

Ecological site group R008XG002WA

Mound - Intermound Complex

Last updated: 09/21/2023
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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): 8 – Columbia Plateau

LRU – Common Resource Areas (CRA):

- 8.1 - Channeled Scablands
- 8.2 - Loess Islands
- 8.3 - Okanogan Drift Hills
- 8.4 - Moist Pleistocene Lake Basins
- 8.5 - Moist Yakima Folds
- 8.6 - Lower Snake and Clearwater Canyons
- 8.7 - Okanogan Valley

Site Concept Narrative:

Mound-Intermound Complex has a mound, inter-mound topography. The Loamy Mound component is surrounded by the Very Shallow component, 65-90% Very Shallow and 10-35% Loamy Mound. Mounds are about 20-40 feet in diameter and one mound is separated from the next closest mound by about 50-100 feet.

The Very Shallow Component:

Very Shallow is a sparsely vegetated, low shrub-short grass, upland site on very shallow soils (generally less than 8 inches deep). Sandberg bluegrass is the short grass in all instances, but the low shrub component is variable. Stiff sagebrush is the most common low shrub, but one to several different buckwheat species are present on some sites, instead of, or with stiff sagebrush. The most common reference community is stiff sagebrush-Sandberg bluegrass.

Refer to the very shallow provisional ecological site for more specific information about the very shallow component.

The Loamy Mound component; moderately deep (20-40") silt loam soil over basalt. In biscuit-swale topography, each silt loam mound is surrounded by very shallow ecological site.

Principle Vegetative Drivers:

- Very Shallow component – very shallow soil depth & the fracturing, or the lack of fracturing, in the underlying basalt bedrock.
- Loamy Mound component – deeper soil depth & intercepted moisture from adjoining Very Shallow immediately uphill of each mound

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 lower part of the soil profile of Very Shallow has high clay content. With winter rain and melting snow, water perches and creates saturated conditions.

In wet years during spring runoff, water runs on the surface of the Very Shallow component for a short period. Even more water runs beneath the surface to sites below. This increases the effective precipitation to the adjacent sites below, including Loamy Mound.

Physiographic Features:

The landscape is part of the Columbia basalt plateau. Occurs on benches and terraces. For Very Shallow the soils are formed in loess and residuum weathered from basalt, while Loamy Mound have moderately deep, well drained soils formed in loess.

Physiographic Division: Intermontane Plateau

Physiographic Province: Columbia Plateau

Physiographic Sections: Walla Walla Plateau Section

Landscapes: Hills and plateaus

Landform: Intermounds, mounds, swales, hummocky areas, side slopes, terraces

Elevation: Dominantly 600 to 4,000 feet

Slope: Total range: 0 to 65 percent

Central tendency: 5 to 20 percent

Aspect: Occurs on all aspects

Geology:

This MLRA is almost entirely underlain by Miocene basalt flows. Columbia River basalt is covered in many areas with as much as 200 feet of loess and volcanic ash. Small areas of sandstones, siltstones, and conglomerates of the Upper Tertiary Ellensburg Formation are along the western edge of this area. Some Quaternary glacial drift covers the northern edge of the basalt flows, and some Miocene-Pliocene continental sedimentary deposits occur south of the Columbia River, in Oregon.

A wide expanse of scablands in the eastern portion of this MLRA, in Washington, was deeply dissected about 16,000 years ago, when an ice dam that formed ancient glacial Lake Missoula was breached several times, creating catastrophic floods. The geology of the northernmost part of this MLRA is distinctly different from that of the rest of the area. Alluvium, glacial outwash, and glacial drift fill the valley floor of the Okanogan River and the side valleys of tributary streams. The fault parallel with the valley separates pre-Tertiary metamorphic rocks on the west, in the Cascades, from older, pre-Cretaceous metamorphic rocks on the east, in the Northern Rocky Mountains. Mesozoic and Paleozoic sedimentary rocks cover the metamorphic rocks for most of the length of the valley on the west.

Climate

The climate is characterized by moderately cold, wet winters, and hot, dry summers, with limited precipitation due to the rain shadow effect of the Cascades. Taxonomic soil climate is either xeric (12 – 16 inches PPT) or aridic moisture regimes (10 – 12 inches PPT) with a mesic temperature regime.

Mean Annual Precipitation:

Range: 10 – 16 inches

Seventy to seventy-five percent of the precipitation comes late October through March as a mixture of rain and snow. June through early October is mostly dry.

Mean Annual Air Temperature:

Range: 44 to 54 F

Central Tendency: 48 – 52 F

Freezing temperatures generally occur from late-October through early-April. Temperature extremes are 0 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 200

Central tendency: 110 to 160

The growing season for Loamy Mound is March through mid-July.

Soil features

Edaphic:

The Mound – Intermound Complex commonly occurs with rock outcrop, Stony Shallow and Stony ecological sites. Components of this complex are 65-90% Very Shallow and 10-35% Loamy Mound.

As an annual occurrence, Very Shallow soils become saturated, frost heave, and in wet years, water runs to sites below. Loamy Mounds receive additional water during this process. Refer to the Very Shallow PESD for a discussion regarding pedestaling.

Very Shallow sites are sensitive to soil disturbances. When the Very Shallow site is saturated and muddy, physical damage to the site – from vehicle ruts and hoof prints from cows, horses or deer for example – remain intact for many years.

Representative Soil Features:

This ecological site components are dominantly Lithic, Calcic, Cambidic, Vitritorrandid, and Calciargidic taxonomic subgroups of Haploxerolls, Durixerolls and Argixerolls great groups of the Mollisols taxonomic order, with Aridisols occurring as well. Soils are very shallow to deep. Average available water capacity of about 5.0 inches (12.7 cm) in the 0 to 40 inches (0-100 cm) depth range.

Soil parent material is dominantly mixed loess, colluvium and residuum.

The associated soils are Argabak, Bakeoven, Horseflat, Morrow, Stubblefield, Toler, Zen and similar soils.

Dominate soil surface is silt loam to very cobbly sandy loam, with ashy modifier sometimes occurring as well.

Dominant particle-size class is fine-silty to loamy-skeletal

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

Minimum: 0

Maximum: 2

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

Minimum: 0

Maximum: 25

Average: 10

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

Minimum: 0

Maximum: 30
Average: 10

Subsurface fragments > 3 inches (% Volume):
Minimum: 0
Maximum: 25
Average: 10

Subsurface fragments \leq 3 inches (% Volume):
Minimum: 0
Maximum: 35
Average: 25

Drainage Class: Dominantly well drained
Water table depth: 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: 4
Maximum: 60

Electrical Conductivity (dS/m):
Minimum: 0
Maximum: 20

Sodium Absorption Ratio:
Minimum: 0
Maximum: 5

Calcium Carbonate Equivalent (percent):
Minimum: 0
Maximum: 35

Soil Reaction (pH) (1:1 Water):
0 - 10 inches: 5.6 to 8.4
10 - 40 inches: 5.6 to 9

Available Water Capacity (inches, 0 – 40 inches depth):
Minimum: 0.5
Maximum: 9.0
Average: 5.0

Vegetation dynamics

Ecological Dynamics:

Very Shallow component (65-90%):
Very Shallow produces about 100-250#/acre.

The Very Shallow ecological site in MLRA 8 has at least four different variations on the low shrub-short grass theme for the Reference Community. Sandberg bluegrass is co-dominant in every variation:

1. Stiff sagebrush – Sandberg bluegrass
2. Stiff sagebrush / thyme-leaved buckwheat / rock buckwheat – Sandberg bluegrass
3. Thyme-leaved buckwheat – Sandberg bluegrass
4. Narrowleaf goldenweed (*Stenotus s.*) – Sandberg bluegrass

Refer to the Very Shallow description in site number R008XY001WA for more information about the Very Shallow component.

Loamy Mound component (10-35%):

Loamy Mound produces 1000# to 2000#/acre depending on the amount of basin wildrye present. Refer to the chart for Reference Community; production is listed in more detail.

In a space as small as 20-feet in diameter a single mound has three reference community situations:

1. North aspect has Idaho fescue
2. West, east and south aspects are Wyoming sage-bluebunch wheatgrass
3. The top of the mound has basin big sagebrush-basin wildrye

At higher elevations within MLRA 8 the Loamy Mound component may be predominately a basin wildrye site. But the Loamy Mound component is also quite variable. Adjacent mounds can vary – no sagebrush and with sagebrush, no basin wildrye and with basin wildrye, with saltgrass or no saltgrass.

Another very important disturbance is rodent activity on the Loamy Mound portion of this ecological site. Direct soil disturbances provide an opportunity for exotic invasive species to colonize the mound or to expand.

The vegetative cover on the Very Shallow component is too low to carry fire, so this ecological site rarely burns. In many pastures, due to surface rocks and limited forage, Very Shallow sites are not attractive to grazing animals and so are rarely if ever grazed. Based on inherent protection from both fire and grazing, most Very Shallow sites are stable.

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.

Note to planners for estimating forage for Mound – Intermound Complex:

1. Often Mound – Intermound Complex receives little to no livestock use. It is perfectly ok to indicate zero AUMs of forage from this ecological site
2. If the complex is being grazed, consider using the process below:
 - a. For the Mound – Intermound Complex polygon estimate the percentages for Very Shallow component and Loamy Mound component.
 - b. Percentages times acres of polygon will give acres of Very Shallow and acres of Loamy mound
 - c. Multiply AUM/acre times acres of Very Shallow for AUMs from Very Shallow
 - d. Multiply AUM/acre times acres of Loamy Mound for AUMs from Loamy Mound

Supporting Information:

Associated Sites:

Mound-Intermound Complex is associated with Very Shallow, and other ecological sites in the Sagebrush Steppe and Grassland Steppe portions of MLRA 8.

Similar Sites:

MLRA 7 Columbia Basin and MLRA 6 East Slope of the Cascades have a similar mound-intermound topography but this is much less extensive than MLRA 8 Columbia Plateau.

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 008X
Columbia Plateau

Subclasses

- R008XY002WA–Mound-Intermound Complex

Stage

Provisional

Contributors

Provisional Site Author: K. Guinn

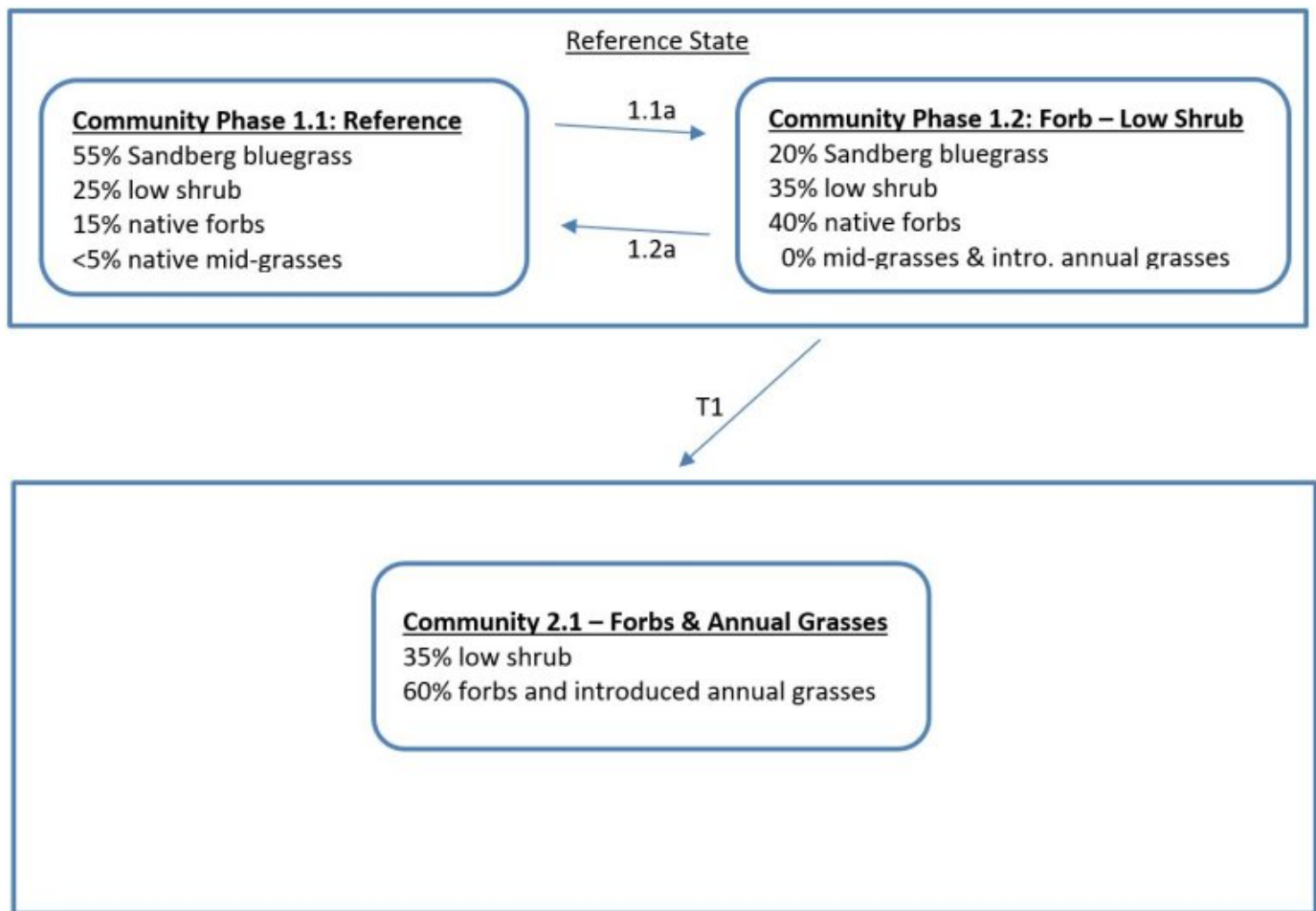
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State and transition model

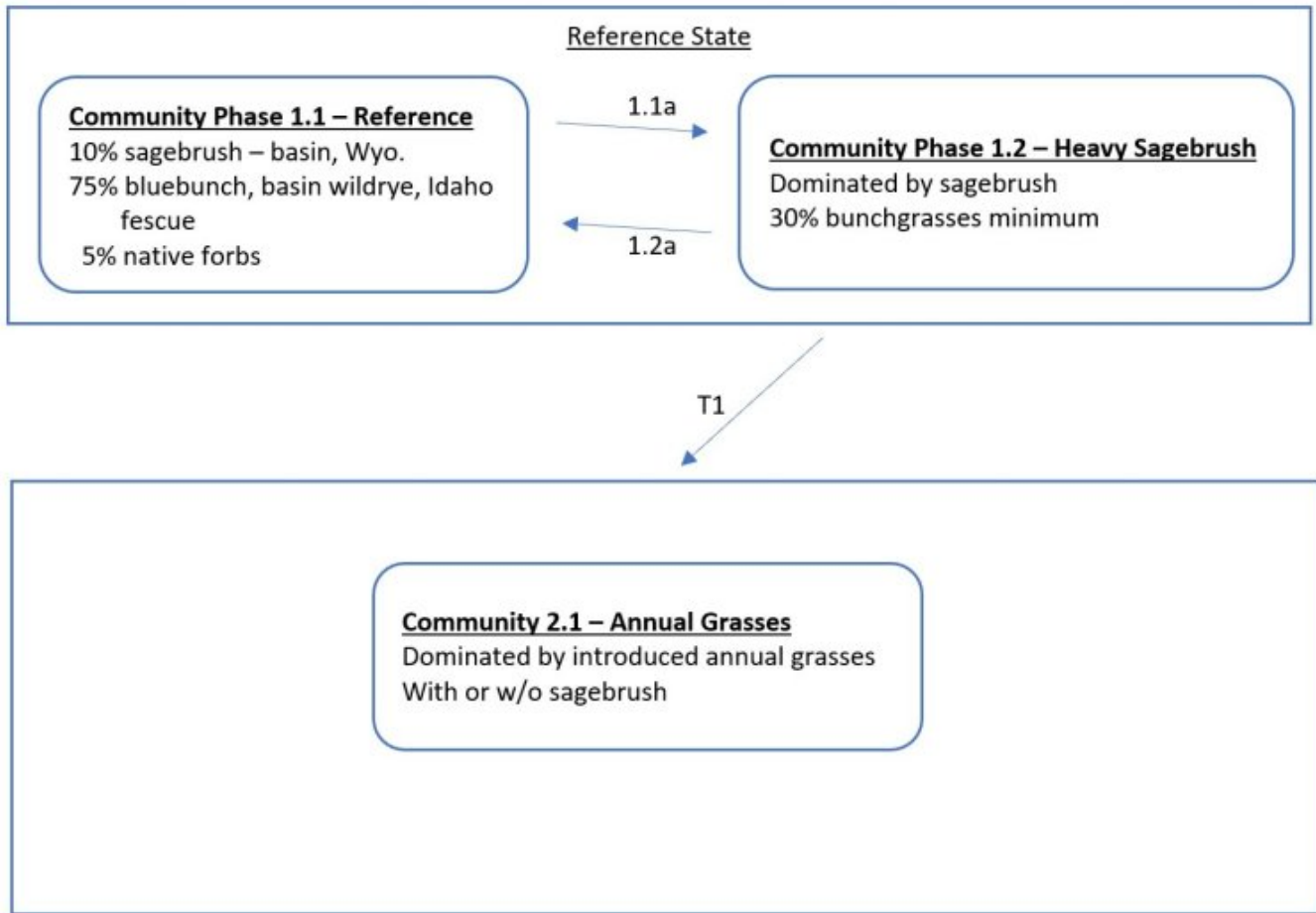
State & Transition Diagram: Mound–Intermound Complex in MLRA 8

This state and transition model (STM), explains the general ecological dynamics for the Biscuit – Swale Complex 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.

Very Shallow Component – 65-90% of the Complex



Loamy Mound Component – 10-35% of the Complex



Reference Community 1.1 for Very Shallow Component in MLRA 8:

Percentages for plant species composition below are by weight and are an approximation. 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.

(see also Reference Community for Loamy Mound component)

		Similarity Index				Similarity Index		
Dominant Low Shrub		25%	65 lbs.	Other Low Shrubs – Minor		less than 5%	10 lbs.	
ARRI2	stiff sagebrush			SADOI	purple sage			
ERTH4	thymeleaf buckwheat			PUTR2	antelope bitterbrush			
ERSP7	rock buckwheat			ERDO	Douglas buckwheat			
				ERMI4	Wyeth buckwheat			
Dominant Short Grass		55%	140 lbs.	Mid-Grasses – Minor		3%	10 lbs.	
POSE	Sandberg bluegrass			ELEL5	bottlebrush squirreltail			
				ACTH7	Thurber needlegrass			
				PSSP6	bluebunch wheatgrass			
Annual Grass – Trace		1%	3 lbs.					
VUOC	sixweeks fescue							
Native Forbs - Subdominant						15%	40 lbs.	
STST5	narrowleaf goldenweed			ERIGE2	fleabane			
PHHO	spiny phlox			LERE7	bitterroot			
LEPU	granite gilia			ERNI2	snow buckwheat			
LOMAT	lomatium / biscuitroot			PENST	penstemon			
BAHO	Hooker balsamroot			ASPU9	woollypod locoweed			
VIVAV	sagebrush violet			PENI	pediocactus			
ALLIU	wild onion							
						Below	Normal	Above
Estimated Production (pounds / acre)						100	200	250

Reference Community 1.1 for Loamy Mound Component in MLRA 8

Percentages for plant species composition below are by weight and are an approximation. The composition of pristine sites can vary somewhat due to variations in site conditions. The maximum allowable pounds for Similarity Index are a range for this ecological site. For sites with minimal basin wildrye use the low value and the high value for sites with lots of basin wildrye. Note the pounds for Idaho fescue count against the maximum for Other Mid-Size Bunchgrasses. Many numbers have been rounded to not show more precision than our current state of knowledge.

(see also Reference Community for Very Shallow component)

Similarity Index		Similarity Index	
Non-Sprouting Shrubs		Sprouting Shrubs – Minor	
	10% 125-200 lbs.		less than 5% 40-60 lbs.
ARTRW8	Wyoming sagebrush	CHRY5	rabbitbrush
ARTRT	Basin big sagebrush	RIBES	currant
PUTR2	antelope bitterbrush	ROSA5	rose
Dominant Bunchgrasses		Other Mid-Size Bunchgrasses – Minor	
	70%		10% 125-200 lbs.
PSSP6	Bluebunch wheatgr. 20% 450- 400 lbs.	FEID	Idaho fescue (5% 75-100 lbs.)
LECI4	Basin wildrye 50% 625-1000 lbs.	POCU3	Cusick’s bluegrass
		HECOC	needle-and-thread
		KOMA	prairie junegrass
		ACNE	Nelson’s needlegrass
Native Forbs – Minor		5% 75- 120 lbs.	
PHLOX	phlox	MELO4	bluebells
BASA3	arrowleaf balsamroot	NEST5	narrowleaf goldenweed
LOMAT	lomatium	CREPI	hawksbeard
CAST12	paintbrush	ERIOG	buckwheat
ASTRA	milkvetch / locoweed	LUPIN	lupine
ANDI2	pussytoes	ERIGE2	fleabane
CALOC	Mariposa lily	PLPA2	woolly plantain
LIRU4	stoneseed	COLLO	collomia
DELPH	larkspur	LIRU4	stoneseed
ACMI	yarrow		
		Below	Normal
Estimated Production (pounds / acre) – minimal basin wildrye		800	1000
Estimated Production (pounds / acre) – basin wildrye dominant		1500	1800
			Above
			1250
			2000

State 1

Reference State

State 1 Narrative: State 1 for both components of this complex represents communities with no invasive species present. Very Shallow sites rarely burn, and in most cases, receives minimal grazing. So, these sites are mostly very stable, remaining in State 1 regardless of climate or management. Similarity Index scores are typically higher on Very Shallow than other ecological sites on the landscape. At-risk communities • All communities in the reference state for both Very Shallow and Loamy Mound are at risk of invasive species. The seed source for annual bromes or other invasive annual seed blows onto most sites annually. • Community 1.1 for Very Shallow and Community 1.1 for Loamy Mound have high bunchgrass cover and are at low risk of shifting to State 2 • Community 1.2 on both components – forb – low shrub on the Very Shallow component and heavy sagebrush on the Loamy Mound component are at high risk of shifting to State 2

Community 1.1

Very Shallow component: Reference Community 1.1 is the classic Very Shallow, dominated by Sandberg bluegrass with one or more low shrub species. The low shrub component may be stiff sage &/or one or more Eriogonum low shrub species. Loamy Mound component: Reference Community 1.1 is dominated by bunchgrasses – basin wildrye, bluebunch wheatgrass, Idaho fescue.

Community 1.2

Very Shallow component: Community 1.2 represents a phase which is quite rare in most of MLRA 8. The species are native, but Sandberg bluegrass has a diminished presence while forbs are more prominent. Community 1.2 still has enough Sandberg bluegrass present, to shift back to reference community 1.1. Loamy Mound component: Community 1.2 is dominated by sagebrush but still has enough bunchgrasses to shift back to Reference Community 1.1.

Pathway 1.1a

Community 1.1 to 1.2

Pathways within State 1 for Very Shallow Refer to Very Shallow PESD R008XY001WA for description of pathways within State 1 and transition from State 1 to State 2. Pathways within State 1 for Loamy Mound 1.1a Result: shifts from bunchgrass dominated Reference Community to sagebrush dominated Community 1.2 Causes: heavy defoliation to basin wildrye or soil disturbances from rodents and badgers Ecological process: basin wildrye plant vigor declines with a significant reduction in root production, and with some plant mortality. Soil disturbances provide openings in soil surface and upper portion of soil profile. In either case sagebrush seedlings have opportunity to establish.

Pathway 1.2a

Community 1.2 to 1.1

1.2a Result: shifts from heavy sagebrush (Community 1.2) to bunchgrass dominated Reference Community Causes: moderate intensity fire followed by several years of light to moderate defoliation pressure Ecological process: moderate intensity fire kills most of the sagebrush and has lasting detrimental effect on bunchgrasses. Light to moderate defoliations allows bunchgrasses to exhibit good vigor and expand root production and surface cover through tillering and new seedlings. Basin wildrye gains the competitive edge on the top of the mounds, Idaho fescue on the north aspect and bluebunch wheatgrass on the other sides of the mound.

State 2

Forbs and/or Annual Grass

State 2: Forbs & Annual Grasses for Very Shallow Very Shallow State 2 represents the rare situation where Very Shallow is dominated by forbs, or annual grasses. Invasive annual grasses, which are common & frequently dominant on Loamy ecological sites, do not compete as well on Very Shallow sites. In most instances the Very Shallow component remains virtually unchanged while the Loamy Mound may shift to Community Phases 1.2 or even to State 2. State 2: Annual Grasses for Loamy Mound Loamy Mound State 2 on Loamy Mound represents a highly disturbed community. Heavy soil disturbances from rodents or badgers, &/or heavy grazing pressure from rodents, rabbits or livestock (heavy to severe grazing intensity, chronic critical period grazing or season long grazing) causes mortality of bunchgrasses (basin wildrye, bluebunch wheatgrass and Idaho fescue. As bunchgrasses decline, annual grasses colonize and eventually become dominant. For mounds with sagebrush, shrubs will increase alongside the annual grasses.

Community 2.1

Forbs and/or Annual Grasses

Dominated by native forbs and/or invasive annual grasses. Forbs which increase in the altered conditions and are competitive with invasive grasses, can include lomatium, fleabane, willow herb, yarrow and onion. Typical invasive grasses may include annual bromes, medusaehead and sixweeks fescue.

Transition T1

State 1 to 2

Transitions for Very Shallow component: T1 Result: Shift from Reference State Community Phase 1.1 to Community Phase 2.1, resulting in the shift of functional groups to forbs and/or invasive annual grasses. Primary Trigger: Extensive spring grazing with heavy use to Sandberg bluegrass. Plant vigor declines and most or all Sandberg bluegrass plants are lost from the community. The soil is more open to evaporation, to wind and water erosion, and facilitates plant community changes from Community 1.2 to Community 2.1. Secondary Triggers: a micro-burst of cheatgrass could put Community 1.2 at risk. The trampling of Very Shallow soils, displacing and disturbing the surface soil structure by grazing animals could also trigger transition to State 2. Ecological process: mortality of Sandberg bluegrass frees resources in the surface soils that allows native forbs to increase, while introduced annual species (forbs and grasses) colonize and expand. A micro-burst of annual grasses could allow even pristine sites to be invaded. Community 1.2 is the community most at risk and is also the pathway for crossing the threshold from State 1 to State 2. Indicators: Declining vigor and cover of Sandberg bluegrass, declining soil biotic crust and, increasing gaps between perennial bunchgrasses. Transitions for Loamy Mound component: T1 Result: Shift from Loamy Mound Community 1.2 across a threshold to Community 2.1, which is dominated by annual grasses. Ecological process: Generally, with grazing activity livestock trail across Very Shallow component to graze the Loamy Mound component. Very Shallow receives minimal grazing while the Loamy Mound can be grazed heavily. As grazing increases livestock trails are evident on the Very Shallow, but the Loamy Mounds are hammered. Primary trigger on Loamy Mound: heavy soil disturbances from rodents/rabbits &/or heavy grazing pressure from rodents, rabbits or livestock (heavy to severe grazing intensity, chronic critical period grazing or season long grazing). Mortality of bunchgrasses occur (basin wildrye, bluebunch wheatgrass and Idaho fescue. As bunchgrasses decline, annual grasses and tumble mustard or Russian thistle colonize and eventually become dominant. For mounds with sagebrush, shrubs will increase alongside the annual grasses. Secondary trigger on Loamy Mounds: Drought cycle coupled with heavy grazing. Indicators on Loamy Mound: Reduced vigor of bunchgrasses, colonization by annual grasses, increasing canopy gaps for perennials species, increasing sagebrush cover.

Restoration pathway R2

State 2 to 1

Very Shallow Component Recovery from State 2 is considered non-reversible. Refer to Very Shallow PESD R008XY001WA for more narrative regarding recovery. Loamy Mound component While the restoration of Loamy Mounds is possible, treatment actions may be both impractical and costly. Each mound is spatially separated from other mounds and it is possible that different mounds could require different treatments. 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

Citations