USDA Natural Resources
Conservation Service

Ecological site R007XY114WA
Shallow Stony Sand

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General information

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.

MLRA notes

Major Land Resource Area (MLRA): 007X–Columbia Basin

This MLRA is in the Walla Walla Plateau section of the Columbia Plateaus province of the Intermontane Plateaus. The Columbia River flows through this MLRA, and the Snake and Yakima Rivers join the Columbia River within it. This MLRA 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. The dominant soil orders in this MLRA are Aridisols and Entisols. The soils in the area dominantly have a mesic temperature regime, an aridic moisture regime, and mixed mineralogy. They generally are moderately deep to very deep and well drained to excessively drained.

Classification relationships

Major Land Resource Area (MLRA): 7 – 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

Ecological site concept

Shallow Stony Sand is a sparsely vegetated upland shrub steppe site in MLRA 7, occurring on soils that have three characteristics:
(1) shallow depth (10-20 inches),
(2) fine sands texture and
(3) rock in soil profile or on 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 12to 20 inches high Wyoming big sagebrush, but some sites can have a lot of 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 subdominant.

Shallow Stony Sand is the lowest producing bluebunch wheatgrass – sagebrush site in MLRA 7. 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 sites.

Associated sites

R007XY449WA	**Sandy**
R007XY143WA	**Sandy Loam**
R007XY140WA	**Sands**
R007XY120WA	**Stony**

Similar sites

R007XY001WA	**Very Shallow** Very shallow occurs on soils that are < 10 inches (25 centimeters) to restrictive horizon.
R007XY120WA	**Stony** Stony sites occur on soils with > 20 inches (50 centimeters) depth.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata ssp. wyomingensis*
Herbaceous	(1) *Pseudoroegneria spicata*

Physiographic features

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

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

Table 2. Representative physiographic features

Landforms	(1) Hills > Hillslope (2) Plateau (3) Terrace (4) Fan (5) Structural bench
Flooding frequency	None
Ponding frequency	None
Elevation	500–2,000 ft
Slope	2–30%
Water table depth	Not specified
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Flooding frequency	None
Ponding frequency	None
Elevation	500–2,800 ft
Slope	0–60%
Water table depth	Not specified

Climatic features

MLRA 7 is the lowest, driest and hottest portions of the entire Columbia River region and the sagebrush-bluebunch wheatgrass zone.

The climate across MLRA 7 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 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.

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 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.

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 (< 20 inches [50 centimeters] depth).

Table 4. Representative soil features

Parent material	(1) Loess (2) Colluvium (3) Outwash
Surface texture	(1) Fine sand (2) Very stony loam
Family particle size	(1) Sandy-skeletal (2) Loamy-skeletal
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately rapid to rapid
Depth to restrictive layer	10–20 in
Soil depth	10–20 in
Surface fragment cover <=3"	15%
Surface fragment cover >3"	15%
Available water capacity (0-40in)	1.5 in
Calcium carbonate equivalent (0-20in)	Not specified
Electrical conductivity (0-20in)	Not specified
Sodium adsorption ratio (0-20in)	Not specified

Soil reaction (1:1 water) (0-10in)	Not specified

Table 5. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	Not specified
Soil depth	Not specified
Surface fragment cover <=3"	0–25%
Surface fragment cover >3"	0–35%
Available water capacity (0-40in)	1–3.4 in
Calcium carbonate equivalent (0-20in)	0–5%
Electrical conductivity (0-20in)	0–5 mmhos/cm
Sodium adsorption ratio (0-20in)	0–5
Soil reaction (1:1 water) (0-10in)	6.1–9

Ecological 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

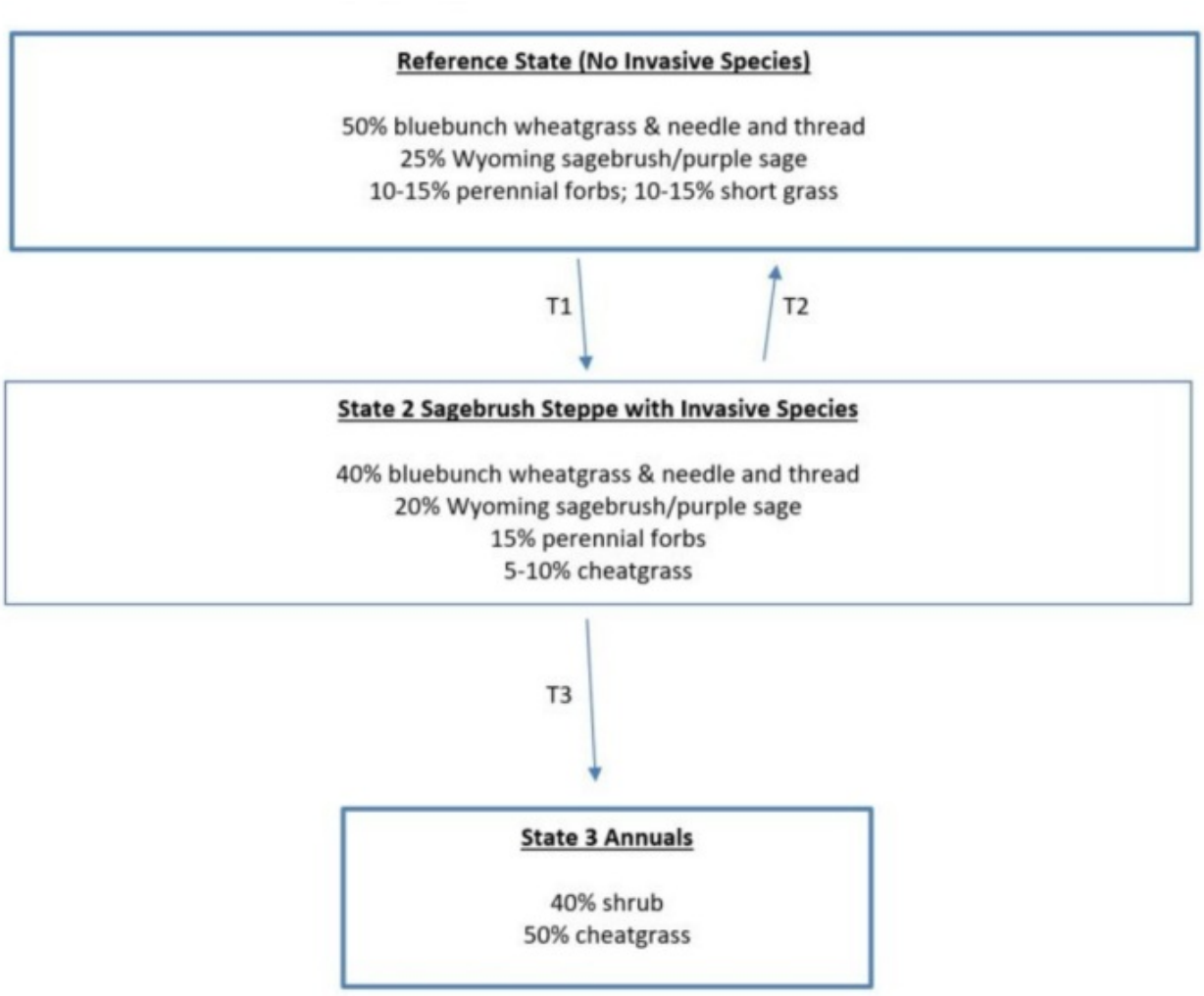
stabilize once altered. For example, vehicle traffic when the soil is saturated will leave ruts that remain for years to come.

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.

State and transition model



State 1
Reference

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.

Dominant plant species

- Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), shrub
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass

- needle and thread (*Hesperostipa comata*), grass

Community 1.1
Bluebunch Wheatgrass and Wyoming Big Sagebrush

Reference community 1.1 is dominated by Bluebunch wheatgrass and Wyoming big sagebrush. Needle and thread is co-dominant to sub- dominant.

Dominant plant species

- Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), shrub
- needle and thread (*Hesperostipa comata*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	–	80	–
Grass/Grasslike	–	217	–
Forb	–	50	–
Total	**–**	**347**	**–**

State 2
Sagebrush Steppe with Invasives

State 2 is Sagebrush Steppe with Invasives, 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 2.1
Sagebrush and Annual Grass

This community resembles the reference community, but with the inclusion of minor amounts of annual grasses such as cheatgrass.

Dominant plant species

- Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), shrub
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass

State 3
Annuals

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 3.1
Annuals

This community is dominated by invasive annual species including cheatgrass, mustards, prickly lettuce, and diffuse knapweed.

Dominant plant species

- cheatgrass (*Bromus tectorum*), grass
- mustard (*Brassica*), other herbaceous
- prickly lettuce (*Lactuca serriola*), other herbaceous
- diffuse knapweed (*Centaurea diffusa*), other herbaceous

Transition T1A
State 1 to 2

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. 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 communities in the Reference State are susceptible to colonization by cheatgrass. The addition of cheatgrass to the community is generally a temporary condition on Shallow Stony sites.

Restoration pathway R2A
State 2 to 1

Result: shift from State 2 community with minor amount of cheatgrass back to State 1 community with no cheatgrass. Primary Trigger: normal to below normal precipitation year.

Transition T2A
State 2 to 3

Chronic heavy grazing, season-long grazing, or late spring grazing causes poor vigor and bluebunch wheatgrass has a significant reduction in cover. 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.

Constraints to 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. 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 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 Sand. Perhaps the only avenue for recovery would be to plant plugs of native species which is a very costly and risky proposition.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
1	**Dominant Shrubs**			100	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	–	–
	purple sage	SADOI	*Salvia dorrii ssp. dorrii var. incana*	–	–
	scabland sagebrush	ARRI2	*Artemisia rigida*	–	–
	spike lovegrass	ERSP2	*Eragrostis spicata*	–	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	–	–
	chrysactinia	CHRYS	*Chrysactinia*	–	–
Grass/Grasslike					
3	**Dominant Mid-Size Bunchgrass**			200	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	–	–
	leafy heliotrope	HECO4	*Heliotropium confertifolium*	–	–
4	**Other Mid-Size Bunchgrasses - Minor**			15	
	squirreltail	ELEL5	*Elymus elymoides*	–	–
	Thurber's needlegrass	ACTH7	*Achnatherum thurberianum*	–	–
5	**Short Grass- Subdominant**			60	
	Sandberg bluegrass	POSE	*Poa secunda*	–	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	–	–
Forb					
6	**Native Forbs - Subdominant**			60	
	spiny phlox	PHHO	*Phlox hoodii*	–	–
	buckwheat	ERIOG	*Eriogonum*	–	–
	onion	ALLIU	*Allium*	–	–
	milkvetch	ASTRA	*Astragalus*	–	–
	Parish's popcornflower	PLPA	*Plagiobothrys parishii*	–	–
	Hooker's balsamroot	BAHO	*Balsamorhiza hookeri*	–	–
	desertparsley	LOMAT	*Lomatium*	–	–
	fleabane	ERIGE2	*Erigeron*	–	–
	low pussytoes	ANDI2	*Antennaria dimorpha*	–	–
	beardtongue	PENST	*Penstemon*	–	–

Inventory data references

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

Other references

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Approval

Kirt Walstad, 2/06/2025

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	07/25/2023
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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5. **Number of gullies and erosion associated with gullies:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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7. **Amount of litter movement (describe size and distance expected to travel):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

14. **Average percent litter cover (%) and depth (in):**

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

17. **Perennial plant reproductive capability:**