Ecological site R006XA219OR
Juniper Dunes 8-10 PZ

Last updated: 9/11/2023
Accessed: 10/12/2024

General information

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.

MLRA notes

Major Land Resource Area (MLRA): 006X–Cascade Mountains, Eastern Slope

Stretching from northern Washington to southern Oregon, MLRA6 encompasses the mountain slopes, foothills, elevated plateaus and valleys on the eastern slopes of the Cascade mountains. This MLRA is a transitional area between the Cascade Mountains to the west and the lower lying Columbia Basalt Plateau to the east. Situated in the rain shadow of the Cascade Crest, this MLRA receives less precipitation than portions of the cascades further west and greater precipitation than the basalt plateaus to the east. Geologically, the majority of the MLRA is dominated by Miocene volcanic rocks, while the northern portion is dominated by Pre-Cretaceous metamorphic rocks and the southern portion is blanketed with a thick mantle of ash and pumice from Mount Mazama. The soils in the MLRA dominantly have a mesic, frigid, or cryic soil temperature regime, a xeric soil moisture regime, and mixed or glassy mineralogy. They generally are moderately deep to very deep, well drained, and loamy or ashy. Biologically, the MLRA is dominated by coniferous forest, large expanses of which are dominated by ponderosa pine, Douglas-fir or lodgepole pine. Areas experiencing cooler and moister conditions include grand fir, white fir, and western larch while the highest elevations include pacific silver fir, subalpine fir and whitebark pine. Economically, timber harvest and recreation are important land uses in these forests. Historically, many of these forests would have experienced relatively frequent, low and mixed severity fire favoring the development of mature forests dominated by ponderosa pine or Douglas-fir. In the southern pumice plateau forests, less frequent, higher severity fire was common and promoted the growth of large expanses of lodgepole pine forests.

LRU notes

This unit is characterized by a landscape of basalt terraces, abandoned lakebeds and dunes where exceedingly dry ponderosa pine – western juniper forests occur. These forests are largely geographically confined to the Lost Forest Research Natural Area, and despite receiving less than 11 inches of annual precipitation, persist among a desert shrubland due to unique soil characteristics. Here, deep eolian deposits of ash and pumice increase water holding capacity relative to nearby soils. Geologically, these deposits are underlain by Pliocene basalt from the High Cascades volcanic province. Botanically, these forests share characteristics with other dry pine forests as well as the nearby shrub steppe. Common members include, antelope bitterbrush, big sagebrush, needle and thread, Indian ricegrass, creeping wildrye and granite prickly gilia. The climate of this unit is cool and very dry with a soil climate defined by a frigid temperature regime and an aridic moisture regime. The historical fire regime of this site is likely similar to other very dry ponderosa pine communities, with moderately frequent, low severity fire common.

Ecological site concept

In reference condition, this site supports a plant community dominated by western juniper (*Juniperus occidentalis*), Basin big sagebrush (*Artemisia tridentata* spp. tridentata), needle and thread (*Hesperostipa comata*) and indian ricegrass (*Achnatherum hymenoides*). Deep deposits of volcanic ash and pumice create the conditions for the plant community of this site and infrequent fire due to fuel limitations likely allowed juniper to persist historically. The influence of ash in these soils increases water holding capacity and bolsters site resilience during drought.

This is a provisional ecological site and is subject to extensive review and revision before final approval. All data herein should be considered provisional and contingent upon field validation prior to use in conservation planning.

Associated sites

R006XA214OR	**Forested Pumice Dunes 8-11 PZ** Sandier Texture, drier soils

Similar sites

R006XA214OR	**Forested Pumice Dunes 8-11 PZ** Sandier Texture, drier soils
R006XA216OR	**Forested Shrubby Dunes 8-11 PZ** Greater cover of ponderosa pine
R006XA218OR	**Juniper Sandy Slopes 8-11 PZ** Higher elevation

Table 1. Dominant plant species

Tree	(1) *Juniperus occidentalis*
Shrub	(1) *Artemisia tridentata ssp. tridentata*
Herbaceous	(1) *Hesperostipa comata ssp. comata* (2) *Achnatherum hymenoides*

Physiographic features

This site is found on dunes in basin landscapes. Slopes are commonly 2 to 20 percent and elevations range from 4,300 to 4,400 feet (1,300 to 1,350 meters). This site occurs on all aspects. This site is not subject to ponding or flooding and no water table is present.

Table 2. Representative physiographic features

Landforms	(1) Basin > Dune
Elevation	4,300–4,400 ft
Slope	2–20%
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

This site is characterized by hot dry summers and cold wet winters. Precipitation, largely in the form of rain and snow, ranges from 8 to 11 inches, averaging 10 inches annually. Frost-free days range from 45 to 55 and the freeze-free period ranges from 80 to 95 days. The soil temperature regime is frigid and the soil moisture regime is aridic. The graphs below are populated from the closest available weather station to representative site locations and are provided to indicate general climate patterns.

Table 3. Representative climatic features

Frost-free period (characteristic range)	45-55 days
Freeze-free period (characteristic range)	80-95 days
Precipitation total (characteristic range)	8-11 in
Frost-free period (average)	50 days
Freeze-free period (average)	87 days
Precipitation total (average)	10 in

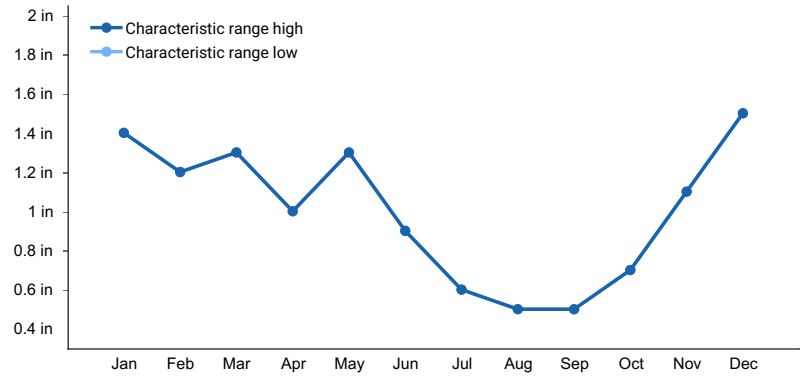


Figure 1. Monthly precipitation range

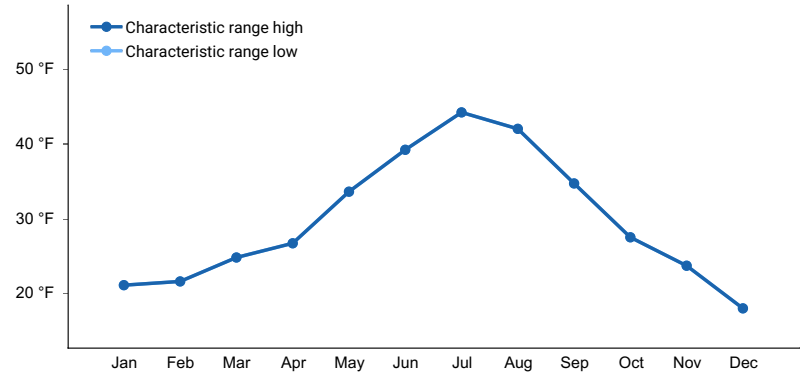


Figure 2. Monthly minimum temperature range

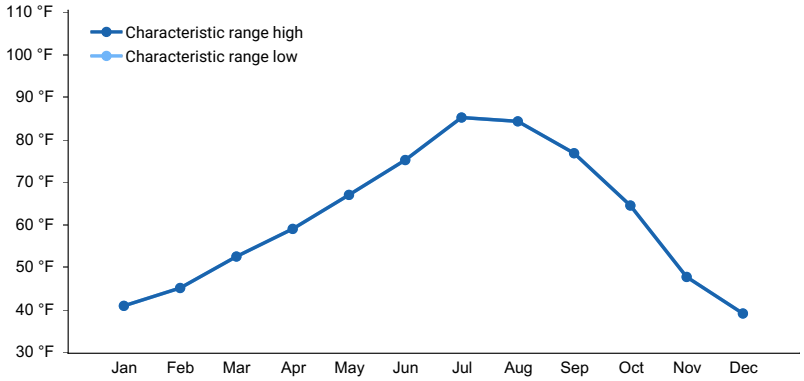


Figure 3. Monthly maximum temperature range

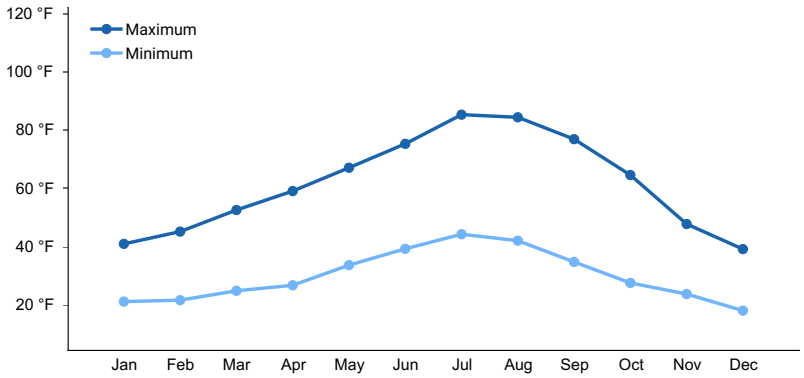


Figure 4. Monthly average minimum and maximum temperature

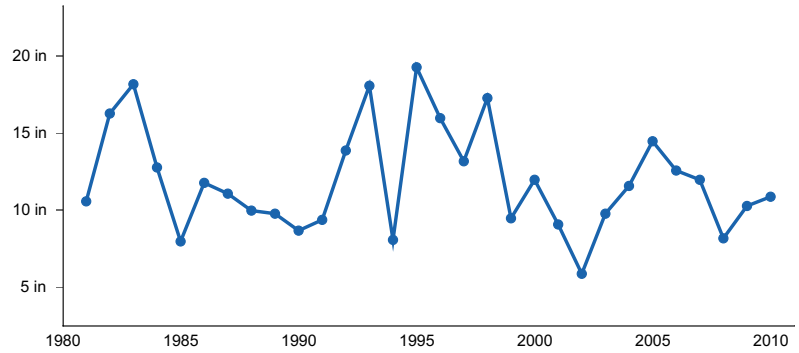


Figure 5. Annual precipitation pattern

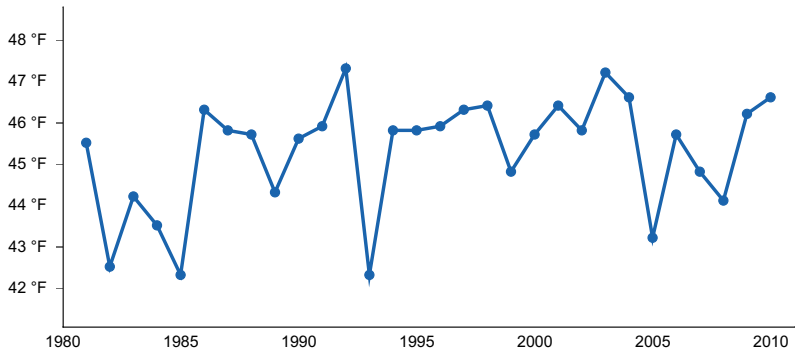


Figure 6. Annual average temperature pattern

Climate stations used

- (1) THE POPLARS [USC00358420], Silver Lake, OR

Influencing water features

This site is not influenced by water from a wetland or stream.

Wetland description

N/A

Soil features

Soils that typify this site concept are deep to very deep ashy loamy sand over sandy loam. These soils were formed in eolian deposits of pumice and volcanic ash, allowing for increased water holding capacity and the ability to sustain ponderosa pine unlike adjacent desert shrub communities. These soils are somewhat excessively to excessively drained and have moderately rapid to rapid permeability. Soils on this site are classified into the Psamments great group, which are largely unconsolidated sand deposits with little soil development.

Table 4. Representative soil features

Parent material	(1) Eolian sands–pumice (2) Volcanic ash
Surface texture	(1) Loamy sand
Family particle size	(1) Ashy
Drainage class	Somewhat excessively drained to excessively drained
Permeability class	Moderately rapid to rapid
Depth to restrictive layer	40–80 in

Soil depth	40–80 in
Surface fragment cover <=3"	0–90%
Surface fragment cover >3"	0–90%
Available water capacity (0-40in)	2.8–5 in
Soil reaction (1:1 water) (0-40in)	7.4–8
Subsurface fragment volume <=3" (4-60in)	0–30%
Subsurface fragment volume >3" (4-60in)	0–20%

Ecological dynamics

Reference Plant community:

In reference condition, this site supports a plant community dominated by western juniper (*Juniperus occidentalis*), Basin big sagebrush (*Artemisia tridentata* spp. tridentata), needle and thread (*Hesperostipa comata*) and indian ricegrass (*Achnatherum hymenoides*). These vegetated dunes are highly erodible and may shift without stabilizing vegetative cover. A comprehensive forest health study of the nearby Lost Forest Research Natural Area was undertaken by the USFS in 2007. On similar landforms and ecological sites, researchers recorded an abundance of western juniper greater than 150 years old, with considerable numbers of younger trees that were less than 150 years old (40 and 60 percent of all trees recorded, respectively) (Chadwick and Eglitis 2007). This suggests that this is a persistent juniper site with historic old growth potential, yet infill of younger trees may be greater than it was previously, possibly due to grazing practices and suppression of fire.

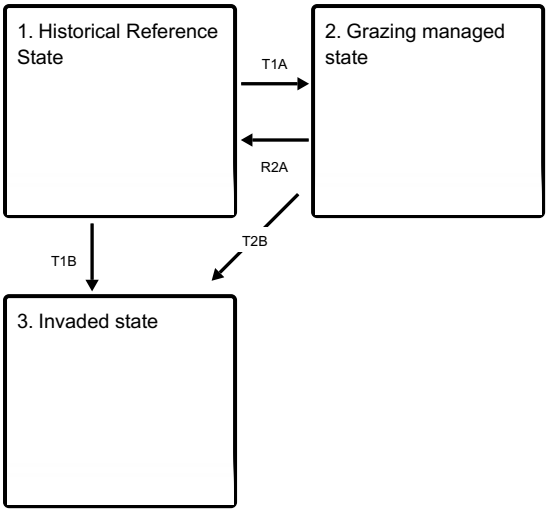
Disturbance:

Grazing disturbance may alter the composition of the herbaceous layer and favor an increase in bottlebrush squirreltail (*Elymus elymoides*) at the expense of Indian ricegrass. According to research on the nearby Lost Forest Research Natural Area, despite a high frequency of lightning strikes, research suggests that fire was likely not a common disturbance agent in this forest due to low fuel loads and continuity (Chadwick and Eglitis 2007). According to the best available knowledge of similar systems, the fire regime is likely comparable to other western juniper woodland plant communities characterized by moderately frequent, mixed severity fire. This system is approximated by the Landfire biophysical setting: 0710170 Columbia Plateau Western Juniper Woodland and Savanna, fire regime group 3: 35 to 100 plus year frequency, mixed severity) (Landfire 2007). While exotic grass invasions may occur on this site, resilience and resistance of this site to widespread invasions of exotic annual grasses is not known.

Given that this site occupies a limited geographic area, little is known about the plant community dynamics over time, therefore the model below represents a generalized and simplified understanding of community response to disturbance. Hotter and drier summer conditions are expected to increase with a changing climate and have historically been associated with fires of greater extent and severity in the Pacific Northwest (Halofsky et al. 2020). When combined with the interacting impacts of fire suppression, drought, and insect outbreaks, it is possible that this ecological system will experience unpredictable ecosystem shifts and additional alternative states. As our understanding of these systems evolves and this site is updated in future iterations, descriptions will include more thorough treatments of disturbance and ecological change.

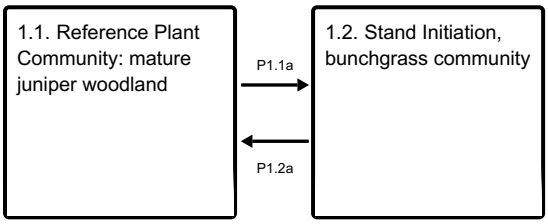
State and transition model

Ecosystem states



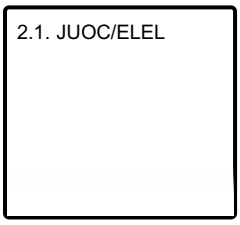
T1A - Prolonged improper grazing management
T1B - Catastrophic fire, prolonged inappropriate grazing management
R2A - Extended rest from grazing, possible reseeding of native grasses
T2B - Continued improper grazing management, catastrophic fire

State 1 submodel, plant communities

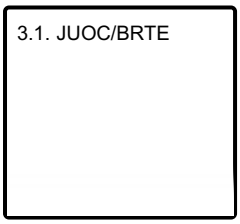


P1.1a - Mixed severity fire, windthrow, prolonged or severe drought, insect outbreak
P1.2a - Time elapses under a moderately frequent, mixed severity fire regime

State 2 submodel, plant communities



State 3 submodel, plant communities



State 1
Historical Reference State

Severe fire is relatively infrequent in this state and the community will be maintained by periodic mortality of young juniper caused by mixed severity fire, drought, insects windthrow and disease (Chadwick and Eglitis 2007). Given the likelihood that this state, even in the best condition and highest potential, will almost always include at least some component of exotic species regardless of management inputs, this may also be referred to as the “current

potential state". In this document, the term "reference state" is used synonymously with "current potential state" for the sake of simplicity.

Dominant plant species

- western juniper (*Juniperus occidentalis*), tree
- basin big sagebrush (*Artemisia tridentata ssp. tridentata*), shrub
- needle and thread (*Hesperostipa comata ssp. comata*), grass
- Indian ricegrass (*Achnatherum hymenoides*), grass

Community 1.1
Reference Plant Community: mature juniper woodland

The reference vegetative community of this site is dominated by western juniper, basin big sagebrush, Indian ricegrass and needle and thread. Mature juniper will characterize the overstory with younger regeneration common in the understory. Exotic annuals may be present in low numbers.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	215	290	360
Shrub/Vine	45	55	70
Tree	20	25	35
Forb	20	30	35
Total	**300**	**400**	**500**

Community 1.2
Stand Initiation, bunchgrass community

Following mixed severity fire, extreme drought, widespread disease outbreak or a severe incidence of windthrow, the overstory canopy may be somewhat diminished. The understory community will be become dominated by perennial grasses with many large juniper surviving and both basin big sagebrush and young juniper beginning to initiate. Complete stand replacing fire events were historically very rare in these old growth juniper ecosites (as long as 2000 years between events, Landfire 2007).

Pathway P1.1a
Community 1.1 to 1.2

Mixed severity fire, windthrow, prolonged or severe drought, insect outbreak

Pathway P1.2a
Community 1.2 to 1.1

Time elapses under a moderately frequent, mixed severity fire regime

State 2
Grazing managed state

In this state, the site is being managed for livestock grazing. This may lead to altered plant community composition and production where plants adapted to grazing disturbance may increase while those sensitive to disturbance may decrease. Additionally, impacts to the abiotic conditions of the site may occur as soil is compacted due to hoof trampling or eroded due to an increase in bare ground.

Dominant plant species

- western juniper (*Juniperus occidentalis*), tree

- basin big sagebrush (*Artemisia tridentata ssp. tridentata*), shrub
- squirreltail (*Elymus elymoides*), grass
- beardless wildrye (*Leymus triticoides*), grass

Community 2.1
JUOC/ELEL

Following prolonged improper grazing management, early seral species adapted to disturbance such as bottlebrush squirreltail, and beardless wildrye, may increase at the expense of the Reference Community dominant species, Indian ricegrass and needle and thread.

State 3
Invaded state

In this state much of the native herbaceous vegetation has been replaced by exotic annual grasses which at high levels may create positive feedbacks that alter fire regimes and promote prolonged invasion.

Dominant plant species

- western juniper (*Juniperus occidentalis*), tree
- basin big sagebrush (*Artemisia tridentata ssp. tridentata*), shrub
- cheatgrass (*Bromus tectorum*), grass

Community 3.1
JUOC/BRTE

Following continued improper grazing, or catastrophic fire, where invasive annual grasses are already present on site, these grasses may increase while perennial grasses decline. Juniper will temporarily decline with catastrophic fire but should return over time. An abundance of annual grass will increase fine fuels and may increase fire frequency, creating a positive feedback that will encourage the maintenance of the site in this state.

Transition T1A
State 1 to 2

Prolonged improper grazing management

Transition T1B
State 1 to 3

Catastrophic fire, prolonged inappropriate grazing management

Context dependence. Invasive species must be present onsite or within a sufficiently close distance for dispersal from nearby invaded sites

Restoration pathway R2A
State 2 to 1

Extended rest from grazing, possible reseeding of native grasses and other practices such as seedbed preparation

Context dependence. Excessive grazing leading to a loss of plant species diversity, plant reproductive output or altered abiotic conditions such as compacted or eroded soil, for example, will not recover by rest alone and will require additional inputs

Transition T2B
State 2 to 3

Continued improper grazing management, catastrophic fire

Context dependence. Invasive species must be present onsite or within a sufficiently close distance for dispersal from nearby invaded sites

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**grass and grasslike plants**			215–350	
	Indian ricegrass	achy	*Achnatherum hymenoides*	80–140	–
	Thurber's needlegrass	ACTH7	*Achnatherum thurberianum*	80–140	–
	needle and thread	hecoc8	*Hesperostipa comata ssp. comata*	60–100	–
	beardless wildrye	letr5	*Leymus triticoides*	10–20	–
	squirreltail	elel5	*Elymus elymoides*	4–10	–
	Ross' sedge	CARO5	*Carex rossii*	4–10	–
2	**other perennial grasses**			10–20	
8	**Big Bluegrass**			4–10	
	Sandberg bluegrass	POSE	*Poa secunda*	4–10	–
Forb					
3	**forbs**			10–25	
	granite prickly phlox	lipu11	*Linanthus pungens*	4–10	–
	common yarrow	ACMI2	*Achillea millefolium*	4–10	–
	beardtongue	PENST	*Penstemon*	4–10	–
4	**other perennial forbs**			4–20	
Shrub/Vine					
5	**shrubs**			90–160	
	basin big sagebrush	artrt	*Artemisia tridentata ssp. tridentata*	20–40	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	4–10	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	4–10	–
6	**other perennial shrubs**			5–30	
Tree					
7	**trees**			20–40	
	western juniper	juoc	*Juniperus occidentalis*	20–40	–

Inventory data references

Information presented here has been derived from NRCS data. Field observations from range trained personnel were also used. Other sources used as references include USDA NRCS Water and Climate Center, USDA NRCS National Range and Pasture Handbook, and USDA NRCS Soil Surveys from various counties.

References

. Fire Effects Information System. http://www.fs.fed.us/database/feis/.

. 2021 (Date accessed). USDA PLANTS Database. http://plants.usda.gov.

Other references

Chadwick, Kristen L. and Andris Eglitis. 2007. Health Assessment of the Lost Forest Research Natural Area, Central Oregon Service Center for Insects and Diseases, United States Forest Service, United States Department of Agriculture, Bend, Oregon.

Halofsky, J.E., Peterson, D.L. & Harvey, B.J. Changing wildfire, changing forests: the effects of climate change on fire regimes and vegetation in the Pacific Northwest, USA. fire ecol 16, 4 (2020). https://doi.org/10.1186/s42408-019-0062-8

LANDFIRE, 2007, Biophysical Settings Model Descriptions, LANDFIRE 1.1.0, U.S. Department of the Interior, USDA Forest service, Accessed 20 April 2020 at https://www.landfire.gov/bps-models.php

Moir, William H., Jerry F. Franklin, and Chris Maser. 1973. Lost Forest Research Natural Area, Pacific Northwest Forest and Range Experiment Station, United States Forest Service, Department of Agriculture, Portland, Oregon.

Tirmenstein, D. 1999. *Artemisia tridentata* subsp. tridentata. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: https://www.fs.fed.us/database/feis/plants/shrub/arttrit/all.ht

Contributors

JPR
Andrew Neary - 2020/2021 PES update of draft site

Approval

Kirt Walstad, 9/11/2023

Acknowledgments

Development of this site as a range site was based on field data collection completed in 1998 by the Burns ESI team. It was revised and updated with information regarding ecological dynamics in 2021.

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	
Date	10/12/2024
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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5. **Number of gullies and erosion associated with gullies:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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7. **Amount of litter movement (describe size and distance expected to travel):**

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

14. **Average percent litter cover (%) and depth (in):**

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

17. **Perennial plant reproductive capability:**