Ecological site group R008XG970WA
Alkali Terrace

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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:

In the upland setting ecological sites are often expansive, and thus, can be delineated and separated on aerial photos. But in the landscape position of bottoms, basins and depressions this is rarely the case as small changes in soil chemistry, the water table and elevation or aspect results in significant changes in plant community composition. In short distances there are often big swings of available water holding capacity, and soils can go from hydric to non-hydric, or from saline-sodic to not. So, in bottoms, riparian areas and depressions, ecological sites and community phases occur as small spots, strips and patches, or as narrow rings around vernal ponds. And generally, in a matter of steps one can walk across several ecological sites. On any given site location, two or more of these sites occur as a patchwork – Loamy Bottom, Alkali Terrace, Sodic Flat, Wet Meadow, Herbaceous Wetland and Riparian Woodland. These ecological sites may need to be mapped as a complex when doing resource inventory.

Diagnostics:

Alkali Terrace is a grassland site featuring a dichotomy of two grasses. Scattered across a carpet of short warm-season sod-forming grass, are tall cool-season bunchgrasses. The overstory is tall, upright basin wildrye while the much shorter saltgrass fills the interspaces.

Alkali Terrace is part of the lentic (standing water) ecosystem. It occurs on moisture receiving sites such as terraces, bottoms, basins, fans and depressions. This site also occurs as a narrow zonal ring around ponds, lakes and vernal pools.

Soils are typically deep, ashy loam or clay loam texture and mostly have little rock fragments. Soils are moderately

alkaline but not hydric. The sols are moderately saline-sodic and conspicuously bare between the vascular plants as there is no moss or lichen.

Occasionally one will find a subset of Alkali Terrace – saltgrass with no basin wildrye or shrubs. This version of Alkali Terrace has much smaller acreage and much lower production than the more prevalent sites with basin wildrye and saltgrass.

Principle Vegetative Drivers:

Moderately saline-sodic soil conditions and deep soils drive the vegetative expression of the Alkali Terrace ecological site. Basin wildrye and saltgrass are both at home on this site. Winter & spring – water table at 30-40 inches.

Influencing Water Features:

Alkali Terrace receives both surface runoff and discharging groundwater from nearby upland sites. The soils are deep and very deep, somewhat poorly to well drained and unrestricted, and thus, remain saturated for only a short period in late winter to early spring. With adequate cover of live plants and litter, there are no water infiltrating restrictions on Alkali Terrace.

Physiographic Features:

The landscape is part of the Columbia basalt plateau. Alkali Terrace occurs on moisture receiving sites such as terraces, bottoms, basins, fans and depressions and this site also occurs as a narrow zonal ring around ponds, lakes and vernal pools. So, in bottoms, riparian areas and depressions, ecological sites and community phases occur as small spots, strips and patches, or as narrow rings around vernal ponds. Generally, in a matter of steps one can walk across several ecological sites. On any given site location, two or more of these sites occur as a patchwork – Loamy Bottom, Alkali Terrace, Sodic Flat, Wet Meadow, Herbaceous Wetland and Riparian Complex. These ecological sites may need to be mapped as a complex when doing resource inventory.

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

Landscapes: Hills, valleys and plateaus
Landform: Floodplains, terraces, drainageways and depressions

Elevation: Dominantly 500 to 2,600 feet
Slope: Total range: 0 to 15 percent
Central tendency: 0 to 5 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 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 200
Central tendency: 110 to 160
The growing season for Saline Terrace is March through end of July. Saltgrass is warm season.

Soil features

Edaphic:

Soils are dominantly deep and very deep, formed in alluvium and might have an ash influence in the surface horizon. Alkali Terrace commonly occurs adjacent to Loamy Bottom, Sodic Flat, Riparian Woodland, and Herbaceous Wetland ecological sites. Alkali Terrace ecological site also occurs with upland sites such as Loamy, Stony and Cool Loamy

Representative Soil Features:

This ecological site components are dominantly Typic, Xeric and Pachic taxonomic subgroups of Haploxerolls, Palexerolls and Haplodurids great groups of the Mollisols and Aridisols taxonomic order, with Inceptisols occurring as well. Soils are dominantly deep or very deep but limited moderately deep occurs as well. 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 alluvium.

The associated soils are Aquolls, Emdent, Gooseflats, Leahy, Mitta, Nack, Pedigo, Stanfield and similar soils.

Dominate soil surface is silt loam to gravelly loam, with ashy modifier sometimes occurring as well.

Dominant particle-size class is fine to loamy-skeletal

Fragments on surface horizon > 3 inches (% Volume):
Minimum: 0
Maximum: 2

Fragments within surface horizon > 3 inches (% Volume):
Minimum: 0

Maximum: 5
Average: 1

Fragments within surface horizon ≤ 3 inches (% Volume):
Minimum: 0
Maximum: 20
Average: 5

Subsurface fragments > 3 inches (% Volume):
Minimum: 0
Maximum: 15
Average: 5

Subsurface fragments ≤ 3 inches (% Volume):
Minimum: 0
Maximum: 45
Average: 10

Drainage Class: Range from somewhat poorly drained to well drained.
Water table depth: 20 to greater than 60 inches

Flooding:
Frequency: None to occasional

Ponding:
Frequency: None to frequent

Saturated Hydraulic Conductivity Class:
0 to 10 inches: Moderately high
10 to 40 inches: Moderately high

Depth to root-restricting feature (inches):
Minimum: 40
Maximum: greater than 60

Electrical Conductivity (dS/m):
Minimum: 0
Maximum: 30

Sodium Absorption Ratio:
Minimum: 0
Maximum: 30

Calcium Carbonate Equivalent (percent):
Minimum: 5
Maximum: 30

Soil Reaction (pH) (1:1 Water):
0 - 10 inches: 5.6 to 11
10 - 40 inches: 5.6 to 11

Available Water Capacity (inches, 0 – 40 inches depth):
Minimum: 1.4
Maximum: 8.3
Average: 5.0

Vegetation dynamics

Ecological Dynamics:

Alkali Terrace produces about 3000 pounds/acre of biomass annually.

Regarding saline-alkali soils Daubenmire (page 50) wrote, “It seems impossible to find areas where one can be confident that the vegetation has not been somewhat altered by domesticated animals.” Some areas were also manipulated by tillage or other farming practices.

Basin wildrye, also called Great Basin wildrye, and inland saltgrass are at the core of the Alkali Terrace ecological site and warrant a degree of understanding. Basin wildrye is a tall, cool-season bunchgrass and has coarse, robust stems and leaves. It grows 5 to 7 feet tall and sometimes exceeds 3 feet in diameter and, is one of the highest producing species. Basin wildrye is commonly found on loamy bottoms, saline-alkali soils and on the tops of loamy mounds. It tolerates alkaline soils and seasonal flooding but not anaerobic conditions. Basin wildrye is considered weakly rhizomatous.

Saltgrass is a short, warm-season, sod-forming grass that can form dense mats with its rhizomes and sometimes stolons. Saltgrass is one of the most common plants found on saline-alkaline soils. It is one of the most drought tolerant species. Being rhizomatous, saltgrass is tolerant of moderate to heavy grazing.

The natural disturbance regime for grassland communities is periodic lightning-caused fires. The fire return intervals (FRI) listed in research for sagebrush steppe communities is quite variable. Ponderosa pine communities have the shortest FRI of about 10-20 years (Miller). The FRI increases as one moves to wetter forested sites or to dries shrub steppe
communities. Given the uncertainties and opinions of reviewers, a mean of 75 years and a range of 50-100 was chosen for Wyoming sagebrush communities (Rapid Assessment Model).

Because basin wildrye produces a large amount of biomass, fire can burn and smolder in the crown of the plant for considerable time. This can leave basin wildrye plants much diminished. It can take years for basin wildrye to fully recover from the effects of fire. Saltgrass, being rhizomatous, is quite tolerant of fire, but due to limited fuel, often does not burn.

Grazing is another common disturbance that occurs in this ecological site. Grazing pressure can be defined as heavy grazing intensity, or frequent grazing during reproductive growth, or season-long grazing. As grazing pressure increases the plant community unravels in stages:
1. Basin wildrye plants produce fewer shoots and tillers and become smaller allowing saltgrass to expand
2. As the decline continues invasive species such as perennial pepperweed and cheatgrass colonize the site
3. With further decline the site can become an invasive weed community

Saltgrass is quite tolerant of grazing, and as a warm-season grass it provides green forage a little longer than adjacent upland sites. Basin wildrye is not tolerant of heavy grazing especially in late spring when the growing points are elevated 4 to 6 inches above the soil surface. For Loamy Bottom basin wildrye should be the key species to manage and monitor.

Managing sagebrush steppe to improve the vigor and health of native bunchgrasses begins with an understanding of grass physiology. New growth for existing bunchgrasses begins each year from basal buds. Basin wildrye plants can expand via tillering, or new plants through natural reseeding. Regrowth from spring grazing comes mostly from photosynthesis.

During seed formation, the growing points of basin wildrye become elevated 4-6 inches and are vulnerable to damage or removal. Repeated grazing during late spring is especially damaging. Over several years each native bunchgrass pasture should be rested during the critical period two out of every three years (approximately April 15–July 15). And each pasture should be rested the entire growing season every third year (approximately March 1 – July 15).

Basin wildrye remains competitive if:
(1) Basal buds are replaced annually,
(2) Enough top-growth is maintained for growth and protection of growing points, and

(3) The timing of grazing and non-grazing is managed over a several-year period. Careful management of late spring grazing is especially critical

In Washington, basin wildrye-saltgrass communities provide habitat for a variety of upland wildlife species.

Supporting Information:

Associated Sites:
Alkali Terrace is associated with bottomland sites – Loamy Bottom, Sodic Flat, Wet Meadow, Wetland Complex and Riparian Complex ecological sites. It is also associated with upland sites such as Loamy, Cool Loamy and Stony.

Similar Sites:
MLRA 7 Columbia Basin has a comparable Alkali Terrace ecological 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

- R008XY970WA–Alkali Terrace

Stage

Provisional

Contributors

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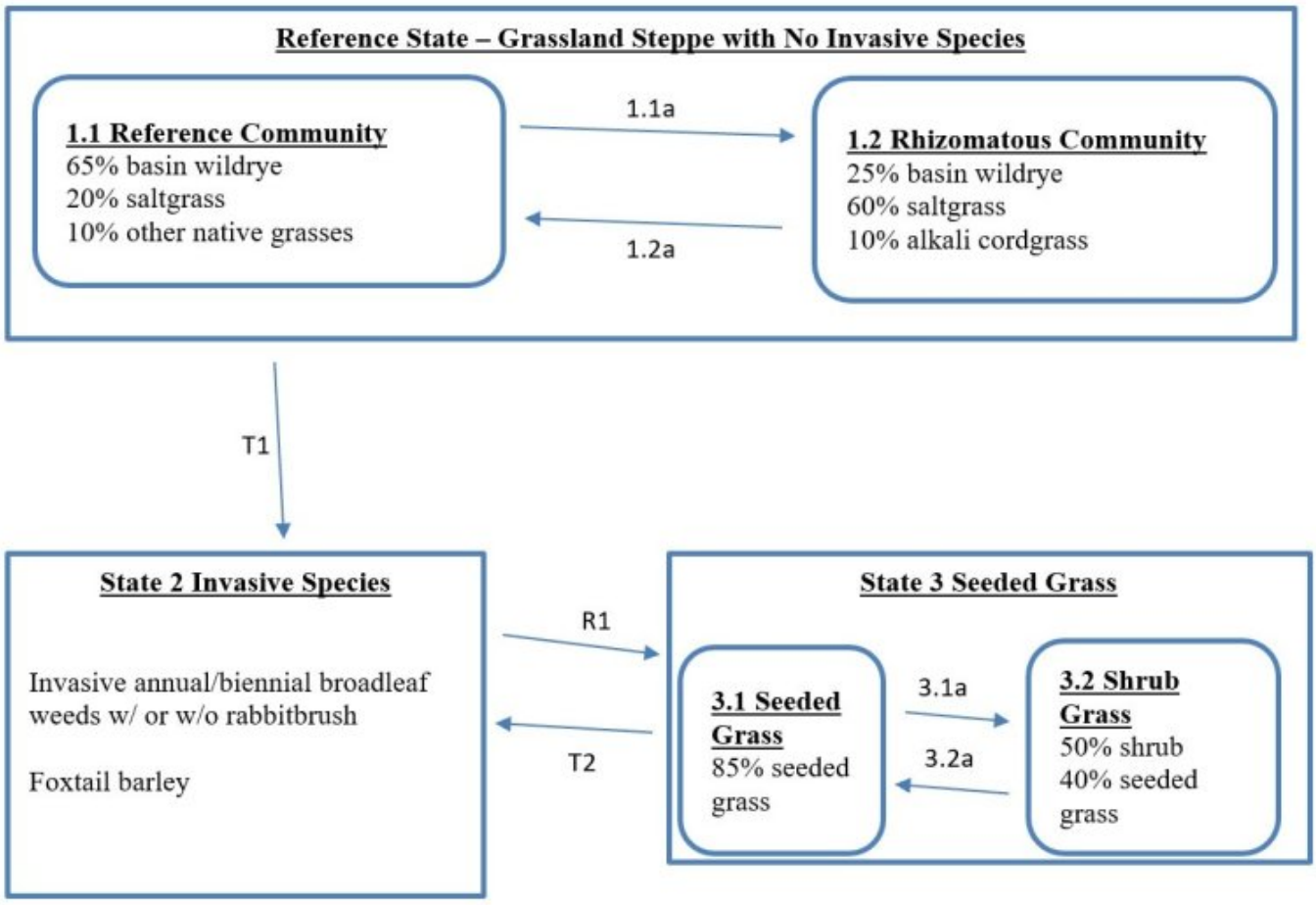
State and transition model

State and Transition Diagram for Alkali Terrace in MLRA 8:

This state and transition model (STM) explains the general ecological dynamics for the Alkali Terrace 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 Alkali Terrace

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 Index			Similarity Index		
			Sprouting Shrubs – Trace	0%-T	0 lbs.
			CHRYS rabbitbrush SAVE4 black greasewood		
Dominant Tall Bunchgrass			**Other Native Grasses – Minor**	10%	400 lbs.
LECI4 basin wildrye	65%	2600 lbs.	POSEJU alkali bluegrass SPGR alkali cordgrass		
Dominant Rhizomatous Grasses Warm season			**Grass Like – Minor**		
DISP inland saltgrass	20%	810 lbs.	CAPR clustered field sedge	<5%	150 lbs.
Native Forbs – Minor					
ACMI2 yarrow				<5%	150 lbs.

	Below	Normal	Above
Estimated Production (pounds / acre)	2000	3000	4000

State 1
Reference State

State 1 Narrative: State 1 represents Alkali Terrace with no invasive or exotic species. All the functional, structural groups have one or more species. By cover saltgrass dominates the Reference Community By weight basin wildrye dominates the Reference Community Reference State Community Phases: 1.1 Reference Basin wildrye – Saltgrass 1.2 Rhizomatous Saltgrass – Basin wildrye Dominate Reference State Species: Basin wildrye, saltgrass At-risk Communities: • All communities in the reference state are at risk of invasive species. Annual or biennial weeds and annual grass seeds blow onto most sites annually

Community 1.1
Reference Plant Community: Basin wildrye – Saltgrass

Community 1.2
Rhizomatous Community: Saltgrass – Basin wildrye

Pathway P1.1a
Community 1.1 to 1.2

1.1a Result: Shift from Reference Community 1.1 (bunchgrass-rhizomatous grass) to Community 1.2 (rhizomatous grass). Basin wildrye declines while saltgrass makes a corresponding increase. Also, alkali bluegrass declines and alkali cordgrass increases. Primary Trigger: Excessive grazing pressure (heavy grazing intensity, season long grazing or frequent late spring grazing) to basin wildrye. Ecological process: with consistent defoliation pressure basin wildrye and has low vigor, shrinking crowns and some mortality. Saltgrass rhizomes move into the areas

vacated by basin wildrye and new saltgrass shoots become established.

Pathway P1.2a
Community 1.2 to 1.1

1.2a Result: Shift from rhizomatous grass community 1.2 back to Reference Community 1.1 with more bunchgrasses. Primary Trigger: Light to moderate grazing especially during dormant season, coupled with favorable moisture years allows basin wildrye to expand. Ecological process: Given the opportunity (good vigor and adequate soil moisture) basin wildrye plants gain the competitive edge and re-establishes dominance via tillering and new seedlings.

State 2
Invasive Species – Annual / Biennial Weeds or Annual Grasses

State 2 Narrative: State 2 represents Alkali Terrace where invasive broadleaf weeds and/or invasive annual grasses have prominence. Basin wildrye is all but missing and saltgrass remains as a patchwork of spots and clumps. State 2 can have two variations, both with or without rabbitbrush: 1. Broadleaf annual or biennial weeds w/ saltgrass patches 2. Annual grasses w/ saltgrass patches Community Phases for State 2: Invasive broadleaf annual or biennial weeds with patches of saltgrass Invasive annual grasses with patches of saltgrass Some Invasive Species in State 2: cheatgrass slender cinquefoil rabbitsfoot grass foxtail barley perennial pepperweed

State 3
Seeded grasses

State 3 Narrative: State 3 represents a site that has been seeded to desirable grasses such as basin wildrye, beardless wildrye, tall wheatgrass, or western wheatgrass. Community Phases for State 3: 3.1 Seeded Grass 3.2 Shrub – Seeded Grass

Community 3.1
Seeded Grasses

Community 3.2
Shrub - Seeded Grass

Pathway P3.1a
Community 3.1 to 3.2

3.1a Result: Shift from Community 3.1 seeded grasses to community 3.2 shrub-seeded grasses. Primary Trigger: Grazing pressure (heavy intensity, season long grazing, frequent late spring grazing) to desirable seeded grasses. Ecological Process: with consistent grazing pressure, seeded grasses have poor vigor, shrinking crowns and some mortality. Rabbitbrush seed which blows onto the site establishes a crop of seedlings. Rabbitbrush cover expands as the shrubs grow.

Pathway P3.2a
Community 3.2 to 3.1

3.2a Result: Shift from Community 3.2 shrub-seeded grasses to Community 3.1 seeded grasses Primary Trigger: chemical spraying to kill rabbitbrush coupled with proper grazing management. A good remnant population of basin wildrye in good vigor is required to respond to the herbicide treatment. Ecological Process: chemical spray kills rabbitbrush plants and this release resources. Basin wildrye expands via tillering and new seedlings.

Transition T1
State 1 to 2

T1 Result: Shift from Reference State to State 2 with invasive species Primary Trigger: Grazing pressure (heavy intensity, season long grazing, frequent late spring grazing) to basin wildrye. Ecological process: with consistent grazing pressure basin wildrye has poor vigor, shrinking crowns and mortality. Initially, saltgrass increases but then

declines with further grazing pressure. Invasive species colonize and as the deterioration continues, eventually dominate the site. Indicators: Increasing gaps between basin wildrye plants, decreasing cover of saltgrass and increasing cover of invasive species.

Restoration pathway R1
State 2 to 3

R1 Transition from State 2, a community dominated by invasive annual species, to State 3, which is predominately desirable seeded grasses. Species selection for the seeding is critical as the site is moderately saline-sodic. This restoration transition does not occur without significant time and inputs to control weeds, prepare a seedbed, seed desirable species, and post-seeding weed control and management. It may take two years or longer to kill invasive annual species and remaining saltgrass, and to exhaust the seedbank of invasive weed seeds. Care must be taken to maintain soil structure so that the seedbed has many safe-sites for the seed. Seed placement must be managed to achieve seed-soil contact at a very shallow depth (about 1/8 inch is desired). Species that can tolerate the saline-sodic conditions include basin wildrye, beardless wildrye, tall wheatgrass, and western wheatgrass. Proper grazing management is essential to maintain the stand post-seeding. The actual transition occurs when the seeded species have successfully established and are outcompeting the annual species for cover and dominance of resources.

Transition T2
State 3 to 2

T2 Result: Shift from State 3 seeded grasses to State 2 with invasive species Primary Trigger: Grazing pressure (heavy intensity, season long grazing, frequent late spring grazing) to desirable seeded grasses. Ecological Process: with consistent grazing pressure desirable grasses have poor vigor, shrinking crowns and mortality. This allows invasive species to colonize and then expand to a position of dominance. Indicators: increasing gaps between basin wildrye plants, increasing cover of invasive species 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