Ecological site group R007XG001WA 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): 007X – Columbia Basin

LRU – Common Resource Areas (CRA):

- 7.1 Sandy Missoula Flood Deposits
- 7.2 Silty Missoula Flood Deposits
- 7.3 Dry Loess Islands
- 7.4 Dry Yakima Folds
- 7.5 Yakima Valley Pleistocene Lake Basins

Site Concept Narrative

Diagnostics:

Very Shallow is a sparsely vegetated, low shrub-short grass, upland site on lithosols (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-to 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.

The most common reference community is stiff sagebrush-Sandberg bluegrass. Sandberg bluegrass is the short grass in all instances, but the low shrub component is variable. Stiff sagebrush is the predominant low shrub, but one to several different eriogonum species are present on some sites, instead of, or with stiff sagebrush. 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 in all cases, (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, scabland sagebrush, locally known as stiff sagebrush, occurs on basalts with highly fractured parent material. Eriogonums 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 ecological site because of soil depth limitations. The fracture system accounts for variation in the low shrub component and the occasional mid-sized stature 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:

The landscape is part of the Columbia basalt plateau. Very shallow sites occur on ridgetops, shoulders, benches, mesas, and hillslopes.

Physiographic Division: Intermontane Plateau Physiographic Province: Columbia Plateau Physiographic Sections: Walla Walla Plateau Section

Landscapes: Hills and plateaus Landform: Hillslopes, ridges and structural benches

Elevation: Range: 500 to 2,300 feet Central tendency: 500 to 2,000 feet

Slope: Range: 0 to 60 percent Central tendency: 2 to 30 percent

Aspect: Occurs on all slopes.

Geology:

This is almost entirely underlain by Miocene basalt flows. Columbia River basalt is covered in most areas with as much as 200 feet of eolian, lacustrine, and alluvial deposits. This basin generally corresponds to the vast temporary lakes created by floodwaters from glacial Lakes Missoula and Columbia. Most of the fluvial and lacustrine sediments were deposited about 16,000 years ago, when an ice dam on the ancient Columbia River burst and when glacial Lake Missoula periodically emptied, creating catastrophic floods.

Climate

MLRA 007X is the lowest, driest and hottest portions of the entire Columbia River region and the sagebrushbluebunch wheatgrass zone.

The climate across MLRA 007X 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 is mostly between 4

and 9 inches. Seventy to seventy-five percent of the precipitation comes late October through March as a mixture of rain and snow. Precipitation that comes after March is not as effective for plant growth. June through early October is dry. Freezing temperatures generally occur from late-October through early-April. Temperature extremes are -10 degrees Fahrenheit in winter and 110 degrees Fahrenheit in summer. Winter fog is variable and often quite localized, as the fog settles on some areas but not others.

Mean Annual precipitation Range: 4 - 9 inches (6 - 10 inches zone) Soil moisture regime is aridic.

Mean Annual Air Temperature Range: 48 to 54 F Central Tendency: 50 – 52 F Soil temperature regime is mesic.

Frost-free period (days) Total range: 135 to 210 Central tendency: 150 to 180 The growing season for very shallow is generally October through mid-November and March through mid-May.

Soil features

Edaphic:

The Very Shallow ecological site commonly occurs with rock outcrop, Loamy, and Stony ecological sites. Typical soil surface has about 40 percent rock, 10 to 20 percent bare ground, 10 to 20 percent biotic crust and 30 percent vegetative cover. Sites with less than 10 percent vegetative cover can be considered rock outcrop.

Very Shallow ecological site is sensitive to soil disturbances. When the Very Shallow ecological 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 to 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 the Very Shallow ecological site 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 humaninduced (water running off cropland onto the rangeland for example).

REPRESENTATIVE SOIL FEATURES

This ecological site components are dominantly Xeric and Lithic taxonomic subgroup of Haplargids and Torriorthents great groups of the Aridisols and Entisols taxonomic orders. Soils are dominantly very shallow. Average available water capacity of about 0.8 inches (2.0 cm) in the 0 to 40 inches (0-100 cm) depth range.

Soil parent material is dominantly loess and colluvium over residuum.

The associated soils are Nevo, Schawana and similar soils.

Dominate soil surface is loamy fine sand to very cobbly loam.

Dominant particle-size class is loamy to loamy-skeletal.

Fragments on surface horizon > 3 inches (% Volume): Minimum: 0 Maximum: 5 Average: 0

Fragments within surface horizon > 3 inches (% Volume): Minimum: 0 Maximum: 35 Average: 15

Fragments within surface horizon ≤ 3 inches (% Volume): Minimum: 0 Maximum: 30 Average: 20

Subsurface fragments > 3 inches (% Volume) Minimum: 0 Maximum: 25 Average: 10

Subsurface fragments ≤ 3 inches (% Volume): Minimum: 0 Maximum: 40 Average: 25

Drainage Class: Well to somewhat excessively drained. Water table depth: Dominantly greater than 60 inches

Flooding: Frequency: None

Ponding: Frequency: None

Saturated Hydraulic Conductivity Class: 0 to 10 inches: Moderately high and high 10 to 20 inches: Moderately high and high

Depth to root-restricting feature (inches): Minimum: 5 Maximum: 15

Electrical Conductivity (dS/m) Minimum: 0 Maximum: 2

Sodium Absorption Ratio Minimum: 0 Maximum: 0

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

Soil Reaction (pH) (1:1 Water): 0 - 10 inches: 6.6 to 7.8 10 - 20 inches: 6.6 to 7.8 Available Water Capacity (inches, 0 – 40 inches depth) Minimum: 0.4 Maximum: 1.5 Average: 0.8

Vegetation dynamics

ECOLOGICAL DYNAMICS: Vegetation Dynamics: Very Shallow produces about 75 to 200 pounds per acre of biomass annually.

The Very Shallow ecological site in MLRA 7 has at least four different variations on the low shrub-short grass theme for the Reference Community. Sandberg bluegrass is co-dominant in every variation:

- 1. Scabland sagebrush Sandberg bluegrass
- 2. Scabland sagebrush / thymeleaf buckwheat / rock buckwheat Sandberg bluegrass
- 3. Thymeleaf buckwheat Sandberg bluegrass
- 4. Narrowleaf goldenweed (Stenotus s.) Sandberg bluegrass

In the spring this site has a rich diversity of native annual and perennial forbs on most sites. Very Shallow ecological site 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 the Very Shallow ecological site 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.

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 ecological sites provide important green forage for deer, elk and upland birds. But these sites also dry up sooner than adjoining sites due to the very shallow soil depth. Grasses are dry from May through September.

Scabland sagebrush, locally known as stiff sagebrush, is low mounding and 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. Scabland sagebrush leaves are forked into three deep lobes like fingers. Unlike other sagebrush species, the leaves of scabland sagebrush are deciduous, and by fall, all the leaves have dropped. The ground under each plant will have a pile of dead leaves.

Fire: The vegetative cover is too low to carry fires, so these sites rarely burn

Grazing: In many pastures the Very Shallow ecological sites are not attractive to grazing animals and so are rarely if ever grazed.

Based on inherent protection from both fire and grazing, most Very Shallow ecological sites are stable and in excellent condition.

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:

In MLRA 7 Very Shallow is associated with Sagebrush Steppe ecological sites (Shallow Stony Sand, Stony, Loamy, Cool Loamy, Dry Loamy, Calcareous Loam, Sandy, Sandy Loam) and Grassland Steppe ecological sites (Loamy and North Slope).

Very Shallow ecological site is also associated with rock outcrop. It is common for Very Shallow sites to transition back and forth with rock outcrop, Shallow Stony, Stony or other ecological sites.

Similar sites:

Very Shallow sites in MLRA 008X Columbia Plateau, MLRA 009X Palouse, and MLRA 006X East Slope of Cascades 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

State Correlation: Washington

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

Site Development and Testing Plan

Future work, as described in a Project Plan, to validate the information in this Provisional Ecological Site Description is needed. This will include field activities to collect low, medium and high intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation specialists. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document.

Annual reviews of the Project Plan are to be conducted by the Ecological Site Technical Team.

Major Land Resource Area

MLRA 007X Columbia Basin

Subclasses

R007XY001WA–Very Shallow

Stage

Provisional

Contributors

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State and transition model

State and Transition Diagram: Very Shallow

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.





Reference Community 1.1 for Very Shallow in MLRA 7:

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	Similarity Index			Similarity		
Index						
Dominant Low Shrubs		Other Low Shrubs – Minor				
25% 5	50 lbs.		1.777.04.07 9 .0707.0707.070	less t	han 5%	5 lbs.
ARRI2 stiff sagebrush		SADOI	purple sage			
ERTH4 thymeleaf buckwheat		PUTR2	antelope bitterb	orush		
ERSP7 rock buckwheat		ERDO	Douglas bucky	vheat		
		ERHE2	Wyeth buckwh	eat		
0		Mid-Size Bunchgrasses – Minor				
				less	than 5%	5 lbs.
		FIFIS	hattlahmish say	nirraltail		
		ACTH7 Thurber paedlagrass				
		DSSD6	bluebunch whe	glass		
Dominant Short Grass		13310	bluebulien wite	argrass		
	15775					
POSE Sandberg bluegrass 55% 11	10 lbs.	2				
Annual Grass – Trace						
VUOC sixweeks fescue Trace						
Native Forbs – Subdominant						
					15%	30 lbs.
NEST5 narrowleaf goldenweed		ERNI	2 snow buck	wheat		
PHHO spiny phlox	ASPU9 woollypod loce				d	
PHLOX phlox		PENI pediocactus				
L1PU11 granite gilia		PENST penstemon				
LOMAT lomatium / biscuitroot		NOTR2 weevil microseris				
BAHO Hooker balsamroot		EPIL	O willow herb			
VITR3 sagebrush violet		ALL	IU wild onion			
ERIGE2 fleabane		LEF	E7 bitterroot			
ERIOG buckwheat						
				Polour	Normal	About
Estimated Declustice (sounds (sous)				Below	Normal	ADOVE
Estimated Production (pounds / acré)				/5	150	200

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 ecological 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 scabland sagebrush and one or more Eriogonum low shrub species. 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 the degraded phase

which is quite rare in MLRA 7. 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 the right conditions, Reference State Community Phases: 1.1 Reference Sandberg bluegrass – low shrub 1.2 Forb – low shrub Native forbs – low shrub Dominant Reference State Species: Sandberg bluegrass and scabland sagebrush and other low shrub Eriogonum 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 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 community 1.1: 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 scabland sagebrush and one or more Eriogonum low shrub species. 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 Community 1.2: Degraded Native Forb – low shrub

Community 1.2 represents the degraded phase which is quite rare in MLRA 7. 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 the right conditions.

Pathway P1.1a Community 1.1 to 1.2

1.1a Result: Shift from Reference Community (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: heavy spring grazing pressure (heavy to severe grazing intensity) to Sandberg bluegrass. The grazing pressure can come from elk, cattle or feral horses. Ecological process: consistent spring defoliation pressure to Sandberg bluegrass causes poor vigor, shrinking crowns and mortality. Grass roots begin to die, and this opens the soil for native forbs to increase via seedlings. The hoof action by large ungulates can disturb the soil surface enough to make them vulnerable to annual grass and forb invasion. Indicators: decreasing Sandberg bluegrass cover and increasing cover of native forbs.

Pathway P1.2a Community 1.2 to 1.1

1.2a Result: Shift from forb – low shrub community back to the Reference Community. Sandberg bluegrass reestablishes dominance over the native annual forb component as it exerts competitive advantage for resources and space. So, Sandberg bluegrass displaces the forbs to become co-dominant with the low shrub component. Primary Trigger: Defoliation pressures are removed, allowing Sandberg bluegrass to recover and re-establish dominance over the forb component. Ecological process: With reduced grazing pressure Sandberg bluegrass experiences increased plant vigor and root production, expanding its size and competitive abilities through seedlings and tillering. Soils stabilize with the removal of the hoof action and increased volume of roots. Indicators: decreased forb cover and increased cover of Sandberg bluegrass.

State 2 Forbs &/or Annual Grass

State 2 Narrative: This state represents the ecological changes that occur when there is a shift from dominance by perennial native grasses to forbs or annual grass dominance in the herbaceous layer. The shrub components generally remain in the overstory. Most Very Shallow sites never cross the threshold into State 2 as they are not attractive to grazing animals and rarely burn (limited forage values and surface rocks). The exception being chronic heavy grazing in the spring from migrating elk, feral horses or livestock. As the cover of Sandberg bluegrass

significantly declines the site becomes open to invasion by invasive annuals, however. Invasive annual grasses, which are common & frequently dominant on adjacent Loamy ecological sites, do not often compete as well on Very Shallow sites. However, the cheatgrass seed blows onto Very Shallow sites annually and can become a minor component. In a year with heavy snowfall and early spring rain, such as 2017, the site had far more moisture that the plant community could utilize. This is the perfect opportunity for cheatgrass seed, which is capable of rapid germination and growth to establish in significant amounts across the site. In following years when moisture is normal or below normal, native species will utilize most of the available moisture and cheatgrass seed will not germinate or make viable plants. Therefore, in most cases, these micro-bursts of cheatgrass tend to be episodic and mostly a temporary condition on Very Shallow sites. A reduction to Sandberg bluegrass cover allows annual grasses the opportunity to colonize and invade on a more permanent basis. 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 as well. State 2 may exhibit either a significant decrease in pedestaling due to the lack of bunchgrass cover and heavy use trampling by ungulates, or there will be a significant increase in pedestaling due to increased erosion from water flows around the remaining bunchgrasses. Community Phases for State 2: Community Phase 2.1: dominated by native forbs and invasive annual grasses. Forbs which increase in the altered conditions and are competitive with invasive grasses, can include lomatium, fleabane, willow herb, yarrow and onion. Typical invasive grasses may include annual bromes, medusahead and sixweeks fescue. No Recovery State 2 is considered non-reversible. Restoration of Sandberg bluegrass, the low shrub component, native forbs and the soil biotic crust would be extremely difficult, labor intensive and costly. Seedlings and plugged plants need soil moisture and time to germinate and become established. In most years, seeds and plugs may not have a chance as site conditions on the Very Shallow ecological site can change quickly and the non-native species are much more adaptable under these conditions. Drying winds and bright sun can turn a snowy or muddy site into a hard crust before plants are established. Timing of all recovery efforts would have an extremely narrow window of opportunity on these altered sites.

Transition T1 State 1 to 2

T1 Result: Shift from Reference Community Phase 1.1 to Sate 2 Community Phase 2.1, resulting in the shift in functional groups to forbs and non-native annual grass dominance. Primary Trigger: Extensive spring grazing with heavy use to Sandberg bluegrass. The grazing pressure can come from elk, cattle or feral horses. Secondary Trippers: a micro-burst of cheatgrass could put Community 1.2 at risk. The trampling of very shallow soils, displacing and disturbing the surface soil structure by grazing animals could also trigger transition to State 2. A micro-burst of annual grasses could allow even pristine sites to be invaded. Community 1.2 is the community most at risk and is also the pathway for crossing the threshold from State 1 to State 2. Ecological process: consistent spring defoliation pressure to Sandberg bluegrass causes poor vigor, shrinking crowns and plant mortality. Most or all Sandberg bluegrass plants are lost from the community, and this allows native forbs to increase and invasive annuals (forbs and grasses) to colonize and expand. This facilitates plant community changes from Community 1.2 to Community 2.1. Indicators: Declining vigor and cover of Sandberg bluegrass, declining soil biotic crust and, increasing gaps between perennial bunchgrasses.

Citations