USDA Natural Resources
Conservation Service

Ecological site R007XY978WA
Sodic Flat

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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): 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

Ecological site concept

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.

Associated sites

R007XY970WA	**Alkali Terrace**
R007XY988WA	**Wetland Complex**
R007XY720WA	**Riparian Complex**
R007XY130WA	**Loamy**
R007XY120WA	**Stony**

Similar sites

R008XY978WA	**Sodic Flat**

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Sarcobatus vermiculatus* (2) *Chrysothamnus*
Herbaceous	(1) *Distichlis spicata* (2) *Leymus cinereus*

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

Table 2. Representative physiographic features

Landforms	(1) Basin (2) Valley (3) Flood plain (4) Depression
Flooding duration	Brief (2 to 7 days)
Flooding frequency	None to occasional
Ponding frequency	None
Elevation	91–457 m
Slope	1–3%

Water table depth	25–76 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Table 3. Representative physiographic features (actual ranges)

Flooding duration	Not specified
Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	76–914 m
Slope	0–5%
Water table depth	Not specified

Climatic features

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.

Table 4. Representative climatic features

Frost-free period (characteristic range)	150-180 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	152-254 mm
Frost-free period (actual range)	140-200 days
Freeze-free period (actual range)	
Precipitation total (actual range)	

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.

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.

Table 5. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Silt loam (2) Loamy fine sand

Drainage class	Somewhat poorly drained
Depth to restrictive layer	152 cm
Soil depth	152 cm
Surface fragment cover <=3"	3%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	45.72 cm
Calcium carbonate equivalent (Depth not specified)	0–30%
Electrical conductivity (Depth not specified)	0–4 mmhos/cm
Sodium adsorption ratio (Depth not specified)	13–50
Soil reaction (1:1 water) (0-25.4cm)	7.3–9.6
Subsurface fragment volume <=3" (Depth not specified)	5%
Subsurface fragment volume >3" (Depth not specified)	2%

Table 6. Representative soil features (actual values)

Drainage class	Not specified
Depth to restrictive layer	Not specified
Soil depth	Not specified
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–5%
Available water capacity (0-101.6cm)	30.48–60.96 cm
Calcium carbonate equivalent (Depth not specified)	Not specified
Electrical conductivity (Depth not specified)	Not specified
Sodium adsorption ratio (Depth not specified)	Not specified
Soil reaction (1:1 water) (0-25.4cm)	Not specified
Subsurface fragment volume <=3" (Depth not specified)	0–15%
Subsurface fragment volume >3" (Depth not specified)	0–10%

Ecological 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.

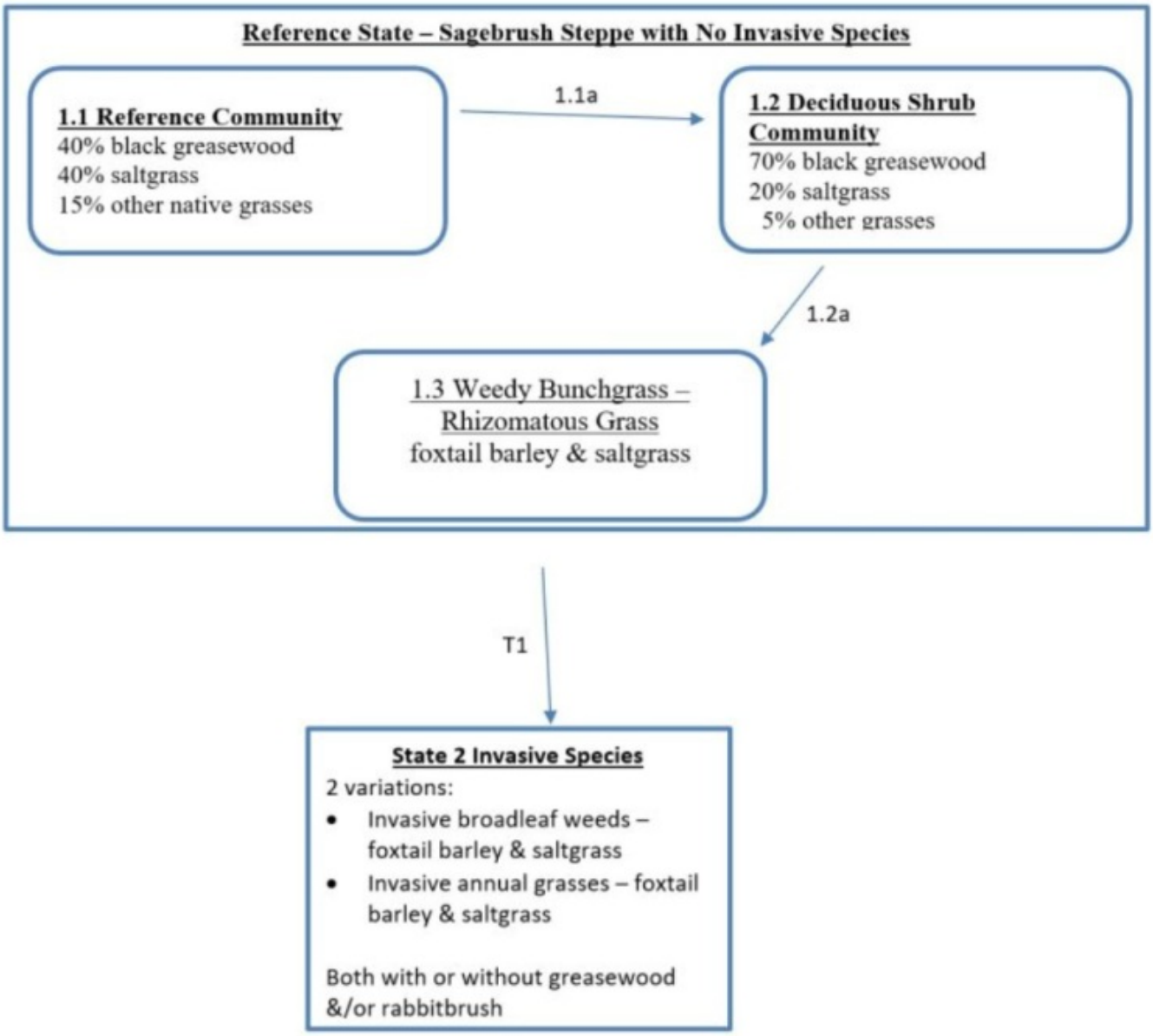
Saltgrass is a short, warm-season, sod-forming grass that can form dense mats with rhizomes and sometimes stolons. Saltgrass is one of the most common plants found on saline-alkaline soils and it is one of the most drought tolerant species. Being rhizomatous, saltgrass is tolerant of moderate to heavy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

State and transition model



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.

State 1
Reference

State 1 represents the Sodic Flat ecological site with no invasive or exotic species. All the functional, structural groups have one or more species. 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
Black Greasewood and Saltgrass

Community 1.2
Black Greasewood Dominated

Community 1.3

Bunchgrass, Foxtail Barley, and Saltgrass

Pathway 1.1A
Community 1.1 to 1.2

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

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.

State 2
Invaded

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 Communities in 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.

Community 2.1
Invasive Broadleaf Weeds and Annual Grasses

Transition T1A
State 1 to 2

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.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
1	**Dominant Shrub**			897	
	greasewood	SAVE4	*Sarcobatus vermiculatus*	–	–
2	**Other Shrubs - Trace**			–	
	rabbitbrush	CHRYS9	*Chrysothamnus*	–	–
Grass/Grasslike					
3	**Dominant Rhizomatous Warm Season Grass**			897	
	saltgrass	DISP	*Distichlis spicata*	–	–
4	**Other Native Grasses - Subdominant**			336	
	basin wildrye	LECI4	*Leymus cinereus*	–	–
	foxtail barley	HOJU	*Hordeum jubatum*	–	–
	Sandberg bluegrass	POSE	*Poa secunda*	–	–
	alkali cordgrass	SPGR	*Spartina gracilis*	–	–
5	**Grass-Like - Minor**			67	
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	–	–
Forb					
6	**Native Forbs - Minor**			67	
	common yarrow	ACMI2	*Achillea millefolium*	–	–

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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Contributors

K. Guinn
R. Fleenor
W. Keller
K. Bomberger
K. Paup-Lefferts

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	02/01/2025
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:**

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

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

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

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):**

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

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

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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:

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17. **Perennial plant reproductive capability:**
