

Ecological site group R006XG001WA

Very Shallow

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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

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

6.6 – Yakima Plateau and Slopes

6.7 – Grand Fir Mixed Forest

6.8 – Oak-Conifer Eastern Cascades-Columbia Foothills

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. Very Shallow covers entire MLRA 6.

Very Shallow is a sparsely vegetated, low shrub-short grass, upland site on very shallow soils (generally less than 8 inches deep). Very Shallow sites are often found on windswept ridges and adjacent to exposed rocky ledges. Daubenmire writes that there appears to be no regular difference in either soils or vegetation between lithosols produced by

glaciofluvial erosion or those or ridges where only wind and rain could have kept the basalt exposed.

Generally, there are sharp lines on the landscape between Very Shallow and the adjacent ecological site. One can stand with one foot on Very Shallow and the other foot on Stony or some other ecological site.

Occasionally the edge of Very Shallow is not so abrupt. This has been witnessed several times – less than 8 inches of soil depth has classic Very Shallow species, while 8-13 inches is a narrow band of Thurber needlegrass, and greater than 13 inches soil depth is a bluebunch wheatgrass site.

Usually, there are abundant rock and soil biotic crust cover, in the interspaces between plants. The lichen and moss play a critical role in water infiltration and resistance to erosion. On some but not all Very Shallow sites, are a few micro-pockets of taller vegetation in association with bedrock fracturing.

Very Shallow has several variations in MLRA 6.

1. Stiff sagebrush / low sage – Sandberg bluegrass (Chelan, Kittitas, Yakima)
2. Buckwheat / Sandberg bluegrass, forbs
3. Sedges, prairie junegrass, forbs (high elevations). Northern MLRA 6: there is no Very Shallow at low and mid elevations.
4. Central MLRA 6: stiff sage-Sandberg & some low sage

Sandberg bluegrass is the short grass in all instances, but the low shrub component is variable. The most common reference community is stiff sagebrush or one to several buckwheat species. In Chelan, Kittitas and Yakima Counties low sagebrush may be present.

While there are minor ecological differences between these low shrubs, they are considered functionally equivalent for the purposes of this ecological site. These low shrubs have been combined into one site for several reasons: (1) the co-dominant short grass is Sandberg bluegrass, (2) Very Shallow has low plant productivity and extreme site limitations. (3) it is common to find three or more of these low shrub species on the same site, and (4) the hydrologic and watershed characteristics is similar regardless of low shrub.

According to Daubenmire, stiff sage occurs on basalts with highly fractured parent material. Buckwheat occupy various parent materials and may dominate on gravelly soils and granitic parent materials.

Principle Vegetative Drivers:

The very shallow soil depth and the fracturing of, or the lack of fracturing in the underlying basalt bedrock drive the vegetative expression of this site. Deep-rooted steppe species do

not grow on Very Shallow because of the limited soil depth. The fracture system accounts for variation in the low shrub component and the occasional mid-sized bunchgrass such as bluebunch wheatgrass or Thurber needlegrass.

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

The lower part of the soil profile of Very Shallow has high clay content. With winter rain and melting snow, water perches and creates saturated conditions.

In wet years during spring runoff, water runs on the surface of Very Shallow sites for a short period. Even more water runs beneath the surface to sites below. This increases the effective precipitation to the adjacent sites below.

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 and hills

Landform: Side-slopes, ridges, hillslopes and structural benches

Elevation: Dominantly 1,100 to 6,000 feet

Central tendency: 2,000 to 4,500 feet

Slope: Total range: 0 to 90 percent

Central tendency: 5 to 30 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. Soil moisture regime is xeric, while soil temperature regime can be mesic, frigid or cryic.

Mean Annual Precipitation:

Range: 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.

Mean Annual Air Temperature:

Range: 39 to 52 degrees

Central tendency: 42 to 48 degrees

The east slopes experience greater temperature extremes and receive less precipitation than the west side of the Cascade Mountains.

Frost-free Period (days):

Total range: 40 to 160

Central tendency: 60 to 110

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. The growing season for very shallow is March through June.

Soil features

Edaphic:

The Very Shallow ecological site commonly occurs with rock outcrop, Shallow Stony sites, Stony South Aspect sites and forestland ecological sites. Soils are very shallow to bedrock. Typical soil surface has about 40% rock, 10-20% bare ground, 10-20% biotic crust and 30% vegetative cover. Sites with less than 10% vegetative cover can be considered rock outcrop.

Very Shallow sites are sensitive to soil disturbances. When the Very Shallow site is saturated and muddy, physical damage to the site – from vehicle ruts and hoof prints from

cows, horses or deer for example – remain intact for many years.

Rocks or plants sitting on pedestals is called pedestaling. Two completely different processes cause the pedestaling. The first process is frost-heaving which pushes the plants upward and is evident across the entire site. The lower part of the soil profile has higher clay content. With winter rain and melting snow, water perches and creates saturated conditions. Freezing weather causes these saturated soils frost-heave, and then during spring thaw, the site becomes muddy. The second pedestaling process is erosion which washes soil away from plants and rocks but only in water flow patterns.

The degree of pedestaling on Very Shallow is quite variable. On many sites the soil surface is smooth and shows little to no evidence of pedestaling. But other sites show a high degree of pedestaling. The difference is presumed to be the amount of clay in the soil and the shrink-swell potential. In some years water runs on the surface and some erosion may occur.

If a site has a high degree pedestaling, the observer must determine whether this process is natural or human-induced (water running off cropland onto the rangeland for example).

Representative Soil Features:

This ecological site components are dominantly Lithic taxonomic subgroups of Haploxerolls, Argixerolls and Haplocryolls great groups of the Mollisols. Soils are very shallow. Average available water capacity of about 0.9 inches (2.3 cm) in the 0 to 40 inches (0-100 cm) depth range.

Soil parent material is dominantly loess mixed colluvium with possible minor amounts of ash in the upper part of the soil over residuum.

The associated soils are Bocker, Shinn, Rockly and similar soils.

Dominate soil surface is very cobbly loam to extremely gravelly silt loam.

Dominant particle-size class is loamy-skeletal.

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

Minimum: 0

Maximum: 3

Average: 1

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

Minimum: 0

Maximum: 40

Average: 25

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

Minimum: 0

Maximum: 50

Average: 20

Subsurface fragments > 3 inches (% Volume):

Minimum: 10

Maximum: 65

Average: 35

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

Depth to root-restricting feature (inches):

Minimum: 4

Maximum: 12

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: 6.1 to 7.3

10 - 40 inches: 6.1 to 7.3

Available Water Capacity (inches, 0 – 40 inches depth):

Minimum: 0.3

Maximum: 2.1

Average: 0.9

Vegetation dynamics

Ecological Dynamics:

Very Shallow in MLRA 6 produces about 100-250 pounds/acre of biomass annually.

MLRA6: Variations of Very Shallow

Very Shallow has several variations in MLRA 6.

1. Stiff sagebrush / low sage – Sandberg bluegrass (Chelan, Kittitas, Yakima)
2. Buckwheat / Sandberg bluegrass, forbs
3. Sedges, prairie junegrass, forbs (high elevations). Northern MLRA 6: there is no Very Shallow at low and mid elevations.
4. Central MLRA 6: stiff sage-Sandberg & some low sage

In the spring this site has a rich diversity of native annual and perennial forbs on most sites. Very Shallow supports edible species that have been an important food source for the Native Americans for many generations. Bitterroot and biscuitroot are the main species harvested for food.

Sandberg bluegrass is a shallow rooted, perennial bunchgrass, perfectly suited to Very Shallow sites. It has short leaves and a green to purplish panicle seed head. On most sites Sandberg is an understory grass, but on Very Shallow it is the dominant grass. It begins growth in the fall then grows rapidly in the spring and sets seed before moisture is gone. Sandberg bluegrass is resistant to drought, grazing, trampling and fire.

Stiff sagebrush is a low mounding, strongly scented with the characteristic sage odor. It is low and spreading with a conspicuously woody base. The base is often heaved from the soil by frost action. The trunk is very irregular, spreading above the base in a dense cluster of short, rigid, and rather brittle branches up to sixteen inches in length. Stiff sagebrush leaves are forked into three deep lobes like fingers. Unlike other sagebrush species, the leaves of stiff sage are deciduous, and by fall, all of the leaves have dropped. The ground under each plant will have a pile of dead leaves.

Low sage (*Artemisia arbuscula*) in eastern Washington - low sagebrush often grows with stiff sagebrush (*A. rigida*) and mountain big sagebrush (*A. t. ssp. vaseyana*) with an

understory of elk sedge (*Carex geyeri*), Idaho fescue, Sandberg bluegrass (*Poa secunda*), and/or bluebunch wheatgrass. Low sagebrush is not particularly common and, for the most part, is restricted to Chelan, Kittitas, and Yakima counties.

Very Shallow is resistant to most natural disturbances and ecologically 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.

The vegetative cover is too low to carry fire, so these sites rarely burn. In many pastures, due to surface rocks and limited forage, Very Shallow sites are not attractive to grazing animals and so receive only incidental grazing. Based on inherent protection from both fire and grazing, most Very Shallow sites are stable.

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 most years many bunchgrasses remain dormant in the fall. Sandberg bluegrass, however, greens up every year. And so, from late fall through winter and into early spring these Very Shallow sites provide important green forage for deer, elk and upland birds. However, these sites dry up much sooner than sites with deeper soils. Grasses are dry from May through September.

Supporting Information:

Associated Sites:

Very Shallow is associated with rock outcrop, the Shallow Stony sites, the Stony South Aspect sites, and various forest ecological sites. It is common for Very Shallow sites to transition back and forth with rock outcrop, Shallow Stony and Stony South Aspect.

Similar Sites:

Very Shallow sites in MLRA 8 Columbia Plateau, MLRA 7 Columbia Basin, and MLRA 9 Palouse Prairie are quite similar.

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

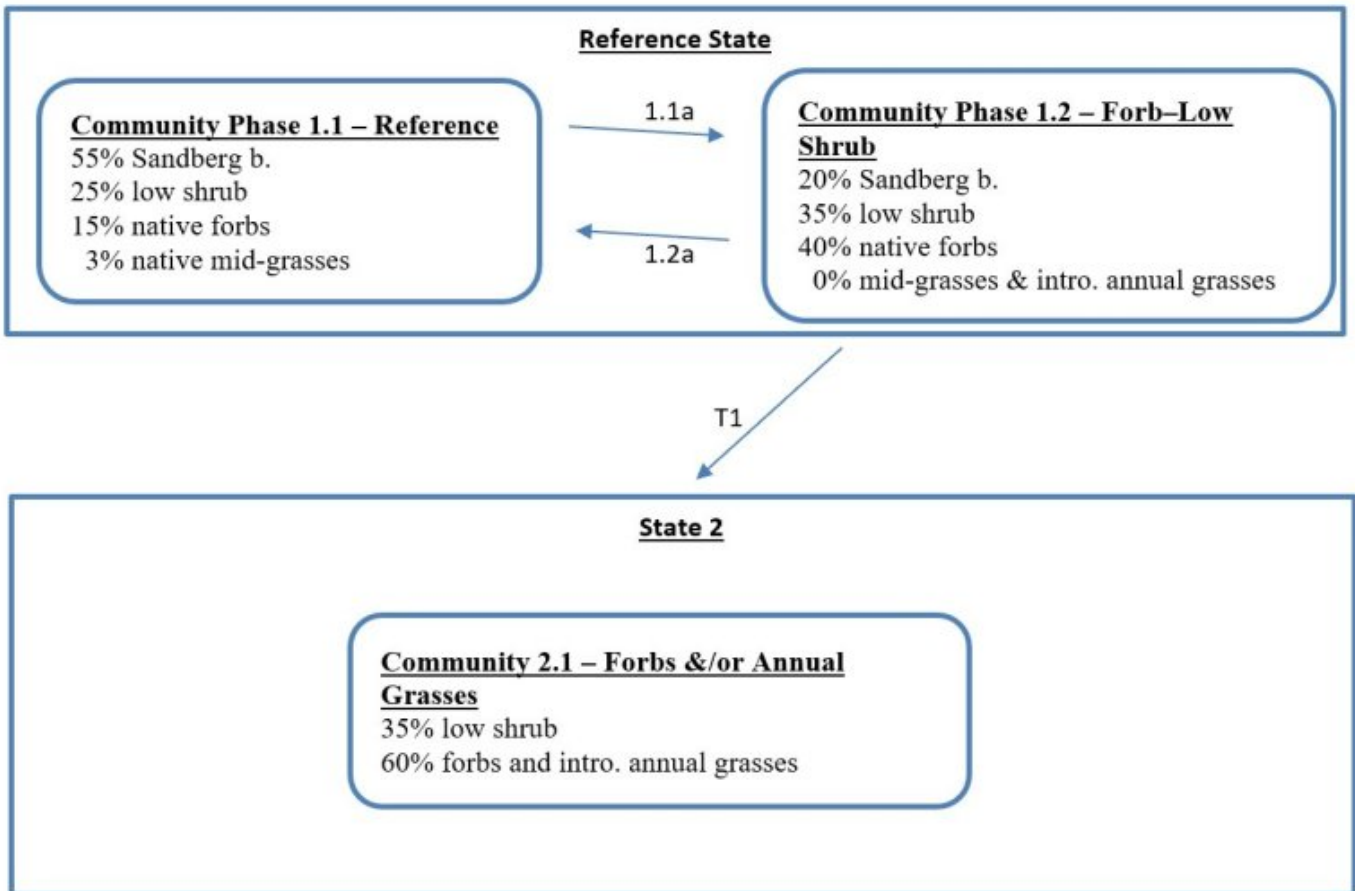
Provisional Site Author: K. Guinn Technical Team: R. Fleenor, W. Keller, K. Paup-Lefferts, K. Bomberger

State and transition model

State and Transition Diagram: Very Shallow in MLRA 6

This state and transition model (STM) explains the general ecological dynamics for the Very Shallow 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.

Very Shallow Ecological Site



Reference Community 1.1 for Very Shallow 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		
Dominant Low Shrub		25%	65 lbs.	Other Low Shrubs – Minor		less than 5%	10 lbs.	
ERTH4	thymeleaf buckwheat			SADOI	purple sage			
ERSP7	rock buckwheat			PUTR2	antelope bitterbrush			
ARRI2	stiff sagebrush			ERDO	Douglas buckwheat			
ARAR8	low sagebrush			ERHE2	Wyeth buckwheat			
Dominant Short Grass		55%	140 lbs.	Mid-Size Bunchgrasses – Minor		less than 5%	10 lbs.	
POSE	Sandberg bluegrass			ELEL5	bottlebrush squirreltail			
				ACTH7	Thurber needlegrass			
				PSSP6	bluebunch wheatgrass			
Annual Grass – Trace								
VUOC	sixweeks fescue		Trace					
Native Forbs – Subdominant						15%	40 lbs.	
TRMA3	bighead clover			ERNI2	snow buckwheat			
NEST5	narrowleaf goldenweed			ERIGE2	fleabane			
PHHO	spiny phlox			PENST	penstemon			
LIPU11	granite gilia			ASPU9	woollypod milkvetch			
LOMAT	lomatium / biscuitroot			LERE7	bitterroot			
BAHO	Hooker balsamroot			ALLIU	wild onion			
VITR3	sagebrush violet			PENI	pediocactus			
						Below	Normal	Above
Estimated Production (pounds / acre)						100	200	250

State 1

Reference State

State 1 Narrative: The Reference State represents non-invaded communities composed of native species. Invasive annual grasses are not present. Very Shallow sites rarely burn, and in most cases, receives minimal grazing. This ecological site is the most stable ecological site on the landscape. Reference Community 1.1 is the classic Very Shallow, dominated by Sandberg bluegrass with one or more low shrub species. The low shrub component may be stiff sage, low sage &/or one or more buckwheat low shrub species. So, Community 1.1 is mostly very stable. remaining in State 1 regardless of climate or management. Similarity Index scores are typically higher on Very Shallow than other ecological sites on the landscape. Community 1.2 represents a community phase which is quite rare in MLRA 6. The species are native, but Sandberg bluegrass has a diminished presence and forbs are more prominent. Community 1.2 still has enough Sandberg

bluegrass present, to shift back to reference community 1.1, given and improvement in grazing use by wildlife, feral horses and livestock. Reference State Community Phases: 1.1 Reference Sandberg bluegrass – low shrub 1.2 Native forb – low shrub Dominant Reference State Species: Sandberg bluegrass and stiff sage, low sage &/or low shrub buckwheat species At-risk Communities: • All communities in the reference state are at risk of moving to State 2. The seed source of cheatgrass is nearby and blowing onto most sites annually • Community 1.1 has a high Sandberg bluegrass cover and is thus, at low risk of moving to State 2, Forb-Annual Grass • Community 1.2, the degraded native community, has low amount of Sandberg bluegrass cover and a high amount of forb cover, and is at considerable risk of moving to State 2

Community 1.1

Reference Sandberg bluegrass – low shrub

Reference Community 1.1 is the classic Very Shallow, dominated by Sandberg bluegrass with one or more low shrub species. The low shrub component may be stiff sage, low sage &/or one or more buckwheat low shrub species. So, Community 1.1 is mostly very stable. remaining in State 1 regardless of climate or management. Similarity Index scores are typically higher on Very Shallow than other ecological sites on the landscape.

Community 1.2

Degraded Native Forb – low shrub

Community 1.2 represents a community phase which is quite rare in MLRA 6. The species are native, but Sandberg bluegrass has a diminished presence and forbs are more prominent. Community 1.2 still has enough Sandberg bluegrass present, to shift back to reference community 1.1, given and improvement in grazing use by wildlife, feral horses and livestock.

Pathway 1.1a

Community 1.1 to 1.2

1.1a Result: Shift from Reference Community 1.1 (low shrub – short grass) to Community 1.2 (forb – low shrub). Sandberg bluegrass has been much reduced but remains in the community. The native forb component has increased. There may be a few invasive forbs. Primary Trigger: extensive spring grazing with heavy to severe use of Sandberg bluegrass. The grazing pressure can come from elk, cattle or horses. Ecological process: consistent defoliation pressure to Sandberg bluegrass results in poor vigor, shrinking crowns, and plant mortality. Unpalatable native forbs increase to take advantage in the release of resources and niche space. If the pressure continues a few invasive forbs colonize the site.

Pathway 1.2a

Community 1.2 to 1.1

1.2a Result: Shift from Community 1.2 (forb-low shrub) back to the Reference Community. Sandberg bluegrass displaces the forbs to become co-dominant with the low shrub. Primary Trigger: heavy grazing pressure is replaced by light to moderate grazing to Sandberg bluegrass. Ecological process: with defoliation pressure eliminated Sandberg bluegrass attains increased vigor and cover via new seedlings and tillering.

State 2

Forbs &/or Annual Grass

State 2 Narrative: This state represents a shift from native grasses to a forb-annual grass dominated situation. The low shrubs usually remain. Most Very Shallow sites never cross the threshold into State 2. They stay at climax or near climax condition, as these sites generally receive limited grazing pressure and rarely burn. State 2 is rare. The situation below has been witnessed on a couple of ridgetops west of Yakima on MLRA 6 sites. Chronic heavy grazing in the spring from migrating elk, feral horses or livestock caused the following: • Near elimination of Sandberg bluegrass, resulting in • A plant community dominated almost exclusively by annual forbs &/or annual grasses. • Annual grasses were rare in the situations witnessed west of Yakima Invasive annual grasses, which are common & frequently dominant on Loamy ecological sites, do not compete as well on Very Shallow sites. But a micro-burst of cheatgrass can occur. Cheatgrass seed blows onto Very Shallow sites annually. In a year with heavy snowfall and early spring rain, such as 2017, the site had far more moisture than the plant community can utilize. This is the opportunity for cheatgrass seed to germinate and produce a huge flush of cheatgrass plants. In following years when moisture is normal or below normal, cheatgrass seed will not germinate or make viable plants. So, these micro-bursts of cheatgrass tend to be episodic and mostly a temporary condition on Very Shallow sites. However, the description above may not apply to Very Shallow sites on the High Prairie in Klickitat county or on the Swauk Prairie in Kittitas County. These prairie sites have been altered by heavy grazing pressure and may be dominated by cheatgrass, medusahead, ventenata or bulbous bluegrass. Lomatium or another native forb are prominent as well. A reduction to Sandberg bluegrass cover allows annual grasses the opportunity to colonize and invade on a more permanent basis. Occasionally one will find minor amounts of scattered annual grasses on Very Shallow sites. Heavy grazing use disrupts the soil surface and the moss-lichen layer via animal hooves, which in turn, causes loss of both soil structure and biological crust. When this happens site resistance to erosional forces are greatly diminished. State 2 will likely have much less or much more pedestaling than the reference condition. Trampling by livestock or game animals can obliterate pedestals and terracettes. Or, erosion in water flow patterns can cause much more pedestaling than reference condition.

Community 2.1

Forbs &/or Annual Grasses

Dominate Species for State 2: Native forbs and/or cheatgrass. Forbs which increase can include lomatium, fleabane, willow herb, yarrow and onion. Annual bromes, medusahead

and sixweeks fescue are other annual grasses that could become prominent.

Transition T1

State 1 to 2

T1 Note: this transition is quite rare. This has been witnessed only a couple of times. Result: Shift from Reference State Community 1.2 to State 2 Community 2.1 which is dominated by forbs and/or annual grasses. Most or all Sandberg bluegrass plants are lost from the community. Primary Trigger: extensive spring grazing with heavy to severe use of Sandberg bluegrass. The grazing pressure can come from elk, cattle or horses. Secondary triggers: a micro-burst of annual grasses could put Community 1.2 at risk. The trampling of Very Shallow soils by grazing animals could also trigger transition to State 2. Ecological process: consistent defoliation pressure to Sandberg bluegrass results in poor vigor, shrinking crowns, and plant mortality. Unpalatable native forbs increase to take advantage in the release of resources and niche space. The soil is more open to evaporation, to wind and water erosion, and facilitates plant community changes from Community 1.2 to Community 2.1. If the pressure continues a few invasive forbs colonize the site. Indicators: Declining vigor and cover of Sandberg bluegrass, declining soil biotic crust and, increasing gaps between perennial species. Recovery State 2 is considered non-reversible. Restoration of Sandberg bluegrass, the low shrub component, native forbs and the soil biotic crust would be very problematic at best on Very Shallow. 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 Very Shallow 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 Very Shallow. 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