

# Ecological site group R006XG112WA

## Shallow Stony, 4000-6000 feet

Last updated: 09/21/2023  
Accessed: 05/02/2024

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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
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 4000-6000 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, 4,000-6,000 feet, is an upland site at mid-elevations in the 18-25" precipitation zone of MLRA 6. 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, 4000-6000 feet is a sparsely vegetated grass-forb site. This ecological site exhibits species richness in a diverse array of grasses and forbs. In the reference state Idaho fescue, prairie junegrass and bluebunch wheatgrass are dominant, while native forbs are subdominant. Sedges, bluegrasses, other mid-grasses and shrubs are present but minor species on the reference community.

Principle Vegetative Drivers:

The soil (dominantly shallow soil depth and stones throughout the profile) and the elevation (4000-6000 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 Mountain Shallow Stony 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 in Washington State 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 3,500 to 6,500 feet

Central tendency: 4,000 to 6,000 feet

Slope: Total range: 15 to 90 percent

Central tendency: 30 to 60 percent

Aspect: Occurs 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.

Mean Annual Precipitation:

Range: 16-28 inches

Central tendency: 18 – 22 inches

Soil moisture regime is xeric

Mean Annual Air Temperature:  
Range: 40 to 52 degrees  
Central tendency: 42 to 48 degrees  
Soil temperature regime is frigid and mesic

Frost-free period (days):  
Total range: 70 to 140  
Central tendency: 90 to 120  
The growing season is early May through July.

## **Soil features**

Edaphic:  
Shallow stony, 4,000 – 6,000 feet, ecological site commonly occurs with Very Shallow, Stony South Aspect 4,000 – 6,000 feet and forest ecological sites. This ecological site is often associated with rock outcrop.

Representative Soil Features:  
This ecological site components are dominantly Lithic taxonomic subgroup of Haploxerolls great group of the Mollisols. Soils are dominantly shallow. Average available water capacity of about 2.0 inches (5.1 cm) in the 0 to 40 inches (0-100 cm) depth range.

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

The associated soils are Johntom, Wynhoff and similar soils.

Dominant soil surface is gravelly loam to very stony ashy sandy loam.

Dominant particle-size class is loamy-skeletal.

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  $\leq$  3 inches (% Volume):  
Minimum: 5  
Maximum: 30  
Average: 15

Subsurface fragments > 3 inches (% Volume):  
Minimum: 10  
Maximum: 50  
Average: 25

Subsurface fragments  $\leq$  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: Moderately high and high  
10 to 40 inches: Moderately high and high

Depth to root-restricting feature (inches):  
Minimum: 10  
Maximum: 40

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: 5.6 to 7.3  
10 - 40 inches: 5.6 to 7.8

Available Water Capacity (inches, 0 – 40 inches depth):  
Minimum: .7  
Maximum: 2.7  
Average: 2.0

## **Vegetation dynamics**

Ecological Dynamics:  
Shallow Stony, 4,000-6,000 feet produces about 300-600 pounds/acre of biomass annually.

Idaho fescue, bluebunch wheatgrass and prairie junegrass, three mid-sized perennial cool-season bunchgrasses, are at the core of Shallow Stony 4000-6000 feet and warrant a degree of understanding.

Idaho fescue, bluebunch wheatgrass and prairie junegrass, three mid-sized bunchgrasses, are at the core of this ecological site and warrant a degree of understanding. Idaho fescue is a shorter grass and has a dense clump of shoots with a more open awned panicle inflorescence. Prairie junegrass has a narrow and dense panicle inflorescence with a gap, while bluebunch wheatgrass has an awned or awnless inflorescence arranged in a spike.

These three grasses provide a crucial and extensive network of roots to the upper portions (up to 48" deep in soils with no root-restrictive horizons) of 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 drought resistant root can compete with, and suppress, the spread of exotic weeds.

The stability and resiliency of the reference communities is directly linked to the health and vigor of Idaho fescue, bluebunch wheatgrass and prairie junegrass. As long as a good population of these three bunchgrasses is

maintained, the ecological sites is stable. If we lose these grasses the ecosystem crashes or unravels.

Shallow Stony 4000-6000 feet is resistant to most natural disturbances and 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, so these sites rarely burn. Based on inherent protection from both fire and grazing, and the fact that invasive species are not very well adapted at this elevation range, most Shallow Stony sites at 4000-6000 feet are stable.

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.

In Washington, bluebunch wheatgrass communities provide habitat for a variety of upland wildlife species.

#### Supporting Information:

##### Associated Sites:

Shallow Stony, 4,000-6,000 feet is associated with other ecological sites at mid-elevations in MLRA 6 including Stony South Aspect, 4000-6000 feet, Very Shallow and various forest sites.

##### Similar sites:

Within MLRA 6, Shallow Stony 2800-4000 feet and Shallow Stony 6000-7600 feet in MLRA 6 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, 4000-6000 feet (MLRA 6)

This state and transition model (STM) explain the general ecological dynamics for the Shallow Stony 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: There is no experience with invasive species on this ecological site, so there is only a Reference State

### Reference State: Shrub Steppe with No Invasive species

#### Reference Community: Bunchgrass-Forb

55% FEID, KOMA, PSSP6  
30% native forbs  
5% other mid-grasses  
5% short grasses  
<5% mountain sagebrush

1.1a

1.1b

#### Community 1.2: Forb-Grass-Shrub

45% native grasses  
40% native forbs  
15% mountain sagebrush

## **Reference Community 1.1 for Shallow Stony, 4,000–6,000 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.

Similarity Index		Similarity Index		
<b>Non-Sprouting Shrubs – Minor</b>				
less than 5% 25 lbs.				
ATRTV	mountain big sagebrush			
<b>Dominant Mid-Size Bunchgrasses</b>		<b>Other Mid-Size Bunchgrasses – Minor</b>		
55% 350 lbs.		5% 30 lbs.		
PSSP6	bluebunch wheatgr. (20-40%)	ELEL5	bottlebrush squirreltail	
FEID	Idaho fescue (10-15%)	ELTR7	slender wheatgrass	
KOMA	prairie junegrass (5-25%)	MEBU	onion grass	
		DAUN	one-spike oatgrass	
<b>Short Grass – Minor</b>		<b>Rhizomatous Grass – Minor</b>		
5% 30 lbs.		less than 5% 25 lbs.		
POA	bluegrass species 2x	CARU	pinegrass	
		<b>Grass-Like – Minor</b>		
		less than 5% 25 lbs.		
		CAREX	sedges	
<b>Native Forbs – Subdominant</b>		30% 200 lbs.		
LUPIN	lupine	ERIOG	buckwheat	
SEDUM	stonecrop	ORTHO	owl's clover	
ZIPA2	death camas	CANU3	Sego lily	
NOTR2	false agoseris	AGGR	bigflower agoseris	
LOMAT	lomatum / biscuitroot	ERIGE2	fleabane	
ASTRA	milkvetch / locoweed	ANMI3	littleleaf pussytoes	
ACMI2	yarrow	PENST	penstemon	
NEST5	narrowleaf goldenweed	PHLOX	phlox	
BALSA	balsamroot	SIDO	Douglas's catchfly	
			Below	Normal
<b>Estimated Production (pounds / acre)</b>			300	450
				Above
				600

### **State 1**

#### **Reference State: Shrub Steppe With No Invasive species**

State 1 Narrative: State 1 represents shrub 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 have never been seen on Mountain Shallow Stony. The Reference Community 1.1 is dominated by a trio of native bunchgrasses – prairie, junegrass, Idaho fescue and bluebunch wheatgrass. Forbs are prominent but mountain big sagebrush is a minor component in the Reference Community. At-risk Communities: Communities appear to resist invasion by invasive weeds. Transitions from State to State: There are no transitions from the Reference State to another state. Invasive species are not as competitive as they are at lower elevations. Recovery: Recovery is not necessary for Shallow Stony, 4,000-6,000 feet as there is no experience with invasive species on this site. If invasive species were to establish dominance, this condition would be considered non-reversible. Due to a short

growing season, shallow soil depth, surface rock and rock within the soil profile, and the equipment limitations thereof, seeding is not practical for the Shallow Stony 4000-6000 feet ecological site. Restoration of native grasses and sedges, sagebrush, native forbs and the soil biotic crust would be very problematic at best on this ecological site. 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 sites 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, 4,000-6,000 feet. 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**

Native Bunchgrass – Native Forb

## **Community 1.2**

### **Forb – Grass – Shrub**

Native Forbs & Bunchgrasses – Mountain Sagebrush

### **Pathway 1.1a**

#### **Community 1.1 to 1.2**

1.1a Result: pathway from bunchgrass dominated Reference Community 1.1 to grass – forb Community 1.2. Primary Trigger: Grazing pressure (heavy grazing intensity, season long grazing or frequent critical period grazing) to Idaho fescue, prairie junegrass and bluebunch wheatgrass, or heavy livestock trailing. Ecological Process: with consistent defoliation pressure Idaho fescue, bluebunch wheatgrass and prairie junegrass exhibit poor vigor and shrinking crowns. Unpalatable forbs and shrubs gain the competitive edge and take advantage of released resources and niche space new forb and shrub seedlings establish. Indicators: declining cover of Idaho fescue, prairie junegrass and bluebunch wheatgrass, and increasing cover of forbs and shrubs

### **Pathway 1.1b**

#### **Community 1.2 to 1.1**

1.1b Result: pathway from grass – forb Community 1.2 to bunchgrass dominated reference Community 1.1. Primary Trigger: Light to moderate fire and improved grazing management (proper intensity and timing). Ecological Process: Fire reduces shrub canopy and improved grazing management promotes improved vigor in the native bunchgrasses. Idaho fescue and prairie junegrass set new seedlings while bluebunch wheatgrass establishes new shoots via tillering Indicators: increasing cover of prairie junegrass, Idaho fescue and bluebunch wheatgrass, 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**