragments ≤ 3 inches (% Volume):

Minimum: 10
Maximum: 50
Average: 30

Drainage Class: Well drained
Water table depth: Greater than 60 inches

Flooding:
Frequency: None

Ponding:
Frequency: None

Saturated Hydraulic Conductivity Class:
0 to 10 inches: High
10 to 40 inches: High

Depth to root-restricting feature (inches):
Minimum: 10
Maximum: 20

Electrical Conductivity (dS/m):
Minimum: 0
Maximum: 0

Sodium Absorption Ratio:
Minimum: 0
Maximum: 0

Calcium Carbonate Equivalent (percent):
Minimum: 0
Maximum: 0

Soil Reaction (pH) (1:1 Water):
0 - 10 inches: 5.1 to 7.3
10 - 40 inches: 5.1 to 7.3

Available Water Capacity (inches, 0 – 40 inches depth):
Minimum: 1.2
Maximum: 2.3
Average: 1.5

Vegetation dynamics

Ecological Dynamics:

Shallow Stony, 6,000 – 7,600 feet produces about 300-600 pounds/acre of biomass annually.

Most shrub steppe and grassland ecological sites in eastern Washington are dominated by one or at most two species. Shallow Stony, 6,000 – 7,600 feet dominance is shared by a complex of grasses and forbs and sedges. Native forbs have the largest presence while, prairie junegrass and grass-like sedges and rushes are also important. Short bluegrasses and alpine timothy are the next in importance.

Prairie junegrass has a narrow and dense panicle inflorescence with a gap. Bluegrasses have an open panicle inflorescence with no awns and leaves with what has been the railroad track. Pinegrass is rhizomatous to sometimes loosely tufted and has a contracted to somewhat contracted panicle inflorescence. One-spike oatgrass is a low, densely tufted grass that is easily identified by the densely hairy sheath. One-spike oatgrass produces one or occasionally two spikelets at the tip of the stem. Alpine timothy is a bunchgrass to short rhizomatous perennial with a densely packet flowerhead, and the leaves are rolled rather than folded.

This complex of forbs, grasses, and sedges provide a crucial and extensive network of roots to the soil profile.

These roots create a massive underground source to stabilize the soils, provide organic matter and nutrients inputs, and help maintain soil pore space for water infiltration and water retention in the soil profile. The extensive rooting system of mid-sized bunchgrasses leave very little soil niche space available for invasion by other species. This network of roots can compete with, and suppress, the spread of exotic weeds. The stability and resiliency of the reference communities is directly linked to this root-network.

Shallow Stony 6000-7600 feet is resistant to most natural disturbances and is ecologically stable. Due to 35-75% surface rocks and limited forage, this ecological site is not attractive to grazing animals and so are rarely if ever grazed. The vegetative cover is too low to carry fire and vegetation is green during fire season, so these sites rarely burn. Based on inherent protection from both fire and grazing and the fact that invasive species are not adapted to the harsh conditions and short growing season, most Shallow Stony sites are stable at 6000-7600 feet.

However, if this site does experience a major disturbance it is not resilient and may be extremely difficult to stabilize once altered. For example, vehicle traffic when the soil is saturated will leave ruts that remain for years to come.

For more grazing management information refer to Range Technical Notes found in Section I Reference Lists of NRCS Field Office Technical Guide for Washington State.

Supporting Information:

Associated Sites:

Shallow Stony 6,000 – 7,600 feet is associated with other ecological sites at high elevation in MLRA 6 including Very Shallow, Stony South Aspect 6000 – 7600 feet, subalpine fir, and other forest sites.

Similar sites:

At lower elevations in MLRA 6, Shallow Stony 2800-4000 feet and Shallow Stony 4000-6000 feet are similar. Other MLRAs also have Shallow Stony ecological sites.

Inventory Data References (narrative):

Data to populate Reference Community came from several sources: (1) NRCS ecological sites from 2004, (2) Soil Conservation Service range sites from 1980s and 1990s, (3) Daubenmire's habitat types, and (4) ecological systems from Natural Heritage Program

Major Land Resource Area

MLRA 006X

Cascade Mountains, Eastern Slope

Stage

Provisional

Contributors

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State and transition model

State & Transition Diagram for Shallow Stony, 6,000–7,600 feet (MLRA 6)

This state and transition model (STM) explain the general ecological dynamics for the Shallow Stony, 6,000 – 7,600 feet ecological site. The STM illustrates the common plant communities that can occur on the site. Boxes around each state represent the ecological threshold, which if crossed, is not reversible without human intervention. Arrows within a state represent the pathway between plant communities, while the arrows between states represent the transition or recovery between the states. Plant species composition is represented as a percentage of total annual production (pounds). The composition of pristine sites can vary somewhat due to variations in site conditions.

Note: looking through Will Keller's inventory worksheets, Community 1.2 is about as bad as it gets for Shallow Stony 6000-7600 feet.

Reference State: Shrub Steppe With no Invasive Species

Reference Community: Bunchgrass-Forb

40% native forbs
15% prairie junegrass
20-25% other native grasses
15% grass-like (sedges & rushes)
5-10% mountain sagebrush

1.1a

1.1b

Community 1.2: Native Forbs

10-30% native grasses, sedges & rushes
60-80% native forbs
10-15% short grasses

Reference Community 1.1 for Shallow Stony, 6,000 – 7,600 feet (MLRA 6)

Plant species composition is represented as a percentage of total annual production (pounds). The composition of pristine sites can vary somewhat due to variations in site conditions. Pounds listed below are the maximum allowable for Similarity Index. Many numbers have been rounded to not show more precision than our current state of knowledge.

Note: Shallow Stony 6000-7600 feet has shared dominance with native forbs, mid-size bunchgrasses, and grass-like species all being important.

Similarity Index		Similarity Index	
Non-Sprouting Shrubs – Minor		Sprouting Shrubs – Trace	
5-10% 75 lbs.		Trace	
ARTRV	mountain big sagebrush	VASC	grouse whortleberry
		JUCO	juniper
		CAME	mountain heather
		DAFR	shrubby cinquefoil
Mid-Size Bunchgrasses – Subdominant		Other Mid-Size Bunchgrasses – Minor	
15% 100 lbs.		5% 30 lbs.	
KOMA	prairie junegrass	FEID	Idaho fescue
		DAUN	one-spike oatgrass
		MEBU	oniongrass
		ELTR7	slender wheatgrass
Short Grasses – Minor		Rhizomatous Grass – Minor	
10-15% 100 lbs.		5% 30 lbs.	
POA	bluegrass species 2x	CARU	pinegrass
PHAL	alpine timothy		
Dominant Native Forbs		Grass-Like – Subdominant	
		15% 100 lbs.	
ERIOG	buckwheat	CAPH2	dunhead sedge
PENST	penstemon (minor)	CAREX	other sedge species
ALLIU	wild onion (minor)	LUSP4	spiked woodrush
ANAR	Angelica		
		40% 250 lbs.	
		Below	Normal
		Above	
Estimated Production (pounds / acre)		300	450
		600	

State 1

Reference State: Shrub Steppe with no invasive species

State 1 Narrative: State 1 represents grassland steppe with no invasive or exotic weed species. Each functional, structural group would have one or more native species. Communities with a dominance of annual grasses are not known to occur on High Mountain Shallow Stony sites. Transitions from State to State: There are no transitions for Shallow Stony, 6,000 – 7,600 feet, as there is no experience with invasive species. Recovery: Recovery is not necessary for Shallow Stony, 6,000 – 7,600 feet. Invasive species are not adapted to the harsh conditions and short growing season. If invasive species established dominance, it would be considered non-reversible. Due to shallow soil depth, surface rock and rock within the soil profile, and the equipment limitations thereof, seeding is not practical for the Shallow Stony ecological site. Restoration of native grasses and sedges, sagebrush, native forbs and the

soil biotic crust would be very problematic at best on Shallow Stony, 6,000 – 7,600 feet. Seeds must germinate. Seedlings and plugged plants need soil moisture and time to become established. In most years, seeds and plugs may not have a chance as site conditions on Shallow Stony can change quickly. Drying winds and bright sun can turn a snowy or muddy site into a hard crust before plants are established. So, the timing of all recovery efforts would have an extremely narrow window of opportunity on Shallow Stony. Perhaps the only avenue for recovery would be to plant plugs of native species which is a very costly and risky proposition.

Community 1.1

Reference Community

Native Bunchgrass Complex – Native Forbs The Reference Community 1.1 is dominated by a complex of native grasses, native forbs and sedges. Mountain big sagebrush is minor in the reference Community.

Community 1.2

Native Forbs

Unpalatable Native Forbs

Pathway 1.1a

Community 1.1 to 1.2

1.1a Result: Transition from grass dominated Reference Community 1.1 to native forb dominated Community 1.2. Primary Trigger: Grazing pressure (heavy grazing intensity, season long grazing or frequent critical period grazing) to native grasses and other palatable species. Pressure can come from cattle or pikas, a relative of rabbits. Ecological Process: consistent defoliation pressure to prairie junegrass, bluegrass, pinegrass and oatgrass results in poor vigor and shrinking crowns. Unpalatable forbs gain the competitive edge and set new seedlings to take advantage of released resources and niche space. As this elevation mountain big sagebrush does not get aggressive. Indicators: declining cover of native bunchgrasses and increasing cover of forbs

Pathway 1.1b

Community 1.2 to 1.1

1.1b Result: Transition from Community 1.2 to Reference Community Primary Trigger: improved grazing management (proper intensity and timing) Ecological Process: with defoliation pressure removed grasses have improved vigor and set new seedlings or establishes new shoots via tillering. Indicators: increasing plant crowns and cover of bunchgrasses and declining cover of forbs and shrubs. References: Boling M., Frazier B., Busacca, A., General Soil Map of Washington, Washington State University, 1998 Daubenmire, R., Steppe Vegetation of Washington, EB1446, March 1968 Davies, Kirk, Medusahead Dispersal and Establishment in Sagebrush Steppe Plant Communities, Rangeland Ecology & Management, 2008 Environmental Protection Agency, map of Level III and IV Ecoregions of Washington, June 2010 Miller, Baisan, Rose and Pacioretty, "Pre and Post Settlement Fire regimes in mountain Sagebrush communities: The Northern Intermountain Region Natural Resources Conservation Service, map of Common Resource Areas of Washington, 2003 Rapid Assessment Reference Condition Model for Wyoming sagebrush, LANDFIRE project, 2008 Rocchio, Joseph & Crawford, Rex C., Ecological Systems of Washington State. A Guide to Identification. Washington State Department of Natural Resources, October 2015. Pages 156-161 Inter-Mountain Basin Big Sagebrush. Rouse, Gerald, MLRA 8 Ecological Sites as referenced from Natural Resources Conservation Service-Washington FOTG, 2004 Soil Conservation Service, Range Sites for MLRA 8 from 1980s and 1990s Tart, D., Kelley, P., and Schlafly, P., Rangeland Vegetation of the Yakima Indian reservation, August 1987, YIN Soil and Vegetation Survey

Citations