USDA Natural Resources
Conservation Service

Ecological site R027XY078NV
OUTWASH PLAIN

Last updated: 6/03/2024
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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 Outwash Plain site occurs on fan skirts, inset fans and axial stream terraces. Slope gradients of less than 4 percent are typical. Elevations are 4000 to 5000 feet. The soils in this site are very deep and well drained. The site is occasionally flooded as additional moisture is received as run-in from higher landscapes or as overflow from adjacent streams.

Associated sites

R028BY084NV	**COARSE SILTY 6-8 P.Z.** Found on mountain shoulder shallow soils.

Similar sites

R027XY009NV	**SANDY 5-8 P.Z.** ACHY dominant plant soils coarse textured.
R027XY041NV	**DEEP SODIC FAN** ATTO dominant shrub; more productive site.
R027XY060NV	**SANDY 3-5 P.Z.** ACHY dominant plant; LYSH major shrub; soils coarse textured.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex canescens*
Herbaceous	(1) *Achnatherum hymenoides*

Physiographic features

The Outwash Plain site occurs on fan skirts, inset fans and axial stream terraces. Slope gradients of 0 to 4 percent are typical. Elevations are 4000 to 5000 feet.

Table 2. Representative physiographic features

Landforms	(1) Fan skirt (2) Inset fan (3) Stream terrace
Runoff class	Low
Flooding frequency	Rare

Ponding frequency	None
Elevation	4,000–5,000 ft
Slope	0–4%
Water table depth	72 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 5 to about 8 inches. Mean annual air temperature is 48 to about 55 degrees F. The average growing season is about 100 to 120 days.

Table 3. Representative climatic features

Frost-free period (average)	120 days
Freeze-free period (average)	
Precipitation total (average)	8 in

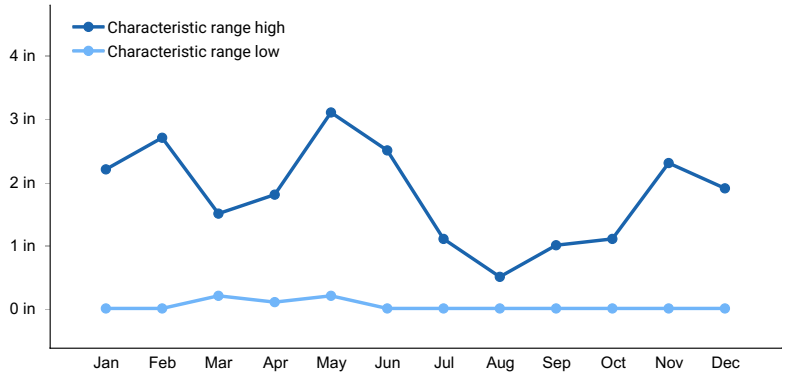


Figure 1. Monthly precipitation range

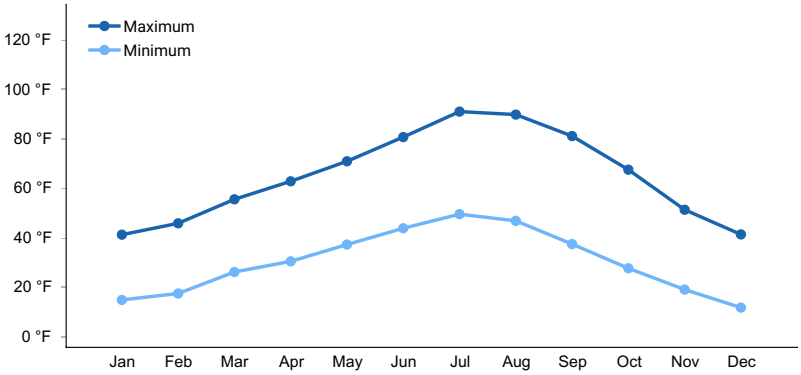


Figure 2. Monthly average minimum and maximum temperature

Influencing water features

There are perennial and intermittent streams associated with this site. This site may receive additional moisture by flooding due to its occurrence on perennial and intermittent streams.

Soil features

The soils in this site are very deep and well drained. The soils are occasionally flooded as additional moisture is received on this site as run-in from higher landscapes or as overflow from adjacent streams. The surface horizon of these soils is slightly to moderately saline/alkali. The soils series associated with this site is Wholan.

Table 4. Representative soil features

Parent material	(1) Alluvium (2) Loess (3) Volcanic ash
Surface texture	(1) Silt loam (2) Very fine sandy loam (3) Very gravelly sand
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate
Soil depth	60 in
Surface fragment cover <=3"	0–38%
Surface fragment cover >3"	0–3%
Available water capacity (0-40in)	7.1 in
Calcium carbonate equivalent (0-40in)	0–15%
Electrical conductivity (0-40in)	0–16 mmhos/cm
Sodium adsorption ratio (0-40in)	0–12
Soil reaction (1:1 water) (0-40in)	7.4–9.6
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

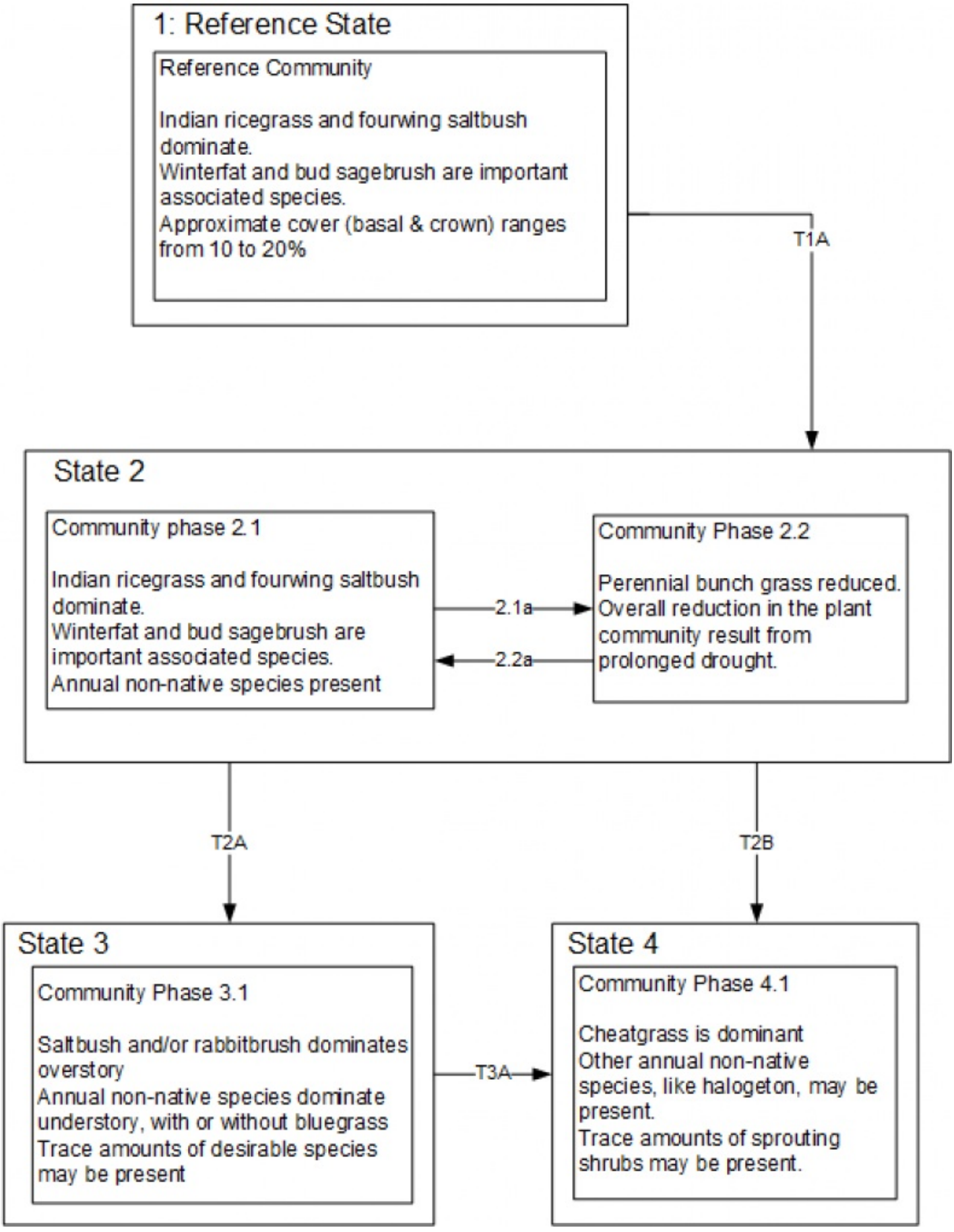
Ecological dynamics

As ecological condition declines, Indian ricegrass and other native perennial grasses and forbs decrease. Annual forbs and grasses such as Russian thistle, halogeton, and cheatgrass readily invade this site.

Fire Ecology:
Sustained surface fire top-kills fourwing saltbush, depending upon ecotype. Fourwing saltbush is fire-resistant compared to most associated shrubs. The salt scurf layer on leaves inhibits burning. Ether extractives in leaves and stems promote shrub flammability. Fourwing saltbush may sprout after top-kill. Some ecotypes fail to sprout, or show only a weak sprouting response. Generally, fourwing saltbush is poorly adapted to frequent fire.

Indian ricegrass reestablishes on burned sites through seed dispersed from adjacent unburned areas. Indian ricegrass plants are generally killed by fire. Indian ricegrass regenerates from seed following fire.

State and transition model



The Reference State 1.0 is a representative of the natural range of variability under pristine conditions. The Reference State has two general community phases: a shrub-grass dominant phase and a shrub dominant phase. State dynamics are maintained by interactions between climatic patterns and disturbance regimes. 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. This site is very stable, with little variation in plant community composition. Plant community changes would be reflected in production response to long term drought or herbivory. Wet years will increase grass production, while drought years will reduce production.

Community phase 1.1
This plant community is dominated by Indian ricegrass and fourwing saltbush. Winterfat and bud sagebrush are present in minor amounts.

T1A: Transition from Reference State 1.0 to Current Potential State 2.0:
Trigger: This transition is caused by the introduction of non-native annual plants, such as halogeton, mustards and cheatgrass.
Slow variables: Over time the annual non-native species will increase within the community.
Threshold: Any amount of introduced non-native species causes an immediate decrease in the resilience of the site. Annual non-native species cannot be easily removed from the system and have the potential to significantly alter disturbance regimes from their historic range of variation.

Current Potential State 2.0 is similar to the Reference State with in the presence of non-native species. 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 is compositionally similar to the reference plant community with a trace of annual non-natives, primarily cheatgrass, halogeton and tansy mustard. Ecological resilience is reduced by the presence of non-native species. Community phase changes are primarily a function of chronic drought or extreme wet periods. Fire is infrequent and patchy due to low fuel loads.

CPP 2.1a Prolonged drought conditions cause overall decrease the perennial bunchgrasses in the understory. Inappropriate growing season grazing favors unpalatable shrubs over bunchgrasses, winterfat and bud sagebrush.

Community phase 2.2:
This community phase is the result of the prolonged drought conditions. Perennial bunchgrass are decline first. Further decline and possible mortality is experienced in the shrub component with continued drought. Inappropriate growing season grazing will favor dominance by fourwing saltbush or rabbitbrush and possible loss of winterfat or bud sagebrush. Fire is infrequent and patchy, but may occur in a mosaic pattern. Continued drought and/or excessive grazing puts this community phase at-risk of crossing a ecological threshold into a alternative stable state.

CPP 2.2a:
Release from drought and/or grazing management that facilitates an increase in perennial grasses, winterfat and bud sagebrush.

T2A: Transition from Current Potential State 2.0 to Shrub State 3.0:
Trigger: Inappropriate grazing management and/or prolonged drought will decrease or eliminate deep rooted perennial bunchgrasses and favor shrub growth and establishment.
Slow variables: Long term decrease in grass density and reduced native species (shrub and grass) recruitment rates. Increased reproduction of non-native invasive species.

Threshold: Loss of deep-rooted perennial bunchgrasses changes nutrient cycling, nutrient redistribution, and reduces soil organic matter.

T2B: Transition from Current Potential State 2.0 to Annual State 4.0:
Trigger: Fire and/or soil disturbing treatments such as drill seeding and plowing. An unusually wet spring may facilitate the increased germination and production of cheatgrass leading to its dominance within the community.
Slow variables: Increased production and cover of non-native annual species.
Threshold: Loss of deep-rooted perennial bunchgrasses and shrubs truncates, spatially and temporally, nutrient capture and cycling within the community. Increased, continuous fine fuels from annual non-native plants modify the fire regime by changing intensity, size and spatial variability of fires.

Shrubs state 3.0: This state is characterized by shadscale, winterfat, spiny hopsage and sprouting shrub overstory. The site has crossed a biotic threshold and site processes are being controlled by shrubs. Shrub cover exceeds the site concept and may be decadent, reflecting stand maturity and lack of seedling establishment due to competition with mature plants. The shrub overstory dominates site resources such that soil water, nutrient capture, nutrient cycling and soil organic matter are temporally and spatially redistributed. Bare ground has increased.

Community phase 3.1: This community phase is characterized by decadent overstory of fourwing saltbush. Winterfat, bud sagebrush and other shrubs may be a significant component of the plant community. Deep-rooted perennial bunchgrass may be present in trace amounts or absent from the community. Annual non-native species increase. Bare ground is significant.

T3A: Transition from Shrub State 3.0 to Annual State 4.0:
Trigger: Repeated fire and/or soil disturbing treatments such as drill seeding and plowing.
Slow variables: Increased production and cover of non-native annual species.
Threshold: Increased, continuous fine fuels modify the fire regime by changing intensity, size and spatial variability of fires. Changes in plant community composition and spatial variability of vegetation due to the loss of perennial bunchgrasses and sagebrush truncate energy capture spatially and temporally thus impacting nutrient cycling and distribution.

Annual state 4.0: This state has crossed a biotic threshold and ecological dynamics are driven by the dominance and persistence of non-native annual species. Non-native annuals provide a continuous cover of fine fuels, perpetuating 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.

Community phase 4.1: This community phase is dominated by non-native annual species. This plant community is at-risk of increased erosion and soil loss or redistribution and reoccurring fire driven by fine fuels. Prescribed grazing may be used to reduce fuel loading and the cheatgrass seedbank. However, caution should be exercised; inappropriate grazing management resulting in the complete defoliation of the site will lead to a more degraded state.

State 1
Reference Plant Community

Community 1.1
Reference Plant Community

The reference plant community is characterized by a open canopy of shrubs and perennial grasses. The plant community is dominated by Indian ricegrass and fourwing saltbush. Potential vegetative composition is about 35% grasses, 5% forbs and less than 60% 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)
Shrub/Vine	150	240	360
Grass/Grasslike	87	140	210
Forb	13	20	30
Total	**250**	**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**			88–160	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	80–140	–
	squirreltail	ELEL5	*Elymus elymoides*	8–20	–
2	**Secondary Perennial Grasses**			8–32	
	basin wildrye	LECI4	*Leymus cinereus*	2–12	–
	Sandberg bluegrass	POSE	*Poa secunda*	2–12	–
Forb					
3	**Perennial Forbs**			8–32	
	globemallow	SPHAE	*Sphaeralcea*	2–12	–
Shrub/Vine					
4	**Primary Shrubs**			200–300	
	fourwing saltbush	ATCA2	*Atriplex canescens*	160–200	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	20–50	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	20–50	–
5	**Secondary Shrubs**			8–32	
	basin saltbush	ATTR3	*Atriplex tridentata*	2–8	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	2–8	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	2–8	–

Animal community

Livestock Interpretations:
This site is suitable for cattle and sheep grazing. 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, and poor for horses in other seasons.
Indian ricegrass has good forage value for domestic sheep, cattle, and horses. It can be important cattle forage in winter, particularly in salt desert communities. Indian ricegrass is often used most heavily in late winter, when succulent and nutritious new green leaves are produced. It supplies a source of green feed before most other native grasses have produced much new growth. Consequently, Indian ricegrass is often heavily grazed before animals leave winter ranges.

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:
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, including scaled and other quail species, grouse, and gray partridge, consume the fruits. Wild ungulates, rodents, and lagomorphs readily consume all aboveground portions of the plant. Palatability is rated good for deer, pronghorn antelope, and bighorn sheep.
Indian ricegrass is eaten by pronghorn in moderate amounts whenever available and in Nevada it is consumed by desert bighorns.

Hydrological functions

Runoff is very low to low.

Other products

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. Branch ashes were added to blue corn dough to make green bread. The roots and flowers were ground to soothe insect bites.

Indian ricegrass seeds make a gluten-free, nutritious flour with a potentially good market. Indian ricegrass was traditionally eaten by some Native American peoples. The Paiutes used seed as a reserve food source.

Other information

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. Fourwing saltbush is drought and cold resistant, palatable, relatively easy to establish with artificial regeneration, and establishes on harsh (and even toxic) sites. Fourwing saltbush is adaptable on sites with declining water tables, brackish groundwater, or saline soils. The deep roots help stabilize erodible soils. It can facilitate establishment of native shrubs, such as sagebrush, that are more resistant to artificial regeneration.

Indian ricegrass is well-suited for surface erosion control and desert revegetation although it is not highly effective in controlling sand movement. Certain native ecotypes exhibit desirable characteristics such as drought and salinity tolerance, low seed dormancy, and good nutritional qualities

Inventory data references

NASIS soil component data.

Type locality

Location 1: Churchill County, NV	
Township/Range/Section	T20 N R39 E S35
General legal description	Edwards Creek Valley, Churchill County, Nevada.
Location 2: Lander County, NV	
Township/Range/Section	T20 N R43 E S27
General legal description	Approximately 6 miles northwest of Austin along NVHwy 305, within drainage of Cottonwood Canyon as it crosses highway, Lander County, Nevada.

Other references

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

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

Contributors

GED

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)	Patti Novak-Echenique
Contact for lead author	State Rangeland Management Specialist
Date	07/19/2013
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are none to rare. A few can be expected in areas subjected to summer convection storms or rapid spring snowmelt.

2. **Presence of water flow patterns:** Water flow patterns are often numerous in areas subjected to summer convection storms. Flow patterns short (< 3 m) and stable.

3. **Number and height of erosional pedestals or terracettes:** Pedestals are rare with occurrence typically limited to areas within water flow patterns.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare Ground up to 60%

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

6. **Extent of wind scoured, blowouts and/or depositional areas:** None. Some wind-scouring may occur after wildfires.

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 runoff 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 1 to 4 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):** Structure of soil surface is typically moderate, medium platy. Soil surface colors are light brownish-grays and typified by an ochric epipedon. Organic matter of the surface 2 to 3 inches is less than to 1 percent. Surface soils are typically silt loams. The surface layer of these soils will normally develop a vesicular crust, inhibiting water infiltration and seedling emergence.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Sparse shrub canopy and associated litter provide some impact from raindrop impact.

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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. Platy or massive sub-surface horizons are not to be interpreted as compacted layers.

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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: Tall shrubs (fourwing saltbush)

    Sub-dominant: deep-rooted, cool season, perennial bunchgrasses (i.e., Indian ricegrass) > associated salt-desert shrubs > shallow-rooted, cool season, perennial bunchgrasses = perennial forbs > annual forbs

    Other:

    Additional: After wildfires, deep-rooted, cool season perennial bunchgrasses and sprouting shrubs (rabbitbrush) will dominate. Four-wing saltbush and black greasewood may resprout depending on severity of fire.

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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 35% of total woody canopy; mature bunchgrasses commonly (±25%) have dead centers.

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14. **Average percent litter cover (%) and depth (in):** Between plant interspaces 10-20% and depth <¼-inch

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** For normal or average growing season (thru June) ± 400 lbs/ac; Favorable years ±600 lbs/ac and unfavorable years ±250 lbs/ac

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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:** Potential invaders include halogeton, Russian thistle, annual mustards, and cheatgrass.

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17. **Perennial plant reproductive capability:** All functional groups should reproduce in average and above average growing season years. Reduced growth or reproduction occurs during extended or extreme drought conditions.
