

# Ecological site group R006XG312WA

## Shallow Stony, 2800-4000 feet

Last updated: 09/21/2023  
Accessed: 05/10/2025

---

### 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

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

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, 2800-4000 feet.

Site Concept Narrative:

Diagnostics:

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

Shallow Stony, 2,800 – 4,000 feet, is a sparsely vegetated shrub steppe site in the 16-18” precipitation zone. Overstory shrubs are short with bitterbrush, mountain big sagebrush, threetip sagebrush and buckwheat. Bluebunch wheatgrass dominates the reference condition. Thurber’s needlegrass, squirreltail and needle and thread are other grasses. Native forbs fill the interspaces.

Principle Vegetative Drivers:

The shallow soil depth, stones throughout the profile and low elevation, 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. Due to elevation this site is hotter and drier than the other Shallow Stony site in MLRA 6. Thus, plant production is quite limited for these low elevation Shallow Stony sites.

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.

#### Physiographic Features:

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, canyons, plateaus and hills

Landform: Summits, shoulders, sideslopes, footslopes

Elevation: Dominantly 1,100 to 4,400 feet

Central tendency: 2,800 to 4,000 feet

Slope: Total range: 15 to 90 percent

Central tendency: 20 to 60 percent

Aspect: Dominantly on southerly aspect, but 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: 16-24 inches

Central tendency: 16 – 18 inches

Soil moisture regime is xeric

Mean Annual Air Temperature:  
Range: 40 to 52 degrees  
Central tendency: 44 to 50 degrees  
Soil temperature regime is dominantly mesic

Frost-free Period (days):  
Total range: 80 to 150  
Central tendency: 100 to 130  
The growing season is early April through the end of June.

## **Soil features**

Edaphic:

The Shallow Stony, 2,800 – 4,000 feet ecological site commonly occurs with Very Shallow, and Stony Foothills south aspect, bitterbrush, 2800-4000 feet ecological sites.

Representative Soil Features:

This ecological site components are dominantly Lithic and Vitrandic taxonomic subgroups of Haploxerolls great group of the Mollisols. Soils are dominantly shallow. Average available water capacity of about 3.0 inches (7.6 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 Baldknob, Johntom, Swakane and similar soils.

Dominant soil surface is silt loam to very stony ashy 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: 35  
Average: 20

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

Minimum: 0  
Maximum: 30  
Average: 10

Subsurface fragments > 3 inches (% Volume):

Minimum: 10  
Maximum: 50  
Average: 30

Subsurface fragments ≤ 3 inches (% Volume):

Minimum: 0  
Maximum: 50  
Average: 25

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: 5.3  
Average: 3.0

## **Vegetation dynamics**

Ecological Dynamics:

Shallow Stony, 2800-4000 feet produces about 300-600 pounds/acre of biomass annually.

Bluebunch wheatgrass, bitterbrush is at the core of the Shallow Stony 2800 – 4000 ft. ecological site and warrants a degree of understanding. This perennial is a long-lived, mid-sized bunchgrass with an awned or awnless inflorescence arranged in a spike. Bluebunch provides 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 leaves 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 elevation range for this ecological site (2800-4000 feet) is the lowest elevation for mountain big sagebrush and the upper elevation for threetip sagebrush. Threetip sagebrush is confined mainly to the hottest and driest portions of this elevation range. Whereas Idaho fescue may be found on east, west and north aspects but not on south facing slopes.

The stability and resiliency of the reference communities is directly linked to the health and vigor of the entire plant community. Research has found, on similar rangeland, that communities remain resistant to medusahead if sites maintain at least 0.8 mid-sized bunchgrass plant/sq. ft. (K. Davies, 2008).

Shallow Stony 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 is 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, most Shallow Stony sites 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 2800 – 4000 ft. is associated with other ecological sites in MLRA 6 including Stony Foothills South Aspect 2800-4000 feet, Very Shallow and ponderosa pine sites.

##### Similar Sites:

Ecological sites similar to Shallow Stony 2800 – 4000 ft.:

Shallow Stony, 4000-6000 feet in MLRA 6

Shallow Stony, 6000-7600 feet in MLRA 6

Shallow Stony, Prairie in MLRA 6

Shallow Stony in sagebrush steppe region of MLRA 8

Shallow Stony on south side of Columbia Hills in MLRA 8

##### 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

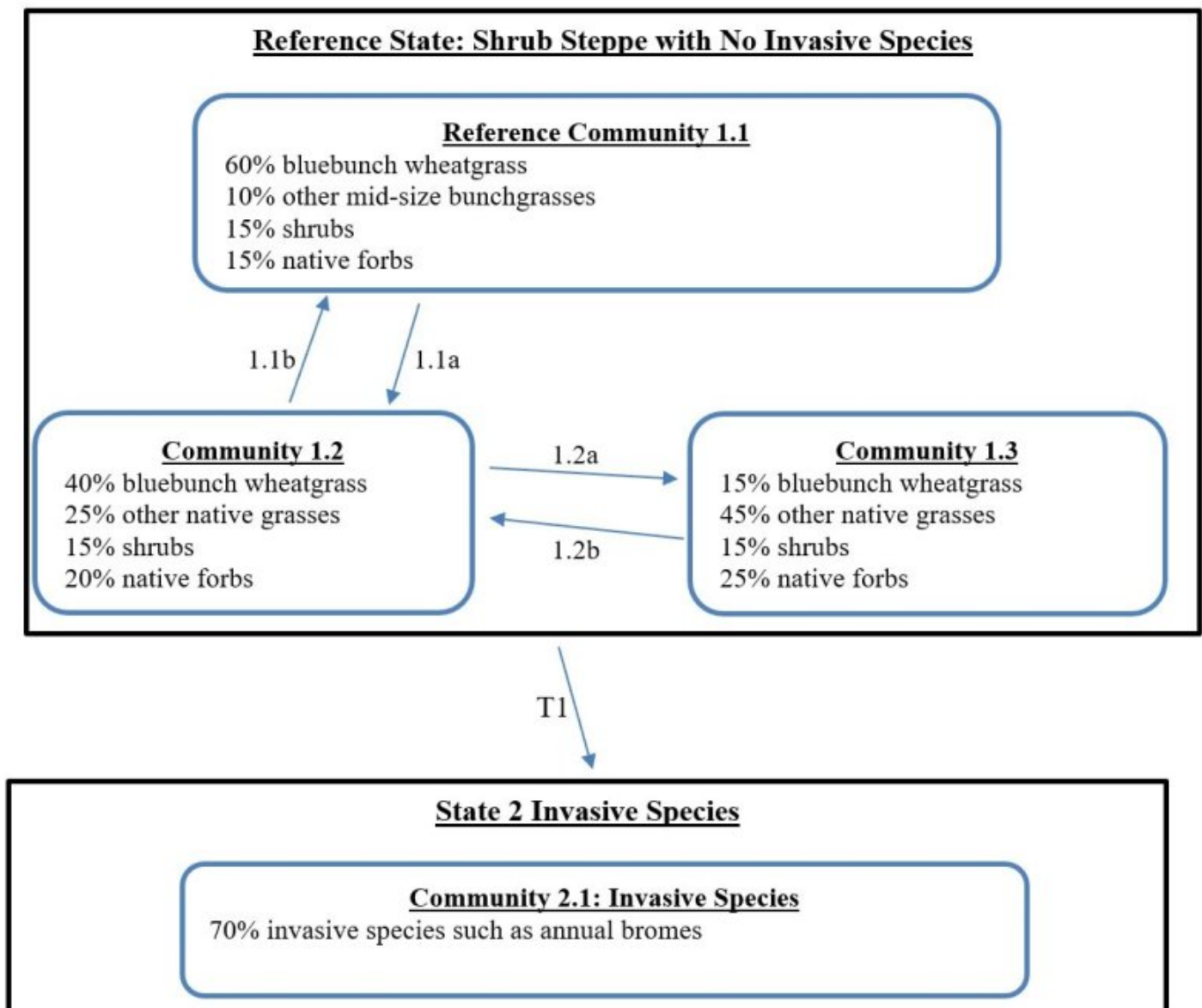
## Contributors

Provisional Site Author: Kevin Guinn Technical Team: W. Keller, K. Paup-Lefferts, R. Fleenor, K. Bomberger

## State and transition model

## State & Transition Diagram for Shallow Stony, 2800-4000 ft. (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.



## **Reference Community 1.1 for Shallow Stony, 2800-4000 ft. (15-18" ppt.) in 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>Shrubs – Subdominant</b>				
	15% 90 lbs.			
PUTR2	bitterbrush			
ARTRV	Mountain big sagebrush			
ERSP7	rock buckwheat			
ARTR4	threetip sagebrush			
ARTR4	stiff sagebrush			
<b>Dominant Mid-Size Bunchgrass</b>		<b>Other Mid-Size Bunchgrasses – Minor</b>		
	60% 360 lbs.		5-10% 60 lbs.	
PSSP6	bluebunch wheatgrass	ELEL5	bottlebrush squirreltail	
		ACTH7	Thurber's needlegrass	
		HECO26	needle-and-thread	
<b>Short Grass – Minor</b>				
	less than 5% 20 lbs.			
POSE	Sandberg bluegrass			
<b>Native Forbs – Subdominant</b>				
			15% 90 lbs.	
LUPIN	lupine	BALSA	balsamroot	
PHHO	spiny phlox	NEST5	narrowleaf goldenweed	
LIPU11	granite gilia	ERIOG	buckwheat	
ERNI2	snow buckwheat	ALLIU	wild onion	
LOMAT	lomatium / biscuitroot	ASTRA	milkvetch / locoweed	
ERIGE2	fleabane	PLPA2	woolly plantain	
ANDI2	low pussytoes	PENST	penstemon	
ACMI2	yarrow			
		Below	Normal	Above
<b>Estimated Production (pounds / acre)</b>		300	450	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 has one or more native species. The Reference Community 1.1 is dominated by bluebunch wheatgrass with shrubs and native buckwheat species prominent. Reference State Community Phases: 1.1 Bunchgrass dominated 1.2 Native grasses – Native Forb 1.3 Other Native Grasses – Native Forb At-risk Communities: Potentially every community is at risk as seeds of invasive species move around by wind and animals.

### **Community 1.1**

#### **Reference Community**

The Reference Community 1.1 is dominated by bluebunch wheatgrass with shrubs and native buckwheat species prominent.

## **Community 1.2**

### **Native Grasses**

Native Forb

## **Community 1.3**

### **Other Native Grasses**

Native Forb

### **Pathway 1.1a**

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

1.1a Result: Pathway from Reference Community 1.1 (bluebunch wheatgrass dominated) to Community 1.2 with less bluebunch wheatgrass, more native grasses & native forbs. Primary Trigger: Grazing pressure (heavy grazing intensity, season long grazing or frequent late spring grazing) to bluebunch wheatgrass or heavy livestock trailing. Ecological Process: consistent defoliation pressure to bluebunch wheatgrass and other palatable species results in poor vigor and shrinking crowns. As bluebunch wheatgrass declines, other native grasses and native forbs take advantage of released resources and niche space and, increase via new seedlings. Indicators: declining cover of bluebunch wheatgrass and increasing cover of native forbs and other native grasses.

### **Pathway 1.1b**

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

1.1b Result: Pathway from Community 1.2 native grass dominated to Reference Community 1.1 with more bluebunch wheatgrass and less forbs. Primary Trigger: improved grazing management (proper grazing intensity and timing) to bluebunch wheatgrass. Ecological Process: with defoliation pressure removed, bluebunch wheatgrass has improved vigor and increases via tillering and possibly new seedlings. Indicators: increasing cover of bluebunch wheatgrass and declining cover of native forbs and other grasses

### **Pathway 1.2a**

#### **Community 1.2 to 1.3**

1.2a Result: Pathway from Community 1.2 (bluebunch wheatgrass dominated) to Community 1.3 (dominated by other native grasses and native forbs). This is a continuation of community decline which started in Pathway 1.1a. Primary Trigger: continued grazing pressure (heavy grazing intensity, season long grazing or frequent late spring grazing) to bluebunch wheatgrass or heavy livestock trailing. Ecological process: As defoliation pressure continues bluebunch wheatgrass still has poor vigor and shrinking crowns, but also suffers some plant mortality. More seedlings of native forbs and other native grasses establish to take advantage of released resources and available niche space. Indicators: declining cover of bluebunch wheatgrass and increasing cover of native forbs and other native grasses.

### **Pathway 1.2b**

#### **Community 1.3 to 1.2**

1.2b Result: Pathway from Community 1.3 (dominated by other native grasses) to Community 1.2 (dominated by bluebunch wheatgrass). Primary Trigger: improved grazing management (proper grazing intensity and timing) to bluebunch wheatgrass. Ecological Process: with defoliation pressure removed, bluebunch wheatgrass has improved vigor and increases via tillering and possibly new seedlings. Indicators: increasing cover of bluebunch wheatgrass and declining cover of native forbs and other native grasses.

## **State 2**

### **Invasive Species**

State 2 Narrative: State 2 represents communities dominated by invasive species such as bulbous bluegrass and invasive annual grasses or broadleaf weeds. Native functional, structural groups are missing or diminished.



Community 2.1 is dominated by bulbous bluegrass and other invasive species. At-risk Communities: Potentially every community is at risk as seeds of invasive species move around by wind and animals.

## **Transition T1**

### **State 1 to 2**

T1 Result: shift from Reference State with no invasive species to State 2 which has a dominance of invasive species. Transition T1 is a continuation of the decline that started with Pathways 1.1a and 1.2a. Primary Trigger: grazing pressure (heavy grazing pressure, season long grazing or frequent late spring grazing) to bluebunch wheatgrass or heavy livestock trailing. Ecological Process: with continued defoliation pressure bluebunch wheatgrass has poor vigor, shrinking crowns and plant mortality. Invasive species such as annual bromes colonize the site and then increase to a position of dominance. Indicators: declining cover of bluebunch wheatgrass, other native grasses and palatable forbs. Also, the occurrence of invasive species on sites where none previously existed and, increasing cover of invasive species. Recovery Since this ecological site does not cross a threshold recovery is not necessary. Also, 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. So, if a site were to cross a threshold to another state, it would be considered non-reversible. 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

## **Citations**