USDA Natural Resources
Conservation Service

Ecological site R030XB076NV
SHALLOW GRAVELLY SLOPE 6-8 P.Z.

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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): 030X–Mojave Basin and Range

The Mojave Desert Major Land Resource Area (MLRA 30) is found in southern California, southern Nevada, the extreme southwest corner of Utah and northwestern Arizona within the Basin and Range Province of the Intermontane Plateaus. The Mojave Desert is a transitional area between hot deserts and cold deserts where close proximity of these desert types exert enough influence on each other to distinguish these desert types from the hot and cold deserts beyond the Mojave. Kottek et. al 2006 defines hot deserts as areas where mean annual air temperatures are above 64 F (18 C) and cold deserts as areas where mean annual air temperatures are below 64 F (18 C). Steep elevation gradients within the Mojave create islands of low elevation hot desert areas surrounded by islands of high elevation cold desert areas.

The Mojave Desert receives less than 10 inches of mean annual precipitation. Mojave Desert low elevation areas are often hyper-arid while high elevation cold deserts are often semi-arid with the majority of the Mojave being an arid climate. Hyper-arid areas receive less than 4 inches of mean annual precipitation and semi-arid areas receive more than 8 inches of precipitation (Salem 1989). The western Mojave receives very little precipitation during the summer months while the eastern Mojave experiences some summer monsoonal activity.

In summary, the Mojave is a land of extremes. Elevation gradients contribute to extremely hot and dry summers and cold moist winters where temperature highs and lows can fluctuate greatly between day and night, from day to day and from winter to summer. Precipitation falls more consistently at higher elevations while lower elevations can experience long intervals without any precipitation. Lower elevations also experience a low frequency of precipitation events so that the majority of annual precipitation may come in only a couple precipitation events during the whole year. Hot desert areas influence cold desert areas by increasing the extreme highs and shortening the length of below freezing events. Cold desert areas influence hot desert areas by increasing the extreme lows and increasing the length of below freezing events. Average precipitation and temperature values contribute little understanding to the extremes which govern wildland plant communities across the Mojave.

Arid Eastern Mojave Land Resource Unit (XB)

LRU notes

The Mojave Desert is currently divided into 4 Land Resource Units (LRUs). This ecological site is within the Arid Eastern Mojave LRU where precipitation is bi-modal, occurring during the winter months and summer months. The Arid Eastern Mojave LRU is designated by the 'XB' symbol within the ecological site ID. This LRU is found across the eastern half of California, much of the mid-elevations of Nevada, the southernmost portions of western Utah, and the mid-elevations of northwestern Arizona. This LRU is essentially equivalent to the Eastern Mojave Basins and Eastern Mojave Low Ranges and Arid Footslopes of EPA Level IV Ecoregions

Elevations range from 1650 to 4000 feet and precipitation is between 4 to 8 inches per year. This LRU is distinguished from the Arid Western Mojave (XA) by the summer precipitation, falling between July and September, which tends to support more warm season plant species. The 'XB' LRU is generally east of the Mojave River and the 117 W meridian (Hereford et. al 2004). Vegetation includes creosote bush, burrobush, Nevada jointfir, ratany, Mojave yucca, Joshua tree, cacti, big galleta grass and several other warm season grasses. At the upper portions of the LRU, plant production and diversity are greater and blackbrush is a common dominant shrub.

Classification relationships

EPA Ecoregions level III - Predominantly Mojave Basin and Range with some areas in Central Basin and Range.

EPA Ecoregions level IV - Amargosa Desert, Arid Valleys and Canyonlands, Death Valley/Mojave Central Trough, Eastern Mojave Basins, Eastern Mojave Low Ranges and Arid Footslopes, Eastern Mojave Mountain Woodland and Shrubland, Tonopah Basin, Tonopah Sagebrush Foothills

United States National Vegetation Classification -

Class - 3 Xeromorphic Woodland, Scrub & Herb Vegetation Class

Subclass - 3.B Cool Semi-Desert Scrub & Grassland Subclass

Formation - 3.B.1 Cool Semi-Desert Scrub & Grassland Formation

Division - 3.B.1.Ne Western North American Cool Semi-Desert Scrub & Grassland Division

Macrogroup - 3.B.1.Ne.1 Chrysothamnus viscidiflorus - *Coleogyne ramosissima* / Achnatherum hymenoides Great Basin & Intermountain Dry Shrubland & Grassland Macrogroup

Group - 3.B.1.Ne.1.a *Yucca brevifolia* - *Eriogonum fasciculatum* - Ephedra fasciculata Mixed Desert Scrub Group

Alliance - 3.B.1.Ne.1.a *Coleogyne ramosissima* Mojave Desert Shrubland Alliance

(Schulz 2014)

Ecological site concept

This ecological site occurs on hills and mountains on all aspects above 3800 feet but can occur as low as 3000 feet on northerly aspects. Mean annual air temperatures are relatively cooler than the majority of the Mojave Desert due to the close proximity of high elevation sky islands. Soils are formed in colluvium and residuum derived from igneous and plutonic metamorphosed material such as basalt, rhyolite, granodiorite and gneiss. Soils are typically shallow but deep soils may have an argillic horizon which act as an aquatard creating hydrologically similar characteristics. These soils do not have a calcic or petrocalcic horizon.

This is a group concept and provisional STM that also covers the following ecological sites: R029XY178CA, R029XY179CA, R029XY180CA, R030XA095NV, R030XB057NV, , R030XB060NV, R030XB166CA, R030XB010NV, R030XB062NV

Associated sites

R030XB072NV	**STONY SLOPE 5-7 P.Z.** R030XB072NV is found soils derived from colluvium and residuum from rhyolite and basalt where rock outcropings produce fragments larger than 10 inches, which cover more than 20% of the soil surface.
R030XB073NV	**VOLCANIC SLOPE 5-7 P.Z.** R030XB073NV is on warmer slopes with higher evapotranspiration rates which usually occur at elevations below 3800 ft (1150 m). Soils are similar between the two ecological sites but R030XB073NV contains a greater mix of plant species found in warmer climates with very little chance of black brush recovery from any disturbance and no monospecific stands of blackbrush in any community phase of this ecological site.

R030XB100NV	**GRAVELLY CLAYPAN 5-7 P.Z.** This site occurs on alluvial fans having a concave shape and with a calcic or petrocalcic horizon present or soil has a calcareous reaction class in the top 25 cm of the soil profile and generally below 3800 ft (1150 m).
R029XY010NV	**LOAMY SLOPE 8-10 P.Z.** R029XY010NV has a mesic soil temperature regime and a xeric-aridic moisture regime with a mean annual precipitation higher than 8 inches.
R029XY077NV	**SHALLOW GRAVELLY LOAM 8-10 P.Z.** R029XY077NV has a mesic soil temperature regime and a xeric-aridic moisture regime with a mean annual precipitation higher than 8 inches.
R030XB140CA	**Shallow Hill 4-6" P.Z.** R030XB140CA is found on warmer, drier slopes generally less than 3800 feet in elevation and likely on south aspects in map units where the R030XB076NV can be found. Mean annual precipitation for the R030XB140CA is roughly between 4-6 inches or effective precipitation is less than -800 mm.
R030XB151CA	**Shallow Gravelly Loam 5-7" P.Z.** R030XB151CA is found on soils derived from colluvium and residuum from granodiorite where rock outcrops produce fragments larger than 10 inches, which cover more than 20% of the soil surface.
R030XB028NV	**VALLEY WASH** R030XB028NV is a wash which drains soils below 3800 ft in elevation.
R030XB029NV	**SHALLOW GRAVELLY LOAM 5-7 P.Z.** R030XB029NV is found on adjacent erosional fan remnants in the upper fan piedmont.
R030XB068NV	**LIMESTONE HILL 5-7 P.Z.** R030XB068NV shallow soils formed in residuum and colluvium from limestone and dolomite where fragments larger than 10 inches cover more than 15% of the soil surface.
R030XB102NV	**GRAVELLY LOAM 5-7 P.Z.** This site occurs on alluvial fans with a calcic or petrocalcic horizon present in the top 25 cm of the soil profile.
R030XB172CA	**Warm Gravelly Shallow Hills** R030XB172CA is found on warmer slopes, generally below 3800 ft where mafic igneous rock outcrops produce fragments over 10 inches which cover more than 15% of the soil surface.
R029XY009NV	**UPLAND WASH** R029XY009NV has a mesic soil temperature regime and a xeric-aridic moisture regime with a mean annual precipitation higher than 8 inches.
R030XB164CA	**Steep South Slopes** R030XB164CA is found on warmer steep slopes, generally less than 4000 ft elevation, with slopes generally greater than 30% slope. Surface fragments larger than 3/4 inch cover more than 80% of the soil surface. Volcanic rock outcrops, including plutonic rock types, are common in and around this ecological site. Soil temperatures for this site are likely hyperthermic even at higher elevations due to aspect, larger heat storage due to larger fragments and higher solar radiation due to slope.
R030XA044NV	**LOAMY HILL 5-7 P.Z.** R030XA044NV is an ecological more likely to be common in MLRA 29 where annual average minimum temperatures are less than 5 degrees C. This site occurs in Plant Hardiness Zone 7b and cooler.
R030XA061NV	**LOAMY 5-7 P.Z.** R030XA061NV is an ecological more likely to be common in MLRA 29 where annual average minimum temperatures are less than 5 degrees C. This site occurs in Plant Hardiness Zone 7b and cooler.
R030XB009CA	**Loamy Cool Aridic Fans 6-8** R030XB009CA is found on adjacent buried fan remnants, non-buried fan remnants, fan aprons, or other landforms which are not an erosional fan remnant and where washes do not deeply dissect the landscape. R030XB009CA soils are derived from alluvium from mixed sources, usually from volcanic and/or metamorphic rock types but not alluvium from limestone.
R030XB030NV	**SHALLOW LIMESTONE SLOPE 5-7 P.Z.** R030XB030NV has shallow soils which developed in colluvium and residuum derived from limestone or dolomite where fragments larger than 10 inches cover less than 15% of the soil surface. A calcic or petrocalcic horizon is likely to be present.

R030XB039NV	**LIMY FAN 5-7 P.Z.** R030XB039NV is found on warmer, drier adjacent buried fan remnants, non-buried fan remnants, fan aprons, or other landforms which are not an erosional fan remnant and where washes do not deeply dissect the landscape. Mean annual precipitation for this site is between 6-8 inches however effective precipitation for R030XB039NV is less than -800 mm. R030XB039NV soils are derived from alluvium of volcanic or limestone origins where soils either have a calcareous reaction class or a calcic or petrocalcic horizon.
R030XB047NV	**ALLUVIAL PLAIN** R030XB047NV occurs within the playa landscape on lake plain or alluvial flat landforms where there is rare to no ponding and having sodic soils where the electrical conductivity is generally below 4 deciSiemens/meter and sodium adsorption ratio greater than 13.
R030XB052NV	**RUBBLY OUTWASH** R030XB052NV is an inset fan, generally above 3800 feet which drains cool thermic soils where the average sum of July, August and September precipitation does not exceed more than 2.5 inches.
R030XB056NV	**SHALLOW GRANITIC SLOPE 5-7 P.Z.** R030XB056NV soils form in colluvium and residuum derived from igneous and plutonic metamorphosed material where the material is intrusive, felsic and where fragments greater than 3 inches in width cover more than 15% of the soil surface.
R030XB070NV	**VOLCANIC HILL 5-7 P.Z.** R030XB070NV soils form in colluvium and residuum derived from igneous and plutonic metamorphosed material where the material is extrusive, felsic and where fragments greater than 3 inches in width cover more than 15% of the soil surface.
R030XB108NV	**GRAVELLY INSET FAN 7-9 P.Z.** This site occurs on alluvial fans having a concave shape and with a calcic or petrocalcic horizon present or soil has a calcareous reaction class in the top 25 cm of the soil profile and generally above 3800 ft (1150 m).
R030XB139CA	**Shallow Dry Hill 4-6 P.Z.** R030XB139CA is the hyper-thermic or more arid equivalent to R030XB076NV and R030XB073NV. High gravel cover is likely to contribute to the development of a weak vesicular horizon and a hydrophobic soil surface. R030XB139CA is most likely to occur on steep south facing slopes within the 3000-4000 elevational range for the R030XB076NV ecological site, where large surface fragments, fragments greater than 3/4, cover less than 80% of the area and cobble, stone and boulder cover is less than 15%.
R030XC047CA	**Bi-Modal Semi-Arid Order 3 Ephemeral Wash** R030XC047CA is an order 2-3 ephemeral stream, generally above 4000 feet, which drains bi-modal xeric-aridic soils with a thermic soil temperature regime where the sum of July, August and September precipitation exceeds 2.5 inches.
R030XC235CA	**Limestone Fan Remnants (Provisional)** R030XC235CA occurs on alluvial fans composed of alluvium from limestone or volcanic sources where soils are moderately deep or deeper and the sum of July, August and September precipitation exceeds 2.5 inches.
R030XC236CA	**Lithic Slopes** R030XC236CA occurs on nearby slopes of volcanic origins where the soils are very shallow to deep with surface fragments larger than 3 inches covering more than 15% of the soil surface. The sum of July, August and September precipitation exceeds 2.5 inches.
R030XB187CA	**Rarely Flooded Warm Thermic Ephemeral System** R030XB187CA is a small wash with headwaters generally above 3800 meters elevation. Although this wash is small, water flow during flash flood events is strong enough to create various patterns of flooding disturbance. Soils in and around this wash generally have no argillic or calcic horizons creating a very deep sandy wash.
R030XC011NV	**GRAVELLY INSET FAN 7-9 P.Z.** R030XC011NV is found on cooler inset fans and small ephemeral streams where flooding disturbance does not destroy calcic horizons within the soil profile nor long lived plant species such as blackbrush. The soil moisture regime is xeric-aridic and the sum of July, August and September precipitation exceeds 2.5 inches.
R030XC238CA	**Bi-Modal Semi-Desert Deep Fans 8-10 inches** R030XC238CA occurs on alluvial fans derived predominantly from granitic sources. If alluvium is not from granitic sources, there is no diagnostic horizon present.

R030XB005NV	**Arid Active Alluvial Fans** R030XB005NV is found on adjacent alluvial fans with a mean annual precipitation between 4-6 inches and where the effective precipitation is less than -800 mm.
F029XY065NV	**PIMO-JUOS/ARTRW8** F029XY065NV has a mesic soil temperature regime and a xeric-aridic moisture regime with a mean annual precipitation higher than 8 inches.
F030XC250NV	**Singleleaf Pinyon Pine Forestland** F030XC250NV has a mesic soil temperature regime and a xeric-aridic moisture regime with a mean annual precipitation higher than 8 inches.

Similar sites

R030XB029NV	**SHALLOW GRAVELLY LOAM 5-7 P.Z.** R030XB029NV is found on adjacent erosional fan remnants in the upper fan piedmont.
R029XY179CA	**SHALLOW GRANITIC SLOPE 5-8 P.Z.** Conceptually the same ecological site.
R030XB071NV	**VOLCANIC SLOPE 7-9 P.Z.** Conceptually the same ecological site.
R030XB166CA	**Dissected Pediment, Cool** Conceptually the same ecological site.
R030XB189CA	**Shallow Cool Hills** Conceptually the same ecological site.
R030XB193CA	**Very Shallow To Moderately Deep Gravelly Slopes** Conceptually the same ecological site.
R030XB213CA	**Moderately Deep Gravelly Mountain Slopes** Conceptually the same ecological site.
R029XY180CA	**SHALLOW GRAVELLY SLOPE 5-8" P.Z.** Conceptually the same ecological site.
R030XA095NV	**SHALLOW GRAVELLY SLOPE 5-7 P.Z.** Conceptually the same ecological site.
R030XB057NV	**SHALLOW GRANITIC LOAM 5-7 P.Z.** Conceptually the same ecological site.
R030XB070NV	**VOLCANIC HILL 5-7 P.Z.** Conceptually the same ecological site.
R030XC236CA	**Lithic Slopes** R030XC236CA occurs on nearby slopes of volcanic origins where the soils are very shallow to deep with surface fragments larger than 3 inches covering more than 15% of the soil surface. The sum of July, August and September precipitation exceeds 2.5 inches.
R030XB151CA	**Shallow Gravelly Loam 5-7" P.Z.** R030XB151CA is found on soils derived from colluvium and residuum from granodiorite where rock outcrops produce fragments larger than 10 inches, which cover more than 20% of the soil surface.
R030XB073NV	**VOLCANIC SLOPE 5-7 P.Z.** R030XB073NV is on warmer slopes with higher evapotranspiration rates which usually occur at elevations below 3800 ft (1150 m). Soils are similar between the two ecological sites but R030XB073NV contains a greater mix of plant species found in warmer climates with very little chance of black brush recovery from any disturbance and no monospecific stands of blackbrush in any community phase of this ecological site.
R030XB072NV	**STONY SLOPE 5-7 P.Z.** R030XB072NV is found on similar soils near rock outcrops where surface fragments larger than 10 inches cover more than 20% of the soil surface.
R030XC170CA	**Bouldery Slopes** R030XC170CA occurs on slopes with soils derived from colluvium and/or residuum from granitic sources or gneiss where rock outcrops produce stones and boulders which cover more than 15% of the surface area.

R030XC189CA	**Bi-Modal Semi-Arid Shallow Cool Hills** R030XC189CA occurs on slopes with soils derived from colluvium and/or residuum from granitic sources or gneiss stones and boulders cover less than 15% of the surface area.
R030XC234CA	**Fine-Loamy Very Deep Slopes** R030XC234CA occurs on slopes with very deep soils derived from colluvium and/or residuum from volcanic sources. Soils have an argillic horizon and cobbles and stones cover less than 15% of the soil surface.
R030XB030NV	**SHALLOW LIMESTONE SLOPE 5-7 P.Z.** R030XB030NV has shallow soils which developed in colluvium and residuum derived from limestone or dolomite where fragments larger than 10 inches cover less than 15% of the soil surface. A calcic or petrocalcic horizon is likely to be present.
R030XB056NV	**SHALLOW GRANITIC SLOPE 5-7 P.Z.** R030XB056NV soils form in colluvium and residuum derived from igneous and plutonic metamorphosed material where the material is intrusive, felsic and where fragments greater than 3 inches in width cover more than 15% of the soil surface.
R029XY178CA	**SHALLOW CLAY LOAM 5-8 P.Z.** Conceptually the same ecological site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Coleogyne ramosissima*
Herbaceous	(1) *Pleuraphis rigida* (2) *Achnatherum speciosum*

Physiographic features

This site occurs on hill sideslopes on all exposures. Slopes range from 4 to 75 percent, but slope gradients of 15 to 50 percent are typical. Elevations are 3000 to 5000 feet.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Mountain (3) Mountain slope
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	None to occasional
Ponding frequency	None
Elevation	914–1,524 m
Slope	4–75%

Climatic features

The mean annual precipitation at this site is between 6 to 8 inches (150 to 200 mm) and the mean annual air temperature ranges from 56 to 63 degrees F (13-17 degrees C) across the elevation range of the site. For outlying areas just outside of this temperature and precipitation range, temperature and precipitation are directly proportional. For example, areas where climate models suggest the air temperature is higher than 17 degrees C should also show the area receives more than 8 inches of precipitation.

Precipitation amounts can vary greatly. Some years the mean annual precipitation can exceed 18 inches, other years the mean annual precipitation can be less 4 inches. The Society of Range Management (1989) define drought as "... prolonged dry weather when precipitation is less than 75% of the average amount". By this definition, it is not uncommon for this site to experience drought every 2 to 5 years. Some decades can pass with no drought and other decades may have several consecutive years of drought. Precipitation is bi-modal with most of the precipitation occurring during the winter and summer months. June, like much of the Mojave Desert and areas west of the Mojave, is typically the driest month of the year with mean temperatures near 80 degrees F. June, July and August are the hottest months of the year and can have maximum maximum temperatures above 100 degrees F. Minimum minimum temperatures can be below 32 degrees F from November to April. The maximum maximum and minimum minimum temperatures should not be confused with average maximum and minimums below.

The climate summary for this ESD was generated using the Climate Summarizer (http://www.nm.nrcs.usda.gov/technical/handbooks/nrph/Climate_Summarizer.xls) using data from the following climate stations: 26739, SEARCHLIGHT, NV (Period of record = 1914 to 2016) [2]; 045721-7 MITCHELL CAVERNS (Period of record = 1958 to 2011) [1]; and 262251, MERCURY DESERT ROCK AP(Period of record = 1978 to 2016) [1]. The data from multiple weather stations were combined to most accurately reflect the climatic conditions of this ecological site. These weather stations occur at the low-elevation range of this ecological site while Mitchell Caverns is higher in elevation than the elevation range of this site.

Table 3. Representative climatic features

Frost-free period (average)	244 days
Freeze-free period (average)	291 days
Precipitation total (average)	203 mm

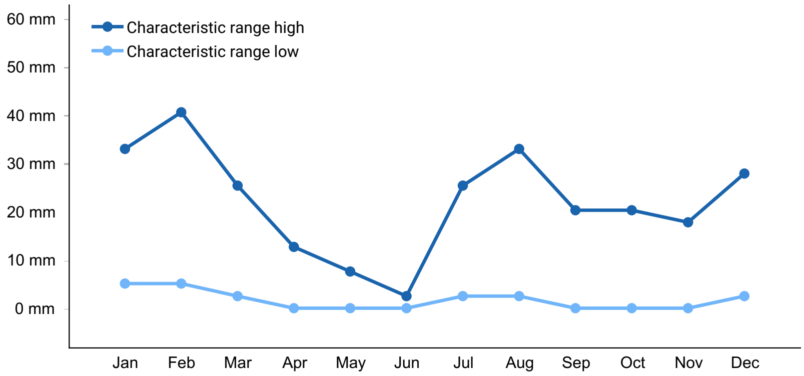

Figure 1. Monthly precipitation range

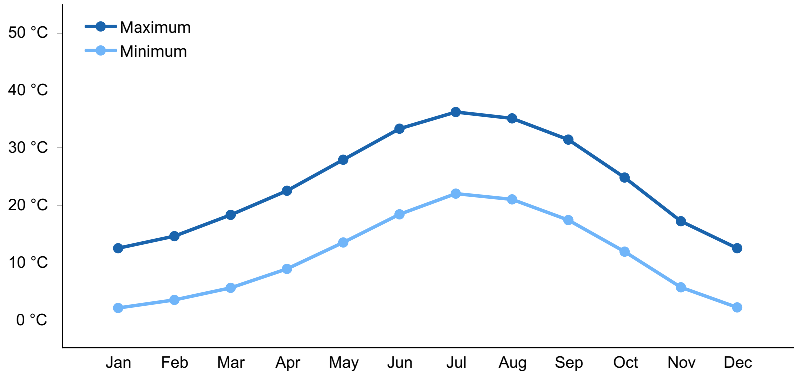

Figure 2. Monthly average minimum and maximum temperature

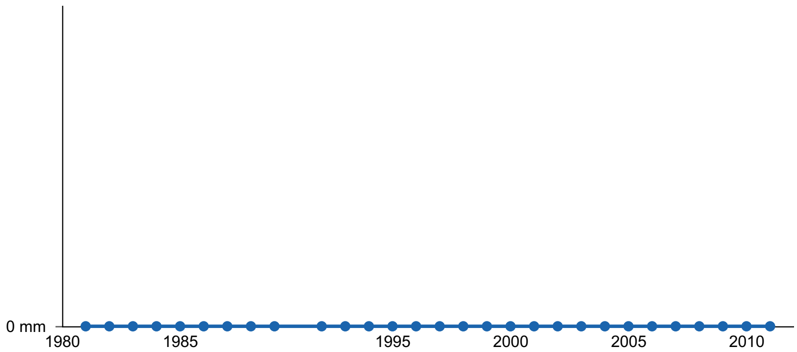

Figure 3. Annual precipitation pattern

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils associated with this site are well drained to somewhat excessively drained and shallow or contain an argillic horizon within the top 25 cm which act as an aquatard and has the hydrological characteristics of a shallow soil. Parent material is colluvium and residuum derived from mafic igneous and plutonic metamorphosed material such as basalt, rhyolite, granodiorite and gneiss. Soil surface textures are medium to moderately coarse textured sandy loams, loamy sands and fine sandy loams. Gravel and cobble-sized rock fragment surface cover typically exceeds 50 percent. Permeability rates are very slow to moderately rapid with runoff is very low to very high.

Table 4. Representative soil features

Parent material	(1) Colluvium–rhyolite (2) Residuum–basalt
Surface texture	(1) Very gravelly sandy loam (2) Extremely gravelly loamy sand (3) Cobbly fine sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Very slow to moderately rapid
Soil depth	10–381 cm
Surface fragment cover <=3"	40–80%
Surface fragment cover >3"	2–55%
Available water capacity (0-101.6cm)	0.51–6.6 cm
Calcium carbonate equivalent (0-101.6cm)	0–40%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–12
Soil reaction (1:1 water) (0-101.6cm)	6.9–9
Subsurface fragment volume <=3" (Depth not specified)	0–62%
Subsurface fragment volume >3" (Depth not specified)	0–13%

Ecological dynamics

This ecological site is above the creosote (*Larrea tridentata*) and blackbrush (*Coleogyne ramosissima*) eco-tone where nearly monospecific stands of blackbrush exist. Cooler temperatures and higher amounts of precipitation exclude creosote bush from establishing at this site. At the lowest elevations and steep south aspects of this ecological site creosote bush is likely to become established due to warmer and drier soils which may occur from vegetation removal and periodically warmer climate. Joshua Tree (*Yucca brevifolia* var. jaegeriana) is often an emergent canopy species which contributes little to vegetation cover and biomass production.

Typical disturbance for this ecological site include prolonged severe drought and fire. Prior to European colonization of the Mojave Desert, widespread fire was an unlikely event due to the lack of a continuous fuel layer. Small burned areas were probably common due to the intense lightning storms which occur at this site and indigenous land management practices (Papierski 1993).

Several bands of Chemehuevi (Hokwaits, Kauyaichits, and the Timpashauwagotsits) spent time in and around the Providence and New York Mountains. These indigenous groups are reported to have employed fire as a hunting technique to capture rabbits and deer (Miller and Miller 1967). Laird (1984) also describes Chemehuevi tales where fire was used to improve the growth and quality of basketry materials as well as to char seeds to be eaten.

Fire frequency and extent may have increased at this ecological site following the arrival of homesteaders in the Mojave. In the 1930s (and probably earlier) ranchers noticed wildfires increased forage production in some areas of this ecological site and adopted fire as tool to increase forage for livestock (Brooks et. al 2007). As a result, a great portion of this ecological site is likely to have been subjected to various fire intensities, seasonality and interval since last fire.

Disturbance at this site can create a variety of responses with an overall trend in reduction of blackbrush and an increase in pioneering and ephemeral species. At the lower elevations white bursage and creosote bush are likely to replace blackbrush following disturbance. At the higher elevations of this ecological site, Eastern Mojave buckwheat (*Eriogonum fasciculatum* var. polifolium) as well as many other pioneering shrubs are likely to increase post disturbance. At all elevations species like spiny menodora (*Menodora spinescens*) and Mormon tea (*Ephedra nevadensis*) are likely to persist following fire while grasses and Yuccas may increase following fire (Gorder et al. 2005, Brooks 2009, Abella 2009 and Abella et al. 2009).

Some areas of this ecological site are devoid of Joshua trees which could be the result of several factors. Joshua trees thrive in Plant Hardiness Zones 8b and cooler (Grant 2015). Areas of this ecological site in Plant Hardiness Zones 9a and warmer are devoid of Joshua trees. Blackbrush is often a nurse plant for Joshua trees and, in areas where blackbrush rarely experiences drought deciduous behavior, healthy blackbrush may prevent Joshua trees from getting the full sunlight they need during the summer (Brittingham and Walker 2000; Cole et. Al 2011; Hickman 1993). Additionally, early settlers intentionally removed Joshua trees for steam engine fuel, fences and corrals (Rodgers 2015).

State and transition model

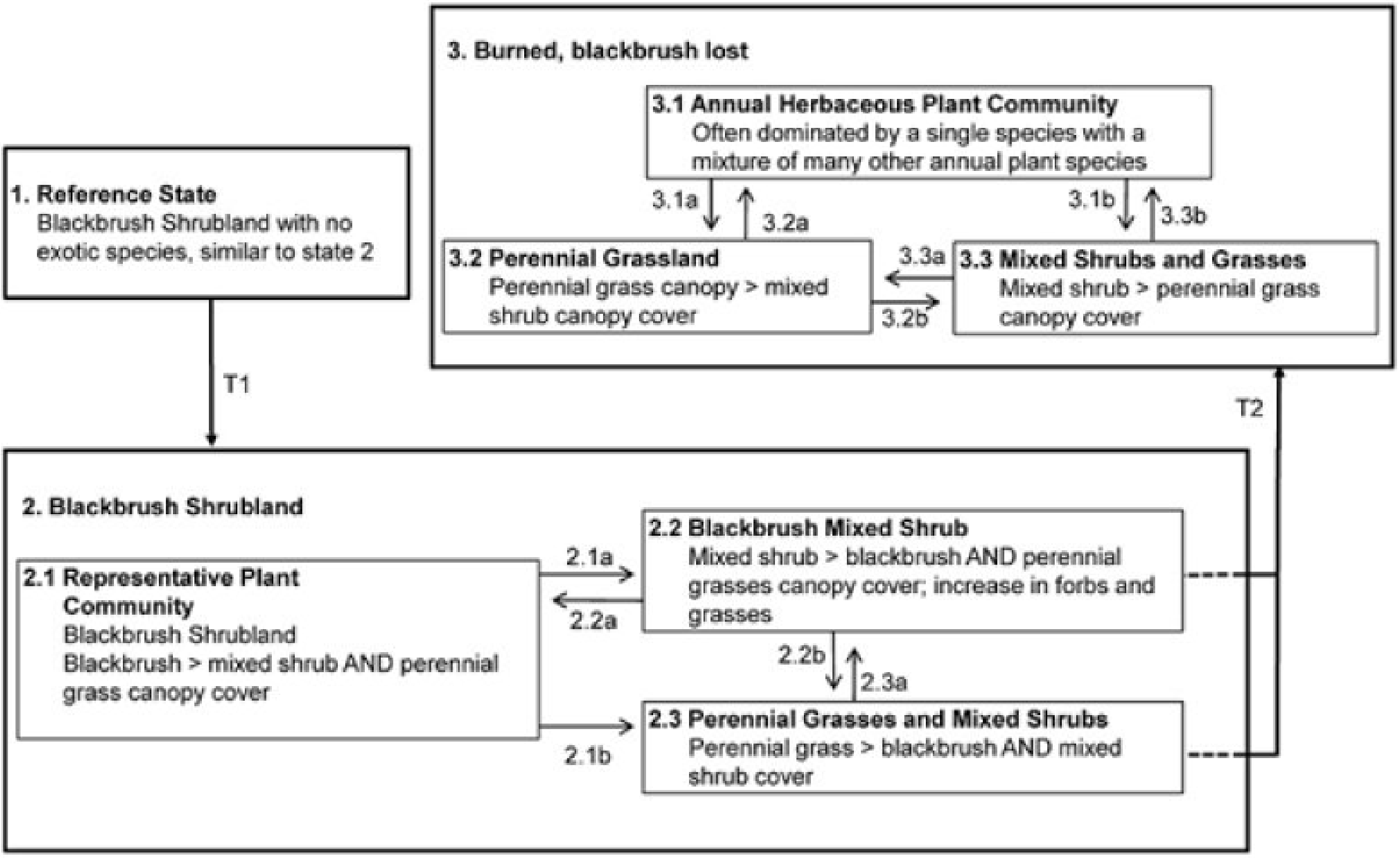

Figure 5. R030XB029NV

State 1
Reference Plant Community

State 1 represents the historic-natural condition for this ecological site. It is similar to State 2, but non-native species are not present. Data is not available for this State. Plant community composition is similar to State 2 but without the presence of annual exotics species such as red brome and redstem stork's bill.

State 2
Blackbrush Shrubland

Non-native annuals, including red brome (*Bromus rubens*) and red-stem storks bill (*Erodium cicutarium*) are naturalized in this state. Their abundance varies with precipitation but they are, at a minimum, sparsely present. Non-native annuals may be present in current year's growth or in the soil seedbank. This ecological state has a long history of livestock grazing which is likely to have obscured our understanding of state and community pathways as well as vegetation composition. Given that this ecological site is at higher elevations of the Mojave Desert and can support perennial bunch grasses, unlike the more harsh and arid Mojave Desert environments, this ecological site would have been attractive to early livestock operations in the Mojave.

Community 2.1
Representative Plant Community

Figure 6. Representative Plant Community

Monospecific blackbrush stands often exist with few other species scattered throughout the stand and under blackbrush canopies. Blackbrush as a climax species is supported by West (1969), Provenza and Urness (1981) and Jeffries and Klopatek (1987) but solid stands may have developed as livestock grazing removed more palatable grasses and shrubs (Bowns and West 1976b, Plummer et. al 1968).

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	280	364	560
Grass/Grasslike	–	25	106
Forb	–	–	6
Total	**280**	**389**	**672**

Community 2.2
Blackbrush Mixed Shrub

Figure 8. Community Phase 2.2 representative area

Response to fire is unpredictable and can vary greatly depending on the climatic conditions at the time of fire, dynamic soil properties as well as varying land uses pre and post-fire (Bowns and West 1976a). The overall response is decreased blackbrush cover and an increase in mixed shrub and herbaceous cover. Grazing this community phase will tend to maintain a mixed shrub cover by removing the more palatable grasses. Shrub dominance may also indicate an older burn, greater than 15 years (Bates 1983, Callison et. al 1985). At the higher elevations of this ecological site, low intensity burns may also increase the number of individual Joshua trees which have been reported to sprout vigorously post fire (Gorder et al. 2005). Fire at the lower elevations of this ecological site are likely to reduce or remove Joshua tree (Minnich 2003). Mojave yucca (*Yucca schidigera*) and banana yucca (*Yucca baccata*) are likely to increase following fire (Abella 2009 and Abella et al 2009). Eastern Mojave buckwheat is commonly very abundant in this community phase. Parish's goldeneye (*Viguiera parishii*), spiny menodora (*Menodora spinescens*), buck-horn cholla (*Cylindropuntia acanthocarpa*), littleleaf ratany (*Krameria erecta*), turpentinebroom (*Thamnosma montana*), burrobrush (*Hymenoclea salsola*) and water jacket (*Lycium andersonii*) are common shrubs in this community phase. Sixweeks grama (*Bouteloua barbata*) is a common annual grass and desert globemallow (*Sphaeralcea ambigua*) is a common forb in this community phase. Red brome (*Bromus rubens*) and redstem stork's bill (*Erodium cicutarium*) are common exotic species found in this community phase. This is an at risk community phase. The loss of blackbrush cover can allow interspaces to become occupied by a more continuous plant cover which can help spread fire (D'Antonio and Vitousek 1992, Brooks and Matchett 2003, Brooks et al. 2004, Brooks and Matchett 2006). If the fire return interval is less than 100 years, this community is very likely to transition to State 3.

Community 2.3
Perennial Grasses and Mixed Shrubs

Response to fire is unpredictable and can vary greatly depending on the climatic conditions at the time of fire, dynamic soil properties as well as varying land uses pre and post-fire (Bowns and West 1976a). The overall response is decreased blackbrush cover and an increase in mixed shrub and herbaceous cover, especially perennial grasses. At the higher elevations of this ecological site, low intensity burns may also increase the number of individual Joshua trees which have been reported to sprout vigorously post fire (Gorder et al. 2005). Fire at the lower elevations of this ecological site are likely to reduce or remove Joshua tree (Minnich 2003). Mojave yucca and banana yucca are likely to increase following fire (Abella 2009 and Abella et al 2009). Big galleta (*Pleuraphis rigida*) is often the most abundant perennial grass but desert needlegrass (*Achnatherum speciosum*) or mesa dropseed (*Sporobolus flexuosus*) may also be abundant. Eastern Mojave buckwheat may also be an abundant shrub in this community phase. Parish's goldeneye, spiny menodora, buck-horn cholla, littleleaf ratany, turpentinebroom, burrobrush and water jacket are common shrubs in this community phase. Sixweeks grama is a common annual grass and desert globemallow is a common forb in this community phase. Red brome and redstem stork's bill are common exotic species found in this community phase. Grazing this community phase is likely to increase mixed shrub cover. Grass dominance may also indicate a middle aged burn (> one year and < 15 years) while older fires are likely to be dominated by shrubs (Callison et. al 1985). This is also an at risk community phase. The loss of blackbrush cover allows interspaces to become occupied by a more continuous herbaceous and shrub cover which can help spread fire (D'Antonio and Vitousek 1992, Brooks and Matchett 2003, Brooks et al. 2004, Brooks and Matchett 2006). If the fire return interval is less than 100 years, this community is very likely to transition to State 3.

Pathway 1a
Community 2.1 to 2.2

Representative Plant Community

→

Blackbrush Mixed Shrub

Occurs with low intensity, patchy fire during early summer or drought years when perennial grasses are dry. This pathway can also occur with other forms of patchy blackbrush removal such as heavy grazing and an increase in flooding intensity.

Pathway 1b
Community 2.1 to 2.3

Occurs with low intensity, patchy fire occurring between late summer and early spring when perennial grasses are green or dormant. This community phase pathway may occur with other forms of patchy blackbrush removal such as heavy grazing and an increase in flooding intensity.

Pathway 2a
Community 2.2 to 2.1

Blackbrush Mixed Shrub

Representative Plant Community

Over time (>20 years), absent the disturbance which removed blackbrush, with the occurrence of mast seed crops followed by favorable climatic conditions, monospecific stands of blackbrush may dominate the landscape. Moderate to heavy winter precipitation is likely to favor mast seed production (Beatley 1974). Livestock grazing may accelerate this transition by removing herbaceous competition (Jeffries and Klopatek 1987).

Pathway 2b
Community 2.2 to 2.3

Given favorable climatic conditions, a seed source and rest from grazing pressures; perennial grass establishment may begin to take place.

Pathway 3a
Community 2.3 to 2.2

Over time, approximately more than 15 years since last fire, shrubs increase and perennial grasses decrease.

State 3
Burned, blackbrush lost

This state exists when blackbrush is lost from the community as a result of large-scale and high intensity fires, where blackbrush seed source is not available to recolonize, and/or recurrent fire does not provide intervals long enough for blackbrush recovery. Evidence suggests that Indigenous land management practices were employed in and around this ecological site for several reasons, which include increasing the number of individual Mojave yucca (*Yucca schidigera*) and banana yucca (*Yucca baccata*) plants. Several bands of Chemehuevi (Hokwaits, Kauyaichits, and the Timpashauwagotsits) spent time in and around the Providence and New York Mountains and are reported to have employed fire as a hunting technique to capture rabbits and deer (Miller and Miller 1967). Laird (1984) also describes Chemehuevi tales where fire was used to improve the growth and quality of basketry materials as well as to char seeds to be eaten. Whether intentional or not, the greatest differences recorded between pre- and post-fire vegetation demographics, aside from the blackbrush removal, is an increase in *Yucca schidigera* and *Yucca baccata* individuals. S.R. Abella (2009) found Mojave yucca (*Yucca schidigera*) to exhibit the highest post-fire sprouting rate than any other plant species in a study of post-fire recovery in the Mojave and Sonoran Deserts. Abella et al (2009) also described vigorous *Yucca baccata* and schidigera resprouting following a Mojave Desert burn. In yet another study of post-fire effects, a similar yucca (*Yucca glauca*) increased the number of rosettes, from pre-burn, by 17% two years following the experimental fire (Parmenter 2008). Many tribes such as the Chemehuevi used Yucca species for food, soap, baskets, bowstrings, sandals and many other items (Bean and Saubel 1972).

Community 3.1
Annual Herbaceous Plant Community

This community phase is dominated by annual grasses and forbs. This community phase could last for 2 to 3 years following fire depending on the intensity of the fire, the extent of the fire, weather conditions following the fire and the elevation of the fire (Bates 1983). This community phase could be short lived at this ecological site's highest elevations and may persist for longer periods at the lower elevations.

Community 3.2
Perennial Grassland

Although perennial grasses dominate this community phase, shrubs can be relatively abundant. This community phase, especially following favorable climatic conditions, is susceptible to repeated burning.

Community 3.3
Mixed Shrubs and Grasses

Although shrubs dominate this site, perennials grasses may be relatively abundant. Heavy grazing and drought will reduce perennial grass cover and maintain a mixed shrub plant community. For these reasons, southwardly facing and slightly drier areas will tend to have more shrubs while northwardly facing and moister areas tend to have more grasses.

Pathway 1a
Community 3.1 to 3.2

With 10-15 years following fire, perennial grasses and shrubs will become established (Bates 1983). Perennial grasses are likely to dominate sites with light livestock utilization (Hughes 1982).

Pathway 1b
Community 3.1 to 3.3

With 25-20 years following fire, shrubs are likely to dominate the sites (Bates 1983). Shrubs may dominate sooner than 25-30 years if the site has experienced heavy livestock use as perennial grasses in the Mojave tend to not recover following heavy utilization (Hughes 1982).

Pathway 2a
Community 3.2 to 3.1

A high intensity fire will return this community phase to an annual herbaceous plant community.

Pathway 2b
Community 3.2 to 3.3

With time, shrubs stabilize the soil surface and allow shrub islands to develop, eventually dominating the site (Bates 1983). Heavy livestock grazing will reduce big galleta and black grama cover (Nelson 1934, Canfield 1939, Miller and Donart 1979, Hughes 1982). Shrub dominance can be merely by grass removal but also by reduced competition from the grasses. Another mechanism which triggers this pathway is severe drought. Black grama cover is reduced by drought (Gibbens and Beck 1988). The combination of repeated burns and grazing may effectively increase soil temperature producing a localized drought which excludes or reduces black grama cover (Vermeire et al. 2005).

Pathway 3b
Community 3.3 to 3.1

A high intensity fire will return this community phase to an annual herbaceous plant community.

Pathway 3a
Community 3.3 to 3.2

Rest from livestock grazing can increase perennial grass cover in less than 15 years (Hughes 1990, Parmenter 2008.). Drought will limit the ability of this community phase pathway to occur. Shrub control is likely necessary to convert and maintain at least a semi-grassland community (Gibbens et al. 2005). Low intensity fires are another mechanism triggering this community phase.

Transition T1
State 1 to 2

Introduction of non-native species due to a combination of factors including; surface disturbance, changes in the kinds of animals and their grazing patterns, drought, changes in fire history or any other type of vegetation removal. Non-natives can alter disturbance regimes significantly from their natural or historic range and change ecological processes therefore creating an unlikely scenario to restore the site back to reference.

Transition T2
State 2 to 3

This transition occurs when large scale, high intensity fire has removed blackbrush from the site and surrounding areas.

Additional community tables

Table 6. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
1	**Shrubs**			280–616	
	blackbrush	CORA	*Coleogyne ramosissima*	168–476	15–35
	Eastern Mojave buckwheat	ERFAP	*Eriogonum fasciculatum var. polifolium*	0–101	0–2
	Mojave yucca	YUSC2	*Yucca schidigera*	0–56	0–4
	Nevada jointfir	EPNE	*Ephedra nevadensis*	0–45	0–3
	California barrel cactus	FECY	*Ferocactus cylindraceus*	0–45	0–2
	spiny menodora	MESP2	*Menodora spinescens*	0–45	0–2
	buck-horn cholla	CYAC8	*Cylindropuntia acanthocarpa*	0–39	0–5
	turpentinebroom	THMO	*Thamnosma montana*	0–33	0–3
	banana yucca	YUBA	*Yucca baccata*	0–17	0–1
	narrowleaf goldenbush	ERLI6	*Ericameria linearifolia*	0–6	0–1
	beavertail pricklypear	OPBA2	*Opuntia basilaris*	0–2	0–1
Grass/Grasslike					
2	**Perennial grasses**			0–22	
	low woollygrass	DAPU7	*Dasyochloa pulchella*	0–22	0–2
	desert needlegrass	ACSP12	*Achnatherum speciosum*	0–11	0–1
	big galleta	PLRI3	*Pleuraphis rigida*	0–6	0–1
3	**Annual grasses**			0–112	
	sixweeks grama	BOBA2	*Bouteloua barbata*	0–112	0–30
	sixweeks threeawn	ARAD	*Aristida adscensionis*	0–6	0–3
5	**Non-native grasses**			0–6	
	red brome	BRRU2	*Bromus rubens*	0–6	0–10
Forb					
4	**Non-native forbs**			0–6	
	redstem stork's bill	ERCI6	*Erodium cicutarium*	0–6	0–1

Animal community

Livestock Interpretations:
This site has limited value for livestock grazing, due to the low forage production, steep slopes and stony surfaces. Big galleta is considered a valuable forage plant for cattle and domestic sheep. Its coarse, rigid culms make it relatively resistant to heavy grazing and trampling. Desert needlegrass produces considerable basal foliage and is good forage while young. Young desert needlegrass is palatable to all classes of livestock. Mature herbage is moderately grazed by horses and cattle but rarely grazed by sheep. 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. Bush muhly is readily eaten by livestock throughout the year when available; however, it is usually not abundant enough to provide much forage. It is grazed heavily in winter when other species become scarce. Because of its branching habit, it is extremely susceptible to heavy grazing. Bush muhly is damaged when continuously grazed to a stubble height of less than 4 inches (10 cm). Blackbrush areas are economically important for winter grazing by domestic livestock, especially sheep. But it does provide poor forage during the spring, summer, and fall for domestic cattle, horses, and domestic sheep. Creosotebush is unpalatable to livestock. Consumption of creosotebush may be fatal to sheep.

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:
Blackbrush areas are economically important for winter grazing primarily for several wildlife species. Mule deer and bighorn sheep generally use the blackbrush vegetation type in winter. Creosotebush is unpalatable to most browsing wildlife. Desert bighorn sheep and feral horses and burros will graze desert needlegrass. Indian ricegrass is eaten by pronghorn in "moderate" amounts whenever available. In Nevada it is consumed by desert bighorns. 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. In Nevada, Indian ricegrass may even dominate jackrabbit diets during the spring through early summer months. 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. The palatability of bush muhly for wildlife species is rated fair to poor.

Hydrological functions

Water intake rates are moderately rapid, available water capacity is low, runoff is medium to rapid and soils are well drained.

Other products

Indian ricegrass was traditionally eaten by some Native Americans. The Paiutes used seed as a reserve food source. Creosotebush has been highly valued for its medicinal properties by Native Americans. It has been used to treat at least 14 illnesses. Twigs and leaves may be boiled as tea, steamed, pounded into a powder, pressed into a poultice, or heated into an infusion.

Other information

Big galleta's clumped growth form stabilizes blowing sand. Desert needlegrass may be used for groundcover in areas of light disturbance, but it is susceptible to excessive trampling. Once established, creosotebush may improve sites for annuals that grow under its canopy by trapping fine soil, organic matter, and symbiont propagules. It may also increase water infiltration and storage.

Inventory data references

High intensity sampling (Caudle et al. 2013) was used to describe this ecological site. Site characteristics such as aspect, slope, elevation and UTMS were recorded for each plot, along with complete species inventory by ocular percent cover. The line-point intercept method was used to measure foliar cover, groundcover, and vegetation structure. At either 300 or 100 points along a 600- or 400-foot step transect, ground cover and intercepted plant species were recorded by height. The first hit method (Herrick et al. 2009) was used to generate the foliar cover values entered in the community phase composition tables. Annual production was estimated using the double-weight sampling method outlined in the 2003 National Range and Pasture Handbook. For herbaceous vegetation, ten 9.6 square foot circular sub-plots were evenly distributed along a 200 foot transect. For woody and larger herbaceous species production was estimated in four 21’X21’ square plots along the same transect. Weight units were collected for each species encountered in the production plots. The number of weight units for each species is then estimated for all plots.

Type locality

Location 1: Clark County, NV	
Township/Range/Section	T26S R63E S25
General legal description	Lower hills on east side of Eldorado Valley, Clark County, Nevada.

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Contributors

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Approval

Sarah Quistberg, 2/26/2025

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)	Dustin Detweiler
Contact for lead author	Dustin Detweiler
Date	05/05/2017
Approved by	Sarah Quistberg
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are none to rare, and may be evident in areas recently subject to intense summer rainfall and on steeper slopes

2. **Presence of water flow patterns:** Water flow patterns none to rare and may be evident in areas recently subject to intense summer rainfall and on steeper slopes. These are short (<1m) and not connected.

3. **Number and height of erosional pedestals or terracettes:** Pedestals are none.

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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 to 0-10% 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 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 weak medium sized subangular blocky. Dry soil surface colors are dull yellowish browns and are typified by an ochric epipedon. Soil surface thickness is typically less than 10 cm with less 1 percent organic matter.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Shrub cover protects bare ground from splash erosion while blackbrush structure does little to protect soil from sheet erosion. Shrub interception reduces runoff. In addition to shrub stem flow, annual plant species in the shrub interspaces as well as heavy armoring by surface fragments may increase infiltration.

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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):** None. Subsoil horizons with massive structure are not be mistaken for compaction.

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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: Mojave Desert shrubs

    Sub-dominant:

    Other: annual grasses >> perennial grasses > annual forbs

    Additional:

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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; annual species standing dead is also common and can make up as much as 15% of the litter.

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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):** Annual production should be expected to fluctuate greatly due to both spatial and temporal climatic variability. Mean annual precipitation from year to year can be as high as 20 inches or as low as 3 inches with spatial variability being nearly as drastic. Approximately one third of the years between 1981-2010 received precipitation amounts below the drought level. Production values are estimated assuming that ideal climatic conditions have led to healthy plant production. Production across the range of this site can vary from 250 to 500 lbs/acre with 375 lb/acre being a representative value.

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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 on this site include red brome and red-stem filaree.

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