Ecological site group R009XG612WA
Shallow Stony

Last updated: 11/22/2023
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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): 9 – Palouse and Nez Perce Prairie

LRU – Common Resource Areas (CRA):
9.1 - Channeled Scablands
9.12 - Moist Loess Islands
9.2 - Palouse Hills
9.3 - Dissected Loess Uplands
9.4 - Deep Loess Foothills
9.5 - Warm Canyons and Dissected Uplands

Site Concept Narrative:
Diagnostics:

Shallow Stony is a bunchgrass-forb, upland site. This site occurs predominately on ridges and north slopes. Soils are both shallow (10-20” deep) and stony to extremely stony. Soils have a stony or cobbly surface and rock fragments (35% or more) throughout the profile. Soil textures loam, silt loam, clay loam and clay are most common. The soil surface is mostly bare soil, soil biotic crust or rock.

This site has a dense herbaceous layer dominated by bunchgrasses in the reference state and with a strong component of forbs. Shrubs are minor to nonexistent. Idaho fescue is dominant while bluebunch wheatgrass is co-dominant bunchgrasses Sandberg bluegrass is the major grass of the lower grass layer. Balsamroot, lupine, biscuitroot and phlox are common forbs.

Principle Vegetative Drivers:

The shallow soil depth limits rooting, while the soil depth and stones limit the water holding capacity in the profile. But despite the soil limitations, Shallow Stony is a productive site. Spring rains and the northerly aspect offset the soil limitation to provide a micro-climate that is more favorable to Idaho fescue.

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:

MLRA 9 is south of the Okanogan Highlands and Spokane Valley, east of the Columbia Basin, includes only the wet end of the Channeled Scablands and forms a horseshoe around the Blue Mtns. The landscape is part of the Columbia basalt plateaus and Northern Rocky foothills.

MLRA 9 has three distinct geographical types:
(1) the Palouse Hills on the east side
(2) the loess hills to the south and west
(3) the Channeled Scabland-loess islands in the northwest

The description below is for Shallow Stony which occurs in all three geographic areas in MLRA 9.

Physiographic Division: Intermontane Plateau and Northern Rocky Mountain System
Physiographic Province: Columbia Plateau and Northern Rocky Mountains
Physiographic Sections: Walla Walla Plateau and Blue Mountain Section

Landscapes: Dominantly hills and plateaus
Landform: Canyons, hillslopes, ridges

Elevation: Dominantly 1,000 to 5,000 feet
Slope: Total range: 0 to 90 percent
Central tendency: 20 to 40 percent
Aspect: Occurs on all aspects

Geology:

MLRA 9 is almost entirely underlain by Miocene basalt flows. Columbia River basalts are covered by wind-blown loess and volcanic ash with a thickness up to 250 feet thick. The oldest layer of loess accumulated between 2 and 1 million years ago, while the uppermost layers of Palouse Loess accumulated between 15,000 years ago and modern times. The mid layers of loess were deposited episodically between 77,000 years and 16,000 years ago. During the Pleistocene era the channeled scablands, the northwest portion of MLRA 9, were scoured of topsoil by the Lake Missoula Floods about 15,000-17,000 years ago. Flows removed topsoil from exposed ridges and basalt rims in canyons.

Climate

The climate across MLRA 9 is characterized by moderately cold, wet winters, and relatively dry summers.

Mean Annual Precipitation:

Range: 16 – 28 inches
Winter precipitation, primarily snow, occurs during low-intensity, Pacific-frontal storms. During winter these storms produce occasional rains that fall on frozen or thawing ground surfaces. High intensity, convective thunderstorms produce some rain during the growing season. Precipitation is evenly distributed throughout fall, winter and spring.

Mean Annual Air Temperature"

Range: 40 to 52 F
Central Tendency: 44 – 49 F
Freezing temperatures generally occur from late-October through early-April. Temperature extremes are -10 degrees in winter and 110 degrees in summer. Winter fog is variable and often quite localized, as the fog settles on some areas but not others.

Frost-free period (days):

Total range: 60 to 180
Central tendency: 100 to 140
The growing season for Shallow Stony is generally March through July.

Soil features

Edaphic:

The Shallow Stony ecological site commonly occurs with rock outcrop, Very Shallow and one of the North Slope ecological sites. Soils are formed in loess and ash mixed with residuum, colluvium, alluvium and tuff weathered from basalt. Soils are shallow, stony and face north.

Representative Soil Features:

This ecological site components are dominantly Lithic, Pachic and Vitrandic taxonomic subgroups of Argixerolls and Haploxerolls great groups of the Mollisols. Soils are shallow to very deep. Average available water capacity of about 2.5 inches (6.4 cm) in the 0 to 40 inches (0-100 cm) depth range.

Soil parent material is dominantly loess and colluvium derived from basalt, possibly mixed with minor amounts of ash in the upper part of the soil.

The associated soils are Gwin, Harlow, Laufer, Mallory, Snell and similar soils.

Dominate soil surface is silt loam to extremely stony loam.

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

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

Fragments within surface horizon > 3 inches (% Volume):
Minimum: 0
Maximum: 30
Average: 15

Fragments within surface horizon ≤ 3 inches (% Volume):
Minimum: 0
Maximum: 30
Average: 15

Subsurface fragments > 3 inches (% Volume):
Minimum: 10
Maximum: 40
Average: 20

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

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
10 to 40 inches: Moderately high to moderately low

Depth to root-restricting feature (inches):
Minimum: 10
Maximum: Greater than 60

Electrical Conductivity (dS/m):
Minimum: 0
Maximum: 4

Sodium Absorption Ratio:
Minimum: 0
Maximum: 5

Calcium Carbonate Equivalent (percent):
Minimum: 0
Maximum: 30

Soil Reaction (pH) (1:1 Water):
0 - 10 inches: 5.6 to 8.4
10 - 40 inches: 5.6 to 9.0

Available Water Capacity (inches, 0 – 40 inches depth):
Minimum: 1.0
Maximum: 6.3
Average: 2.5

Vegetation dynamics

Ecological Dynamics:

Shallow Stony produces about 700 -1500 pounds/acre of biomass annually

Shallow Stony is a bunchgrass-forb ecological site. Idaho fescue is dominant, bluebunch wheatgrass is sub-dominant, while forbs are important and, shrubs are minor. The presence and relative abundance of Idaho fescue is an indication of the comparatively mesic environment for this site. The ratio of Idaho fescue to bluebunch wheatgrass plants on any site can vary due to aspect and elevation

Idaho fescue is shorter and has a dense clump of shoots, while bluebunch wheatgrass is taller and is less dense. Both species are long-lived bunchgrasses. Bluebunch has an awned or awnless inflorescence arranged in a spike, while Idaho fescue has an awned inflorescence arranged in a panicle. The ratio of Idaho fescue to bluebunch wheatgrass plants on any site can vary due to aspect and elevation.

In healthy communities, these mid-sized grasses provide a crucial and extensive network of roots to the upper portions (up to 48” deep in soils with no root-restrictive horizons) of the soil profile. This root-network stabilizes the soils, provides organic matter and nutrients, and helps to maintain soil pore space for water infiltration and retention un the soil profile. The extensive rooting system of mid-sized grasses leave very little space for invasion by other species. This drought resistant root mass can compete with, and suppress, the spread of exotic weeds.

The stability and resiliency of the reference communities is directly linked to the health and vigor of Idaho fescue and bluebunch wheatgrass. Refer to page 8 for more details about bunchgrass physiology. Research has found that

the community remains resistant to medusahead if the site maintains at least 0.8 mid-sized bunchgrass plant/sq. ft. (K. Davies, 2008). The relationship between bunchgrasses and other invasive species should be similar. These two bunchgrasses hold the system together. If we lose Idaho fescue the ecosystem begins to unravel.

Impacts of fire and grazing on Shallow Stony North Slope:
Fire: The vegetative cover is too low to carry fires, so these sites rarely burn
Grazing: In many pastures the Shallow Stony North Slope sites are so stony that these sites are not attractive to grazing animals, and so are rarely if ever grazed.

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

For sites that are grazed, as grazing pressure increases the plant community unravels in stages:
1. Idaho fescue declines while bluebunch wheatgrass and unpalatable forbs increase.
2. Both Idaho fescue and bluebunch wheatgrass decline, while unpalatable forbs species increase.
3. As fescues and bluebunch continue to decline, invasive species such as tarweed, bulbous bluegrass and others colonize the site

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, Idaho fescue communities provide habitat for a variety of upland wildlife species.

Supporting Information:

Associated Sites:
Shallow Stony is associated with other ecological sites in MLRA 9, including Very Shallow, Stony South Aspect, and the North Aspect sites.

Similar Sites:
This MLRA 9 Shallow Stony site extends into MLRA 43c the Blue mountains.
MLRAs 6, 7 & 8 also have Shallow Stony sites.

Inventory Data References (narrative):
Data to populate Reference Community came from several sources: (1) NRCS ecological sites from 2004, (2) Soil Conservation Service range sites from 1980s and 1990s, (3) Daubenmire’s habitat types, and (4) ecological systems from Natural Heritage Program

Major Land Resource Area

MLRA 009X
Palouse and Nez Perce Prairies

Subclasses

- R009XY612WA–Shallow Stony

Stage

Provisional

Contributors

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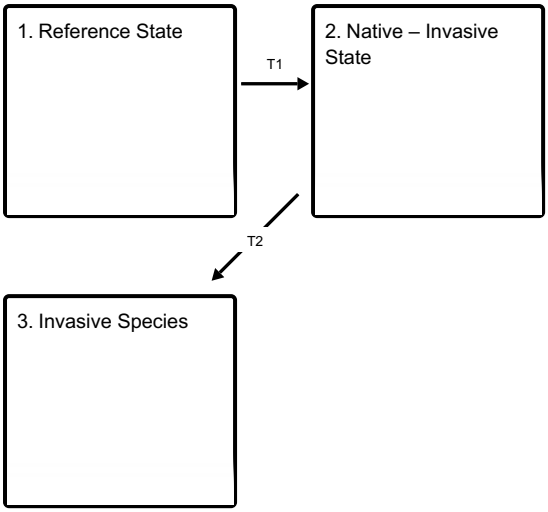
State and transition model

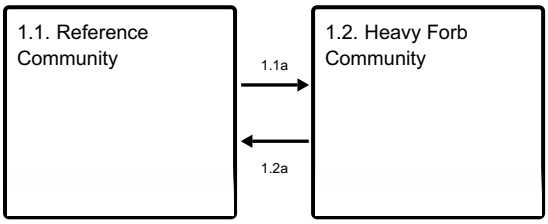
Ecosystem states



T1 - grazing pressure

T2 - grazing pressure

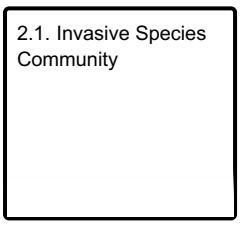
State 1 submodel, plant communities



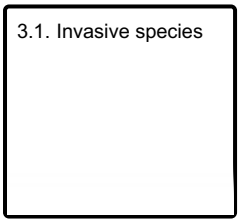
1.1a - grazing pressure

1.2a - improved grazing management or complete rest

State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Reference State

State 1 Narrative: State 1 represents grassland with no invasive or exotic weed species. All functional and structural groups are present. Reference community 1.1 is dominated by Idaho fescue Reference State Community Phases: 1.1 Reference Idaho fescue – bluebunch wheatgrass – native forbs 1.2 Heavy Forb Native forbs – Idaho fescue – bluebunch wheatgrass Dominant Reference State Species: Idaho fescue, bluebunch wheatgrass, native forbs At-risk Communities: • Any community in the reference state is at risk of moving to State 2. The seed source of annual grasses is nearby and moving into most sites annually. • The Reference community for Shallow Stony is quite

stable

Community 1.1
Reference Community

This Shallow Stony ecological site has high precipitation and is found along ridges and on north aspects. Hence, the high production for shallow, stony soils.

	Similarity Index			Similarity Index	
			Sprouting Shrubs – Minor	less than 5%	50 lbs.
			ROSA5 rose SYAL snowberry		
Dominant Mid-Size Bunchgrasses	**65%**		**Other Mid-Size Bunchgrasses – Minor**	5-10%	150 lbs.
PSSP6 bluebunch wheatgr.	25%	400 lbs.	ELEL5 bottlebrush squirreltail		
FEID Idaho fescue	40%	600 lbs.	KOMA prairie junegrass PPGG other native bunchgrasses		
Short Grasses – Minor	5%	75 lbs.			
POSE Sandberg bluegrass VUOC sixweeks fescue					
Native Forbs – Subdominant				20%	300 lbs.

Idaho fescue – bluebunch wheatgrass – native forbs 40% Idaho fescue 25% bluebunch wheatgrass 20% native forbs

Community 1.2
Heavy Forb Community

Native forbs – Idaho fescue – bluebunch wheatgrass 25% Idaho fescue 15% bluebunch wheatgrass 40% native forbs

Pathway 1.1a
Community 1.1 to 1.2

1.1a Result: shift from Reference Community 1.1 to Heavy Forb Community 1.2. Moderate reduction in bunchgrasses and a big increase in unpalatable native forbs Primary Trigger: grazing pressure (heavy grazing intensity, season long grazing or frequent late spring grazing) to Idaho fescue, bluebunch wheatgrass and other palatable species. Ecological process: with consistent defoliation pressure Idaho fescue, bluebunch wheatgrass and other palatable species have poor vigor and shrinking crowns. Unpalatable forbs gain the competitive edge and increase via new seedlings. Indicators: decreasing cover and shrinking crowns for Idaho fescue, increasing cover for unpalatable forbs.

Pathway 1.2a
Community 1.2 to 1.1

1.2a Result: shift from Heavy Forb Community 1.2 to Reference Community 1.1. Primary Trigger: improved grazing management or complete rest Ecological process: with defoliation pressure released native bunchgrasses have restored vigor and increase via tillering and new seedlings. Perennial bunchgrasses can readily compete with annual native forbs. Indicators: increasing cover for Idaho fescue, bluebunch wheatgrass and other palatable species, and decreased cover for forbs.

State 2
Native – Invasive State

State 2 Narrative State 2 represents a moderate invasion by invasive species. Native species are present and dominant, but invasive species have gained a foothold. Grazing pressure weakens the stand of native species allowing the invasive species to colonize and establish themselves in the community. The community is about evenly distributed between native forbs, invasive species and native bunchgrasses. Community Phases for State 2: 2.1 Native community with invasive species: bluebunch wheatgrass – native forbs – invasive species Dominant Species in State 2: native forbs, invasive species & native bunchgrasses

Community 2.1
Invasive Species Community

Native community with invasive species: bluebunch wheatgrass – native forbs – invasive species 10% Idaho fescue 20% bluebunch wheatgrass 30% native forbs 30% invasive species

State 3
Invasive Species

State 3 Narrative: State 3 represents sites that are dominated by invasive species and has crossed a biological threshold. State 3 is rare for Shallow Stony sites. The main species include bulbous bluegrass, tarweed and ventenata. Invasive annual grasses such as ventenata, are not as competitive on Shallow Stony North as on adjoining deeper ecological sites. But a micro-burst of annual grass and weeds can occur. Annual grass seed blows onto Shallow Stony 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 are episodic and mostly a temporary condition on Stony Shallow. Within a couple of years annual grasses and weeds will be nonexistent to at most a very minor component.

Community 3.1
Invasive species

Invasive species such as bulbous bluegrass, tarweed, ventenata 80% invasive species

Transition T1
State 1 to 2

T1 Transition from Reference State with no invasive species to State 2 a with a mixed stand of native plants with some invasive species. Previously the stand has not had alien species. The result of this transition is the presence of invasive species. Depending on seeds in the soil bank and what is growing nearby, bulbous bluegrass, tarweed, ventenata or other invasives enter the stand of native species. Primary Trigger: grazing pressure (heavy grazing intensity, season long grazing or frequent late spring grazing) to Idaho fescue, bluebunch wheatgrass and other palatable grasses species Ecological process: with consistent grazing pressure bluebunch wheatgrass, Idaho fescue and other palatable species exhibit poor vigor, shrinking crowns and plant mortality. The release of resources and niche space provide invasive species the opportunity to colonize and establish. Indicators: decreasing cover of palatable native species and the occurrence of invasive species on sites where they had been absent.

Transition T2
State 2 to 3

T2 Result: shift from State 2 of native species with some invasive plants to State 3 which is dominated by invasive species. This transition occurs once the cover of invasive species is dominate and the cover of dominant native species are minor. Primary Trigger: grazing pressure (heavy grazing intensity, season long grazing or frequent late spring grazing) to Idaho fescue, bluebunch wheatgrass and other palatable species. Ecological Process: with consistent defoliation pressure Idaho fescue, bluebunch wheatgrass and other palatable species have poor vigor, shrinking crowns and plant mortality. In a series of retrogressions palatable native species are weakened, and the invasive species increase to fill the void. This continues until the stand is dominated by invasive species rather than natives. Also, 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. Indicators: Decreasing cover of Idaho fescue and bluebunch wheatgrass and increasing cover of invasive species. Increasing distance between perennial bunchgrass crowns. 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 ecological site. Restoration of bluebunch wheatgrass, sagebrush, native forbs and the soil biotic crust would be very problematic at best on Shallow Stony. 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 can change quickly. Drying winds and bright sun can turn a snowy or muddy site into a hard crust before plants are established. So, the timing of all recovery efforts would have an extremely narrow window of opportunity on Shallow Stony. Perhaps the only avenue for recovery would be to plant plugs of native species which is a very costly and risky proposition. 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 Liston, A, B.L. Wilson, W.A. Robinson, P.S. Doescher, N.R. Harris, and T. Svejar. 2003. The Relative Importance of Sexula Reproduction Versus Clonal Spread in an Arid Bunchgrass. Oecologia 137:216-225 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 Vallentine, John F. 1971. Range Development and Improvement. BYU Press, Provo, Utah

Citations