

Ecological site group R008XG112WA

Shallow Stony, Sagebrush

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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): 8 – Columbia Plateau

LRU – Common Resource Areas (CRA):

- 8.1 - Channeled Scablands
- 8.2 - Loess Islands
- 8.3 - Okanogan Drift Hills
- 8.4 - Moist Pleistocene Lake Basins
- 8.5 - Moist Yakima Folds
- 8.6 - Lower Snake and Clearwater Canyons
- 8.7 - Okanogan Valley

Site Concept Narrative:

Note: for MLRA 8 there are two ecological sites with the name "Shallow Stony":

1. One for the sagebrush steppe region
2. One for grasslands on south side of Columbia Hills

The Shallow Stony ESD below is for the sagebrush region.

Diagnostics:

Shallow Stony is a sparsely vegetated upland site in the sagebrush steppe areas of MLRA 8 occurring on soils that 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.

Plants on Shallow Stony are widely scattered. Fire-sensitive shrubs dominate the reference state overstory, while perennial bunchgrasses and forbs provide the understory. The shrub layer is typically 18"-24" high Wyoming sagebrush. Cool-season bunchgrasses form two distinct layers. Bluebunch wheatgrass is the dominant bunchgrass in the top grass layer, while Sandberg bluegrass is the major grass of the lower grass layer.

Principle Vegetative Drivers:

The 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.

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:

The landscape is part of the Columbia basalt plateau. Shallow Stony sites occur on sideslopes of ridges and plateaus, ridges & benches, footslopes and hillslopes, and canyon walls.

Physiographic Division: Intermontane Plateau

Physiographic Province: Columbia Plateau

Physiographic Sections: Walla Walla Plateau Section

Landscapes: Hills, valley, channel scablands and plateaus

Landform: Sideslopes, terraces, alluvial fans, nose slopes

Elevation: Dominantly 600 to 4,000 feet

Slope: Total range: 0 to 65 percent

Central tendency: 2 to 35 percent

Aspect: Occurs on all aspects

Geology:

This MLRA is almost entirely underlain by Miocene basalt flows. Columbia River basalt is covered in many areas with as much as 200 feet of loess and volcanic ash. Small areas of sandstones, siltstones, and conglomerates of the Upper Tertiary Ellensburg Formation are along the western edge of this area. Some Quaternary glacial drift covers the northern edge of the basalt flows, and some Miocene-Pliocene continental sedimentary deposits occur south of the Columbia River, in Oregon.

A wide expanse of scablands in the eastern portion of this MLRA, in Washington, was deeply dissected about 16,000 years ago, when an ice dam that formed ancient glacial Lake Missoula was breached several times, creating catastrophic floods. The geology of the northernmost part of this MLRA is distinctly different from that of the rest of the area. Alluvium, glacial outwash, and glacial drift fill the valley floor of the Okanogan River and the side valleys of tributary streams. The fault parallel with the valley separates pre-Tertiary metamorphic rocks on the west, in the Cascades, from older, pre-Cretaceous metamorphic rocks on the east, in the Northern Rocky Mountains. Mesozoic and Paleozoic sedimentary rocks cover the metamorphic rocks for most of the length of the valley on the west.

Climate

The Wyoming sagebrush-bluebunch wheatgrass areas are both warmer and drier than grasslands or other shrub steppe sites (Daubenmire). The climate is characterized by moderately cold, wet winters, and hot, dry summers, with limited precipitation due to the rain shadow effect of the Cascades. Taxonomic soil climate is either xeric (12 – 16 inches PPT) or aridic moisture regimes (10 – 12 inches PPT) with a mesic temperature regime.

Mean Annual Precipitation:

Range: 10 – 16 inches

Seventy to seventy-five percent of the precipitation comes late October through March as a mixture of rain and snow. June through early October is mostly dry.

Mean Annual Air Temperature:

Range: 44 to 54 F

Central Tendency: 48 – 52 F

Freezing temperatures generally occur from late-October through early-April. Temperature extremes are 0 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: 90 to 210

Central tendency: 120 to 160

The growing season for Shallow Stony is March through June.

Soil features

Edaphic:

The Shallow Stony ecological site commonly occurs with Stony, Loamy, Very Shallow, Cool Loamy and Loamy Bottom ecological sites.

Representative Soil Features:

This ecological site components are dominantly Lithic, Aridic and Argiduridic taxonomic subgroups of Haploxerolls, Durixerolls and Argixerolls great groups of the Mollisols taxonomic order, with Aridisols occurring as well. Soils are dominantly shallow. Average available water capacity of about 5.0 inches (12.7 cm) in the 0 to 40 inches (0-100 cm) depth range.

Soil parent material is dominantly mixed loess, colluvium and residuum, with mixed ash possible.

The associated soils are Camaspatch, Disage, Durtash, Fortyday, Horseflat, Licksillet, Rock Creek, Starbuck, Vantage and similar soils.

Dominate soil surface is clay to very cobbly loam, with ashy modifier sometimes occurring as well.

Dominant particle-size class is clayey to loamy-skeletal

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

Minimum: 0

Maximum: 5

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

Minimum: 5

Maximum: 30

Average: 10

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

Minimum: 5

Maximum: 30

Average: 10

Subsurface fragments > 3 inches (% Volume):

Minimum: 10

Maximum: 40

Average: 20

Subsurface fragments \leq 3 inches (% Volume):

Minimum: 15

Maximum: 45

Average: 25

Drainage Class: Dominantly 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 moderately low

10 to 40 inches: Moderately high and moderately low

Depth to root-restricting feature (inches):

Minimum: 10

Maximum: 20

Electrical Conductivity (dS/m):

Minimum: 0

Maximum: 5

Sodium Absorption Ratio:

Minimum: 0

Maximum: 0

Calcium Carbonate Equivalent (percent):

Minimum: 0

Maximum: 5

Soil Reaction (pH) (1:1 Water):

0 - 10 inches: 5.6 to 9.0

10 - 40 inches: 6.1 to 9.0

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

Minimum: 1.0

Maximum: 7.9

Average: 5.0

Vegetation dynamics

Ecological Dynamics:

Shallow Stony produces about 200-450 pounds/acre of biomass annually

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

Wyoming sagebrush is a long-lived, multi-branched, evergreen shrub. Size is no more than 18" to two feet high on Shallow Stony. 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/or 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 is resistant to most natural disturbances and ecologically stable. Due to 35-75% 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 sites are stable.

In many pastures, 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.

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

1. Bluebunch wheatgrass declines while sagebrush and buckwheat species increase
2. As bluebunch wheatgrass continues to decline, invasive species such as cheatgrass and knapweed colonize the site
3. Shallow Stony 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 sagebrush is associated with other ecological sites in the sagebrush steppe areas of MLRA 8, including Stony, Loamy, Very Shallow and Cool Loamy.

Similar Sites:

Shallow Stony sagebrush in MLRA 8 Columbia Plateau is a sparsely vegetated Wyoming sagebrush – bluebunch wheatgrass ecological site. It lands between Very Shallow and deeper Wyoming sagebrush – bluebunch wheatgrass sites which are more productive.

MLRA 7 Columbia Basin Shallow Stony Sand, and MLRA 6 East Slope of the Cascades Shallow Stony 2800-4000 feet are also sparsely populated shrub-bluebunch wheatgrass site.

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 008X

Columbia Plateau

Subclasses

- R008XY112WA–Shallow Stony sagebrush

Stage

Provisional

Contributors

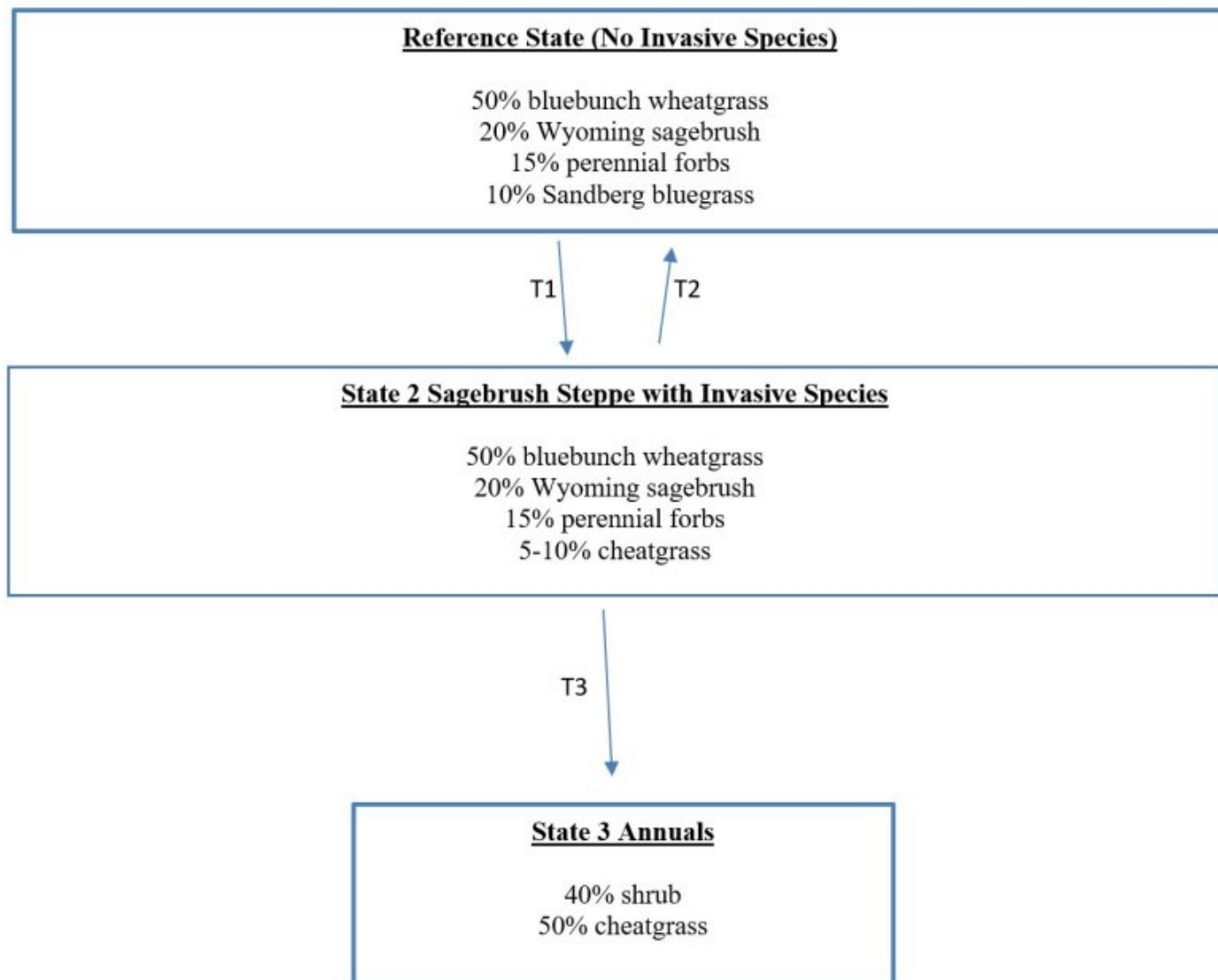
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State and transition model

State and Transition Diagram for Shallow Stony, sagebrush in MLRA 8:

This state and transition model (STM), explains the general ecological dynamics for the Shallow Stony 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 Shallow Stony in MLRA 8

Percentages for plant species composition below are by weight and are an approximation. 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.

Index	Similarity Index	Similarity
Dominant Shrubs (3-7% canopy)		
	20% 100 lbs.	
ARTRW8	Wyoming sagebrush	
PUTR2	bitterbrush	
CHRYS	rabbitbrush	
SADOI	purple sage	
ARRI2	stiff sage	
ERSP7	rock buckwheat	
Dominant Mid-Size Bunchgrass		
	50% 225 lbs.	
PSSP6	bluebunch wheatgrass	
Other Mid-Size Bunchgrasses – Minor		
		5% 25 lbs.
ELEL5	bottlebrush squirreltail	
ACTH7	Thurber needlegrass	
Short Grass – Subdominant		
	10% 45 lbs.	
POSE	Sandberg bluegrass	
VUOC	sixweeks fescue	
Native Forbs – Subdominant		
		15% 70 lbs.
ERIOG	buckwheat	
PHHO	spiny phlox	LIPU11 granite gilia
NEST5	narrowleaf goldenweed	BAHO Hooker balsamroot
ERIOG	buckwheat	LOMAT lomatium / biscuitroot
ALLIU	wild onion	ERIGE2 fleabane
ASTRA	milkvetch / locoweed	ANDI2 low pussytoes
PLPA2	woolly plantain	PENST penstemon
		Below Normal Above
Estimated Production (pounds / acre)		200 350 450

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. Reference community 1.1 is dominated by bluebunch wheatgrass and Wyoming sagebrush. Reference State Community Phases: 1.1 Reference Bluebunch wheatgrass-Wyoming sagebrush Dominate Reference State Species: Wyoming big sagebrush (overstory) and bluebunch wheatgrass 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 sites in the sagebrush steppe region

State 2

Sagebrush Steppe with Invasive Species

State 2 Narrative: State 2 represents sagebrush steppe, similar to the Reference State, but with the inclusion of minor amounts of invasive annual grasses such as cheatgrass. Most Shallow Stony 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-Wyo. sagebrush Dominate Species in State 2: Bluebunch wheatgrass, Wyoming sagebrush

State 3

Annual Grasses

State 3 Narrative: State 3 represents sites that have invasive annual grasses and sagebrush as co-dominants, and have crossed a biological threshold. State 3 is rare for Shallow Stony sites. Cheatgrass is the major invasive species. Mustard, prickly lettuce or diffuse knapweed may also be present. 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 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: Shrub – Annual Grass Wyoming sagebrush – cheatgrass Dominate Species in State 3: Cheatgrass, Wyoming sagebrush

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 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. Indicators: The occurrence of annual grasses on sites where they had been absent.

Transition T2

State 2 to 1

T2 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. Ecological process: with normal to below normal precipitation the native species in the community utilize all available moisture and cheatgrass is unable to compete with the native species.

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 sites. This transition occurs once the cover of invasive species is co-dominant 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. Indicators: Decreasing cover of

bluebunch wheatgrass and increasing cover of invasive annual species. Increasing distance between perennial bunchgrass plants. Decreasing soil organic matter, soil water retention, limited water infiltration and percolation in the soil profile.

Restoration pathway R1

State 3 to 1

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 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

Citations