USDA Natural Resources
Conservation Service

Ecological site R030XC045NV
SHALLOW NORTH SLOPE 9-11 P.Z.

Last updated: 2/25/2025
Accessed: 04/11/2026

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.

Ecological site concept

This site occurs primarily on north-facing mountain sideslopes and toeslopes. Slopes range from 25 to 75 percent, but slope gradients from 30 to 50 percent are most typical. Elevations range from 5500 to 7000 feet. The soils associated with this site are shallow, well drained, and formed in residuum and colluvium derived from limestone and dolomitic limestone.

This site is part of group concept R030XC040NV.

Associated sites

R030XC046NV	**LOAMY SLOPE 9-11 PZ** Loamy Slope 9-11

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia nova*
Herbaceous	(1) *Poa fendleriana* (2) *Bouteloua gracilis*

Physiographic features

This site occurs primarily on north-facing mountain sideslopes and toeslopes. Slopes range from 25 to 75 percent, but slope gradients from 30 to 50 percent are most typical. Elevations range from 5500 to 7000 feet.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope
Flooding frequency	None
Ponding frequency	None
Elevation	1,676–2,134 m
Slope	25–75%
Aspect	N, NE, NW

Climatic features

The climate is semiarid with cool, moist winters and warm, intermittently moist summers. Precipitation is greatest in the winter with a lesser secondary peak in the summer, typical of the Mojave Desert transitional to the Great Basin. Average annual precipitation is 9 to 11 inches. Mean annual air temperature is 45 to 50 degrees F. The average growing season is about 90 to 150 days.

Table 3. Representative climatic features

Frost-free period (average)	150 days
Freeze-free period (average)	
Precipitation total (average)	279 mm

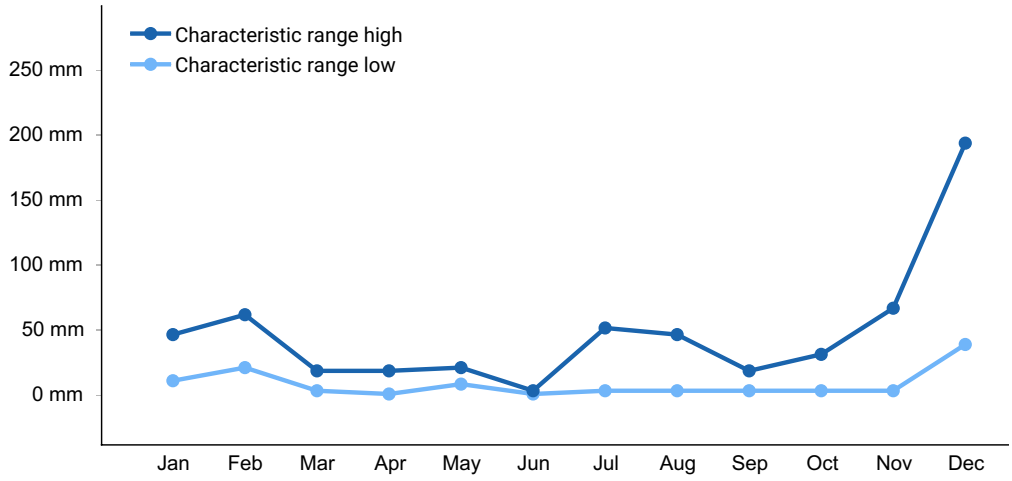


Figure 1. Monthly precipitation range

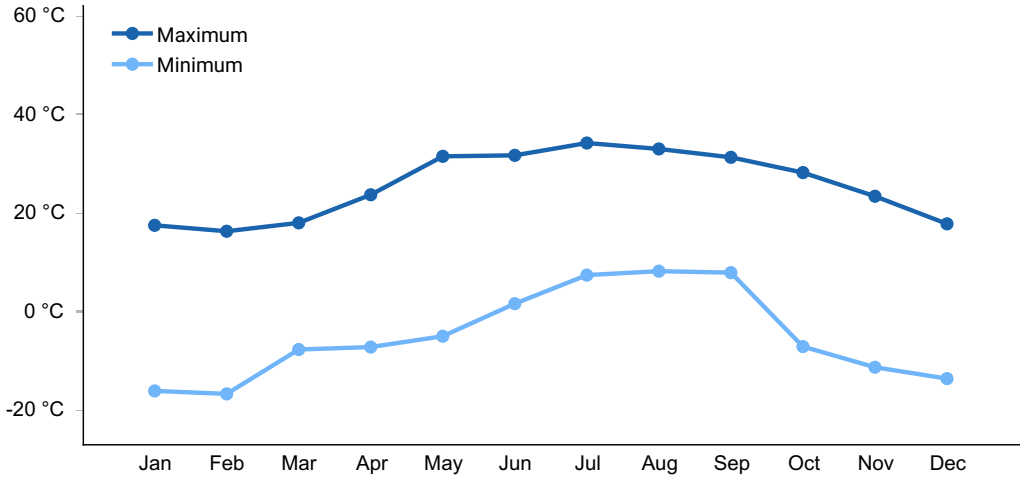


Figure 2. Monthly average minimum and maximum temperature

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils associated with this site are shallow, well drained, and formed in residuum and colluvium derived from limestone and dolomitic limestone. The soil surface is covered with 45 to 60 percent rock fragments. The soils have very high runoff, low available water holding capacity and moderately rapid permeability. Soil series associated with this site include Scrapy, a loamy-skeletal, carbonatic, mesic Lithic Ustic Haplocalcid. A ochric epipedon from 0 to 1 inches and a calcic horizon occurs from 1 to 12 inches.

Table 4. Representative soil features

Parent material	(1) Colluvium–dolomite (2) Residuum–limestone
Surface texture	(1) Very gravelly very fine sandy loam (2) Very gravelly fine sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately rapid
Soil depth	25–36 cm
Surface fragment cover <=3"	50–60%
Surface fragment cover >3"	0–15%
Available water capacity (0-101.6cm)	1.19–3.2 cm

Calcium carbonate equivalent (0-101.6cm)	5–35%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	8.4–8.6
Subsurface fragment volume <=3" (Depth not specified)	50–60%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

Plant communities on the site are dynamic in response to changes in disturbance patterns and weather events. Plant community structure is controlled in part by infrequent wildfire and in part by pulses of seedling recruitment.

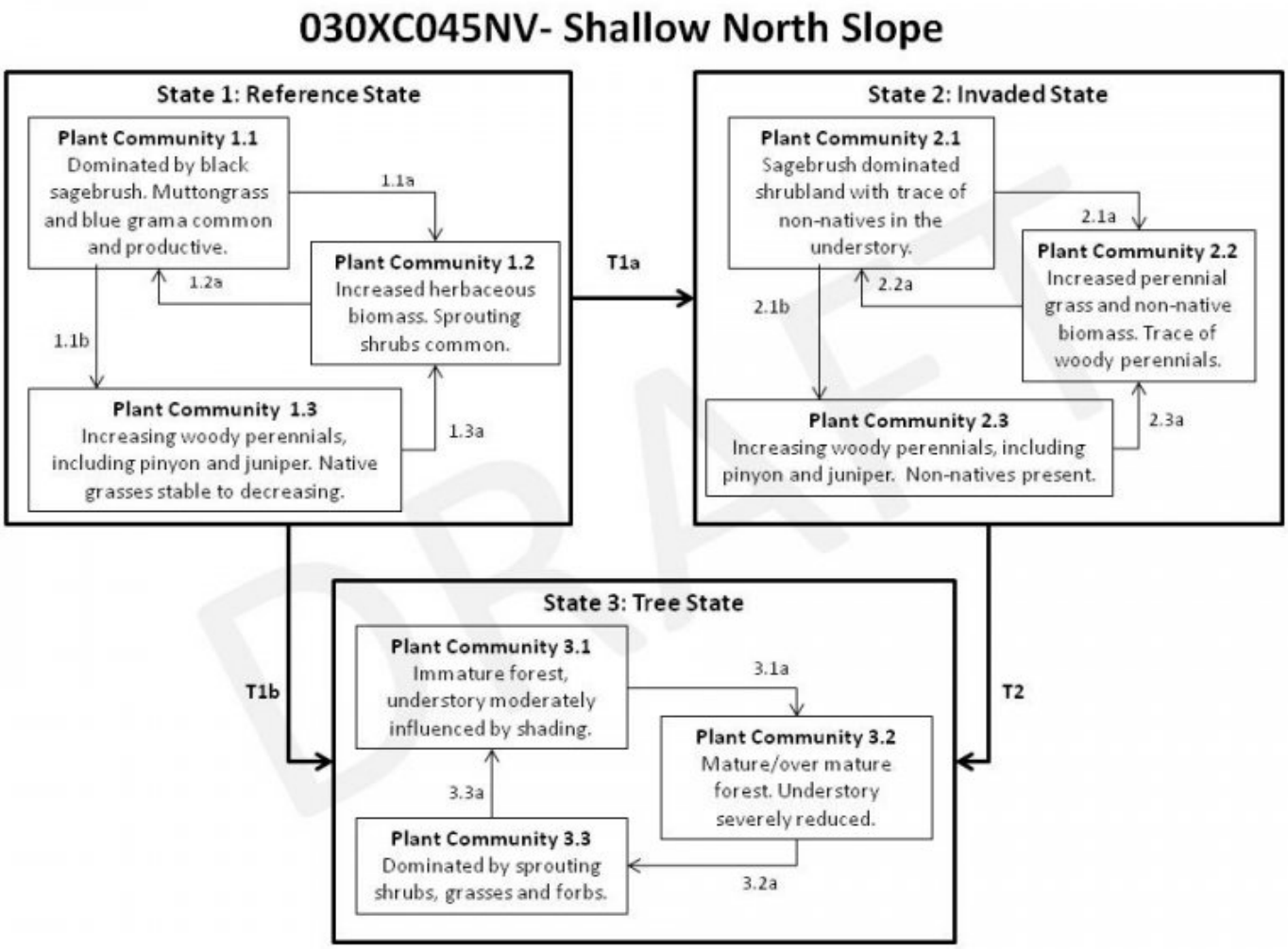
Black sagebrush is an evergreen, aromatic shrub that is low-growing and decumbent. Black sagebrush has a taproot and wide-spreading lateral roots. Roots can be deep on favorable sites, but shallow soils prevent deep root development on most sites where black sagebrush is dominant. Black sagebrush tends to have a larger number of fibrous roots than big sagebrush. Black sagebrush is highly drought tolerant; it is more likely to endure drought than most sagebrush taxa. It is slightly salt tolerant and flood intolerant. Black sagebrush occurs throughout the successional process, it is highly light tolerant and shade intolerant (Fryer 2009).

Seeds typically overwinter and germinate the spring after production. Beetle reported that black sagebrush seeds disperse too late in fall to germinate. Overwintering seeds germinate as early as April on some sites. Vegetative growth may also start in April. Ephemeral leaves are shed during summer drought, while persistent leaves remain on the branches through winter. Black sagebrush's flowering time in the Intermountain West is later than that of associated sagebrush species. Black sagebrush flowers from midsummer to midfall across its range. Survival of sagebrush seedlings is dependent on adequate moisture conditions. Young plants are susceptible to less than desirable condition for several years following germination (Fryer 2009).

Sagebrush species are generally long-lived, therefore it is not necessary for new individuals to recruit every year for perpetuation of the stand. Infrequent large recruitment events and simultaneous low, continuous recruitment is the foundation of population maintenance (Noy-Meir 1973). Mature properly functioning sagebrush communities have higher infiltration rates and lower sediment production, than degraded systems. Reoccurring disturbances, natural or anthropogenic, will result in decreased sagebrush cover and increased cover of disturbance tolerant shrubs and non-natives. Loss of structural and functional groups effects ecosystem functioning and can result in soil loss.

Improper grazing or recreation management can result in the reduction, or potential loss, of black sagebrush degrading ecosystem function.
The accumulation and decomposition of litter increase nutrient concentrations under sagebrush shrub canopies. The breakdown of aging roots also contributes to organic matter and nutrient cycling in the sagebrush system. Carbon and nitrogen concentration are higher under sagebrush canopies when compared to interspaces (Chen and Stark 2000). The root systems of sagebrush maximizes water uptake with a deep taproot and shallow branching roots. The combination of deep and shallow roots also provides excellent soil stabilization.
Fire Ecology:
There are few records of historic fire frequencies or fire regimes for black sagebrush communities. Black sagebrush communities tend to occupy unproductive sites that have little fuel build-up, so fire was probably historically rare on many black sagebrush-dominated landscapes. Black sagebrush plants are readily killed by all fire intensities. Reestablishment of sagebrush occurs through wind-dispersed seed sources. Black sagebrush requires 15 to 60 years post fire to regain dominance. Therefore, frequent and repeated fires can eliminate it from the plant community. Following wildfire, black sagebrush will be replaced by sprouting species such as Mormon tea, Stansbury cliffrose, spiny greasebush and desert ceanothus. Perennial grasses generally respond favorably to wildfire. Muttongrass has limited tolerance to fire. Blue grama is tolerant of fire when dormant but experiences higher mortality if burned during active growth, especially during drought. Blue grama responds favorably post-fire, generally increasing its occurrence, production, and percent cover.

State and transition model



State 1
Reference State

This state is representative of the natural range of variability under pristine conditions. The reference state is dominated by black sagebrush with a significant amount of perennial bunchgrasses. Long-term plant community phase changes are primarily driven by periodic wildfire, insect attack or long-term drought. Plant community dynamics are driven by interactions between climatic patterns and disturbance regimes.

Community 1.1
Reference Plant Community

This plant community is characteristic of a black sagebrush dominated shrubland. Associated shrubs include green ephedra, spiny greasebush, mountain big sagebrush and Utah serviceberry. Historically, black sagebrush communities experienced an extended fire return interval due to widely spaced shrubs and low herbaceous production. Establishment of sagebrush seedlings occurs solely from seed and recruitment pulses are episodic, based on favorable climatic conditions. Potential vegetative composition is 20 percent grasses, 10 percent forbs, 70 percent shrubs and up to 1 percent of mature trees.

Approximate ground cover (basal and foliar) is 15 to 25 percent.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	233	300	448
Grass/Grasslike	67	90	129
Forb	34	45	67
Tree	2	13	28
Total	**336**	**448**	**672**

Community 1.2
Plant Community 1.2

This plant community is characterized by a post-disturbance plant community, increased perennial bunchgrasses and decreased shrubs. Sprouting shrubs quickly return and provide favorable conditions for the establishment of other shrubs seedlings, including black sagebrush. This plant community is ‘at-risk’ of invasion by non-native annuals, like red brome and red-stem filaree. Invasion on non-natives will cause this plant community to cross an irreversible biotic threshold (T1a) into state 2.

Community 1.3
Plant Community 1.3

Figure 4. Increasing tree cover

This plant community is characterized by encroachment of pinyon and juniper. This plant community is identified as ‘at-risk’, total tree cover is near 20 percent and without fire or other disturbance tree cover will increase. This community phase is in danger of crossing

an irreversible biotic threshold into state 3. Management options to keep this community phase from crossing a threshold include cutting trees and reducing dominance by woody vegetation.

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Tree	252	482	650
Shrub/Vine	224	280	392
Grass/Grasslike	56	90	123
Forb	28	45	67
Total	**560**	**897**	**1232**

Pathway 1.1a
Community 1.1 to 1.2

Wildfire, prolonged drought or disease/insect attack removes shrubs.

Pathway 1.1b
Community 1.1 to 1.3

Absence of fire and other disturbance and encroachment by pinyon and juniper. This ecological site is at higher risk of pinyon-juniper invasion when located near a woodland.

Pathway 1.2a
Community 1.2 to 1.1

Natural regeneration over time. Successful establishment of native woody perennials. Complete recovery of sagebrush ecosystems can take a significant amount of time (>20 years).

Pathway 1.3a
Community 1.3 to 1.2

Wildfire, insect/disease attack or prolonged drought removes shrubs and trees.

State 2
Invaded State

The invaded state is characterized by the presence of non-native species. Introduced annuals, such as red brome and redstem filaree, have invaded the reference plant community. These non-natives annuals are highly flammable and promote wildfires where

fires historically have been infrequent. A biotic threshold is crossed, with the introduction of non-native annuals that are difficult to remove from the system and have the potential to significantly alter disturbance regimes from their historic range of variation. The presence of non-natives has reduced the ecological resilience of the site.

Community 2.1
Invaded Plant Community 2.1

Compositionally this plant community is similar to the reference plant community with the presence of non-native species in the understory. Ecological processes are not compromised at this time. However, ecological resilience is reduced by the presence of non-natives and this state will respond differently following a disturbance, when compared to non invaded plant communities. Management focused on reducing anthropogenic impacts is important for maintaining the health of sagebrush communities and protecting the site from further degradation.

Community 2.2
Invaded Plant Community 2.2

This plant community is characteristic of a post-disturbance plant community dominated by herbaceous vegetation. Non-native plant cover increases post disturbance, species include annual grasses and forbs. Early successional communities may or may not be dominated by non-native annual grasses. Needleandthread grass may temporally decrease following wildfire. Sprouting shrubs (spiny greasebush, banana yucca, desert ceanothus) quickly recover and provide protection of the establishment of sagebrush seedlings. Fast moving, low intensity fires result in incomplete removal of sagebrush, allowing for direct reestablishment. Remnant patches of mature sagebrush will result in a faster recovery. Abundance of non-native biomass varies annually depending on weather, droughty conditions favor native perennials and decrease abundance of non-natives.

Community 2.3
Invaded Plant Community 2.3

This plant community is characterized by encroachment of pinyon and juniper. Non-natives are present in the understory. This plant community is identified as ‘at-risk’, total tree cover is near 20% and without fire or other disturbance tree cover will increase. This community phase is in danger of crossing an irreversible biotic threshold into state 3. Management options to keep this community phase from crossing a threshold include cutting trees and reducing dominance by woody vegetation.

Pathway 2.1a
Community 2.1 to 2.2

Surface disturbance, wildfire, insect/disease attack or drought removes shrubs.

Pathway 2.1b
Community 2.1 to 2.3

Absence of disturbance and invasion by pinyon and juniper. This ecological site is at higher risk of pinyon-juniper invasion when adjacent to a woodland.

Pathway 2.2a
Community 2.2 to 2.1

Absence of disturbance and natural regeneration over time. Complete recovery on sagebrush may take greater than 20 years.

Pathway 2.3a
Community 2.3 to 2.2

Wildfire, insect/disease attack or prolonged drought removes woody perennials.

State 3
Tree State

The tree state is characterized by the invasion of pinyon and juniper and tree cover greater than 20 percent. Lack of fire, drought and insect/disease attack allows seedlings and saplings to infill and eventually dominate, changing the ecological dynamics of the site. Non-native annuals may or may not be present in the understory. This state experiences reduced infiltration and increased runoff during precipitation events, diminishing soil moisture. Feedbacks contributing to the stability of this state include reduced understory vegetation resulting from decreased soil moisture and overstory shading.

Community 3.1
Plant Community 3.1

Figure 6. tree state

This plant community is characterized by an immature forest, trees constitute more than half of the plant community. Understory vegetation is moderately affected by the overstory shading. Shrubs and bunchgrasses are decreasing. Non-natives may or may not be present in the understory. Tree canopy is greater than 20 percent.

Community 3.2
Plant Community 3.2

This plant community is characterized by pinyon and juniper trees that have reached or are near maximal height for the site. Without disturbance, the trees on this site become very old. Remaining understory vegetation is strongly influenced or even absent due to overstory shading, competition and duff accumulation. Dead shrubs are common in the understory, perennial grasses and forbs are mostly absent. Surface erosion is common and bare ground is dominant. Non-native species may or may not be present. Tree canopy ranges from 30-50 percent.

Community 3.3
Plant Community 3.3

This plant community is dominated by grasses and forbs under full sunlight. Standing stags remaining after disturbance have little to no effect on the composition and production of the herbaceous vegetation. Sprouting shrubs and those that readily establish from see are the first to appear. Long-lived perennials and late successional species will colonize the site with protection from large scale disturbance and abusive land use practices. Increased availability of critical resources following wildfire or other disturbance may result in increased non-native biomass.

Pathway 3.1a

Community 3.1 to 3.2

Absence of disturbance and continued infilling by pinyon and juniper. Bare ground increasing.

Pathway 3.2a
Community 3.2 to 3.3

Wildfire, insect/disease attack or prolonged drought removes tree canopy.

Pathway 3.3a
Community 3.3 to 3.1

Continued absence from disturbance and natural regeneration over time.

Transition T1a
State 1 to 2

Introduction of non-native species due to a combination of factors including: 1) surface disturbance, 2) changes in the kinds of animals and their grazing patterns, 3) drought and/or 4) changes in fire history.

Transition T1b
State 1 to 3

Continued lack of disturbance. Encroachment and establishment of pinyon and juniper. Tree canopy is greater than 20 percent and bare ground is increasing.

Transition T2
State 2 to 3

Continued lack of disturbance. Encroachment and establishment of pinyon and juniper. Tree canopy is greater than 20 percent and bare ground is increasing.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Primary Perennial Grasses**			54–170	
	blue grama	BOGR2	*Bouteloua gracilis*	22–67	–
	muttongrass	POFE	*Poa fendleriana*	22–67	–
	Parish's	ACPA13	*Achnatherum parishii*	4–18	–

	Pauche's needlegrass	ASPA18	*Achnatherum pauchii*	1–13	
	desert needlegrass	ACSP12	*Achnatherum speciosum*	4–18	–
2	**Secondary Perennial Grasses**			1–22	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	1–9	–
	squirreltail	ELEL5	*Elymus elymoides*	1–9	–
	Sandberg bluegrass	POSE	*Poa secunda*	1–9	–
Forb					
3	**Perennial Forbs**			22–45	
	Indian paintbrush	CASTI2	*Castilleja*	1–9	–
	buckwheat	ERIOG	*Eriogonum*	1–9	–
	Cooper's rubberweed	HYCO2	*Hymenoxys cooperi*	1–9	–
	hoary tansyaster	MACAC	*Machaeranthera canescens ssp. canescens*	1–9	–
	desert globemallow	SPAM2	*Sphaeralcea ambigua*	1–9	–
4	**Annual Forbs**			1–13	
	bird's-beak	CORDY	*Cordylanthus*	1–3	–
	cryptantha	CRYPT	*Cryptantha*	1–3	–
Shrub/Vine					
5	**Primary Shrubs**			197–269	
	black sagebrush	ARNO4	*Artemisia nova*	179–224	–
	mormon tea	EPVI	*Ephedra viridis*	9–22	–
	spiny greasebush	GLSP	*Glossopetalon spinescens*	9–22	–
6	**Secondary Shrubs**			22–67	
	Utah serviceberry	AMUT	*Amelanchier utahensis*	2–13	–
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	2–13	–
	desert ceanothus	CEGR	*Ceanothus greggii*	2–13	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	2–13	–
	slender buckwheat	ERMI4	*Eriogonum microthecum*	2–13	–

	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	2–13	–
	desert almond	PRFA	*Prunus fasciculata*	2–13	–
	Stansbury cliffrose	PUST	*Purshia stansburiana*	2–13	–
	desert snowberry	SYLO	*Symphoricarpos longiflorus*	2–13	–
	banana yucca	YUBA	*Yucca baccata*	2–13	–
	grizzlybear pricklypear	OPPOE	*Opuntia polyacantha var. erinacea*	1–6	–
	Whipple cholla	CYWH	*Cylindropuntia whipplei*	1–6	–
Tree					
7	**Evergreen**			1–27	
	Utah juniper	JUOS	*Juniperus osteosperma*	1–13	–
	singleleaf pinyon	PIMO	*Pinus monophylla*	1–13	–

Table 8. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Primary Perennial Grasses**			18–45	
	muttongrass	POFE	*Poa fendleriana*	18–45	–
2	**Secondary Perennial Grasses**			9–36	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	2–9	–
	Parish's needlegrass	ACPA13	*Achnatherum parishii*	2–9	–
	desert needlegrass	ACSP12	*Achnatherum speciosum*	2–9	–
	blue grama	BOGR2	*Bouteloua gracilis*	2–9	–
	squirreltail	ELEL5	*Elymus elymoides*	2–9	–
	Sandberg bluegrass	POSE	*Poa secunda*	2–9	–
Forb					
3	**Perennial Forbs**			18–45	
	Cooper's rubberweed	HYCO2	*Hymenoxys cooperi*	9–18	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	9–18	–

	beardtongue	PENST	*Penstemon*	9–18	–
4	**Annual Forbs**			4–27	
	bird's-beak	CORDY	*Cordylanthus*	2–9	–
Shrub/Vine					
5	**Primary Shrubs**			224–314	
	black sagebrush	ARNO4	*Artemisia nova*	224–314	–
6	**Secondary Shrubs**			45–135	
	Utah serviceberry	AMUT	*Amelanchier utahensis*	9–27	–
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	9–27	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	9–27	–
	mormon tea	EPVI	*Ephedra viridis*	9–27	–
	slender buckwheat	ERMI4	*Eriogonum microthecum*	9–27	–
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	9–27	–
	spiny greasebush	GLSP	*Glossopetalon spinescens*	9–27	–
	desert almond	PRFA	*Prunus fasciculata*	9–27	–
	Stansbury cliffrose	PUST	*Purshia stansburiana*	9–27	–
	desert snowberry	SYLO	*Symphoricarpos longiflorus*	9–27	–
Tree					
7	**Evergreen**			179–448	
	Utah juniper	JUOS	*Juniperus osteosperma*	90–224	–
	singleleaf pinyon	PIMO	*Pinus monophylla*	90–224	–

Animal community

Livestock interpretations: This site has limited value for livestock grazing, due to low forage production, steep slopes and distance from adequate water resources. Grazing management should be keyed to dominant perennial grasses and palatable shrubs. Muttongrass is a valuable forage resource. It has been rated excellent forage for domestic cattle and horses. Blue grama is important forage for all classes of domestic livestock. It is most productive following summer rains, but cures well and provides forage year around. Dominant shrubs provide additional grazing resource on this ecological site. Black sagebrush is a preferred browse species for domestic sheep. It is generally less palatable to cattle. However, cattle use it during the fall and winter when more desirable forage is

unavailable. Green ephedra or Mormon tea is palatable to most domestic livestock. It generally experiences its highest use in the winter.

Stocking rates vary over time depending upon season of use, climate variation, site, and previous and current management goals. A safe starting stocking rate is an estimated stocking rate that is fine tuned by the client by adaptive management through the year and from year to year.

Wildlife Interpretations: A variety of wildlife species find valuable foraging and habitat resources on this ecological site. Muttongrass provides good forage for sheep, elk and deer. Pronghorn antelope commonly eat seedheads during the winter. The seeds and leaves are also used by a variety of birds. Blue grama is an important source of forage for mule deer and bighorn sheep. It is most desirable during the summer growing season, but holds its nutritional value and can be grazed throughout the year. As a low growing grass, blue grama may be unavailable during the winter months due to snow cover. Dominant shrubs provide additional foraging resource on this ecological site. Black sagebrush is an important source of fall and winter forage and habitat for wildlife. It is especially important to mule deer, pronghorn and sage-grouse. Black sagebrush communities are used by rodents and small mammals such as deer mice and kangaroo rats. These communities also support predators. Small mammals and ground nesting birds are the preferred prey of the golden eagle and other raptors. Green ephedra is commonly browsed by mule deer and pronghorn antelope on winter ranges, because it extends above the snow.

Hydrological functions

Runnoff is very high. Permeability is moderately rapid. Rills and water flow patterns are rare. Perennial herbaceous plants slow runoff and increase infiltration. Shrub canopy and associated litter break raindrop impact and provide opportunity for snow catch and accumulation on site.

Recreational uses

Aesthetic value is derived from the diverse floral and faunal composition and the colorful flowering of wild flowers and shrubs during the spring and early summer. This site offers rewarding opportunities for photography and nature study. This site is used for camping and hiking and has potential for upland and big game hunting.

Other products

A concotion of black sagebrush stems, leaves and twigs was used by Native Americans to treat bronchitis. Vapors from the crushed leaves were also used to treat nasal congestions. Ephedra was traditionally used a beverage and medicine. Native Americans made tea from the slender twigs and inner bark by boiling them. The beverage was used as tonic and blood purifier. However, ephedra is considered toxic and should be used with caution. Indian tribes native to Nevada traditionally used spiny greasebush to treat

tuberculosis.

Other information

Muttongrass is drought tolerant and has the potential to be used in restoration projects across the West. The fibrous root system of this species reaches a depth of approximately 10 inches providing good surface erosion control in arid sites. Blue grama is tolerant of drought, salinity, moderate alkalinity and capable of forming mats, therefore, it is a desirable species for revegetating disturbed sites and controlling erosion. Black sagebrush is commonly used for postfire restoration, erosion control, wildlife plantings, rangeland plantings and mining reclamation. It grows on harsh sites where many other shrubs cannot survive. Generally, postfire seeding or transplanting of nursery stock is required to reestablish black sagebrush on rangelands.

Type locality

Location 1: Clark County, NV	
Township/Range/Section	T15S` R61E S12
UTM zone	N
UTM northing	4057439
UTM easting	670235
Latitude	36° 38′ 50″
Longitude	115° 5′ 44″
General legal description	Approximately 360 meters from Mormon Well, on the east side of Sheep Range, Desert National Wildlife Refuge, Clark County, Nevada. Mormon Well 7.5 minute topographic quadrangle.

Other references

Chen, J. and J.M. Stark. 2000. Plant species effect and carbon and nitrogen cycling in sagebrush-crested wheatgrass soil. Soil Biology and Biochemistry. 32:47-57.

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Noy-Meir, I. 1973. Desert ccosystems: environment and producers. Annual Review of Ecology and Systematics. 4: 25-51.

USDA-NRCS 2011. Plants Database [Online]. Available: http://plants.usda.gov/

Contributors

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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)	P.Novak-Echenique
Contact for lead author	State Rangeland Management Specialist
Date	08/16/2011
Approved by	Sarah Quistberg
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are rare. A few rills can be expected on steeper slopes in areas subjected to summer convection storms or rapid spring snowmelt.

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2. **Presence of water flow patterns:** Water flow patterns are rare but can be expected in areas recently subjected to summer convection storms or rapid snowmelt, usually on steeper slopes.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals are rare. Occurrence is usually limited to areas of water flow patterns.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare Ground 1-10% depending on amount of

surface rock fragments

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5. **Number of gullies and erosion associated with gullies:** None

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None

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7. **Amount of litter movement (describe size and distance expected to travel):** Fine litter (foliage from grasses and annual & perennial forbs) expected to move distance of slope length during intense summer convection storms or rapid snowmelt events. Persistent litter (large woody material) will remain in place except during large rainfall events.

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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):** Soil stability values should be 3 to 6 on most soil textures found on this site. (To be field tested.)

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Surface structure is typically moderate thin and medium platy structure. Soil surface colors are yellowish-browns and soils are typified by an ochric epipedon. Organic matter of the surface 2 to 4 inches is typically less than 1 percent dropping off quickly below. Organic matter content can be more or less depending on micro-topography.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Perennial herbaceous plants (especially deep-rooted bunchgrasses) slow runoff and increase infiltration. Shrub canopy and associated litter break raindrop impact and provide opportunity for snow catch and accumulation on site.

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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):** Compacted layers are none. Massive sub-surface horizons or subsoil calcic horizons are not to be interpreted as compacted.

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: Low evergreen shrubs (black sagebrush)>>

    Sub-dominant: deep-rooted cool season, perennial bunchgrasses > tall shrubs > deep-rooted, cool season perennial forbs > warm season rhizomatous grasses > shallow-rooted, cool season, perennial bunchgrasses > fibrous, shallow-rooted, cool season, perennial forbs > annual forbs.

    Other: evergreen trees, succulents

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Dead branches within individual shrubs common and standing dead shrub canopy material may be as much as 25% of total woody canopy; some of the mature bunchgrasses (<20%) have dead centers.

14. **Average percent litter cover (%) and depth (in):** Under canopy and between plant interspaces (10 - 20%) and litter depth is ±¼ inch.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** For normal or average growing season (through mid-June) ±400 lbs/ac; Favorable years 600 lbs/ac and unfavorable 300 lbs/ac.

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:** Potential invaders

include cheatgrass and red brome.

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17. **Perennial plant reproductive capability:** All functional groups should reproduce in average (or normal) and above average growing season years. Some functional groups may not reproduce in unfavorable years.
