Ecological site group R007XG978WA
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): 007X – 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

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 ecological sites occur as a patchwork – Loamy Bottom, Alkali Terrace, Sodic Flat, Herbaceous Wetland and Riparian Woodland. These ecological sites may need to be mapped as a complex when doing resource inventory.

Diagnostics:
Sodic Flat ecological site has a two-layered plant community. The top-layer is scattered or patchy black greasewood, which is a three to six feet tall deciduous shrub with spines and round, narrow, fleshy leaves. The bottom layer, saltgrass, is a short, warm season rhizomatous grass. At the soil surface of the Sodic Flat ecological site is a patchy network of bare ground and saltgrass as there is no moss or lichen.

Sodic Flat ecological site 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 percent 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 ecological 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 to 80 percent of the soil surface is bare. Saltgrass is spotty and greasewood is scattered or patchy across the site.

INFLUENCING WATER FEATURES
Sodic Flat ecological site soils are poorly 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. This ecological site sits on the lowest position on the landscape on landforms such as bottoms, floodplains, basins & depressions. Sodic flat also occurs as fringes around ponds and lakes at elevations of 300 to 1,500 feet. 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.

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

Landscapes: basin and valleys
Landform: bottoms, floodplains and depressions

Elevation:
Range: 250 to 3,000 feet
Central tendency: 300 to 1,500 feet

Slope: Total range: 0 to 5 percent
Central tendency: 1 to 3 percent

Aspect: Occurs on all aspects

Geology:
This 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. This basin generally corresponds to the vast temporary lakes created by floodwaters from glacial Lakes Missoula and Columbia. Most of the fluvial and lacustrine sediments were deposited about 16,000 years ago, when an ice dam on the ancient Columbia River burst and when glacial Lake Missoula periodically emptied, creating catastrophic floods.

Climate

Climate:
The climate across MLRA 007X is characterized by moderately cold, wet winters, and hot, dry summers, with limited precipitation due to the rain shadow effect of the Cascades. This MLRA is the warmest and driest MLRA within the Columbia Plateau geographic area. 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, but June through early-October can be dry. Freezing temperatures generally occur from late-October through early-April. Temperature extremes are -10 degrees Fahrenheit in winter and 110 degrees Fahrenheit in summer.

Mean Annual precipitation
Range: 6 - 10 inches
Soil moisture regime is aquic.

Mean Annual Air Temperature
Range: 48 to 54 F
Central Tendency: 50 – 52 F
Soil temperature regime is mesic.

Frost-free period (days)
Total range: 140 to 200

Central tendency: 150 to 180
The growing season for Sodic Flat is March through mid-July.

Soil features

Edaphic:
Soils are deep, silt loam, silty clay loam or sandy loam formed in glaciolacustrine or glaciofluvial, or alluvium. The Sodic Flat ecological site 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 soil components are dominantly Typic taxonomic subgroup of Halaquepts and Natraquolls great groups of the Inceptisols and Mollisols taxonomic orders. Soils are very deep. Average available water capacity of about 7.0 inches (17.8 cm) in the 0 to 40 inches (0 to 100 cm) depth range.

Soil parent material is dominantly alluvium derived from mixed sources with possibly minor amounts of ash in the upper part of the soil.

The associated soils are Fiander, Outlook, Umapine and similar soils.

Dominate soil surface is silt loam to fine loamy sand.

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

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

Fragments within surface horizon ≤ 3 inches (% Volume):
Minimum: 0
Maximum: 10
Average: 3

Subsurface fragments > 3 inches (% Volume)
Minimum: 0
Maximum: 10
Average: 2

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

Drainage Class: Dominantly somewhat poorly drained.
Water table depth: Dominantly 10 to 30 inches

Flooding:
Frequency: None to brief

Ponding:
Frequency: None

Saturated Hydraulic Conductivity Class:

0 to 10 inches: Moderately high
10 to 40 inches: Moderately high

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

Electrical Conductivity (dS/m)
Minimum: 0
Maximum: 4.0

Sodium Absorption Ratio
Minimum: 13
Maximum: 50

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

Soil Reaction (pH) (1:1 Water):
0 - 10 inches: 7.3 to 9.6
10 - 40 inches: 7.4 to 11.0

Available Water Capacity (inches, 0 – 40 inches depth)
Minimum: 12
Maximum: 24
Average: 18

Vegetation dynamics

ECOLOGICAL DYNAMICS:
Vegetation Dynamics:
Sodic Flat ecological site produces about 1500 pounds per 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 ecological site.

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 ecological 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 ecological site is associated with Alkali Terrace, Wet Meadow, Wetland Complex and Riparian Complex ecological sites. It is also associated with upland ecological sites such as Loamy, and Stony.

Similar sites:
MLRA 008X 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

State Correlation: Washington

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 Paciorettty, "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

Site Development and Testing Plan
Future work, as described in a Project Plan, to validate the information in this Provisional Ecological Site Description is needed. This will include field activities to collect low, medium and high intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation specialists. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document.

Annual reviews of the Project Plan are to be conducted by the Ecological Site Technical Team.

Major Land Resource Area

MLRA 007X
Columbia Basin

Subclasses

- R007XY978WA–Sodic Flat

Stage

Provisional

Contributors

Provisional Site Author: Kevin Guinn
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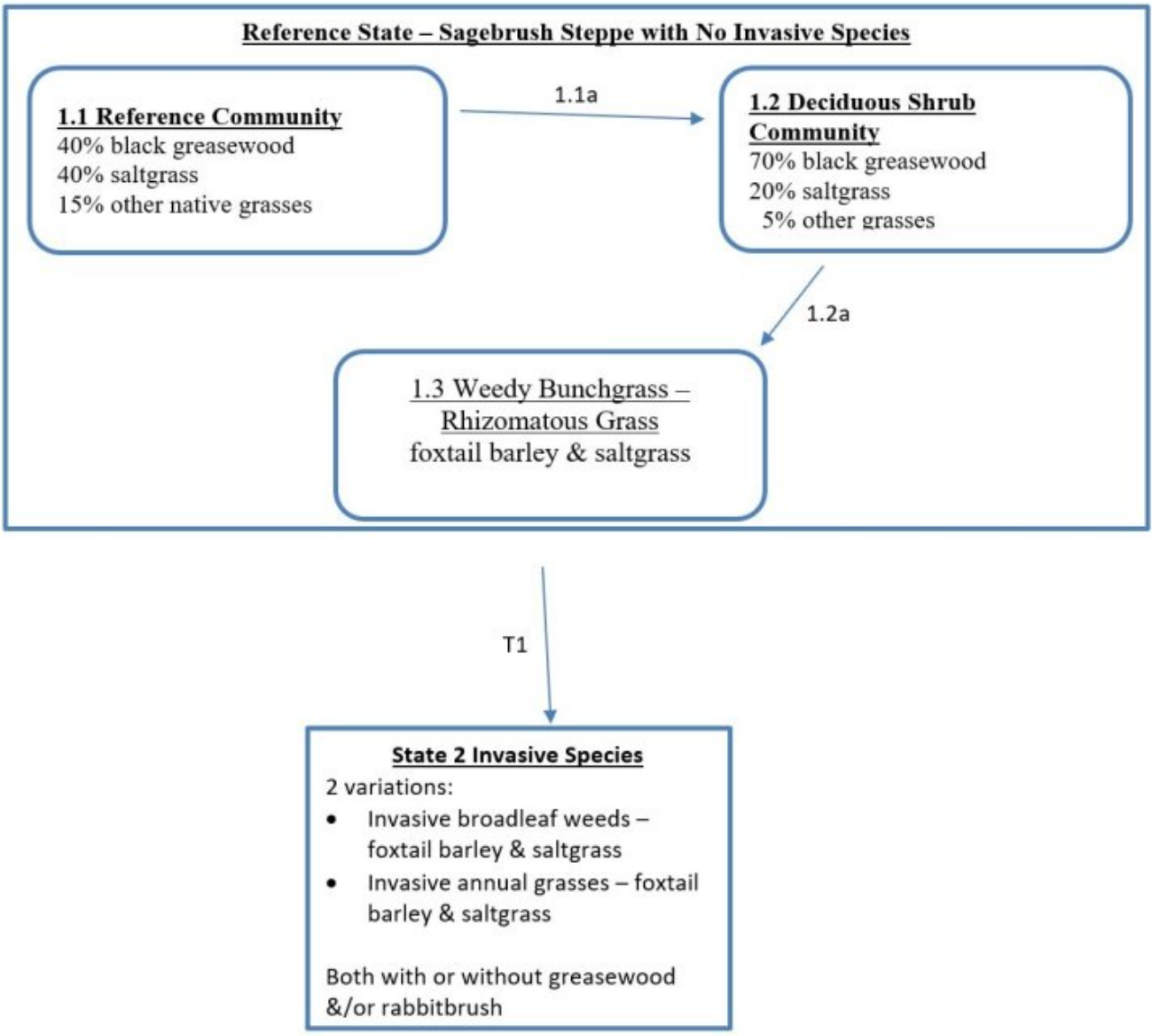
State and transition model

State and Transition Diagram for Sodic Flat:

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 7

Percentages for plant species composition below are an approximated weight. 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 Shrub				**Other Shrubs – Trace**		
SAVE4	black greasewood	40%	800lbs.	CHRYS rabbitbrush	Trace	
Dominant Rhizomatous Warm Season Grass				**Other Native Grasses – Subdominant**	15%	300 lbs.
DISP	inland saltgrass	40%	800 lbs.	LECI4 basin wildrye HOJU foxtail barley POSEJU alkali bluegrass SPGR alkali cordgrass		
				Grass-Like – Minor		
				CABA Baltic rush	less than 5%	60 lbs.
Native Forbs – Minor						
ACMI2	yarrow				less than 5%	60 lbs.
Estimated Production (pounds / acre)				Below	Normal	Above
				1000	1500	2000

State 1
Reference

State 1 Narrative: State 1 represents the Sodic Flat ecological site 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
Reference Plant Community

Black greasewood – Saltgrass dominated community

Community 1.2
Deciduous Shrub Community

Black Greasewood dominated community

Community 1.3
Weedy Bunchgrass – Rhizomatous Grass

Bunchgrass – Rhizomatous Grass Foxtail barley – Saltgrass

Pathway P1.1a

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 P1.2a
Community 1.2 to 1.3

1.2a Result: shift from 1.2 deciduous shrub community to 1.1 reference shrub-grass community Causes: Light to moderate grazing especially during dormant season coupled with favorable moisture years allows basin wildrye vigor and growth to improve. Ecological process:

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

State 2 Narrative: State 2 represents the Sodic Flat ecological site where invasive broadleaf weeds and 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 and 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. 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 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