Ecological site group R008XG978WA
Sodic Flat

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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:

Sodic Flat has a two-layered plant community. The top layer is scattered or patchy black greasewood, which is a 3-6 feet tall deciduous shrub with spines and fleshy leaves. The bottom layer, saltgrass, is a short, warm season rhizomatous grass. At the soil surface Sodic Flat is a patchy network of bare ground and saltgrass as there is no moss or lichens.

Sodic Flat is part of the lentic (standing water) ecosystem. It occurs on valley flats, bottoms, basins, terraces and depressions. This site may also occur as a narrow zonal ring around ponds and vernal pools. Soils are typically deep, clay loam and silt loam texture and have limited rock fragments (generally 10% or less) in the root-growing portions of the soil profile. Soils are hydric and strongly to very strongly alkaline.

Sodic Flat is a harsh site. Not many plant species can tolerate the sodic conditions.

Principle Vegetative Drivers:

An elevated water table and very strongly alkaline-sodic soil chemistry drive the vegetative expression of the Sodic Flat ecological site. A limited number of plant species are adapted to the high pH. Conditions are so harsh that 40-80% of the soil surface is bare. Saltgrass is spotty and greasewood is scattered or patchy across the site.

Influencing Water Features:

Sodic Flat soils are poorly drained to moderately well drained and have mostly slow permeability. So, there are significant restrictions with water infiltrating into the soil, and thus, the soils remain saturated and in an anaerobic condition from late winter to mid-spring. By late summer Sodic Flat is dry.

Physiographic Features:

The landscape is part of the Columbia basalt plateau. Sodic Flat occurs on valley flats, bottoms, basins, terraces and depressions. This site may also occur as a narrow zonal ring around ponds 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 and plateaus
Landform: Drainageways, depressions and terraces

Elevation: Dominantly 1,000 to 3,600 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 Sodic Flat is March through end of July.

Soil features

Edaphic:

Soils are deep, silt loam, silty clay loam or sandy loam formed in glaciolacustrine or glaciofluvial, or alluvium. Sodic Flat commonly occurs adjacent to Alkali Terrace, Loamy Bottom, Riparian Woodland, and Herbaceous Wetland ecological sites. Sodic Flat also occurs with upland sites such as Loamy, Stony and Cool Loamy.

Representative Soil Features:

This ecological site components are dominantly Typic and Duric taxonomic subgroups of Halaquepts and Natrixerolls great groups of the Mollisols and Inceptisols taxonomic order. Soils are moderately deep to very deep. Average available water capacity of about 5.5 inches (14.0 cm) in the 0 to 40 inches (0-100 cm) depth range.

Soil parent material is dominantly mixed alluvium.

The associated soils are Emdent, Halaquepts, Spofford, Umapine, Weissenfels and similar soils.

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

Dominant particle-size class is fine to coarse-loamy.

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

Fragments within surface horizon > 3 inches (% Volume):
Minimum: 0
Maximum: 5
Average: 1

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

Average: 2

Subsurface fragments > 3 inches (% Volume):
Minimum: 0
Maximum: 10
Average: 4

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

Drainage Class: Range from poorly drained to somewhat well drained.
Water table depth: 5 to greater than 40 inches

Flooding:
Frequency: None to rare

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: 20
Maximum: greater than 60

Electrical Conductivity (dS/m):
Minimum: 0
Maximum: 10

Sodium Absorption Ratio:
Minimum: 15
Maximum: 30

Calcium Carbonate Equivalent (percent):
Minimum: 0
Maximum: 20

Soil Reaction (pH) (1:1 Water):
0 - 10 inches: 6.6 to 11
10 - 40 inches: 7.4 to 11

Available Water Capacity (inches, 0 – 40 inches depth):
Minimum: 4.0
Maximum: 8.3
Average: 5.5

Vegetation dynamics

Ecological Dynamics:

Sodic Flat produces about 1500 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.

Black greasewood is a spiny, deciduous, semi-evergreen shrub that grows 3-10 feet tall. It has high tolerance to sodic and saline affected soils. Greasewood is highly drought tolerant but can also tolerate a high, water table.

Generally, greasewood receives limited grazing from livestock. Greasewood plants contain sodium and potassium oxalates, and are toxic to livestock, but can be safely grazed in light amounts in the spring while the leaves ae growing. This shrub sprouts readily following a fire. Greasewood can tap into groundwater at a great depth.

Greasewood and saltgrass have greater tolerance of high salinity, high water table and pH than does basin wildrye. So, basin wildrye has limited adaptation to Sodic Flat.

Saltgrass is a short, warm-season, sod-forming grass that can form dense mats with rhizomes and sometimes stolons. Saltgrass is one of the most common plants found on saline-alkaline soils and it is one of the most drought tolerant species. Being rhizomatous, saltgrass is tolerant of moderate to heavy grazing, and as a warm-season grass, it provides green forage a little longer than adjacent upland sites.

Among plants there is a decreasing tolerance of high-water table and high salinity:
Winterfat spiny hopsage rabbitbrush big sagebrush
Saltgrass alkaligrass spike-rush basin wildrye western wheatgrass

Fire and grazing are two of the main disturbances to the rangeland of Eastern Washington. Fire has minimal effect on Sodic Flat sites. Saltgrass is rhizomatous with growing points protected below ground, while greasewood readily sprouts when burned. Under heavy grazing pressure the amount of bare ground will increase and over time invasive species colonize.

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

Supporting Information:

Associated Sites:
Sodic Flat is associated with other ecological sites in bottoms and basin areas of MLRA 8, including Alkali Terrace, Loamy Bottom, Wet Meadow, Wetland Complex and Riparian Complex. Alkali Terrace is also associated with upland sites such as Loamy, Stony, Very Shallow and Cool Loamy.

Similar Sites:
MLRA 7 Columbia Basin has a comparable Sodic Flat 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

- R008XY978WA–Sodic Flat

Stage

Provisional

Contributors

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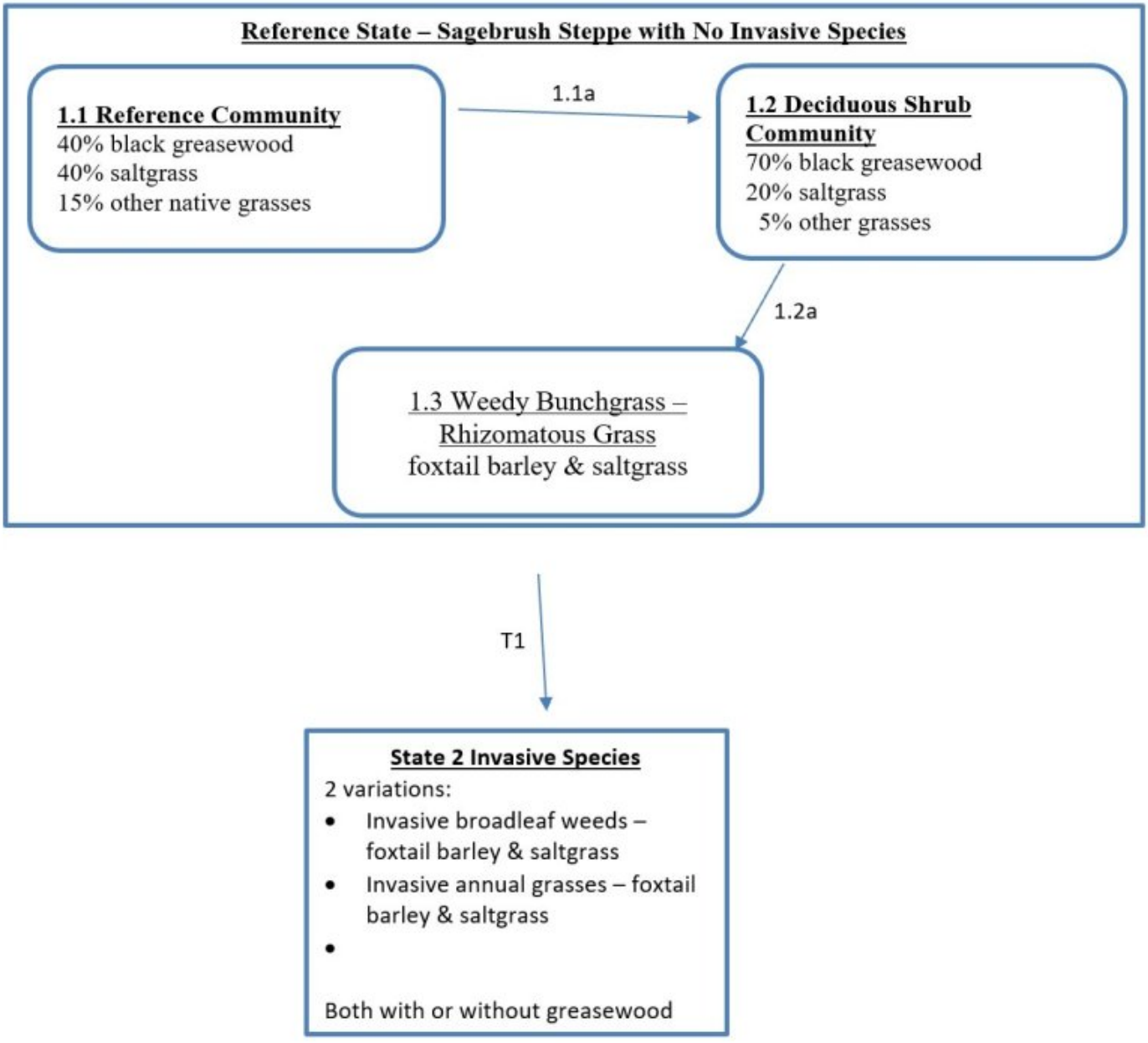
State and transition model

State and Transition Diagram for Sodic Flat in MLRA 8:

This state and transition model (STM) explains the general ecological dynamics for the Sodic Flat 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.



Note: Sodic Flat is a harsh site – bare/slick spots & salt crust spots on the surface. This makes seeding very problematic. Seeding isn't a viable option on Sodic Flat, economically or from plant adaptability standpoint.

Reference Community 1.1 for Sodic Flat in MLRA 8

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	
Dominant Sprouting Shrub			**Other Sprouting Shrubs – Trace**	
SAVE4 black greasewood	40%	600lbs.	CHRYS rabbitbrush	T-2% lbs.
Dominant Rhizomatous Grasses warm-season			**Other Native Grasses – Minor**	15% 300 lbs.
DISP inland saltgrass	40%	600 lbs.	LECI4 basin wildrye HOJU foxtail barley POSEJU alkali bluegrass SPGR alkali cordgrass	
			Grasslike – Minor	
			CABA Baltic rush	3% 45 lbs.
Native Forbs – Minor				
ACMI2 yarrow				2% 30 lbs.

Estimated Production (pounds / acre)	Below	Normal	Above
	1000	1500	2000

State 1
Reference State – Sagebrush Steppe with No Invasive Species

State 1 Narrative: State 1 represents Sodic Flat with no invasive or exotic species. All the functional, structural groups have one or more species. Reference State Community Phases: 1.1 Reference Black greasewood – Saltgrass 1.2 Shrub Black Greasewood 1.3 Bunchgrass – Rhizomatous Grass Foxtail barley – Saltgrass Dominate Reference State Species: Black greasewood, 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 1.3 is most at risk of invasion

Community 1.1
1.1 Reference Community

Community 1.2
1.2 Deciduous Shrub Community

Community 1.3
1.3 Weedy Bunchgrass – Rhizomatous Grass

Pathway 1.1a
Community 1.1 to 1.2

1.1a Result: Shift from Reference Community 1/1 (shrub-rhizomatous grass) to Community 1.2 (deciduous shrub dominated community). Greasewood increases as saltgrass declines. Primary Trigger: heavy to severe grazing (heavy grazing intensity or an extended grazing period) Ecological process: with consistent defoliation pressure saltgrass has poor vigor, fewer shoots and shorter shoots. As saltgrass cover declines greasewood increases via new seedlings. Rabbitbrush may also increase. Indicators: declining saltgrass cover, increasing greasewood

(number of plants and cover).

Pathway 1.2a
Community 1.2 to 1.3

1.2a Result: shift from Community 1.2 (deciduous shrub) to Community 1.3 (weedy bunchgrass-rhizomatous grass). Primary Trigger: Moderate-severity to high-severity fire. Secondary trigger would be a mechanical shrub control treatment. Ecological Process: fire or mowing kills the greasewood. This releases resources and niche space. Foxtail barley is a pioneer species following disturbances, and seedlings establish quickly. Indicators: greatly diminished greasewood cover, increased cover of foxtail barley.

State 2
State 2 Invasive Species

State 2 Narrative: State 2 represents Sodic Flat where invasive broadleaf weeds and/or invasive annual grasses have prominence. Foxtail barley is present and saltgrass has been reduced.to scattered patches Community Phases for State 2: State 2 can have several variations: 1. Invasive broadleaf weeds with foxtail barley and saltgrass patches 2. Invasive annual grasses with foxtail barley and saltgrass patches 3. Both variations above can be with or without some greasewood &/or rabbitbrush Some Invasive Species in State 2: cheatgrass perennial pepperweed rabbitsfoot grass alkali grass

Transition T1
State 1 to 2

T1 Result: shift from Reference State with no invasive species to State 2 with invasive species Primary Trigger: heavy to severe grazing pressure (heavy to severe grazing intensity or extended grazing period). Ecological process. With consistent defoliation saltgrass has reduced vigor and bare ground increases which provide opportunities for invasive species to colonize and expand. Weed seeds blow onto most sites annually. Indicators: initially reduced cover of saltgrass and increasing bare ground. The presence of invasive species where none has occurred. Later increasing cover of invasive species. Recovery State 2 is considered non-reversible. Sodic Flat is a harsh site. Soils are very strongly alkaline and sodic. Seeding success would be very problematic. Seeding is not a viable option economically or from a plant adaptability standpoint. 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 Natural Resources Conservation Service, map of Common Resource Areas of Washington, 2003 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