

Ecological site group R007XG140WA

Sands

Last updated: 09/22/2023
Accessed: 04/29/2024

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): 007X – Columbia Basin

LRU – Common Resource Areas (CRA):

7.1 – Sandy Missoula Flood Deposits

7.5 – Yakima Valley – Pleistocene Lake Basins

Site Concept Narrative:

Diagnostics:

Sands is an upland shrub steppe site occurring on moderately deep to deep sand textured soils. The most common textures are sand, coarse sand and loamy fine sand.

Indian ricegrass, needle and thread, basin/Wyoming big sagebrush or bitterbrush are the dominate species in the Reference State. Snow buckwheat, rabbitbrush, Carey balsamroot, and fleabane are also common.

Principle Vegetative Drivers:

The coarse-textured, well drained soils drive the vegetative expression of this site. Sands ecological site favors shrubs and species adapted to sand.

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

Sands ecological sites are excessively drained and dry down quicker than adjacent Loamy ecological sites.

Physiographic features:

The landscape is part of the Columbia basalt plateau. Sands is commonly found on dunes, terraces and terrace escarpments, benches and hillslopes.

Physiographic Division: Intermontane Plateau

Physiographic Province: Columbia Plateau

Physiographic Sections: Walla Walla Plateau Section

Landscapes: Basin and hills

Landform: Terraces, terraces escarpments, and dunes

Elevation:

Range: 300 to 3,000 feet

Central tendency: 300 to 1,200 feet

Slope:

Total range: 0 to 60 percent

Central tendency: 10 to 40 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 Sands 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: 46 to 54 F

Central Tendency: 50 – 52 F

Soil temperature regime is mesic.

Frost-free period (days)

Total range: 120 to 210

Central tendency: 150 to 180

Soil features

Edaphic:

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

REPRESENTATIVE SOIL FEATURES

This ecological site components are dominantly Xeric taxonomic subgroup of Torripsamments, Torriorthents and Haplocambids great groups of the Entisols and Aridisols taxonomic orders. Soils are dominantly very deep. Average available water capacity of about 3.0 inches (7.6 cm) in the 0 to 40 inches (0 to 100 cm) depth range.

Soil parent material is dominantly eolian or alluvium derived from mixed sources.

The associated soils are Burbank, Hezel, Quincy, Royal, Winchester and similar soils.

Dominant soil surface is loamy fine sand to sand.

Dominant particle-size class is sandy skeletal or sandy to sandy over loamy.

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

Minimum: 0

Maximum: 2

Average: 0

Fragments within surface horizon > 3 inches (% Volume):

Minimum: 0

Maximum: 15

Average: 2

Fragments within surface horizon \leq 3 inches (% Volume):

Minimum: 0

Maximum: 25

Average: 5

Subsurface fragments > 3 inches (% Volume)

Minimum: 0

Maximum: 25

Average: 5

Subsurface fragments \leq 3 inches (% Volume):

Minimum: 0

Maximum: 35

Average: 15

Drainage Class: Well to excessively 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: 2

Sodium Absorption Ratio

Minimum: 0

Maximum: 0

Calcium Carbonate Equivalent (percent):

Minimum: 0

Maximum: 15

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: 0.9

Maximum: 7.5

Average: 3.0

Vegetation dynamics

ECOLOGICAL DYNAMICS:

Vegetation Dynamics:

Sands produces about 500 to 800 pounds per acre of biomass annually.

Big sagebrush (Wyoming, basin) or bitterbrush with needle and thread and Indian ricegrass are dominant in the Reference State and warrants a degree of understanding.

Wyoming sagebrush is 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 or soils are less ideal for grass species to maintain the competitive advantage.

Antelope bitterbrush is a very palatable, high quality shrub for big game and livestock. It is adapted to a wide range of soils and precipitation. Bitterbrush is usually 2-6 feet in height and up to 8 feet in width. Rodents normally cache bitterbrush seed within 50-75 feet of an existing seed source. Following a fire, the rodent seed caches become an important source of regeneration. Another important source of regeneration are pockets of unburned rangeland that provide much needed seed to the system.

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.

Indian ricegrass is a winter hardy, cool-season bunchgrass. It has tightly rolled, slender leaves. Indian ricegrass is known for its ability to reseed and stabilize shifting sand.

The stability and resiliency of the reference communities is directly linked to the health and vigor of needle and thread and Indian ricegrass. Research has found that the community remains resistant to medusahead if the site maintains at least 0.8 mid-sized bunchgrass plant/sq. ft. (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 10-20 years (Miller). The FRI increases as one moves to wetter forested sites or to drier shrub steppe communities. 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 around 30-50 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 and Indian ricegrass are 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. Needle and thread and Indian ricegrass may have weak vigor for a few years but generally survive.

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. Indian ricegrass declines while needle and thread increase
2. Needle and thread also declines. Invasive species such as cheatgrass and knapweed colonize the site
3. With further decline the site can become a cheatgrass dominated community

Managing grasslands to improve the vigor and health of needle and thread and Indian ricegrass begins with an understanding their needs. New growth each year begins from basal buds. Both grasses reproduce via seed and need to produce viable seed on a regular basis.

Repeated critical period grazing (boot stage through seed formation) 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 – June 30). And each pasture should be rested the entire growing-season every third year (approximately March – 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.

Needle and thread and Indian ricegrass remains competitive if:

- (1) Basal buds are replaced annually,
- (2) Enough top-growth is maintained for growth, protection of growing points, seed production 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, needle and thread-Indian ricegrass communities provide habitat for a variety of upland wildlife species.

Supporting Information:

Associated Sites:

Sandy, Sandy Loam, Shallow Stony Sand and Stony ecological sites are associated with Sands.

Similar sites:

Sands South Aspect Columbia Hills in MLRA 008X is also a needle and thread – Indian ricegrass site but does not have a shrub component.

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

- R007XY140WA–Sands

Stage

Provisional

Contributors

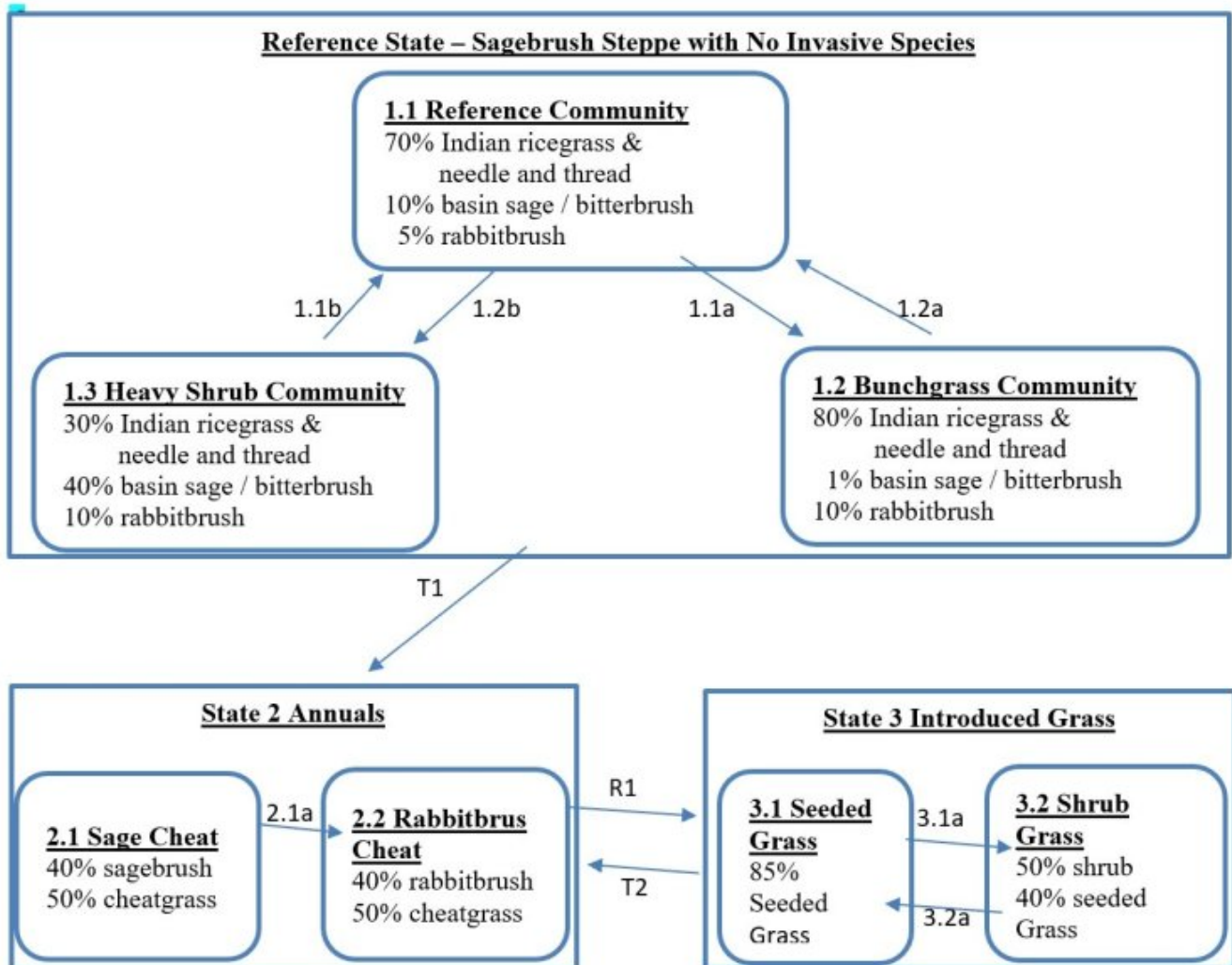
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State and transition model

State and Transition Diagram for Sands 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 Sands 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.	
ARTRT	basin big sagebrush	ERNA10	gray rabbitbrush
PUTR2	bitterbrush	CHVI8	green rabbitbrush
		TECA2	horsebrush
Dominant Mid-Size Bunchgrasses		Other Mid-Size Bunchgrasses – Minor	
70% 600 lbs.		5% 40 lbs.	
ACHY	Indian ricegrass	ELLA3	thickspike wheatgrass
HECO26	needle and thread	SPCR	sand dropseed
		PSSP6	bluebunch wheatgrass
		ELEL5	bottlebrush squirreltail
		ACTH7	Thurber needlegrass
Short Grasses – Minor		Grass like	
5% 40 lbs.			
POSE	Sandberg bluegrass		
VUOC	sixweeks fescue		
Native Forbs – Minor			
		5% 40 lbs.	
SPMU2	globemallow	ERNI 2	snow buckwheat
BACA3	Carey’s balsamroot	LUPIN	lupine
OENOT	evening primrose	PHLO2	longleaf phlox
CREPIS	hawksbeard	LOMAT	lomatium / biscuitroot
ERIGE2	fleabane	ASTRA	milkvetch / locoweed
ERIOG	buckwheat	ORTHO	owl clover
CASTI2	paintbrush	PHHO	spiny phlox
ANDI2	low pussytoes	LIPU11	granite gilia
CHDO	Douglas dusty-maiden	DELPH	larkspur
COLLO	collomia	LIRU4	stoneseed
PLPA2	woolly plantain		
ACMI2	yarrow		
Estimated Production (pounds / acre)		Below	Normal
		500	600
			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 native grass - shrub dominated by needle and thread, Indian ricegrass, sagebrush, or bitterbrush. Native forbs are also present. Fire eliminates the shrubs, so Community 1.2 is a grassland community. Community 1.3 is heavy shrub-grass. Reference State Community Phases: 1.1 Reference Sagebrush/bitterbrush – needle and thread – Indian ricegrass At-risk Communities: • Community 1.3 is most at risk of transitioning to State 3 • All communities are at risk when native bunchgrass density falls to 10 percent and cheatgrass has colonized the site.

Community 1.1

Reference Community

The Reference Community 1.1 is native grass - shrub dominated by needle and thread, Indian ricegrass sagebrush and/or bitterbrush. Native forbs are also present.

Community 1.2

Grassland Community

Community 1.2 is a grassland community.

Community 1.3

Heavy Shrub Community

Community 1.3 is heavy shrub-grass

Pathway P1.1a

Community 1.1 to 1.2

1.1a Result: shift from reference community to bunchgrass community Primary Trigger: moderate severity fire Ecological Process: fire kills fire sensitive shrubs (sagebrush and bitterbrush) and this releases resources for bunchgrasses and rabbitbrush. The fire does not burn into bunchgrass crowns, so they thrive and expand post-fire via tillering and new seedlings. Burned rabbitbrush plants sprout and new seedlings are established.

Pathway P1.2b

Community 1.1 to 1.3

1.2b Result: shift from reference community to heavy shrub community. This shift is from bunchgrass dominance to shrub dominance. Primary Trigger: heavy grazing pressure (heavy grazing intensity, season long grazing and frequent late spring grazing) Ecological Process: consistent defoliation pressure to Indian ricegrass and needle and thread results in poor vigor, shrinking crowns and quite a bit of plant mortality. Sagebrush and needle and thread expand cover via new seedlings into the niche space available from the declining bluebunch wheatgrass plants.

Pathway P1.2a

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, which increases germination and some seedlings become established in the process. Shading causes a slight decrease in bunchgrasses.

Pathway P1.1b

Community 1.3 to 1.1

1.1b Result: shift from heavy shrub community to reference community. The community shifts from shrub dominance to bunchgrass dominance. Primary Trigger: moderate severity fire Ecological Process: fire is spotty and kills most but not all the fire sensitive shrubs (sagebrush and rabbitbrush). The fire does not burn into bunchgrass crowns, so they thrive and expand post-fire via tillering and new seedlings. Burned rabbitbrush plants sprout and new seedlings are established.

State 2

Annual Grasses

State 2 Narrative: State 2 represents sites dominated by invasive annual species and have crossed a biological threshold. As Reference State 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: 2.1 Sagebrush – Annual Grass 2.2 Rabbitbrush – Annual Grass Dominate State 2 Species: Annual grasses such as cheatgrass, sagebrush and rabbitbrush. Other species can include mustard, prickly lettuce, Russian thistle and diffuse knapweed. Pathways within State 2 2.1a Result: shift from sagebrush-cheatgrass community to rabbitbrush-cheatgrass community. Primary Trigger: moderate severity fire Ecological Process: fire sensitive shrubs (sagebrush and bitterbrush) are killed by the fire. Rabbitbrush expands via sprouting and new seedlings while cheatgrass expands by seedlings.

State 3

Seeded introduced grasses

State 3 Narrative: State 3 represents a site that has been seeded to grasses such as Siberian wheatgrass, crested wheatgrass and Secar Snake River wheatgrass. State 3 is stable if 0.8 plant 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 4: 3.1 Seeded Grass 3.2 Shrub Grass Pathways within State 3 3.1a Result: shift from seeded grass community to shrub-seeded grass community. Primary Trigger: grazing pressure to desirable seeded grasses Ecological Process: consistent defoliation pressure to seeded grasses results in poor vigor, shrinking crowns and plant mortality. Shrubs increase to occupy the niche space vacated by the seeded grasses.

Transition T1

State 1 to 2

T1 Result: shift from Reference State to State 2 which is dominated by annuals and shrubs. This transition occurs once the cover of needle and thread and Indian ricegrass declines to less than 10 percent and invasive species cover is greater than 40 percent. Primary Trigger: 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. Secondary Trigger: Repeated fire does the same thing. In Washington, chronic season-long grazing caused more acres of State 2 than repeated fire. Repeated fire is a much more common event in south Central Washington. Ecological process. 1. 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. 2. Dominance by annuals: the unraveling of the native plant community begins with weakened vigor and less cover of the dominant bunchgrasses, or the sudden loss of a major species such as Indian ricegrass. The invasive annual grasses in make a dramatic increase to dominate the community. Consistent defoliation pressure causes low vigor and reduced cover of Indian ricegrass and needle and thread. Initially needle and thread and the annual grasses increase while Indian ricegrass declines. As the defoliation pressure continues, needle and thread also decreases allowing the annual grasses to become dominate. Grazing pressure is defined as heavy grazing, season long grazing or frequent late spring grazing. Indicators: The occurrence of annual grasses on sites where they had been absent. Decreasing vigor and cover of needle and thread and Indian ricegrass 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 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. Siberian wheatgrass, crested wheatgrass, Secar Snake River wheatgrass, thickspike wheatgrass and Sherman big bluegrass may be seeded. The actual transition occurs when the seeded species have successfully established and are outcompeting the annual species for cover and dominance of resources.

Restoration pathway T2

State 3 to 2

T2 Result: Transition from State 3 seeded grass to State 2 annual grasses. This transition occurs when the desirable seeded grasses become minor to the dominant annual grasses. Ecological process: consistent defoliation pressure to the seeded grasses results in poor vigor, shrinking crowns and plant mortality. At the seeded grass community unravels, invasive annual grasses colonize the site and become more and more common with the loss of each bunchgrass. Primary trigger: grazing pressure on the seeded grasses reduce the vigor and density of key bunchgrass species. Indicators: shrinking crowns and mortality of desirable species, increasing caps gaps between perennial species, increasing cover by annual grasses.

Citations