Ecological site R027XY012NV
SODIC SANDS

Last updated: 6/03/2024
Accessed: 06/30/2024

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): 027X–Fallon-Lovelock Area

Physiography
Found in the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus this area is characterized by isolated uplifted fault block mountain ranges trending north to south that are separated by broad, hydrologically closed basins. The entire area occurs in the rain-shadow of the Sierra Nevada mountains and is influenced by Pleistocene Lake Lahontan which reached its most recent high stand about 12,000 years ago. There is substantial evidence suggesting the western Great Basin has been the site of pluvial-interpluvial cycles for at least the past two million years.
The mountains and valleys are dissected by the Humboldt, Truckee, Carson, and Walker Rivers and their tributaries, all of which terminate within MLRA 27. Extensive playas can be found throughout this area and are the result of drying of ancient Lake Lahontan. Elevation generally ranges from 3,300 to 5,900 feet (1,005 to 1,800 meters) in valleys, but on some mountain peaks it is more than 7,870 feet (2,400 meters).

Geology
Landforms and soils of this MLRA have been heavily influenced by fluctuating lake level over the last 40,000 years. There is a level line evident on the higher slopes marking the former extent of glacial Lake Lahontan. Almost half of this area has surface deposits of alluvial valley fill influenced by lacustrine sediment. The rest has andesite and basalt rocks of different ages. Mesozoic and Tertiary intrusives are concentrated along the western border of the area, and Lower Volcanic Rocks (17 to 43 million years old) are common on the eastern side of the area. Also, some scattered outcrops of Mesozoic sedimentary and volcanic rocks and tuffaceous sedimentary rocks are in the mountains within the interior of this MLRA.

Climate
The average annual precipitation is 5 to 10 inches (125 to 255 millimeters) in most of the area but is as much as 19 inches (485 millimeters) on high mountain slopes. Most of the rainfall occurs as high-intensity, convective thunderstorms during the growing season. The amount of precipitation is very low from summer to midautumn. The precipitation in winter occurs mainly as snow. The average annual temperature is 43 to 54 degrees F (6 to 12 degrees C). The freeze-free period averages 155 days and ranges from 110 to 195 days, decreasing in length with elevation.

Water
The amount of precipitation is very low, and water for irrigation is obtained principally from diversions on the four large rivers in the area and from water stored in the Lahontan, Rye Patch, and Weber Reservoirs. Pyramid Lake and Walker Lakes are terminal lakes for the Truckee and Walker Rivers, respectively. Much of the annual flow of both rivers is diverted for irrigation, causing lake levels to fall and levels of dissolved salts to increase causing problems for the native Lahontan cutthroat trout.

Soils
The dominant soil orders are Aridisols and Entisols. The soils in the area are predominantly a mesic temperature

regime, aridic moisture regime, and have a mixed mineralogy. They are generally well drained, loamy or sandy, commonly skeletal, and shallow to very deep. Accumulation of salts, tufa deposits, and eolian sediments with soluble salts over lacustrine deposits influence most of the soils in the basin landforms of this MLRA. Soils on bedrock-controlled landforms are typically comprised of volcanic or tuffaceous sedimentary colluvium over residuum.

Biological Resources
This area supports extensive areas of salt-desert shrub vegetation. Shadscale and Bailey's greasewood are widespread, occurring both individually and together. Grasses are generally sparse, although Indian ricegrass is prominent, especially on the sandy soils. Fourwing saltbush, winterfat, spiny hopsage, wolfberry, ephedra, dalea, and bud sagebrush are common shrubs. Basin wildrye, creeping wildrye, alkali sacaton, saltgrass, black greasewood, rubber rabbitbrush, and big saltbush are important plants on saline bottom lands and terraces. A few marsh areas support cattail, bulrushes, sedges, and rushes. Big sagebrush, along with scattered Utah juniper and singleleaf pinyon, is associated with Thurber needlegrass, desert needlegrass, Sandberg bluegrass, and squirreltail on the higher elevation piedmont slopes and mountains.

Ecological site concept

The Sodic Sands site occurs on lake plains, lake terraces, and sand sheets. Slopes are less than 3 percent. Elevations are 3500 to 6000 feet. The soils are very deep and have formed in alluvium from mixed sources. Soil surface horizons are moderately coarse to coarse textured and typically represent wind-borne sand deposition.

Associated sites

R027XY024NV	**SODIC TERRACE** ATCO-SAVE4 codominant shrubs
R027XY025NV	**SODIC FLAT** DISP dominant grass; ACHY minor species, if present

Similar sites

R027XY016NV	**SODIC DUNES** Occur on sand hill (dune) landform; steeper slopes
R027XY009NV	**SANDY 5-8 P.Z.** ATCA2 dominant shrub; SAVE4 minor shrub, if present
R027XY036NV	**DRY SODIC TERRACE** Much les productive site; SAVE4-ATCO codominant shrubs; LYSH important shrub

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Sarcobatus vermiculatus*
Herbaceous	(1) *Achnatherum hymenoides*

Physiographic features

This site occurs on lake plains, lake terraces, and sand sheets. Slopes range from 1 to 3 percent. Elevations are 3500 to 6000 feet.

Table 2. Representative physiographic features

Landforms	(1) Lake plain (2) Lake terrace (3) Sand sheet
Runoff class	Negligible to medium
Ponding frequency	None

Elevation	3,500–6,000 ft
Slope	1–3%
Water table depth	48–66 in
Aspect	Aspect is not a significant factor

Climatic features

The climate on this site is arid, characterized by cool, moist winters, and hot, dry summers. Average annual precipitation is 4 to 8 inches. Mean annual air temperature is 49 to 55 degrees F. The average growing season is about 120 to 180 days.

Table 3. Representative climatic features

Frost-free period (average)	180 days
Freeze-free period (average)	
Precipitation total (average)	8 in

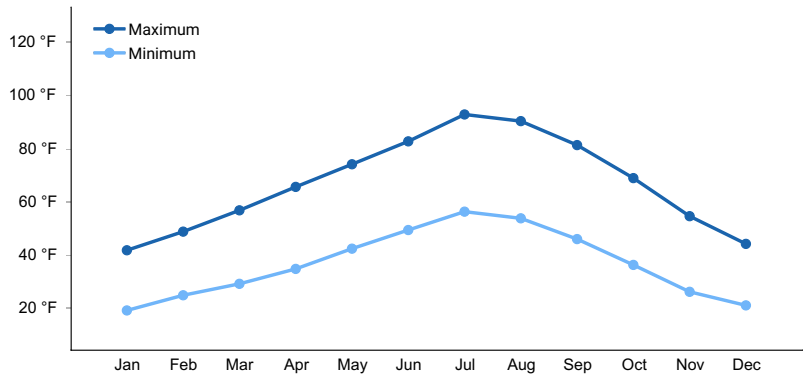


Figure 1. Monthly average minimum and maximum temperature

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils associated with this site are very deep and have formed in alluvium from mixed sources. Soil surface horizons are moderately coarse to coarse textured and typically represent wind-borne sand deposition. Subsoils are medium to fine textured. Runoff is very low to medium and surface soil infiltration is rapid. Permeability is slow to rapid in the subsoil. These soils are calcareous and soil reaction ranges from slight to strongly alkaline. Available water capacity is very low to high. The soil series associated with this site include: Hawsley, Mazuma, and Swingler.

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Eolian deposits
Surface texture	(1) Silty clay loam (2) Gravelly coarse sand (3) Silt loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Slow to rapid

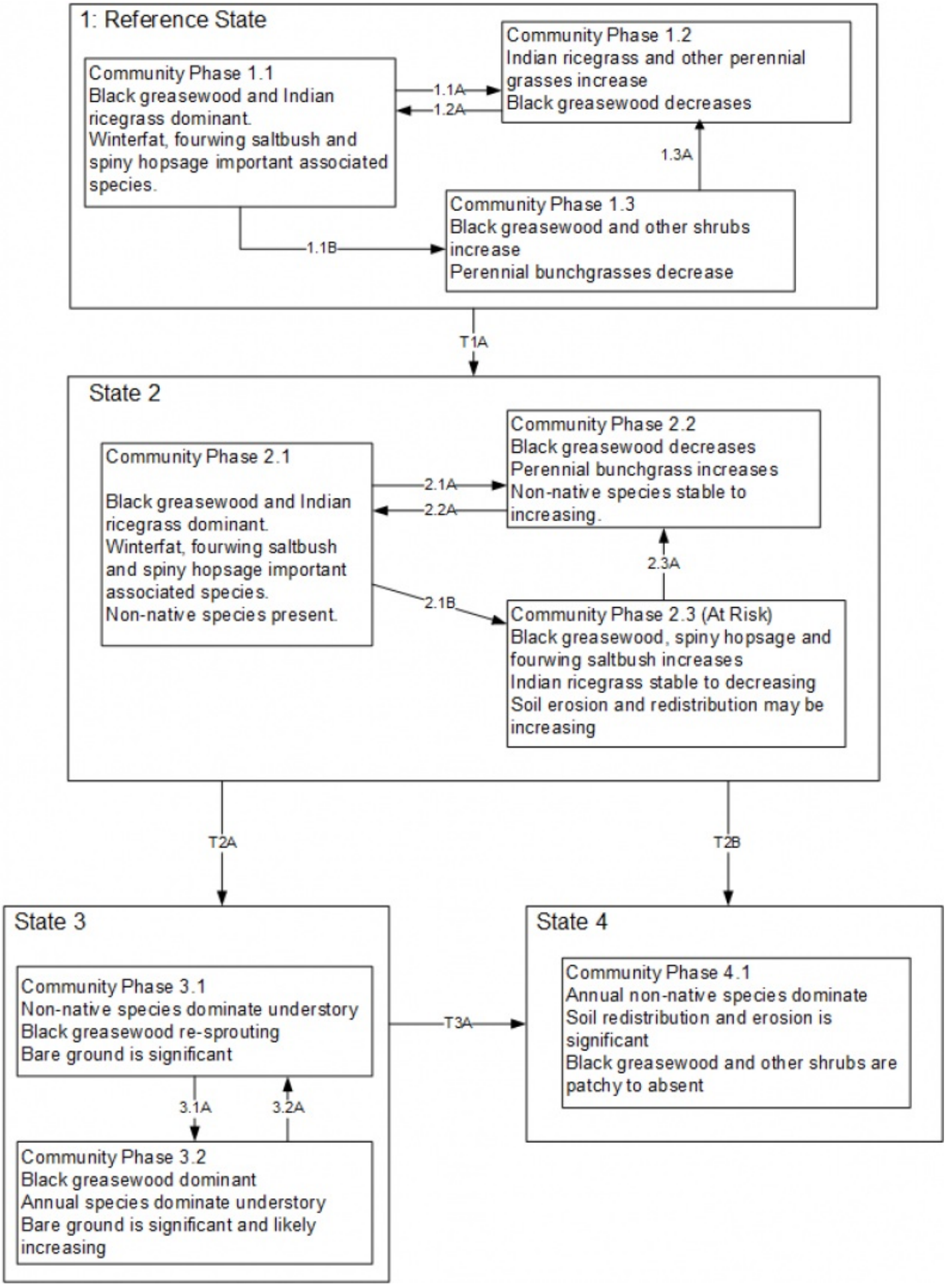
Soil depth	72–84 in
Surface fragment cover <=3"	2–12%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	3–8 in
Calcium carbonate equivalent (0-40in)	0–10%
Electrical conductivity (0-40in)	0–32 mmhos/cm
Sodium adsorption ratio (0-40in)	0–45
Soil reaction (1:1 water) (0-40in)	7.4–9.6
Subsurface fragment volume <=3" (Depth not specified)	2–12%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

Where management results in abusive grazing use by livestock, rabbitbrush and black greasewood increase as Indian ricegrass and other desirable forage plants decrease. With further site degradation, black greasewood typically becomes the dominant overstory species and perennial herbaceous species are absent. Species likely to invade this site are annual plants such as Russian thistle, mustards and cheatgrass.

Fire Ecology:
Black greasewood communities have been historically subject to stand-replacing fire regimes with intervals of <100 years. Black greasewood may be killed by severe fires, but it commonly sprouts soon after low to moderate-severity fires.
Indian ricegrass can be killed by fire, depending on severity and season of burn. Indian ricegrass reestablishes on burned sites through seed dispersed from adjacent unburned areas.

State and transition model



The Reference State 1.0 is a representative of the natural range of variability under pristine conditions. State dynamics are maintained by interactions between climatic patterns and disturbance regimes, including burning by native people. Negative feedbacks enhance ecosystem

disturbance regimes, including burning by native people. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. Plant community phase changes are primarily driven by fire, periodic drought and/or insect or disease attack.

Community phase 1.1: This community is dominated by black greasewood and Indian ricegrass. Needleandthread, fourwing saltbrush, winterfat and spiny hopsage are present throughout the plant community. This community phase is stable and long-lived, it is tolerant of prolonged drought conditions. Drought favors shrubs over grasses, due to their well developed root systems. However, prolonged drought will result in an overall decline in the plant community.
1.1a: Low severity fire resulting in a mosaic pattern.
1.1b: Time and lack of disturbance such as fire, drought, herbivory, or combinations of these.

Community phase 1.2: This community is characteristics of a post disturbance plant community. Perennial bunchgrasses increase and greasewood temporarily decreases, but likely sprouts from the root crown and returns to dominance within a few years. Fire is typically low severity and patchy due to limited fine fuels.
1.2a: Time, natural regeneration and lack of disturbance such as fire, drought, herbivory, or combinations of these.

Community phase 1.3: Black greasewood, spiny hopsage and fourwing saltbush increase in the absence of disturbance. Decadent shrubs dominate the overstory and deep-rooted perennial bunchgrasses in the understory are reduced, or mostly absent.
1.3a: Fire significantly reduces shrub cover.

Transition T1A: Introduction of non-native plants.

Current Potential State 2.0: This state is similar to the Reference State 1.0. Ecological function has not changed, however the resiliency of the state has been reduced by the presence of invasive weeds. Non-natives may increase in abundance but will not become dominant within this State. These non-natives can be highly flammable and can promote fire where historically fire had been infrequent. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These feedbacks include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. Positive feedbacks decrease ecosystem resilience and stability of the state. These include the non-natives' high seed output, persistent seed bank, rapid growth rate, ability to cross pollinate, and adaptations for seed dispersal.

Community Phase 2.1:
This community phase is compositionally similar to the Reference State Community Phase 1.1 with the presence of non-native species in trace amounts. This community is dominated by black greasewood and Indian ricegrass. Needleandthread, fourwing saltbrush, spiny hopsage and other shrubs are present in minor amounts. Non-native annual species such as halogeton and cheatgrass are present.

2.1a: Fire or brush treatments (i.e. mowing) with minimal soil disturbance.
2.1b: Time and lack of disturbance such as fire. Drought, inappropriate grazing management, or combinations of these would
also decrease the perennial understory.

Community Phase 2.2:
This community phase is characteristic of a post-disturbance plant community with annual non-native species present. Perennial bunchgrasses such as Indian ricegrass, needleandthread and basin wildrye are increasing. Depending on fire severity patches of intact shrubs may remain. Black greasewood, fourwing saltbush, spiny hopsage and rabbitbrush may be sprouting. Annual non-native species are stable to increasing in the community.
2.2a: Time, natural regeneration and lack of disturbance such as fire. Drought, inappropriate grazing management, or combinations of these would also decrease the perennial understory.

Community Phase 2.3 (at risk):

Community Phase 2.3 (at-risk):
Black greasewood dominates the overstory and perennial bunchgrasses in the understory are reduced, either from competition with shrubs or from inappropriate grazing, or from both. Rabbitbrush, fourwing saltbush and spiny hopsage may be a significant component. Inland saltgrass is more grazing tolerant and may increase within the community. Annual non-native species are stable or increasing. This community is at risk of crossing a threshold to State 3.0 (grazing or fire).
2.3a: Low severity/patchy fire or heavy late fall/winter grazing causing mechanical damage to shrubs and/or brush treatment with minimal soil disturbance.

Transition T2A: Time and lack of disturbance often coupled with excessive grazing pressure would reduce the perennial understory (3.1). Severe fire, lowering of water table from groundwater pumping and/or soil disturbing brush treatments (3.2)
Transition T2B: Severe fire, lowering of water table from groundwater pumping and/or soil disturbing brush treatments (4.1)

Shrub State 3.0: This state is characterized by a dominance of black greasewood and rabbitbrush in the overstory. This site has crossed a biotic and abiotic threshold and site processes are being controlled by shrubs. Bare ground has increased and non-natives are present and likely increasing.

Community Phase 3.1:
Black greasewood, rabbitbrush, fourwing saltbrush and spiny hopsage may be sprouting. Deep-rooted perennial bunchgrasses have significantly declined. Annual nonnative species increase. Bare ground is significant.
3.1a: Drought and/or lowering of the water table due to groundwater pumping and/or severe fire.

Community Phase 3.2:
Greasewood, fourwing saltbush and spiny hopsage dominate the site. Perennial grasses are present but a minor component. Annual non-native species are present and may be increasing in the understory.
3.2a: Release of drought and/or grazing pressure may allow perennial bunchgrasses to increase, fire will reduce greasewood
Transition T3A: Severe fire, lowering of water table by groundwater pumping and/or soil disturbing treatments (4.1)

Annual State 4.0
In this state, a biotic threshold has been crossed and state dynamics are driven by the dominance and persistence of the annual plant community which is perpetuated by a shortened fire return interval. The herbaceous understory is dominated by annual non-native species such as cheatgrass and halogeton. Bare ground may be abundant. The fire return interval has shortened due to the dominance of cheatgrass in the understory and is a driver in site dynamics.

Community Phase 4.1:
This community is dominated by annual non-native species. Halogeton is common, cheatgrass and mustards may also be present. Trace amounts of greasewood and other shrubs may be present, but are not contributing to site function. Bare ground may be abundant, especially during low precipitation years. Soil erosion from wind and soil temperature are driving factors in site function.

State 1
Reference Plant Community

Community 1.1
Reference Plant Community

The reference plant community is dominated by black greasewood and Indian ricegrass. Potential vegetative composition is about 65% grasses, 5% forbs and 30% shrubs. Approximate ground cover (basal and crown) is 10 to 20 percent.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	130	260	390
Shrub/Vine	60	120	180
Forb	10	20	30
Total	**200**	**400**	**600**

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	**Primary Perennial Grasses**			188–280	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	160–200	–
	needle and thread	HECO26	*Hesperostipa comata*	20–60	–
	basin wildrye	LECI4	*Leymus cinereus*	8–20	–
2	**Secondary Perennial Grasses**			8–32	
	saltgrass	DISP	*Distichlis spicata*	2–12	–
	squirreltail	ELEL5	*Elymus elymoides*	2–12	–
	thickspike wheatgrass	ELLAL	*Elymus lanceolatus ssp. lanceolatus*	2–12	–
	western wheatgrass	PASM	*Pascopyrum smithii*	2–12	–
Forb					
3	**Perennial Forbs**			8–32	
4	**Annual Forbs**			0–12	
Shrub/Vine					
5	**Primary Shrubs**			165–450	
	greasewood	SAVE4	*Sarcobatus vermiculatus*	75–225	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	30–75	–
	spiny hopsage	GRSP	*Grayia spinosa*	30–75	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	30–75	–
6	**Secondary Shrubs**			30–120	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	2–12	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	2–12	–
	Nevada dalea	PSPO	*Psorothamnus polydenius*	2–12	–

Animal community

Livestock Interpretations:
This site is suitable for livestock grazing. Grazing management should be keyed to indian ricegrass production. Indian ricegrass is highly palatable to all classes of livestock in both green and cured condition. It supplies a source of green feed before most other native grasses have produced much new growth.
Needleandthread provides highly palatable forage, especially in the spring before fruits have developed. Needlegrasses are grazed in the fall only if the fruits are softened by rain.
Black greasewood is an important winter browse plant for domestic sheep and cattle. It also receives light to moderate use by domestic sheep and cattle during spring and summer months. Black greasewood contains soluble sodium and potassium oxalates that may cause poisoning and death in domestic sheep and cattle if large amounts are consumed in a short time.

Winterfat is an important forage plant for livestock, especially during winter when forage is scarce. Abusive grazing practices have reduced or eliminated winterfat on some areas even though it is fairly resistant to browsing. Effects depend on severity and season of grazing.
Spiny hopsage provides a palatable and nutritious food source for livestock, particularly during late winter through spring. Domestic sheep browse the succulent new growth of spiny hopsage in late winter and early spring.
Fourwing saltbush is one of the most palatable shrubs in the West. Its protein, fat, and carbohydrate levels are comparable to alfalfa. It provides nutritious forage for all classes of livestock. Palatability is rated as good for domestic sheep and domestic goats; fair for cattle; fair to good for horses in winter, poor for horses in other seasons.

Stocking rates vary over time depending upon season of use, climate variations, 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:
Indian ricegrass is eaten by pronghorn in moderate amounts whenever available. A number of heteromyid rodents inhabiting desert rangelands show preference for seed of Indian ricegrass. Indian ricegrass is an important component of jackrabbit diets in spring and summer. Indian ricegrass seed provides food for many species of birds. Doves, for example, eat large amounts of shattered Indian ricegrass seed lying on the ground.
Needleandthread is moderately important spring forage for mule deer, but use declines considerably as more preferred forages become available.
Black greasewood is an important winter browse plant for big game animals and a food source for many other wildlife species. It also receives light to moderate use by mule deer and pronghorn during spring and summer months.
Winterfat is an important forage plant for wildlife, especially during winter when forage is scarce. Winterfat seeds are eaten by rodents and are a staple food for black-tailed jackrabbits. Mule deer and pronghorn antelope browse winterfat. Winterfat is used for cover by rodents. It is potential nesting cover for upland game birds, especially when grasses grow up through its crown.
Spiny hopsage provides a palatable and nutritious food source for big game animals. Spiny hopsage is used as forage to at least some extent by domestic goats, deer, pronghorn, and rabbits.
Fourwing saltbush provides valuable habitat and year-round browse for wildlife. Fourwing saltbush also provides browse and shelter for small mammals. Additionally, the browse provides a source of water for black-tailed jackrabbits in arid environments. Granivorous birds consume the fruits. Wild ungulates, rodent and lagomorphs readily consume all aboveground portions of the plant. Palatability is rated good for deer and pronghorn.

Hydrological functions

Runoff is very low to medium. Permeability is slow to rapid.

Other products

Indian ricegrass was traditionally eaten by some Native Americans. The Paiutes used the seed as a reserve food source.
The leaves, seeds and stems of black greasewood are edible.
Some Native American peoples traditionally ground parched seeds of spiny hopsage to make pinole flour.
Fourwing saltbush is traditionally important to Native Americans. They ground the seeds for flour. The leaves, placed on coals, impart a salty flavor to corn and other roasted food. Top-growth produces a yellow dye. Young leaves and shoots were used to dye wool and other materials. The roots and flowers were ground to soothe insect bites.

Other information

Needleandthread is useful for stabilizing eroded or degraded sites.
Black greasewood is useful for stabilizing soil on wind-blown areas. It successfully revegetates eroded areas and sites too saline for most plant species.
Winterfat adapts well to most site conditions, and its extensive root system stabilizes soil. However, winterfat is intolerant of flooding, excess water, and acidic soils.
Spiny hopsage has moderate potential for erosion control and low to high potential for long-term revegetation

projects. It can improve forage, control wind erosion, and increase soil stability on gentle to moderate slopes. Spiny hopsage is suitable for highway plantings on dry sites in Nevada.
Fourwing saltbush is widely used in rangeland and riparian improvement and reclamation projects, including burned area recovery. It is probably the most widely used shrub for restoration of winter ranges and mined land reclamation.

Inventory data references

NASIS data was used for the Physiographic and Soil section.

Type locality

Location 1: Washoe County, NV	
Township/Range/Section	T30N R19E S28
General legal description	About 13 miles north of Sand Pass, Smoke Creek Desert, Washoe County, Nevada. This site also occurs in Churchill, Lyon, Mineral and Pershing Counties, Nevada.

Other references

Fire Effects Information System (Online; http://www.fs.fed.us/database/feis/plants/).

USDA-NRCS Plants Database (Online; http://www.plants.usda.gov).

Contributors

DK/GD

Approval

Kendra Moseley, 6/03/2024

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	06/30/2024
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

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

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

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

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

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

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

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

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

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:

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):**

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

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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:**

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17. **Perennial plant reproductive capability:**
