Ecological site group R007XG143WA
Sandy Loam

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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
7.5 – Yakima Valley – Pleistocene Lake Basins

Site Concept Narrative:

Diagnostics:
Carey balsamroot is a marker for MLRA 007X.
Sandy Loam is a shrub steppe upland site occurring on moderately deep to deep sandy loam textured soils. Depth to carbonates is 18 inches or deeper below the surface.

In the reference state this site is dominated by Wyoming sage, bluebunch wheatgrass and needle and thread. Carey balsamroot, lupine, fleabane and hawksbeard are also common.

The Sandy site, on the other hand, has the same soil texture as Sandy Loam, but is a grassland community because the carbonates are at or near the surface.

The line between Sandy Loam and Sandy is often sharp. It is possible to stand with one foot on Sandy Loam and the other on Sandy.

Principle Vegetative Drivers:
The shrub steppe vegetative expression for Sandy Loam is driven by the sandy loam soil texture and no carbonates until a depth of 18 inches or deeper.

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

Sandy Loam ecological sites have more available moisture than Sandy sites since the carbonates are not reached until a depth of 18 inches or deeper. Soils are well drained and dry down quicker than adjacent Loamy ecological sites.

Physiographic features:
The landscape is part of the Columbia basalt plateau. Sandy loam is commonly found on terraces, terrace escarpments, benches and plateaus.

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

Landscapes: Basin, hills and plateaus
Landform: Hillslopes, ridges, terraces, terraces escarpments and alluvial flats

Elevation:
Range: 300 to 3,500 feet
Central tendency: 300 to 1,200 feet

Slope:
Total range: 0 to 60 percent
Central tendency: 10 to 55 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

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. The average annual precipitation for Sandy Loam is mostly between 4 and 10 inches. 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. 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. Winter fog is variable and often quite localized, as the fog settles on some areas but not others.

Mean Annual precipitation
Range: 4 - 10 inches
Soil moisture regime is aridic.

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: 130 to 200
Central tendency: 150 to 180
The growing season for Sandy Loam is March through June.

Soil features

Edaphic:
The Sandy Loam ecological site occurs with Sands, Sandy, and Shallow Stony Sand ecological sites.

REPRESENTATIVE SOIL FEATURES
This ecological site components are dominantly Xeric taxonomic subgroup of Haplocalcids and Haplocambids great groups of the Aridisols taxonomic orders. Soils are dominantly very deep, but strongly contrasting textural stratification can occur up to 20 inches. Average available water capacity of about 5.0 inches (12.7 cm) in the 0 to 40 inches (0 to 100 cm) depth range.

Soil parent material is dominantly alluvium derived from mixed sources.

The associated soils are Adkins, Ephrata, Finley, Prosser, Royal, Taunton, Wiehl and similar soils.

Dominate soil surface is very fine sandy loam to cobbly fine sandy loam.

Dominant particle-size class is coarse-silty to loamy-skeletal.

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

Fragments within surface horizon > 3 inches (% Volume):
Minimum: 0
Maximum: 25
Average: 2

Fragments within surface horizon ≤ 3 inches (% Volume):
Minimum: 0
Maximum: 30
Average: 10

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

Subsurface fragments ≤ 3 inches (% Volume):
Minimum: 0
Maximum: 40
Average: 25

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 and high
10 to 40 inches: Moderately high and high

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

Electrical Conductivity (dS/m)
Minimum: 0

Maximum: 10

Sodium Absorption Ratio
Minimum: 0
Maximum: 10

Calcium Carbonate Equivalent (percent):
Minimum: 10
Maximum: 30

Soil Reaction (pH) (1:1 Water):
0 - 10 inches: 6.1 to 9.0
10 - 40 inches: 6.1 to 9.0

Available Water Capacity (inches, 0 – 40 inches depth)
Minimum: 1.8
Maximum: 7.9
Average: 5.0

Vegetation dynamics

Vegetation Dynamics:
Sandy Loam ecological site produces about 500 to 850 pounds per acre of biomass annually.

Sandy Loam ecological site is a shrub steppe site with Wyoming sagebrush, needle and thread and bluebunch wheatgrass dominant in the reference state.

Wyoming sagebrush in a long-lived, multi-branched, evergreen shrub. Size varies from three to five feet depending on soil and site conditions. Wyoming big sagebrush has a significant rooting system, composed of a two-part rooting structure with a primary deep taproot, and a shallow extensive network of finer roots that spread laterally. This rooting system allows Wyoming big sagebrush to survive in the hottest and driest portions of the sagebrush range by tapping into groundwater sources deep into the soil profile itself. This also allows Wyoming big sagebrush to be more competitive with bunchgrasses when the landscape positions and/or soils are less ideal for grass species to maintain the competitive advantage.

Needle and thread is a very drought tolerant perennial bunchgrass. It prefers excessively drained sandy and coarse textured gravelly loam soils. Needle and thread produces erect, unbranched stems about three feet in height. The seeds have a 4 to 5-inch long twisted awn. With wetting and drying the seed drills itself into the ground. Thus, needle and thread is one of the best seeders in the reference community. With grazing pressure needle and thread initially increases.

Bluebunch wheatgrass is a long-lived, mid-sized bunchgrass with an awned or awnless seed head arranged is a spike. Bluebunch provides a crucial and extensive network of roots to the upper portions (up to 48 inch deep in soils with no root-restrictive horizons) of the soil profile. These roots create a massive underground source to stabilize the soils, provide organic matter and nutrients inputs, and help maintain soil pore space for water infiltration and water retention in the soil profile. The extensive rooting system of mid-sized bunchgrasses leave very little soil niche space available for invasion by other species. This drought resistant root 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 bluebunch wheatgrass and needle and thread Research has found that the community remains resistant to medusahead if the site maintains at least 0.8 plants per square foot of mid-sized bunchgrass (K. Davies, 2008). These two grasses help hold the system together. If we lose either grass 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 to 20 years (Miller). The FRI increases as one moves to wetter forested sites or to dries shrub steppe

communities. Given the uncertainties and opinions or reviewers, a mean of 75 years was chosen for Wyoming sagebrush communities (Rapid Assessment Model). This would place the historic FRI for grassland steppe around 30 to 50 years.

The effect of fire on the community depends upon the severity of the burn. With a light to moderate fire there can be a mosaic of burned and unburned patches. Bunchgrasses thrive as the fire does not get into the crown. With adequate soil moisture the bunchgrasses can make tremendous growth the year after the fire. Largely, the community is not affected by lower intensity fire. Needle and thread is a native species that can increase via new seedlings following a fire.

A severe fire puts stress on the entire community. Spots and areas that were completely sterilized are especially vulnerable to exotic invasive species. Sterilized spots must be seeded to prevent invasive species (annual grasses, tumble mustard) from totally occupying the site. Bluebunch wheatgrass may have weak vigor for a few years but generally survive. Needle and thread is largely unaffected by fire.
Grazing is another common disturbance that occurs in 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. Bluebunch wheatgrass declines while needle and thread increases
2. Both bluebunch wheatgrass and needle and thread decline. Invasive species such as cheatgrass colonize the site
3. With further decline the site can become a cheatgrass dominated community

Managing grasslands to improve the vigor and health of bluebunch wheatgrass and needle and thread begins with an understanding their needs. New growth each year begins from basal buds. B wheatgrass plants rely principally on tillering while needle and thread establishes new plants through natural seeding. During seed formation, the growing points of bluebunch wheatgrass becomes elevated and are vulnerable to damage or removal.

Repeated critical period grazing (boot stage through seed formation) is especially damaging to bluebunch. Over several years each native bunchgrass pasture should be rested during the critical period two out of every three years (approximately April 1 throughJune 30). And each pasture should be rested the entire growing-season every third year (approximately March 1 through June 30).

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, and (3) to protect the elevated growing points of bluebunch wheatgrass.

Bluebunch wheatgrass and needle and thread remain competitive if:
(1) Basal buds are replaced annually,
(2) Viable seed is produced by needle and thread in most years
(3) Enough top-growth is maintained for growth and protection of growing points, and
(4) 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, Wyoming sagebrush – bluebunch wheatgrass – needle and thread communities provide habitat for a variety of upland wildlife species.

Supporting Information:

Associated Sites:
Sandy Loam ecological site is associated with Sandy, Sands, Loamy, Stony, Shallow Stony Sand and Very Shallow ecological sites.

Similar sites:
Sandy Loam ecological site is a Wyoming sage – bluebunch wheatgrass – needle-and-thread ecological site. Non-

sandy shrub steppe sites do not have the needle and thread but are similar otherwise.

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 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

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

- R007XY143WA–Sandy Loam

Stage

Provisional

Contributors

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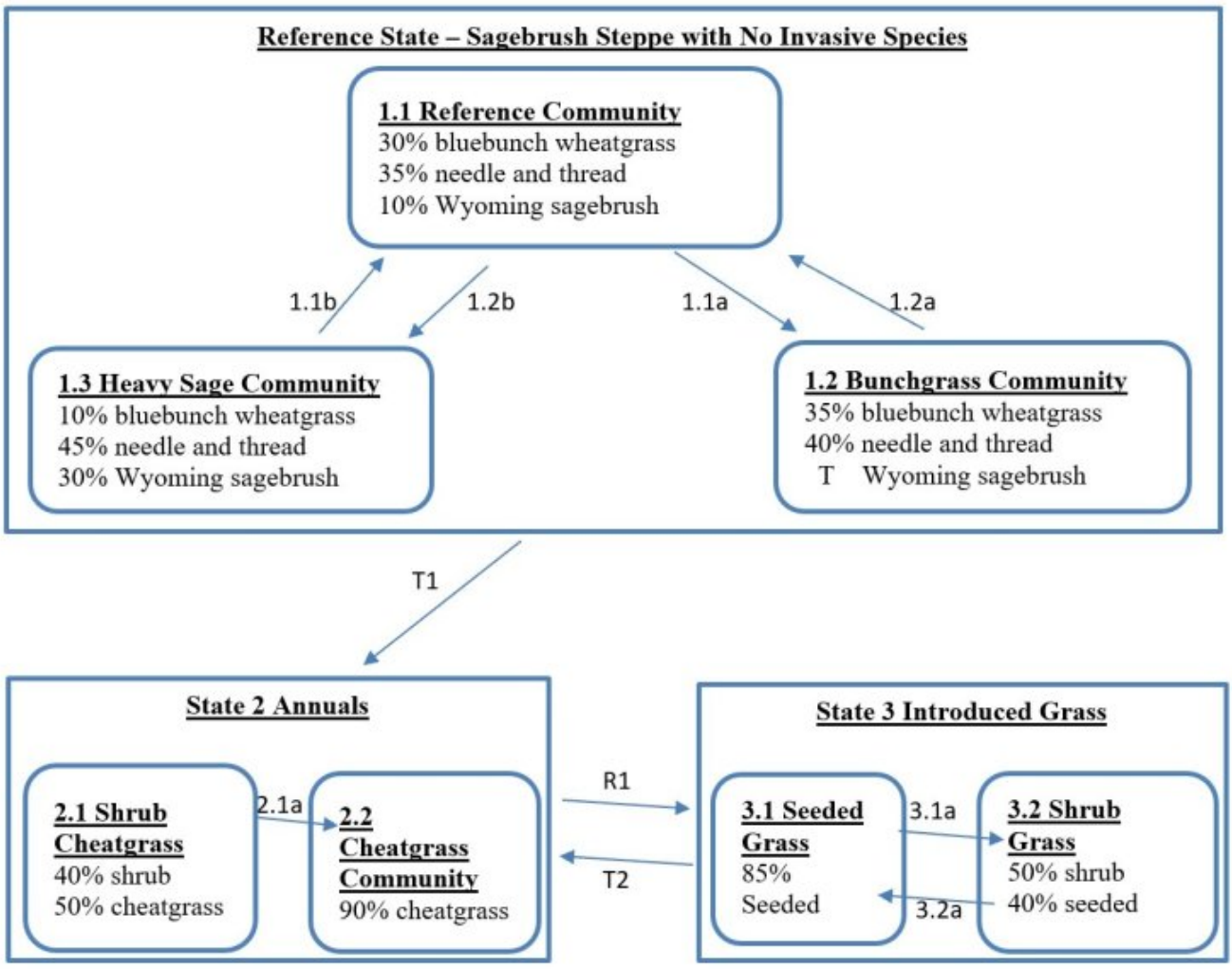
State and transition model

State and Transition Diagram for Sandy Loam in MLRA 7:

This state and transition model (STM), explains the general ecological dynamics for the Stony Foothills South Slope 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.



Reference Community 1.1 for Sandy Loam in MLRA 7

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.

Similarity Index			Similarity Index		
Non-Sprouting Shrubs – Subdominant			**Sprouting Shrubs – Minor**		
	10%	80 lbs.		5%	40 lbs.
ARTRW8 Wyoming sagebrush			ERNA10 gray rabbitbrush CHVI8 green rabbitbrush TECA2 horsebrush		
Dominant Mid-Size Bunchgrasses			**Other Mid-Size Bunchgrasses – Minor**		
	65%			5%	40 lbs.
HECO26 needle and thread	35%	300 lbs.	SPCR sand dropseed KOMA prairie junegrass ELEL5 bottlebrush squirreltail ACTH7 Thurber needlegrass		
PSSP6 bluebunch wheatgrass	30%	250 lbs.			
Short Grasses – Minor			**Grass Like**		
	5%	40 lbs.			
POSE Sandberg bluegrass VUOC sixweeks fescue					
Native Forbs – Minor					
				10%	80 lbs.
SPMU2 globemallow BACA3 Carey's balsamroot OENOT evening primrose CREPI hawksbeard ERIGE2 fleabane ERIOG buckwheat CASTI2 paintbrush ANDI2 low pussytoes CHDO Douglas dusty-maiden COLLO collomia PLPA2 woolly plantain ACMI2 yarrow			ERNI2 snow buckwheat LUPIN lupine PHLO2 longleaf phlox LOMAT lomatium / biscuitroot ASTRA milkvetch / locoweed ORTHO owl clover PHHO spiny phlox LIPU11 granite gilia DELPH larkspur LIRU4 stoneseed		

Estimated Production (pounds / acre)	Below	Normal	Above
	500	700	800

State 1
Reference State

State 1 Narrative: State 1 represents shrub steppe with no invasive or exotic weed species. All the functional, structural groups are represented by one or more native species. The Reference Community 1.1 is dominated by Wyoming sagebrush, needle and thread and bluebunch wheatgrass. Native forbs are also present. Reference State Community Phases: 1.1 Reference Wyoming sagebrush – Needle and thread / Indian ricegrass Dominate Reference State Species: Wyoming sagebrush, needle and thread, bluebunch wheatgrass At-risk Communities: All communities in the reference state are at risk on invasion by cheatgrass. Cheatgrass seeds blow onto most sites annually. Community 1.3 Heavy Sagebrush is more at risk of shifting into State 2 than the other Reference State communities.

Community 1.1
1.1 Reference Community

Community 1.2
1.2 Bunchgrass Community

Community 1.3
1.3 Heavy Sagebrush Community

Pathway 1.1a
Community 1.1 to 1.2

1.1a Result: shift from Reference Community to Bunchgrass Community. Big reduction in sagebrush and a moderate increase in bunchgrasses. Primary trigger: moderate severity fire kills sagebrush while bunchgrasses thrive and expand. Fire removes surface vegetation but leaves the bunchgrass crowns intact. Ecological Process: the death of sagebrush releases resources. Fire conditions and post-fire management allows bunchgrasses to thrive. Bunchgrasses expand via tillering and new seedlings.

Pathway 1.2b
Community 1.1 to 1.3

1.2b Result: shift from Reference Community to Heavy Sagebrush Community. Primary Trigger: heavy grazing pressure (heavy grazing intensity, season-long grazing and frequent late-spring grazing) Ecological Process: consistent defoliation pressure to bluebunch wheatgrass results in poor vigor, shrinking crowns and quite a bit of plant mortality. Sagebrush and needle and thread expand cover vis new seedlings into the niche space available from the declining bluebunch wheatgrass plants.

Pathway 1.2a
Community 1.2 to 1.1

1.2a Result: shift from Bunchgrass Community to Reference Community. Primary Trigger: soil disturbance and the natural regeneration process of sagebrush. Ecological Process: sagebrush seed spreads from sagebrush plants that survived the fire. At spots of soil disturbance, the sagebrush seeds have soil-soil contact, germinate and some seedlings become established. Shading causes a slight decrease in bunchgrasses.

Pathway 1.1b
Community 1.3 to 1.1

1.1b Result: shift from Heavy Sagebrush Community to Reference Community. There is a significant reduction in shrub cover and a corresponding increase in bunchgrass cover. Primary trigger: moderate severity fire kills sagebrush while bunchgrasses thrive and expand. Fire removes surface vegetation but leaves the bunchgrass crowns intact. Ecological Process: the death of sagebrush releases resources. Fire conditions and post-fire management allows bunchgrasses to thrive. Bunchgrasses expand via tillering and new seedlings.

State 2
Annual Grasses

State 2 Narrative: State 2 represents sites dominated by invasive annual species and has crossed a biological threshold. As Reference State 1 begins to unravel the dominant bunchgrasses decline while invasive grasses become more and more prominent. Virtually all the native functional, structural groups are missing in State 2. Community Phases for State 2: 2.2 Annual Grass: Cheatgrass Dominate State 2 Species: Annual grasses such as cheatgrass, the main species can include mustard, Russian thistle, prickly lettuce and diffuse knapweed. Pathways within State 2 2.1a Result: shift from sagebrush-cheatgrass community to cheatgrass community Primary trigger: moderate severity fire kills sagebrush. Ecological process: death of sagebrush releases resources and niche space. Cheatgrass expands cover to the point of dominance.

State 3
Seeded Grasses

State 3 Narrative: State 3 represents a site that has been seeded to desirable grasses such as needle and thread, Indian ricegrass, Secar Snake River wheatgrass, Sherman big bluegrass, or Siberian wheatgrass. State 4 is stable if 0.8 plants per square foot or greater of the desired bunchgrasses is maintained. Dominate Species for State 3: Desirable seeded grass species with or without legumes Community Phases for State 3: 3.1 Seeded Grass

Community 3.1
3.1 Seeded Grass

Community 3.2
3.2 Shrub Grass

Pathway 3.1a
Community 3.1 to 3.2

3.1a Result: shift from seeded grass to shrub-seeded grass community. Primary Trigger: heavy grazing pressure to desirable seeded grasses Ecological Process: consistent defoliation pressure to desirable seeded grasses results in poor vigor, shrinking crowns and some mortality. The sagebrush population expands via new seedlings.

Pathway 3.2a
Community 3.2 to 3.1

3.2a Result: shift from shrub-grass community to seeded grass community. Primary Trigger: human treatment activity to kill sagebrush. Ecological Process: sagebrush is killed from human treatment activity (herbicide application, prescribed fire or mechanical mowing). This requires a good population of desirable grasses in good vigor prior to and after treatment to kill the shrubs. The desirable grasses expand vis tillering and new seedlings. In the instance where there is not a good population of desirable grasses, shrub treatment will need to be coupled with seed control and then a seeding operation.

Transition T1
State 1 to 2

T1 Result: transition from Reference State to State 2 which is dominated by annual grasses. This transition occurs once the cover of needle and thread and bluebunch wheatgrass decline to less than 10 percent and invasive species cover is greater than 40 percent. Primary Trigger: heavy grazing pressure (heavy grazing intensity, season long grazing and frequent late spring grazing) results in declining bunchgrasses and invasion by invasive annual grasses. Ecological process: consistent defoliation pressure to bluebunch wheatgrass and other native bunchgrasses results in poor vigor, shrinking crowns and mortality. The unraveling of the native plant community begins with a decline in bluebunch wheatgrass, while both needle and thread and sagebrush increase. As the grazing pressure continues, needle and thread will also decrease allowing the annual grasses to colonize and then become dominate. Soil disturbances (rodents, badgers) create openings or opportunities in the community or a high moisture year causes a micro-burst of cheatgrass and is the principle means of colonization. Annually cheatgrass seed blows onto most Reference State sites. This seed is waiting for opportunity to germinate and compete with the native species for space, light and moisture. When the right year happens even pristine communities in the Reference State are susceptible to colonization by cheatgrass Indicators: The occurrence of annual grasses on sites where there has been none. Decreasing vigor and cover of needle and thread and bluebunch wheatgrass and increasing cover of invasive annual species. Increasing distance between perennial species. Decreasing soil organic matter, soil water retention, limited water infiltration and percolation in the soil profile.

Restoration pathway R1
State 2 to 3

Recovery R1 Result: shift from State 2 dominated by annual grasses to State 3 desirable seeded grasses. 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. Needle and thread, Indian ricegrass, Secar Snake River wheatgrass, thickspike wheatgrass, Sherman big bluegrass, Sandberg bluegrass, and intermediate wheatgrass are typical species seeded on Sandy Loam ecological site. The actual transition occurs when the seeded species have successfully established and are outcompeting the annual species for cover and dominance of resources.

Transition T2
State 3 to 2

T2 Result: Transition from State 3 seeded grasses to State 2 annual grasses. This transition occurs when the desirable seeded grasses become minor to the dominant annual grasses. This shift can happen with or without sagebrush. Primary Trigger: grazing pressure on the seeded grasses reduce the vigor and density of key bunchgrass species. Ecological process: consistent defoliation pressure to desirable seeded grasses results in poor vigor, shrinking crowns and plant mortality. As the unraveling of the seeded grass community continues invasive annual grasses colonize the site and become more and more common with the loss of each bunchgrass. Indicators: shrinking crowns and mortality of desirable species, increasing caps gaps between perennial species, increasing cover by annual grasses.

Citations