Ecological site group R007XG114WA Shallow Stony Sand

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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:

Shallow Stony Sand ecological site is a sparsely vegetated upland shrub steppe site in MLRA 007X, occurring on soils that have three characteristics:

(1) shallow depth (10-20inches),

(2) fine sands texture, and

(3) rock in soil profile or on the soil surface.

Soil texture ranges from loamy fine sand to fine sand. The soil surface is mostly bare soil, soil biotic crust, or rock.

The shrub layer is typically 12 to 20 inches high Wyoming big sagebrush, but some sites can have a lot of San Luis purple sage. Bluebunch wheatgrass is the dominant bunchgrass in the top grass layer, while Sandberg bluegrass is the major grass of the lower grass layer. Needle and thread is sub-dominant.

Principle Vegetative Drivers:

Shallow Stony Sand ecological site is the lowest producing bluebunch wheatgrass – sagebrush site in MLRA 007X. Plants are widely scattered. Water perching on duripan or basalt, the shallow soil depth, and stones throughout the profile drive the vegetative expression of this site. The shallow soil depth limits rooting, while the soil depth and stones limit the water holding capacity in the profile. Thus, plant production is quite limited for Shallow Stony Sand ecological 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

In most years Shallow Stony Sand ecological sites 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:

The landscape is part of the Columbia basalt plateau. Shallow Stony Sand ecological sites occur on hillsides, ridges, benches and plateaus

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

Landscapes: Hills and plateaus Landform: Terraces, hillslopes, fans and structural benches

Elevation: Range: 500 to 2,800 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 inch 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 the Shallow Stony Sand ecological site is March through mid-May.

Soil features

Edaphic:

The Shallow Stony Sand ecological site commonly occurs with Sandy, Sandy Loam and Sands ecological sites.

REPRESENTATIVE SOIL FEATURES

This ecological site components are dominantly Xeric and some Lithic taxonomic subgroup of Haplocambids, Haplargids, Haplodurids great group of the Aridisols taxonomic orders. Soils are dominantly shallow. Average available water capacity of about 1.5 inches (3.8 cm) in the 0 to 40 inches (0 to 100 cm) depth range.

Soil parent material is dominantly loess, colluvium and glacial outwash.

The associated soils are Ekrub, Fortyday, Malaga, Wanapum and similar soils.

Dominate soil surface is fine sand to very stony loam.

Dominant particle-size class is sandy-skeletal 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: 25 Average: 15

Subsurface fragments > 3 inches (% Volume) Minimum: 0 Maximum: 30 Average: 15

Subsurface fragments ≤ 3 inches (% Volume): Minimum: 0 Maximum: 45 Average: 30

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: 10 Maximum: 20

Electrical Conductivity (dS/m) Minimum: 0 Maximum: 5

Sodium Absorption Ratio Minimum: 0 Maximum: 5

Calcium Carbonate Equivalent (percent): Minimum: 0 Maximum: 5

Soil Reaction (pH) (1:1 Water): 0 - 10 inches: 6.1 to 9.0 10 - 20 inches: 6.1 to 9.0

Available Water Capacity (inches, 0 – 40 inches depth) Minimum: 1.0 Maximum: 3.4 Average: 1.5

Vegetation dynamics

ECOLOGICAL DYNAMICS: Vegetation Dynamics: The Shallow Stony Sand ecological site produces about 200 to 400 pounds per acre of biomass annually

Wyoming big sagebrush and bluebunch wheatgrass are at the core of the Shallow Stony Sand ecological site and warrant a degree of understanding.

Wyoming big sagebrush in a long-lived, multi-branched, evergreen shrub. Size is no more than 18 inches to two feet high on Shallow Stony Sand ecological site. Wyoming big sagebrush has a significant rooting system, composed of a two-part rooting structure with a primary deep taproot, and a shallow extensive network of finer roots that spread laterally. This rooting system allows Wyoming big sagebrush to survive in the hottest and driest portions of the sagebrush range by tapping into groundwater sources deep into the soil profile itself. This also allows Wyoming big sagebrush to be more competitive with bunchgrasses when the landscape positions and soils are less ideal for grass species to maintain the competitive advantage.

Bluebunch wheatgrass is a long-lived, mid-sized bunchgrass with an awned or awnless seed head arranged in a spike. Bluebunch provides a crucial and extensive network of roots to fill the soil profile on Shallow Stony. 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 bluebunch wheatgrass. As long as bluebunch wheatgrass plants occupy the site, the system holds together. If we lose the bluebunch the ecosystem crashes or unravels.

Shallow Stony Sand ecological site is resistant to most natural disturbances and ecologically stable. Due to 35 to 75 percent 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, most Shallow Stony Sand ecological sites are stable.

In many pastures, 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 sites that are grazed, as grazing pressure increases the plant community unravels in stages:

1. Bluebunch wheatgrass declines while sagebrush, needle and thread and buckwheat species increase 2. Bluebunch wheatgrass continues to decline as does needle and thread, while invasive species such as cheatgrass and knapweed colonize the site. Shallow Stony Sand ecological sites rarely have more than thinly scattered cheatgrass.

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, Wyoming sagebrush – bluebunch wheatgrass communities provide habitat for a variety of upland wildlife species.

Supporting Information

Associated Sites:

Shallow Stony Sand ecological site is associated with other ecological sites in MLRA 007X, including Sandy, Sandy Loam, Sands and Stony.

Similar sites:

Shallow Stony Sand (MLRA 007X) and Shallow Stony (MLRA 008X) ecologically are between Very Shallow and other Wyoming big sagebrush – bluebunch wheatgrass 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 State Correlation:

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

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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

R007XY114WA–Shallow Stony Sand

Stage

Provisional

Contributors

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State and transition model



Reference Community 1.1 for Shallow Stony Sand 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.

Note: this site rarely burns so all shrubs are listed together in one group

Similarity Index	х			Similarity Index		
Dominant Shrubs (3-7% canopy)						
25% 100 lbs.						
ARTRW8 Wyoming sagebrush						
SADOI purple sage						
ARRI2 stiff sage						
ERSP7 rock buckwheat						
PUTR2 bitterbrush						
CHRYS rabbitbrush						
Dominant Mid-Size Bunchgrasses Other	Mid-Size	Bunch	orasses -	Minor		
50% 200 lbs	Mild Size	Dunen	less t	than 5%	15 lbs	
PSSP6 bluebunch wheatgrass ELEL	5 bottle	brush s	uirreltail		10 105.	
HECO26 needle and thread ACTH	7 Thurb	er need	egrass			
		er need	Grubb			
Short Grass – Subdominant						
10-15% 60 lbs.						
POSE Sandberg bluegrass						
VUOC sixweeks fescue						
N.C. F.L. S.L.L.						
Native Forbs - Subdominant				10-15%	60 lbs.	
PHHO spiny phlox I	IPU11	granite	oilia			
NEST5 narrowleaf goldenweed B	BAHO		Hooker balsamroot			
ERIOG buckwheat	LOMAT		lomatium / biscuitroot			
ALLIU wild onion E	ERIGE2 fleaba		ine			
ASTRA milkvetch / locoweed A	ANDI2 low p		issytoes			
PLPA2 woolly plantain P	PENST penstemon					
× .			Below	Normal	Above	
Estimated Production (pounds / acre)			200	350	400	

State 1 Reference State

State 1 Narrative: State 1 represents sagebrush steppe with no invasive or exotic weed species. Communities with heavy sagebrush or a dominance of annual grasses have never been seen on Shallow Stony Sand. Reference community 1.1 is dominated by bluebunch wheatgrass and Wyoming sagebrush. Needle and thread is co-dominant to sub-dominant Reference State Community Phases: 1.1 Reference Bluebunch wheatgrass-Wyo. sagebrush Dominate Reference State Species: Wyoming big sagebrush (overstory) and bluebunch wheatgrass Needle and thread is co-dominant to sub-dominant to sub-dominant At-risk Communities: • Any community in the Reference State is at risk of moving to State 2. The seed source of cheatgrass is nearby and blowing onto most sites annually. • Reference Community is quite stable as it receives limited grazing pressure and rarely burns • State 3 has not been seen on Shallow Stony Sand ecological sites

Community 1.1 Reference Plant Community: Bluebunch wheatgrass-Wyoming big sagebrush

Reference community 1.1 is dominated by bluebunch wheatgrass and Wyoming big sagebrush. Needle and thread is codominant to subdominant

State 2 Sagebrush Steppe with Invasive Species

State 2 Narrative: State 2 is sagebrush steppe, similar to the Reference State, but with the inclusion of minor amounts of invasive annual grasses such as cheatgrass. Most Shallow Stony Sand 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. Community Phases for State 2: 2.1 Reference w/ Annual Grasses Bluebunch wheatgrass-Wyoming big sagebrush Pathways within State 2 N/A as there is only one community in State 2 Dominate Species in State 2: Bluebunch wheatgrass, needle and thread, Wyoming big sagebrush No Transition available back to the Reference State due to Invasive species.

Community 2.1 Reference w/ Annual Grasses

State 3 Annual Grasses

State 3 Narrative: State 3 represents sites that are dominated by invasive annual species and has crossed a biological threshold. State 3 is rare for Shallow Stony Sand sites. The main species include cheatgrass, mustard, prickly lettuce and diffuse knapweed. Invasive annual grasses such as cheatgrass, are not as competitive as on adjoining deeper ecological sites. But a micro-burst of cheatgrass can occur. Cheatgrass seed blows onto Shallow Stony Sand sites annually. In a year with heavy snowfall and early spring rain, such as 2017, the site has 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 are episodic and mostly a temporary condition in MLRA 8 Shallow Stony sites. Within a couple of years cheatgrass will be nonexistent to at most a very minor component. Community Phases for State 3: Only one community. Dominate Species in State 3: Cheatgrass and Wyoming sagebrush No Recovery State 3 is considered non-reversible. Due to shallow soil depth, surface rock and rock within the soil profile, and the equipment limitations thereof, seeding is not practical for the Shallow Stony Sand ecological site. Restoration of bluebunch wheatgrass, needle and thread, sagebrush, native forbs and the soil biotic crust would be very problematic at best on Shallow Stony Sand ecological sites. 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 Sand ecological site can change guickly. 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 Sand ecological site. Perhaps the only avenue for recovery would be to plant plugs of native species which is a very costly and risky proposition.

Transition T1 State 1 to 2

T1 Result: shift from State 1 (bunchgrass-shrub) to State 2 with minor additions of cheatgrass. Primary Triggers: A high moisture year causes a micro-burst of cheatgrass and is the principle means of colonization. Loss of soil biological crusts contributes to the invasion. Also, soil disturbances (rodents, badgers) create openings in the community and encourage weed germination. Ecological process: Most sites in the Reference State have cheatgrass seed as the seed blows onto the sites annually. Cheatgrass is a prolific seeder and the seed is waiting for enough moisture to germinate and to compete with the native species for space, light and moisture. When there is more moisture available than the plant community can utilize, even pristine community is generally a temporary condition on Shallow Stony sites. Indicators: The occurrence of annual grasses on sites where they had been

Transition T3 State 2 to 3

T3 Result: Shift from State 2 to State 3 which is dominated by annuals. State 3 is rare and has not been seen on Shallow Stony Sand ecological sites. This transition occurs once the cover of invasive species is co-dominate with sagebrush and the cover of bluebunch wheatgrass is minor. Primary Trigger: Chronic heavy grazing, season-long grazing, or late spring grazing causes poor vigor and bluebunch wheatgrass has a significant reduction in cover. Ecological Process: With consistent defoliation pressures bluebunch wheatgrass cover declines due to shrinking crowns and some mortality. More and more of the soil surface and upper soil rooting surface become open to opportunistic, exotic weeds that take advantage of the available niche space to colonize and expand. The invasive annual grasses in State 2 communities make a dramatic increase to dominate the community. Annuals such as cheatgrass have the competitive advantage. The site has lost its primary species that stabilize and protect the soil from wind and water erosion and has also lost the ability to retain adequate soil moisture for many of the native perennial species. Increasing distance between perennial species. Decreasing soil organic matter, soil water retention, limited water infiltration and percolation in the soil profile.

Citations