Ecological site group R009XG430WA
Loamy, Bunchgrass, 15-18" ppt.

Last updated: 11/22/2023
Accessed: 10/12/2024

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 Prairie

LRU – Common Resource Areas (CRA):
9.3 - Dissected Loess Uplands
9.4 - Deep Loess Foothills

Site Concept Narrative:

Diagnostics:
Loamy, bunchgrass, 15-18” ppt. is an upland grassland site in the loess hills portion of MLRA 9 (Common Resource Areas 9.3 dissected loess uplands and 9.4 deep loess foothills). This site also occurs within Daubenmire’s Agropyron-Fescue vegetative zone. The Agropyron-Fescue zone is dissected by the lower Snake River. The Agropyron-Poa zone along the Snake River is included in MLRA 8 and not MLRA 9. Note that the genus Agropyron is now Pseudoroegneria.

The loamy soils are moderately deep (20-40”) to deep (40-60”) inches with limited rock fragments in the root-growing portion of the soil profile. Silt loam is the most common texture. This site occurs on all aspects except north to northeast.

Loamy, bunchgrass, 15-18” ppt. is a classic bunchgrass site. Perennial bunchgrasses dominate the reference state, while rabbitbrush and forbs are only a minor presence. Cool-season bunchgrasses form two distinct layers. Bluebunch wheatgrass, and less frequently, Idaho fescue, form the top layer, while Sandberg bluegrass is the major grass of the lower layer. The shrub layer consists of few, scattered rabbitbrush plants, typically knee- to waist-high. Forbs are only a minor component on this ecological site.

Loamy, bunchgrass, 15-18” ppt. has rabbitbrush but no sagebrush, no snowberry and little to no rose. This ecological site differs from shrub steppe with the absence of sagebrush. But some sage occurs on the lee slopes of the Blue Mountains, a remnant of the Pleistocene climate (Daubenmire, 1970).

Principle Vegetative Drivers:

The moderately deep to deep silt loam soils and the warmest temperatures in MLRA 9 drive the vegetative expression of this site. Most species have unrestricted rooting on this site. The warm temperatures favor bluebunch wheatgrass over Idaho fescue.

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 run off-site or infiltrates into the soil
2. Whether soil condition remain aerobic or become saturated and anaerobic
3. Water drainage and how quickly the soil reaches wilting point

The Loamy, bunchgrass, 15-18" ppt. 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 types:
(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

Note for MLRA 9 there are four ecological sites with "Loamy" in the name:
1. Cool loamy, channeled scabland occurs on the Channeled Scablands
2. Loamy, dwarf shrub, 18-24" ppt. occurs in the Palouse Hills
3. Loamy, bunchgrass, 15-18" ppt. occurs in the loess hills
4. Loamy Bottom occurs on bottomland sites

The ecological site description below is for the Loamy, bunchgrass, 15-18" ppt. which occurs only in the loess hills.

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

Landscapes: hills and foothills
Landform: Dominantly hills, plateaus, canyons

Elevation: Dominantly 1,200 to 4,000 feet
Slope: Total range: 0 to 90 percent
Aspect: 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.

Climate

The loess hills are drier and warmer than the Palouse Hills and warmer than the channeled scabland. The climate across MLRA 9 is characterized by moderately cold, wet winters, and relatively dry summers.

Mean Annual Precipitation:
Range: 15 to 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.

Frost-free Period (days):
Total range: 90 to 180
Central tendency: 110 to 150
The growing season for Loamy, bunchgrass, 15-18” ppt. is generally March through mid-July

Soil features

Edaphic:

Loamy, bunchgrass, 15-18” ppt. ecological site commonly occurs with North aspect, bunchgrass, 15-18” ppt., and Shallow Stony ecological sites. The soils are formed in loess on hills, or in loess and colluvium from basalt with minor amounts of volcanic ash in the surface layers. Soils are moderately deep to deep.

Representative Soil Features:

This ecological site components are dominantly Pachic, Calcic and Typic taxonomic subgroups of Argixerolls and Haploxerolls taxonomic great group of the Mollisols taxonomic order. Soils are dominantly very deep but can range to moderately deep. Average available water capacity of about 5.8 inches (14.8 cm) in the 0 to 40 inches (0-100 cm) depth range.

Soil parent material is dominantly loess, colluvium and residuum derived from basalt.

The associated soils are Asotin, Athena, Neissenberg, Palouse, Peola, Tucannon and similar soils.

Dominate soil surface is silt loam to loam.

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

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: 10

Subsurface fragments > 3 inches (% Volume):
Minimum: 0
Maximum: 20
Average: 5

Subsurface fragments ≤ 3 inches (% Volume):
Minimum: 0

Maximum: 25
Average: 10

Drainage Class: Dominantly well drained
Water table depth: Dominantly greater than 60 inches, but can range to 40 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 bedrock can occur up to 40 inches occurrences
Maximum: greater than 60

Electrical Conductivity (dS/m):
Minimum: 0
Maximum: dominantly 0
Some soils with natric horizons have been included in this site. In those cases, the range for EC would be 0-3

Sodium Absorption Ratio:
Minimum: 0
Maximum: dominantly 0
Some soils with natric horizons have been included in this site. In those cases, the range for SAR would be 0-25

Calcium Carbonate Equivalent (percent):
Minimum: 0
Maximum: dominantly 0
Some soils with calcic horizons have been included in this site. In those cases, the range for $CaCO_3$ would be 0-50

Soil Reaction (pH) (1:1 Water):
0 - 10 inches: 5.6 to 8.4
10 - 40 inches: 5.6 to 9.0

Available Water Capacity (inches, 0 – 40 inches depth):
Minimum: 2.8
Maximum: 9.6
Average: 5.8

Vegetation dynamics

Ecological Dynamics:

Loamy, bunchgrass, 15-18” ppt. in MLRA 9 produces about 1100-1500 pounds/acre of biomass annually.

The line between sagebrush steppe and true grasslands has been discussed and debated for many years. Rexford Daubenmire, a professor and plant ecologist at Washington State University for 29 years, in his 1970 book, Steppe Vegetation of Washington, makes the following conclusions. There is no evidence that the distribution of vegetative types is related to fire. And the line has nothing to do with pre-settlement as native ungulates played no significant role in the evolution of ecotypes. He also says there is no useful correlation between soil classification and the line between grasslands and sagebrush steppe.

Daubenmire states that the ecotones between grassland and sagebrush steppe can be defined on consistent

differences in climate and consistent differences in vegetation. Higher spring precipitation, especially in March, favors grasses over sagebrush. Shrubs common to the most arid portion of this steppe rely on moisture deeper in the soil profile, particularly in summer after cool season grasses have gone dormant. The loess hills and Palouse Prairie regions of MLRA 9 have greater total precipitation, higher spring precipitation, and a longer growing season for grasses than the sagebrush steppe, leaving less of the deep moisture for the shrubs. This is consistent with Daubenmire's findings.

Three grasses are especially important to the loess hills portion of MLRA 9. The breaks of the Snake River have both bluebunch wheatgrass and Snake River wheatgrass. Idaho fescue, the third important grass, is shorter and has a dense clump of shoots, while bluebunch and Snake River wheatgrass are taller and less dense. All three grasses are long-lived, mid-sized, cool-season bunchgrasses. Idaho fescue's inflorescence is arranged in a panicle, while the inflorescence for bluebunch and Snake River is arranged in a spike. Snake River wheatgrass and Idaho fescue are awned while bluebunch wheatgrass can be awned or awnless.

On the Loamy, bunchgrass, 15-18" ppt. ecological site, bluebunch or Snake River wheatgrass are dominant, while Idaho fescue is sub-dominant. The ratio of Idaho fescue to bluebunch wheatgrass plants on any site can vary due to aspect and elevation.

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 in 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 the mid-sized grasses listed above. 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). The relationship between bunchgrasses and other invasive species should be similar. It is the mid-sized grasses that hold the system together. If we lose the mid-sized grasses the ecosystem begins to unravel.

The natural disturbance regime for grassland communities is periodic lightning-caused fires. Ponderosa pine communities have the shortest Fire Return Interval (FRI) of about 10-20 years (Miller). The FRI increases as one moves to wetter forested sites or to drier shrub steppe communities. The FRI listed in research for sagebrush steppe communities is quite variable. Given the uncertainties and opinions of reviewers, a mean of 75 years was chosen for Wyoming sagebrush communities (Rapid Assessment Model). This would place the historic FRI for grassland steppe at 30-50 years perhaps, and even as short as 5-10 years in some locations.

The effect of fire on the community depends upon both the severity and season of the burn. See Vallentine's Range Improvement for more detail. With a light to moderate fire there can be a mosaic of burned and unburned patches. The perennial grasses thrive as the fire does not get into the crown. With adequate soil moisture Idaho fescue, bluebunch wheatgrass and prairie junegrass can make tremendous growth the year after the fire. Largely, the community is not affected by lower intensity fire.

A severe fire puts stress on the entire community. Rabbitbrush is likely to increase by crown sprouting. Bluebunch wheatgrass and Snake River wheatgrass, both fire-resilient grasses, will have weak vigor for a few years but generally survive. Reduced vigor of these grasses allows weeds to become established. Some spots and areas can be completely sterilized. Under windy conditions, a fire can burn into the crown of Idaho fescue, leaving behind "black holes" or nothing but ash where fescue plants were incinerated. Sterilized spots and dead Idaho fescue plants makes the site vulnerable to exotic invasive species, so seeding should be strongly considered. Bluebunch wheatgrass keeps the site resistant to change, while Idaho fescue makes the site more at risk.

Spring burning can also be especially damaging to Idaho fescue.

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. Idaho fescue declines while bluebunch & Snake River wheatgrasses, rabbitbrush yarrow, and other unpalatable forbs increase

2. All grasses decline while rabbitbrush and unpalatable forbs continue to increase. Invasive species such as cheatgrass and yellow star-thistle colonize the site
3. As grazing progressively thins the native perennials, the alien species take their place, finally becoming dominant.

For 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, bluebunch wheatgrass communities provide habitat for
many / more upland wildlife species.

Supporting Information:

Associated Sites:
Loamy, bunchgrass, 15-18” ppt. is associated with other ecological sites in MLRA 9 including Very Shallow, North Aspect, bunchgrass. 15-18” ppt. ppt. and Shallow Stony.

Similar sites:
Loamy, bunchgrass, 15-18” ppt. is similar to the Loamy grassland (9-15” ppt.) site in MLRA 8 Columbia Plateau. Loamy, bunchgrass, 15-18” ppt. differs from shrub steppe sites with the absence of sagebrush.

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

Stage

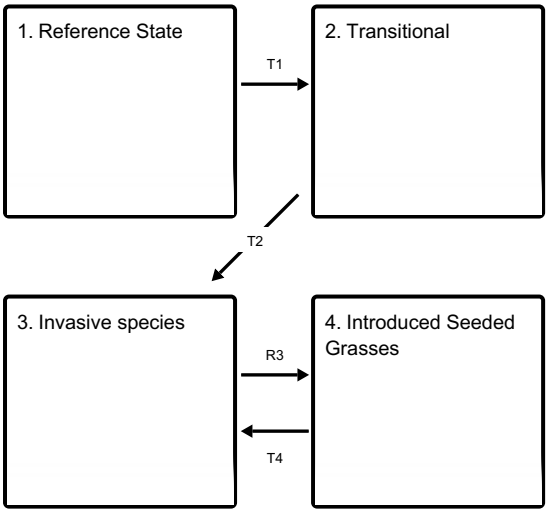
Provisional

Contributors

Kevin Guinn, Technical Team: C. Smith, R. Fleenor, K. Paup-Lefferts

State and transition model

Ecosystem states



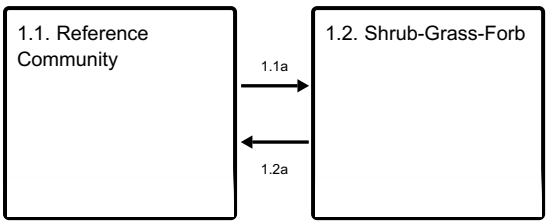
T1 - grazing pressure

T2 - grazing pressure and precipitation

R3 - seed desirable species, and post-seeding weed control and management

T4 - grazing pressure

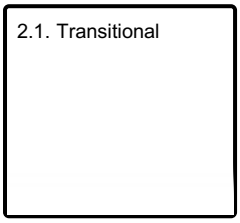
State 1 submodel, plant communities



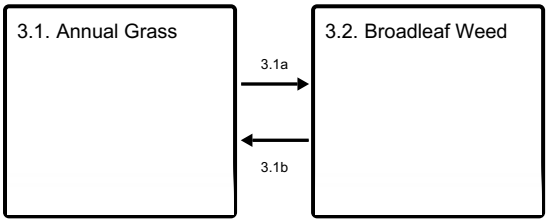
1.1a - grazing pressure

1.2a - rabbitbrush die-off

State 2 submodel, plant communities



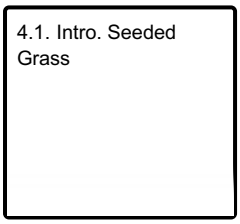
State 3 submodel, plant communities



3.1a - Precipitation

3.1b - Precipitation

State 4 submodel, plant communities



State 1
Reference State

State 1 Narrative: State 1 represents grassland steppe with no invasive or exotic weed species. Grassland sites have no sagebrush and no bitterbrush. Rabbitbrush and forbs are minor species in the Reference Community but more prominent in Community 1.2. All the functional, structural groups have one or more native species present. Reference State Community Phases: 1.1 Bunchgrass Bluebunch wheatgrass 1.2 Shrub–Bunchgrass –Forb Rabbitbrush–Bluebunch wheatgrass–Unpalatable Forbs Dominant Reference State Species: Bluebunch / Snake River wheatgrass At-risk Communities: • Different communities have different degrees of risk • All communities in the reference state are at risk of invasive species • All communities in the reference state are at risk of moving to State 2. The seed source of invasive species is nearby and moving onto most sites annually. • Any community is at risk when fire kills Idaho fescue plants. The holes could quickly be filled by invasive grass or weeds • A community has moved to State 2 when cheatgrass or broadleaf weeds have colonized the site • Any community becomes at-

risk of moving to State 3 when Idaho fescue and bluebunch have low cover and cheatgrass or broadleaf weeds have colonized the site

Community 1.1
Reference Community

Similarity Index	Similarity Index
	Sprouting Shrubs – Minor less than 5% 50 lbs. CHVI8 yellow rabbitbrush ERNA10 rubber rabbitbrush RIBES currant OPPO prickly pear cactus
Dominant Mid-Size Bunchgrasses **85%** PSSP6 bluebunch/Snake R 65% 1000 lbs. FEID Idaho fescue 20% 300 lbs.	**Other Mid-Size Bunchgrasses – Minor** 5% 75 lbs. ACNE9 Nelson's / Columbia needlegrass POSEJ big bluegrass
Short Grass – Minor less than 5% 50 lbs. POSE Sandberg bluegrass	
Native Forbs – Minor 5% 75 lbs. ACMI2 yarrow LUPIN lupine LOMAT Lomatium / biscuitroot ERIGE2 fleabane	BASA3 arrowleaf balsamroot PHLOX phlox ASTRA milkvetch / locoweed PLPA2 woolly plantain

65% Bluebunch wheatgrass/Snake River wheatgrass 20% Idaho fescue 5% native forbs <5% rabbitbrush

Community 1.2
Shrub-Grass-Forb

Rabbitbrush–Bluebunch wheatgrass–Unpalatable Forbs 55% Bluebunch wheatgrass/Snake River wheatgrass 5% Idaho fescue 15% unpalatable forbs 25% rabbitbrush

Pathway 1.1a
Community 1.1 to 1.2

1.1a Result: shift from Reference Community 1.1 to Community 1.2 Shrub – Bunchgrass – Forb. Moderate reduction in bunchgrasses and a moderate increase in rabbitbrush and unpalatable native forbs Primary Trigger: grazing pressure (heavy grazing intensity, season long grazing or frequent late spring grazing) to bluebunch wheatgrass/Snake River and Idaho fescue Ecological process: consistent defoliation pressure causes poor vigor and shrinking crowns. Rabbitbrush and forbs gain the competitive edge and take advantage of released resources and niche space to set new seedlings. Indicators: increasing rabbitbrush canopy, increasing forb cover and declining bluebunch wheatgrass cover.

Pathway 1.2a
Community 1.2 to 1.1

1.2a Result: shift from Community 1.2 Shrub – Bunchgrass – Forb to Reference Community 1.1. Rabbitbrush and forbs decline while bunchgrasses increase Primary Trigger: periodically some unknown vector (disease, insects) causes a major rabbitbrush die-off. Ecological process: good grazing management promotes improved vigor and gives bunchgrasses the competitive edge. Bluebunch wheatgrass expands via tillering and Idaho fescue by new seedlings. Indicators: decreased rabbitbrush canopy and forb cover, and increasing cover of bluebunch wheatgrass

State 2
Transitional

State 2 Narrative: State 2 represents a moderate invasion by invasive species and is the transition between State 1 and State 3. Native species are present and dominant, but invasive species have gained a foothold that they do not easily relinquish. Grazing pressure weakens the stand of native species allowing the invasive species to colonize and establish themselves in the community. The invasion can be either cheatgrass or broadleaf weeds (yellow star thistle, chervil, etc.).

Community 2.1
Transitional

Native community with: 20% annual bromes or 20% broadleaf weeds

State 3
Invasive species

State 3 represents the situation where invasive species and rabbitbrush dominate the plant community. Based on opportunity, State 3 is dominated by either cheatgrass or alien broadleaf weeds. Opportunity refers to what seeds are in the seedbank and moisture available from year to year. Soil disturbances by rodents or badgers allow invasive species to colonize. In State 3 native bunchgrasses which were dominant in the Reference State are virtually missing and the other native, functional-structural groups have been altered. Community Phases for State 3: 3.1 Annual Grass – Shrub Cheatgrass – Rabbitbrush 3.2 Broadleaf Weed – Shrub Yellow star thistle, etc – Rabbitbrush Community 3.1 is dominated by cheatgrass and rabbitbrush Community 3.2 is dominated by broadleaf weeds and rabbitbrush

Community 3.1
Annual Grass

Cheatgrass – Rabbitbrush 60% Cheatgrass 30% Rabbitbrush

Community 3.2
Broadleaf Weed

Yellow starthistle, etc – Rabbitbrush 60% Broadleaf weeds 30% Rabbitbrush

Pathway 3.1a
Community 3.1 to 3.2

3.1a Result: there is a natural fluctuation between communities 3.1 and 3.2. Primary Trigger: wetter years favor the introduced forbs/weeds Ecological process: in State 3 the seedbank of annual grasses and introduced forbs/weeds is full. In any given year one or more invasive species will have the opportunity to expand to become dominant or co-dominant. The next year a different species may have a similar opportunity.

Pathway 3.1b
Community 3.2 to 3.1

3.1b Result: there is a natural fluctuation between communities 3.1 and 3.2. Primary Trigger: drier years favor the annual grasses Ecological process: in State 3 the seedbank of annual grasses and introduced forbs/weeds is full. In any given year one or more invasive species will have the opportunity to expand to become dominant or co-dominant. The next year a different species may have a similar opportunity.

State 4
Introduced Seeded Grasses

State 4 Narrative: State 4 represents a stand of desirable introduced grasses such as Secar Snake River wheatgrass. Or intermediate wheatgrass The State 3 community has been eliminated and the site seeded to desirable grasses such as intermediate wheatgrass. State 4 remains stable as long as a full stand is maintained (1.0 plant / sq. ft. or greater of the desired bunchgrasses)

Community 4.1
Intro. Seeded Grass

85% Introduced seeded grasses

Transition T1

State 1 to 2

T1 Transition from Reference State with no invasive species to State 2 transitional is a stand of native plants with some invasive species. Previously the stand has not had alien species. The result of this transition is the presence of invasive species. Depending on seeds in the soil bank and what is growing nearby, either cheatgrass of broadleaf weeds enter the stand of native species. Also, in State 2 rabbitbrush makes a significant increase. Primary Trigger: grazing pressure (heavy grazing intensity, season long grazing or frequent late spring grazing) to bluebunch/Snake River wheatgrass and other palatable species. Ecological process: consistent defoliation pressure to bluebunch wheatgrass and other palatable species results in poor vigor, shrinking crowns and some plant mortality. The release of resources and niche space allows invasive species such as cheatgrass, yellow star thistle and chervil to colonize and establish. Indicators: decreasing cover of bluebunch wheatgrass and the presence of invasive species. Increasing gaps between bluebunch wheatgrass plants.

Transition T2
State 2 to 3

T2 Result: shift from native species with some invasive plants in State 2 to State 3 which is dominated by invasive species. T2 can go two directions, to annual greases Community 3.1 or to broadleaf weeds Community 3.2. Wetter years favor broadleaf weeds while drier years favor annual grasses. Rabbitbrush occurs on both communities. Primary Trigger: grazing pressure (heavy grazing intensity, season long grazing or frequent late spring grazing) to bluebunch wheatgrass and other palatable species Ecological process: consistent defoliation pressure to bluebunch wheatgrass and other palatable species results in poor vigor, shrinking crowns and some plant mortality. The release of resources and niche space allows rabbitbrush and invasive species such as cheatgrass, yellow star thistle and chervil to colonize and establish. This takes place in a series of retrogressions. The native species are weakened, the invasive species increase to fill the void, and an equilibrium at a lower ecological level has been reached. This continues until the community is dominated by rabbitbrush and invasive species rather than natives. Indicators: decreasing cover of native species and increasing cover of invasive species, rabbitbrush and rose

Restoration pathway R3
State 3 to 4

R3 Transition from State 3 (a community dominated by invasive annual species) to State 4, which is predominately desirable seeded grasses (native or introduced). 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 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. Secar Snake River wheatgrass, crested wheatgrass, Covar sheep fescue, Whitmar wheatgrass and Sherman bluegrass are typical species seeded on Loamy, bunchgrass, 15-18” ppt. site in the Loess Hills. The actual transition occurs when the seeded species have successfully established and are outcompeting the annual species for cover and dominance of resources.

Transition T4
State 4 to 3

T4 Result: shift from State 4 seeded grass to State 3 which is dominated by invasive species. T4 can go to annual grass Community 3.1 or to broadleaf weeds Community 3.2. Wetter years favor broadleaf weeds while drier years favor annual grasses. Rabbitbrush occurs on both communities. Primary Trigger: grazing pressure (heavy grazing intensity, season long grazing or frequent late spring grazing) to desirable seeded species Ecological process: consistent defoliation pressure to seeded species results in poor vigor, shrinking crowns and some plant mortality. The release of resources and niche space allows rabbitbrush and invasive species such as cheatgrass, yellow star thistle and chervil to colonize and establish. This takes place in a series of retrogressions. The native species are weakened, the invasive species increase to fill the void, and an equilibrium at a lower ecological level has been reached. This continues until the community is dominated by rabbitbrush and invasive species rather than natives. Indicators: decreasing cover of seeded species and increasing cover of invasive species, rabbitbrush and rose Indicators: shrinking crowns and mortality of desirable species, increasing cover of invasive species and canopy cover of rabbitbrush References: Boling M., Frazier B., Busacca, A., General Soil Map of Washington, Washington State University, 1998 Caldwell, M.M., J.H. Richards, D.A. Johnson, R.S. Nowak, and R.S. Dzurec. Coping with

Herbivory: Photosynthetic Capacity and Resource Allocation in Two Semiarid Agropyron bunchgrasses. Oecologia, 50:14-24. Daubenmire, R., Steppe vegetation of Washington, EB1446, Washington State University Cooperative Extension, 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 Liston, A, B.L. Wilson, W.A. Robinson, P.S. Doescher, N.R. Harris, and T. Svejar. 2003. The Relative Importance of Sexula Reproduction Versus Clonal Spread in an Arid Bunchgrass. Oecologia 137:216-225 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 Vallentine, John F. 1971. Range Development and Improvement. BYU Press, Provo, UT.

Citations