Ecological site group R009XG153WA
Cool Loamy, Channeled Scabland

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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): 9 – Palouse and Nez Perce Prairie

LRU – Common Resource Areas (CRA):
9.1 - Channeled Scablands
9.12 - Moist Loess Islands

Site Concept Narrative:
Diagnostics:

The channeled scabland-loess island region is the only portion of MLRA 9 that is shrub steppe. Cool Loamy occurs on two Common Resource Areas – 9.1 channeled scabland and 9.12 loess islands. This site is also found in Daubenmire's Threetip Sagebrush-Fescue vegetative zone.

In the reference condition this shrub steppe plant community features threetip sagebrush and Idaho fescue. Fire tolerant, knee-high, three-tip sage dominates the shrub layer while Idaho fescue, with or without bluebunch wheatgrass, is dominant in the herbaceous understory. Cool Loamy has a lush herbaceous component with many perennial forbs.

A mix of other shrub species can be scattered throughout, including Wyoming or basin big sagebrush, rabbitbrush, and horsebrush. The cover of Wyoming and basin sagebrush will depend on how long it has been since the site burned. Snowberry and rose are all but absent from Cool Loamy and the threetip sagebrush-fescue zone.

Principle Vegetative Drivers:

The vegetative expression of this productive site is driven by two factors: (1) moderately deep to deep soil depth provides unrestricted rooting for most species, and (2) the microclimate which favors Idaho fescue. The Channeled Scabland has the coldest winter temperatures in MLRA 9 and a longer lasting snowpack. This site provides crucial water to the vegetation at the hottest time of the growing season, allowing the ecological site more resilience when impacted by disturbances. Cool Loamy supports a denser plant cover than the Loess Hills Loamy ecological site.

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

The Loess Hills Loamy (14-18” PZ) site consists of deep soils and occurs for the most part on gently sloping landforms with little limitations for water infiltration. On steeper slopes and localized high silt or sodic soils, infiltration may be limited. Calcic and petrocalcic horizons may be present indicating long-term moisture penetration. There is generally no run-in moisture from surrounding sites or long-term soil moisture saturation.

Physiographic Features:

The landscape is part of the Columbia basalt plateaus and Northern Rocky foothills. MLRA 9 is south of the Okanogan Highlands and Spokane Valley, east of the Columbia Basin, includes only the wet end of the Channeled Scablands and forms a horseshoe around the Blue Mtns.

MLRA 9 has three distinct geographical areas:
(1) the Palouse Hills on the east side
(2) the loess hills to the south and west
(3) the Channeled Scabland-loess islands in the northwest

Physiographic Division: Intermontane Plateau and Northern Rocky Mountain System
Physiographic Province: Columbia Plateau and Northern Rocky Mountains
Physiographic Sections: Walla Walla Plateau

Landscapes: plateaus and loess hills
Landform: Dominantly benches, terraces, terraces escarpments

Elevation: Dominantly 1,800 to 3,000 feet
Slope: Total range: 0 to 60 percent
Aspect: Dominantly northern aspects, but can occur on all aspects

Geology:

MLRA 9 is almost entirely underlain by Miocene basalt flows. Columbia River basalts are covered by wind-blown loess and volcanic ash with a thickness up to 250 feet thick. The oldest layer of loess accumulated between 2 and 1 million years ago, while the uppermost layers of Palouse Loess accumulated between 15,000 years ago and modern times. The mid layers of loess were deposited episodically between 77,000 years and 16,000 years ago. During the Pleistocene era the channeled scablands, the northwest portion of MLRA 9, were scoured of topsoil by the Lake Missoula Floods about 15,000-17,000 years ago. Flows removed topsoil from exposed ridges and basalt rims in canyons.

The Channeled Scabland was impacted by the Missoula Floods, but the Loess Islands were not inundated or scoured by the floodwaters.

Climate

The channeled scabland region is the coldest and driest part of MLRA 9. The climate across MLRA 9 is characterized by moderately cold, wet winters, and relatively dry summers.

Mean Annual Precipitation:
Range: 14 – 18 inches
Winter precipitation, primarily snow, occurs during low-intensity, Pacific-frontal storms. During winter these storms produce occasional rains that fall on frozen or thawing ground surfaces. High intensity, convective thunderstorms produce some rain during the growing season. Precipitation is evenly distributed throughout fall, winter and spring.

Mean Annual Air Temperature:
Range: 42 to 52 F
Central Tendency: 47 to 50 F

Freezing temperatures generally occur from late-October through early-April. Temperature extremes are -10 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.

Areas with threetip sagebrush and Idaho fescue when compared to Wyoming sagebrush-bluebunch wheatgrass regions, are cooler from late fall to early spring (October through April), and has higher P (precipitation) and P/T (precipitation-transpiration) for five months (September, November, December, January and March) (Daubenmire).

Frost-Free Period (days):
Total range: 60 to 180
Central tendency: 100 to 140
The growing season for Cool Loamy is April through end of July.

Soil features

Edaphic:

The Cool Loamy channeled scabland ecological site occurs with Stony Foothills, channeled scabland and Very Shallow ecological sites. Cool Loamy channeled scabland is an upland sagebrush-bunchgrass site loamy soil.

Representative Soil Features:

This ecological site components are dominantly Pachic, Typic and Ultic taxonomic subgroups of Argixerolls and Haploxerolls taxonomic great group of the Mollisols taxonomic order but may also include the Vitrandic subgroup. Soils are dominantly very deep. Average available water capacity of about 7 inches (17.8 cm) in the 0 to 40 inches (0-100 cm) depth range.

Soil parent material is dominantly loess, residuum and colluvium.

The associated soils are Thatuna, Tilma, Hesseltine, Hanning and similar soils.

Dominate soil surface is silt loam to stony loam.

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

Fragments within surface horizon > 3 inches (% Volume):
Minimum: 0
Maximum: 10
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: 2

Subsurface fragments ≤ 3 inches (% Volume):
Minimum: 0
Maximum: 30
Average: 10

Drainage Class: Dominantly well drained

Water table depth: Dominantly greater than 60 inches

Flooding:
Frequency: None

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, but strongly contrasting textural stratification can occur up to 20 inches occurrences
Maximum: greater than 60

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

Sodium Absorption Ratio:
Minimum: 0
Maximum: 0

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

Soil Reaction (pH) (1:1 Water):
0 - 10 inches: 5.1 to 7.8
10 - 40 inches: 5.6 to 7.8

Available Water Capacity (inches, 0 – 40 inches depth):
Minimum: 3.5
Maximum: 9.3
Average: 7

Vegetation dynamics

Ecological Dynamics:

Cool Loamy, channeled scabland in MLRA 9 produces about 900-1500 pounds/acre of biomass annually

Cool Loamy, channeled scabland is sagebrush steppe with threetip sagebrush and Idaho fescue the featured species. Bluebunch wheatgrass and threadleaf sedge are also important species on this site.

Compared to the Loamy, bunchgrass, 15-18” ppt., Cool Loamy, channeled scabland of the channel scabland has more available soil moisture as the season gets hotter. With cooler temperatures, less runoff and less evaporation the precipitation on Cool Loamy is more effective. Threetip sage and Idaho fescue are especially linked to the additional soil moisture on this ecological site. The third dominant species in the reference state, bluebunch wheatgrass, is not as linked to the additional soil moisture.

Threetip sagebrush is a short, shallow-rooted, evergreen shrub. Leaves are more deeply lobed than big sagebrush. Compared to big sagebrush, threetip sage grows on sites that are moister, north slopes or at higher elevations. Threetip sagebrush has a very slow growth rate, reaching a height of one foot after twenty years. In Washington threetip sage generally sprouts following fire but it is not a big-time sprouter like rabbitbrush. It can take years for threetip sage to get back to pre-burn conditions.

Idaho fescue is shorter and has a dense clump of shoots, while bluebunch wheatgrass is taller and is less dense. Both species are long-lived bunchgrasses. Bluebunch has an awned or awnless seed head arranged in a spike, while Idaho fescue has an awned seed head arranged in a panicle. The ratio of Idaho fescue to bluebunch wheatgrass plants on any site can vary due to aspect and elevation.

Threadleaf sedge is a sod-forming, densely tufted, native perennial graminoid. In nature threadleaf sedge seedlings are rare as it reproduces mainly from asexual tillers. Often threadleaf sedge is an increaser when other species in the community are in decline.

In healthy communities, these mid-sized grasses provide a crucial and extensive network of roots to the upper portions (up to 48” deep in soils with no root-restrictive horizons) of the soil profile. This root-network stabilizes the soils, provides organic matter and nutrients, and helps to maintain soil pore space for water infiltration and retention un the soil profile. The extensive rooting system of mid-sized grasses leave very little space for invasion by other species. This drought resistant root mass 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 Idaho fescue and bluebunch wheatgrass. Refer to page 8 for more details about bunchgrass physiology. Research has found, on similar rangeland, that communities remain resistant to medusahead if sites maintain at least 0.8 mid-sized bunchgrass plant/sq. ft. (K. Davies, 2008). These two bunchgrasses hold the system together. If we lose either or both bunchgrass the ecosystem begins to unravel.

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). Threetip sage-fescue areas should have a comparable fire return interval.

Some fires are spotty or do not burn hot enough to fully remove the sagebrush. Fires with light severity will remove less sagebrush and open smaller patches for grass and forb recovery, whereas the more severe fires will remove almost all the sagebrush and leave vast areas open to return to bunchgrass dominance. This is how the patchy distribution occurs. Rabbitbrush and horsebrush are sprouting shrubs and may also increase following fire.

The effect of fire on the main species is mixed for the Cool Loamy, channeled scabland site. Threetip sagebrush in Central Washington sprouts from lateral roots or the root crown following fire and bluebunch wheatgrass is fire tolerant. Threetip is also a vigorous, wind-dispersed seeder. And in many cases, after fire, threetip will both re-sprout and disperse new seed from the surviving plants. Both species recover quickly. But Idaho fescue is much more sensitive to fire. Threetip sage and bluebunch wheatgrass keep the site resistant to change, while Idaho fescue makes the site more at risk.

A severe fire puts stress on the entire community. The Wyoming sagebrush layer is completely lost. Spots or patches with heavy sagebrush are sterilized by the fire and must be seeded to prevent invasive species (annual grasses, tumble mustard) from totally occupying the site. Bluebunch wheatgrass and basin wildrye may have weak vigor for a few years but generally survive. Idaho fescue plants are very much at risk with a severe burn coupled with wind. The result can be “black holes” or ash 2-3 inches into the crown. The death of Idaho fescue plants creates holes in the community, and the opportunity for exotic species to colonize. Needle and thread is one native species that can increase via new seedlings.

Idaho fescue and bluebunch wheatgrass exhibit rapid tillering when there is light severity fires and favorable soil moisture. But, the longer the site goes without fire and the more grazing pressure added, the more threetip sagebrush cover increases and the bunchgrasses decline.

Grazing is another common disturbance that occurs to this ecological site. Grazing pressure can be defined as heavy grazing intensity, or frequent grazing during reproductive growth, or season-long grazing (the same plants grazed more than once). As grazing pressure increases the plant community unravels in stages:
1. Cusick bluegrass is eliminated. Adjacent natives fill the void
2. Idaho fescue declines while bluebunch wheatgrass and threadleaf sedge increase

3. Both Idaho fescue and bluebunch wheatgrass decline. Threadleaf sedge, Sandberg bluegrass, Nelson needlegrass and woolly plantain increase
4. With further decline invasive species such as Japanese brome and cheatgrass colonize the site
5. The site can become a threetip sage-threadleaf sedge community

Managing sagebrush steppe to improve the vigor and health of native bunchgrasses begins with an understanding of grass physiology. New growth each year begins from basal buds. Given the opportunity Idaho fescue readily produces new seedlings while bluebunch wheatgrass plants rely principally on tillering. During seed formation, the growing points of bluebunch wheatgrass become elevated and are vulnerable to damage or removal. Idaho fescue has weak stems, and is thus, much more sensitive to grazing than bluebunch wheatgrass.

If defoliated during the formation of seeds, bluebunch wheatgrass has limited capacity to tiller compared with other, more grazing resistant grasses (Caldwell et al., 1981). Repeated critical period grazing 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).

In the spring each year it is important to monitor and maintain an adequate topgrowth: (1) so plants have enough energy to replace basal buds annually, (2) to optimize regrowth following spring grazing, (3) to protect the elevated growing points of bluebunch wheatgrass, and (4) to avoid excessing defoliation of Idaho fescue with its weak stems.

These grasses remain competitive if:
(1) Basal buds are replaced annually, and Idaho fescue produces seed and,
(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

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, threetip sagebrush – Idaho fescue/bluebunch wheatgrass communities provide habitat for a variety of upland wildlife species such as sharp-tail grouse.

Supporting Information:

Associated Sites:
Cool Loamy, channeled scabland is associated with Very Shallow and Stony Foothills.

Similar Sites:
Cool Loamy, channeled scabland has threetip sage with Idaho fescue and bluebunch wheatgrass. MLRA 8 Columbia Plateau has a comparable Cool Loamy site. MLRA 7 Columbia Basin Cool Loamy has less Idaho fescue and less threetip sage.

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 009X
Palouse and Nez Perce Prairies

Subclasses

- R009XA153WA–Cool Loamy Channeled Scabland

Stage

Provisional

Contributors

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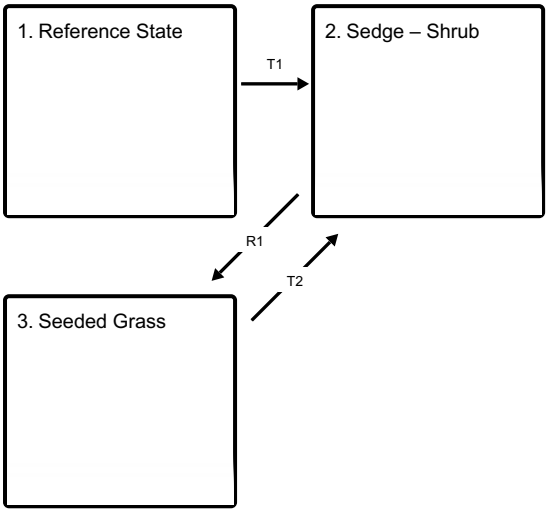
State and transition model

Ecosystem states

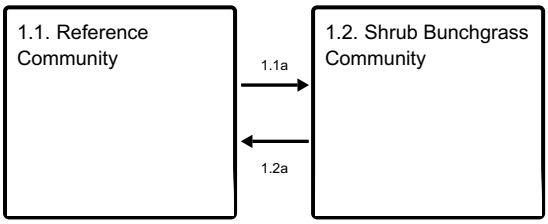


T1 - Heavy grazing pressure

R1 - restoration

T2 - heavy grazing pressure

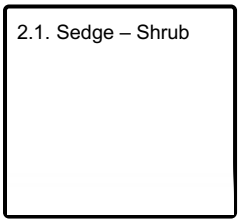
State 1 submodel, plant communities



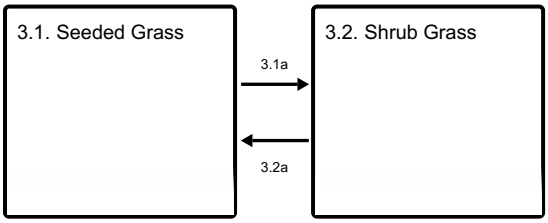
1.1a - grazing pressure

1.2a - Moderate severity fire

State 2 submodel, plant communities



State 3 submodel, plant communities



3.1a - Grazing pressure

3.2a - shrub control and seeded

State 1
Reference State

State 1 Narrative: State 1 represents sagebrush steppe with no invasive or exotic species. All the functional, structural groups have one or more species. Reference State Community Phases: 1.1 Reference Idaho fescue-bluebunch wheatgrass / threetip sagebrush 1.2 Shrub Steppe Threetip sage / Idaho fescue-bluebunch wheatgrass Communities 1.1 and 1.2 are stable with a high cover of Idaho fescue/bluebunch wheatgrass and low to moderate cover of threetip sage. Both communities have a minor amount of threadleaf sedge which is native, but also rhizomatous. But when the dominant bunchgrasses exhibit low vigor and decline, threadleaf sedge and threetip sage increase and field brome colonizes the disturbed sites. Dominant Reference State Species: Threetip sagebrush, Idaho fescue, bluebunch wheatgrass At-risk Communities: • All communities in the reference state are at risk of invasive species. The seed source for field brome or other invasive annual weeds move into most sites annually. • Any community becomes at-risk of moving to State 3 when Idaho fescue and bluebunch have low vigor and the cover of threadleaf sedge is expanding • Any community is at risk when fire kills the Idaho fescue plants. The holes could quickly be filled by threadleaf sedge or field brome. The site should be inter-seeded that fall or early the following spring.

Community 1.1
Reference Community

Reference Community 1.1 for Cool Loamy, channeled scabland in MLRA 9

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	
Non-sprouting Shrubs – Minor	less than 5%	50 lbs.	**Sprouting Shrubs – Subdominant**	10%	150 lbs.
ARTRW8 Wyoming sagebrush			ARTR4 three-tip sage		
ARTR2 basin big sagebrush			CHVI8 rabbitbrush		
PUTR2 bitterbrush			RIBES currant		
			ROSA5 rose		
			TECA2 horsebrush		
Dominant Mid-Size Bunchgrasses	70%	1050 lbs.	**Other Mid-Size Bunchgrasses – Minor**	5%	75 lbs.
FEID Idaho fescue			POCU3 Cusick's bluegrass		
PSSP6 bluebunch wheatgrass			ELEL5 bottlebrush squirreltail		
			HECOC8 needle and thread		
			KOMA prairie junegrass		
			ACNE9 Nelson needlegrass		
Short Grass – Minor	less than 5%	50 lbs.	**Tall Bunchgrasses – Minor**	less than 5%	50lbs.
POSE Sandberg bluegrass			LECI4 basin wildrye		
			Grass-Like – Trace		
			CAFI threadleaf sedge	Trace	
Native Forbs – Minor				10%	150 lbs.
BASA3 arrowleaf balsamroot			MICRO6 microseris		
LUPIN lupine			CREPI hawksbeard		
CALOC Mariposa lily			PHLOX phlox		
ERIGE2 fleabane			LOMAT lomatium / biscuitroot		
ERIOG buckwheat			ASTRA milkvetch / locoweed		
CASTI2 paintbrush			PLPA2 woolly plantain		
LIRU4 stoneseed			ACMI2 yarrow		
HYCA4 waterleaf			POTEN cinquefoil		
HIERA hawkweed					

Estimated Production (pounds / acre)	Below	Normal	Above
	900	1200	1500

Idaho fescue-bluebunch wheatgrass / threetip sagebrush 70% Idaho fescue & bluebunch wheatgrass 10% threetip sagebrush 10% native forbs

Community 1.2
Shrub Bunchgrass Community

Threetip sage / Idaho fescue-bluebunch wheatgrass 50% Idaho fescue & bluebunch wheatgrass 30% threetip sagebrush 10% threadleaf sedge

Pathway 1.1a
Community 1.1 to 1.2

1.1a Result: shift from Reference Community 1.1 to Shrub-Bunchgrass Community 1.2. Moderate reduction in bunchgrasses and a moderate increase in threetip sage Primary Trigger: grazing pressure (heavy grazing intensity, season long grazing or frequent late spring grazing) to Idaho fescue and bluebunch wheatgrass Ecological process: with consistent defoliation pressure Idaho fescue, bluebunch wheatgrass and other palatable species exhibit poor vigor and shrinking crowns. The release of resources and niche space allow the shrubs to gain the competitive edge. Indicators: New sagebrush seedlings, decreasing cover of Idaho fescue and bluebunch wheatgrass, and increasing shrub cover.

Pathway 1.2a
Community 1.2 to 1.1

1.2a Result: shift from Shrub-Bunchgrass Community 1.2 to Reference Community 1.1. Threetip sage declines while bunchgrasses increase. Primary Trigger: Moderate severity fire reduces the shrub component but has minimal effect on the bunchgrasses Ecological process: fire sets threetip sagebrush and kills Wyoming sagebrush back but does not burn into the crown of bunchgrasses. Idaho fescue and bluebunch wheatgrass have good vigor post-fire and expand via tillering and new seedlings. Indicators: decrease in shrub cover, increase in bunchgrasses

State 2
Sedge – Shrub

State 2 Narrative: State 2 represents a community dominated by threadleaf sedge and threetip sage. Many native functional, structural groups have been altered or are missing. Annual grasses such as field brome are present but secondary to the shrub and sedge components. Community Phases for State 2: 2.1 Shrub-Sedge Threetip sage – Threadleaf sedge Dominant Species in State 2: Threadleaf sedge, threetip sagebrush

Community 2.1
Sedge – Shrub

Threetip sage – Threadleaf sedge In Community 2.1, sod-forming threadleaf sedge has expanded to a position of dominance. Threetip sage has increased but is quite variable. In some instances, threetip sage is co-dominant and in other instances is secondary to threadleaf sedge. But when the dominant bunchgrasses exhibit low vigor and decline, threadleaf sedge and threetip sagebrush increase. Field brome or ventenata may colonize the disturbed sites. The loss of soil biological crusts contributes to the invasion by annual grasses. 40% threetip sagebrush 50% threadleaf sedge 5% Annual bromes 5% Nelson needlegrass

State 3
Seeded Grass

Narrative for State 3: State 3 represents sites that have been seeded. The site was no longer productive for intended uses so, a commitment was made to kill existing stand and seed more desirable species. Community Phases for State 3: 3.1 Seeded grasses 3.2 Shrub – Seeded Grasses Refer to narrative for R1. Dominant Species in State 3: Desirable seeded grass species with or without legume

Community 3.1
Seeded Grass

85% seeded grass

Community 3.2
Shrub Grass

50% shrub 40% seeded grass

Pathway 3.1a
Community 3.1 to 3.2

3.1a Result: Seeded grass community 3.1 shifts to a shrub-grass community 3.2. Primary Trigger: Grazing pressure (heavy grazing, season long grazing or frequent late spring grazing) to the seeded grasses. Ecological process: consistent grazing to seeded grasses result in poor vigor, shrinking crowns and plant mortality. Shrubs and invasive species increase.

Pathway 3.2a
Community 3.2 to 3.1

3.2a Shrub-grass community shifts back to seeded grass community Primary Trigger: shrubs are controlled by chemical treatment and seeded grasses increase. Ecological Process: for this plan to work there must be a good stand of grasses with good vigor pre- and post-treatment to respond when shrubs are killed. It can take a couple of light to moderate grazing intensity to improve vigor in the seeded grass population.

Transition T1
State 1 to 2

T1 Transition from Reference State to State 2 (sedge-shrub). The Reference State has only a minor amount of threadleaf sedge and no invasive species. In State 2 threadleaf sedge makes a significant increase along with threetip sage and invasive species colonize the site. Primary Trigger: Heavy grazing pressure (heavy grazing intensity, season long grazing or frequent late spring grazing) to Idaho fescue and bluebunch wheatgrass. Ecological process. Consistent defoliation pressure to native bunchgrasses results in poor vigor, shrinking crowns and plant mortality. The cover of threadleaf sedge and threetip sagebrush increases as the cover of the dominant bunchgrasses decline. Soil disturbances by rodents and badgers enable seed-soil contact, for invasive weeds so they colonize the site and later, expand as opportunity presents itself. Indicators: increasing gaps between dominant bunchgrasses (Idaho fescue and bluebunch wheatgrass). Expanding cover of threadleaf sedge and threetip sage, and the presence of invasive species where there has been none.

Restoration pathway R1
State 2 to 3

R1 Result: Transition from State 2 sedge-shrub. State 3 seeded grass 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. This requires a commitment of two years or more to kill threadleaf sedge and threetip sagebrush, and for weed control. 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 very shallow depth (about 1/8 inch is desired). Proper grazing management is essential to maintain the stand post-seeding. Snake River wheatgrass, thickspike wheatgrass, Sherman big bluegrass, Sandberg bluegrass, crested or intermediate wheatgrass are typical species seeded on Cool Loamy ecological site. The actual transition occurs when the seeded species have successfully established and are outcompeting the threadleaf sedge, shrubs and annual species for cover and dominance of resources.

Transition T2
State 3 to 2

T2 Transition from State 3 seeded grasses to State 2 threadleaf sedge – threetip sage. This transition occurs when the cover of dominant bunchgrasses drops to less than 10%, and threadleaf sedge has assumed a dominant position in the community. Primary trigger: heavy grazing pressure (heavy grazing intensity, season long grazing or frequent late spring grazing) to the desirable seeded grasses. Ecological process: consistent defoliation pressure to seeded grasses results in poor vigor, shrinking crowns and plant mortality. This releases resources and niche space to threadleaf sedge and threetip sage. Indicators: Declining cover for the seeded species and increasing canopy gaps between seeded grass plants. Increasing cover of threadleaf sedge, threetip sage and 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, 1970 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