# Ecological site R026XY012NV
# DRY FLOODPLAIN 8-10 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): 026X–Carson Basin and Mountains

The area lies within western Nevada and eastern California, with about 69 percent being within Nevada, and 31 percent being within California. Almost all this area is in the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. Isolated north-south trending mountain ranges are separated by aggraded desert plains. The mountains are uplifted fault blocks with steep side slopes. Most of the valleys are drained by three major rivers flowing east across this MLRA. A narrow strip along the western border of the area is in the Sierra Nevada Section of the Cascade-Sierra Mountains Province of the Pacific Mountain System. The Sierra Nevada Mountains are primarily a large fault block that has been uplifted with a dominant tilt to the west. This structure leaves an impressive wall of mountains directly west of this area. This helps create a rain shadow affect to MLRA 26. Parts of this eastern face, but mostly just the foothills, mark the western boundary of this area. Elevations range from about 3,806 feet (1,160 meters) on the west shore of Pyramid Lake to 11,653 feet (3,552 meters) on the summit of Mount Patterson in the Sweetwater Mountains.

Valley areas are dominantly composed of Quaternary alluvial deposits with Quaternary playa or alluvial flat deposits often occupying the lowest valley bottoms in the internally drained valleys, and river deposited alluvium being dominant in externally drained valleys. Hills and mountains are dominantly Tertiary andesitic flows, breccias, ash flow tuffs, rhyolite tuffs or granodioritic rocks. Quaternary basalt flows are present in lesser amounts, and Jurassic and Triassic limestone and shale, and Precambrian limestone and dolomite are also present in very limited amounts. Also of limited extent are glacial till deposits along the east flank of the Sierra Nevada Mountains, the result of alpine glaciation.

The average annual precipitation in this area is 5 to 36 inches (125 to 915 millimeters), increasing with elevation. Most of the rainfall occurs as high-intensity, convective storms in spring and autumn. Precipitation is mostly snow in winter. Summers are dry. The average annual temperature is 37 to 54 degrees F (3 to 12 degrees C). The freeze-free period averages 115 days and ranges from 40 to 195 days, decreasing in length with elevation.

The dominant soil orders in this MLRA are Aridisols and Mollisols. The soils in the area dominantly have a mesic soil temperature regime, an aridic or xeric soil moisture regime, and mixed or smectitic mineralogy. They generally are well drained, are clayey or loamy and commonly skeletal, and are very shallow to moderately deep.

This area supports shrub-grass vegetation characterized by big sagebrush. Low sagebrush and Lahontan sagebrush occur on some soils. Antelope bitterbrush, squirreltail, desert needlegrass, Thurber needlegrass, and Indian ricegrass are important associated plants. Green ephedra, Sandberg bluegrass, Anderson peachbrush, and several forb species also are common. Juniper-pinyon woodland is typical on mountain slopes. Jeffrey pine, lodgepole pine, white fir, and manzanita grow on the highest mountain slopes. Shadscale is the typical plant in the drier parts of the area. Sedges, rushes, and moisture-loving grasses grow on the wettest parts of the wet flood plains and terraces. Basin wildrye, alkali sacaton, saltgrass, buffaloberry, black greasewood, and rubber rabbitbrush grow on the drier sites that have a high concentration of salts.

Some of the major wildlife species in this area are mule deer, coyote, beaver, muskrat, jackrabbit, cottontail, raptors, pheasant, chukar, blue grouse, mountain quail, and mourning dove. The species of fish in the area include trout and catfish. The Lahontan cutthroat trout in the Truckee River is a threatened and endangered species.

## LRU notes

The Semiarid Fans and Basins LRU includes basins, alluvial fans and adjacent hill slopes immediately east of the Sierra Nevada mountain range and are affected by its climate or have its granitic substrate. Elevations range from 1355 to 1920 meters and slopes range from 0 to 30 percent, with a median value of 6 percent. Frost free days range from 121 to 170.

## Ecological site concept

The Dry Floodplain 8-10 P.Z. site occurs on alluvial flats/fans, fan remnants, lake terraces and stream terraces. Slopes range from 0 to 2 percent. Elevations are 4,200 to 5,500 feet. The soils are moderately deep to very deep, somewhat poorly drained to well drained, and are formed in mixed alluvium. The dominant vegetation is basin big sagebrush (*Artemisia tridentata* ssp. tridentata) and basin wildrye (Leymus cinereus).

## Associated sites

| | |
|---|---|
| R026XY001NV | **MOIST FLOODPLAIN** |
| R026XY004NV | **SALINE BOTTOM** |
| R026XY030NV | **LOAMY BOTTOM 8-12 P.Z.** |

## Similar sites

| | |
|---|---|
| R026XY001NV | **MOIST FLOODPLAIN**<br>LETR5 codominant grass; more productive site |
| R026XY032NV | **DEEP SODIC FAN**<br>ATCA2 - ATTO codominant |
| R026XY004NV | **SALINE BOTTOM**<br>ARTR2 rare to absent |
| R026XY030NV | **LOAMY BOTTOM 8-12 P.Z.**<br>SAVE4 & DISP absent |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | Not specified |
| Shrub | (1) *Artemisia tridentata ssp. tridentata* |
| Herbaceous | (1) *Leymus cinereus* |

## Physiographic features

The Dry Floodplain 8-10 P.Z. site occurs on alluvial flats/fans, fan remnants, lake terraces and stream terraces. Slopes range from 0 to 2 percent. Elevations are 4200 to 5500 feet.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Alluvial fan<br>(2) Fan remnant<br>(3) Lake terrace<br>(4) Alluvial flat<br>(5) Stream terrace<br>(6) Flood plain |
| Flooding duration | Very brief (4 to 48 hours) to brief (2 to 7 days) |

| | |
|---|---|
| Flooding frequency | Occasional to rare |
| Ponding frequency | None |
| Elevation | 4,200–5,500 ft |
| Slope | 0–2% |
| Water table depth | 20–72 in |
| Aspect | Aspect is not a significant factor |

## Climatic features

The climate associated with this site is semiarid, characterized by cool, moist winters and warm, dry summers. Mean annual precipitation is 8 to 10 inches. Mean annual air temperature is 48 to 50 degrees F. The average growing season is about 90 to 120 days.

Nevada's climate is predominantly arid, with large daily ranges of temperature, infrequent severe storms, heavy snowfall in the higher mountains, and great location variations with elevation. Three basic geographical factors largely influence Nevada's climate: continentality, latitude, and elevation. Continentality is the most important factor. The strong continental effect is expressed in the form of both dryness and large temperature variations. Nevada lies on the eastern, lee side of the Sierra Nevada Range, a massive mountain barrier that markedly influences the climate of the State. The prevailing winds are from the west, and as the warm moist air from the Pacific Ocean ascend the western slopes of the Sierra Range, the air cools, condensation occurs and most of the moisture falls as precipitation. As the air descends the eastern slope, it is warmed by compression, and very little precipitation occurs. The effects of this mountain barrier are felt not only in the West but throughout the state, with the result that the lowlands of Nevada are largely desert or steppes. The temperature regime is also affected by the blocking of the inland-moving maritime air. Nevada sheltered from maritime winds, has a continental climate with well-developed seasons and the terrain responds quickly to changes in solar heating.

Nevada lies within the mid-latitude belt of prevailing westerly winds which occur most of the year. These winds bring frequent changes in weather during the late fall, winter and spring months, when most of the precipitation occurs. To the south of the mid-latitude westerlies, lies a zone of high pressure in subtropical latitudes, with a center over the Pacific Ocean. In the summer, this high-pressure belt shifts northward over the latitudes of Nevada, blocking storms from the ocean. The resulting weather is mostly clear and dry during the summer and early fall, with scattered thundershowers. The eastern portion of the state receives significant summer thunderstorms generated from monsoonal moisture pushed up from the Gulf of California, known as the North American monsoon. The monsoon system peaks in August and by October the monsoon high over the Western U.S. begins to weaken and the precipitation retreats southward towards the tropics (NOAA 2004).

**Table 3. Representative climatic features**

| | |
|---|---|
| Frost-free period (characteristic range) | |
| Freeze-free period (characteristic range) | |
| Precipitation total (characteristic range) | 8-10 in |
| Frost-free period (average) | 105 days |
| Freeze-free period (average) | |
| Precipitation total (average) | 10 in |

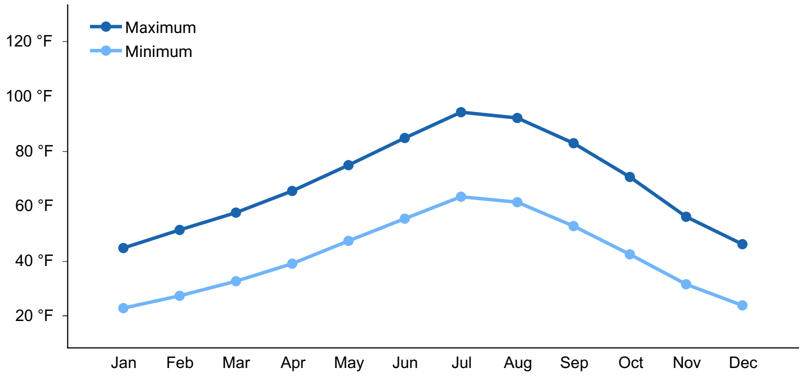



**Figure 1. Monthly average minimum and maximum temperature**

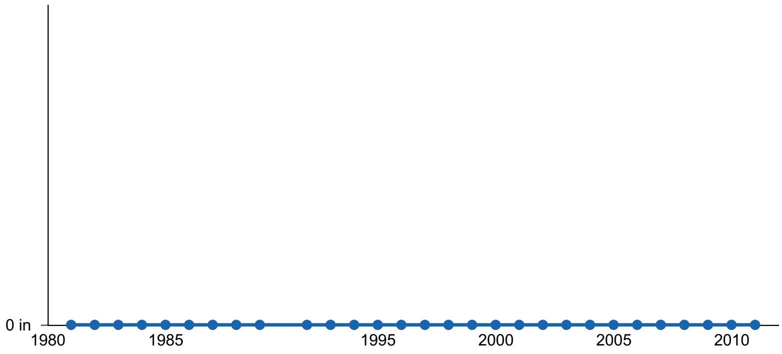



**Figure 2. Annual precipitation pattern**

## Influencing water features

This site may recieve additional moisture due to its occurrence on stream and lake terraces.

## Soil features

The soils are moderately deep to very deep, somewhat poorly drained to well drained, and are formed in mixed alluvium. The available water capacity is low to high. Occurring most commonly on stream terraces, the soils have not undergone adequate leaching to remove all salts and alkali. The soil surface tends to be moderately sodium affected and will crust and bake upon drying. The water table fluctuates between 20 inches in spring to over 60 inches during drier periods. These soils are subject to flooding on an average of at least one year in three. Deep rooted plants are able to utilize moisture from the water table and capillary fringe. The soil series associated with this site include: Appian, Brockliss, Dalzell, Dangberg, Dressler, Gardnerville, Godecke, Gurdugee, Henningsen, Hussman, Kazul, Mindlebaugh, Nofet, Oest, Orizaba, Pizene, Steerlay, and Updike.

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Alluvium |
| Surface texture | (1) Sandy loam<br>(2) Fine sandy loam<br>(3) Clay loam<br>(4) Loam |
| Family particle size | (1) Loamy |
| Drainage class | Somewhat poorly drained to well drained |
| Permeability class | Very slow to moderately rapid |
| Soil depth | 20–72 in |
| Surface fragment cover <=3" | 0–12% |
| Surface fragment cover >3" | 0% |

| | |
|---|---|
| Available water capacity (0-40in) | 3.1–7.9 in |
| Calcium carbonate equivalent (0-40in) | 0–5% |
| Electrical conductivity (0-40in) | 0–32 mmhos/cm |
| Sodium adsorption ratio (0-40in) | 0–45 |
| Soil reaction (1:1 water) (0-40in) | 6.1–11 |
| Subsurface fragment volume <=3" (Depth not specified) | 0–25% |
| Subsurface fragment volume >3" (Depth not specified) | 0% |

## Ecological dynamics

An ecological site is the product of all the environmental factors responsible for its development, and it has a set of key characteristics that influence a site's resilience to disturbance and resistance to invasive species. Key characteristics include 1) climate (precipitation, temperature), 2) topography (aspect, slope, elevation, and landform), 3) hydrology (infiltration, runoff), 4) soils (depth, texture, structure, organic matter), 5) plant communities (functional groups, productivity), and 6) natural disturbance regime (fire, herbivory, etc.) (Caudle et al. 2013). Biotic factors that influence resilience include site productivity, species composition and structure, and population regulation and regeneration (Chambers et al. 2013).

The ecological sites in this disturbance response group (DRG) are dominated by deep-rooted cool season perennial bunchgrasses and long-lived shrubs (50+ years) with high root to shoot ratios. The sites included in this DRG are R026XY012NV (this site), R026XY032NV, and R026XY034NV. The dominant shrubs usually root to the full depth of the winter-spring soil moisture recharge, which ranges from 1.0 to over 3.0 m (Dobrowolski et al. 1990). Root length of mature sagebrush plants was measured to a depth of 2 meters in alluvial soils in Utah (Richards and Caldwell 1987). These shrubs have a flexible generalized root system with development of both deep taproots and laterals near the surface (Comstock and Ehleringer 1992).

Periodic drought regularly influences sagebrush ecosystems, and drought duration and severity has increased throughout the 20th century in much of the Intermountain West. Major shifts away from historic precipitation patterns have the greatest potential to alter ecosystem function and productivity (Snyder et al. 2019). Species composition and productivity can be altered by the timing of precipitation and water availability within the soil profile (Bates et al. 2006).

The Great Basin sagebrush communities have high spatial and temporal variability in precipitation both among years and within growing seasons (MacMahon 1980). Nutrient availability is typically low but increases with elevation and closely follows moisture availability. The invasibility of plant communities is often linked to resource availability. Disturbance changes resource uptake and increases nutrient availability, often to the benefit of non-native species; native species are often damaged and their ability to use resources is depressed for a time, but resource pools may increase from lack of use and/or the decomposition of dead plant material following disturbance (Whisenant 1999, Miller et al. 2013). The invasion of sagebrush communities by cheatgrass (*Bromus tectorum*) has been linked to disturbances (fire, abusive grazing) that have resulted in fluctuations in resources (Beckstead and Augspurger 2004, Chambers et al. 2007, Johnson et al. 2011).

Native insect outbreaks are also important drivers of ecosystem dynamics in sagebrush communities. Climate is generally believed to influence the timing of insect outbreaks especially sagebrush defoliator, Aroga moth (Aroga websteri). Aroga moth infestations have occurred in the Great Basin in the 1960s, early 1970s, and have been ongoing in Nevada since 2004 (Bentz et al. 2008). Thousands of acres of big sagebrush have been impacted, with partial to complete die-off observed. Aroga moth can partially or entirely kill individual plants or entire stands of big sagebrush (Furniss and Barr 1975).

Basin big sagebrush tends to occupy areas with deeper soil that receive run-on moisture (Barker and McKell 1983, Winward 1980). Big sagebrush is generally long-lived; therefore, it is not necessary for new individuals to recruit every year for perpetuation of the stand. Infrequent large recruitment events and simultaneous low, continuous recruitment is the foundation of population maintenance (Noy-Meir 1973). Survival of the seedlings of big sagebrush is dependent on adequate moisture conditions.

Perennial bunchgrasses generally have somewhat shallower root systems than shrubs, but root densities are often as high as or higher than those of shrubs in the upper 0.5 m, but taper off more rapidly than shrubs. However, basin wildrye is weakly rhizomatous and has been found to root to depths of up to 2 meters and to exhibit greater lateral root spread than many other grass species (Abbott et al. 1991, Reynolds and Fraley 1989).

Basin wildrye is a large, cool-season perennial bunchgrass with an extensive deep coarse fibrous root system (Reynolds and Fraley 1989). Clumps may reach up to six feet in height (Ogle et al. 2012b). Basin wildrye does not tolerate long periods of inundation; it prefers cycles of wet winters and dry summers and is most commonly found in deep soils with high water holding capacities or seasonally high water tables (Ogle et al. 2012b, Perryman and Skinner 2007). Western wheatgrass is a rhizomatous grass it is capable of spreading vegetatively and thrives in disturbed soil (Cronquist et al. 1994).

The ecological sites in this DRG have moderate resilience to disturbance and resistance to invasion. Increased resilience increases with elevation, aspect, increased precipitation and increased nutrient availability. Five possible alternative stable states have been identified for this DRG.

Invasive Annual Grasses:
The species most likely to invade these sites is cheatgrass. Cheatgrass is a cool season annual grass that maintains an advantage over native plants in part because it is a prolific seed producer, can germinate in the autumn or spring, tolerates grazing, and increases with frequent fire (Klemmedson and Smith 1964, Miller et al. 1999). Cheatgrass originated from Eurasia and was first reported in North America in the late 1800s (Mack and Pyke 1983; Furbush 1953). Pellant and Hall (1994) found 3.3 million acres of public lands dominated by cheatgrass and suggested that another 76 million acres were susceptible to invasion by winter annuals including cheatgrass and medusahead.

Recent modeling and empirical work by Bradford and Lauenroth (2006) suggests that seasonal patterns of precipitation input and temperature are also key factors determining regional variation in the growth, seed production, and spread of invasive annual grasses. The phenomenon of cheatgrass “die-off” provides opportunities for restoration of perennial and native species (Baughman et al. 2016, Baughman et al. 2017). The causes of these events are not fully understood, but there is ongoing work to try to predict where they occur, in the hopes of aiding conservation planning (Weisberg et al. 2017, Brehm 2019).

Methods to control cheatgrass include herbicide, fire, targeted grazing, and seeding. Mapping potential or current invasion vectors is a management method designed to increase the cost effectiveness of control methods. Spraying with herbicide (Imazapic or Imazapic + glyphosate) and seeding with crested wheatgrass and Sandberg bluegrass has been found to be more successful at combating cheatgrass (and medusahead) than spraying alone (Sheley et al. 2012). To date, most seeding success has occurred with non-native wheatgrass species. Perennial grasses, especially crested wheatgrass, are able to suppress cheatgrass growth when mature (Blank et al. 2020). Where native bunchgrasses are missing from the site, revegetation of annual grass invaded rangelands has been shown to have a higher likelihood of success when using introduced perennial bunchgrasses such as crested wheatgrass (Clements et al. 2017, Davies et al. 2015). Butler et al. (2011) tested four herbicides (Imazapic, Imazapic + glyphosate, rimsulfuron, and sulfometuron + Chlorsulfuron) for suppression of cheatgrass, medusahead and ventenata (North Africa grass, *Ventenata dubia*) within residual stands of native bunchgrass. Additionally, they tested the same four herbicides followed by seeding of six bunchgrasses (native and non-native) with varying success (Butler et al. 2011). Herbicide-only treatments appeared to remove competition for established bluebunch wheatgrass by providing 100% control of ventenata and medusahead and greater than 95% control of cheatgrass (Butler et al. 2011). Caution in using these results is advised, as only one year of data was reported.

In considering the combination of pre-emergent herbicide and prescribed fire for invasive annual grass control, it is important to assess the tolerance of desirable brush species to the herbicide being applied. Vollmer and Vollmer (2008) tested the tolerance of mountain mahogany (*Cercocarpus montanus*), antelope bitterbrush, and multiple sagebrush species to three rates of Imazapic with and without methylated seed oil as a surfactant. They found a cheatgrass control program in an antelope bitterbrush community should not exceed Imazapic at 8 oz./ac with or without surfactant. Sagebrush, regardless of species or rate of application, was not affected. However, many environmental variables were not reported in this study and managers should install test plots before broad scale herbicide application is initiated.

Fire Ecology:
Natural fire return intervals are estimated to vary between less than 35 years up to 100 years in sagebrush ecosystems with basin wildrye (Paysen et al. 2000). In many basin big sagebrush communities, changes in fire frequency occurred along with fire suppression, livestock grazing and OHV use. Few if any fire history studies have been conducted on basin big sagebrush; however, Sapsis and Kauffman (1991) suggest that fire return intervals in basin big sagebrush are intermediate between mountain big sagebrush (15 to 25 years) and Wyoming big sagebrush (*Artemisia tridentata* ssp. wyomingensis) (50 to 100 years). Fire severity in big sagebrush communities is described as "variable" depending on weather, fuels, and topography. However, fire in basin big sagebrush communities are typically stand replacing (Sapsis and Kauffman 1991). Basin big sagebrush does not sprout after fire. Because of the time needed to produce seed, it is eliminated by frequent fires (Bunting et al. 1987).

Basin big sagebrush reinvades a site primarily by off-site seed or seed from plants that survive in unburned patches. Approximately 90% of big sagebrush seed is dispersed within 30 feet (9 m) of the parent shrub (Goodrich et al. 1985) with maximum seed dispersal at approximately 108 feet (33 m) from the parent shrub (Shumar and Anderson 1986). Therefore, regeneration of basin big sagebrush after stand replacing fires is difficult and dependent upon proximity of residual mature plants and favorable moisture conditions (Johnson and Payne 1968, Humphrey 1984). Higher production sites will have experienced fire more frequently than lower production sites. Fire maintained the grass dominance of these ecosystems, therefore, increases in the fire return interval favors the shrub component of the plant community, potentially facilitating a rise in bare ground and invasive weeds. Lack of fire combined with excessive herbivory converts these sites to big sagebrush and rabbitbrush dominance.

Fourwing saltbush is the most widely distributed shrubby saltbush in North America (Meyer 2003). It is highly variable across landscapes and even within populations (McArthur et al. 1983, Petersen et al. 1987). Its ability to sprout following fire may depend on the population and fire severity. A study by Parmenter (2008) showed 58% mortality rate of fourwing saltbush following fire in New Mexico, the surviving shrubs produced sprouts shortly after fire.

The effect of fire on bunchgrasses relates to culm density, culm-leaf morphology, and the size of the plant. The initial condition of bunchgrasses within the site along with seasonality and intensity of the fire all factor into the individual species response. For most forbs and grasses the growing points are located at or below the soil surface providing relative protection from disturbances which decrease above ground biomass, such as grazing or fire. Thus, fire mortality is more correlated to duration and intensity of heat which is related to culm density, culm-leaf morphology, size of plant and abundance of old growth (Wright 1971, Young 1983). In addition, season and severity of the fire will influence plant response as will post-fire soil moisture availability.

Basin wildrye is relatively resistant to fire, particularly dormant season fire, as plants sprout from surviving root crowns and rhizomes (Zschaechner 1985). Miller et al. (2013) reported increased total shoot and reproductive shoot densities in the first year following fire, although by year two there was little difference between burned and control treatments. The rhizomatous growth form of western wheatgrass makes it capable of surviving fire and may increase vegetative growth afterward (Bushey 1987, Wasser 1982).

The majority of research concerning rabbitbrush has been conducted on green rabbitbrush (*Chrysothamnus viscidiflorus*). Green rabbitbrush has a large taproot and is known to be shorter-lived and less competitive than sagebrush. Seedling density, flower production, and shoot growth decline as competition from other species increases (McKell and Chilcote 1957, Miller et al. 2013). Depending on fire severity, rabbitbrush may increase after fire. Rubber rabbitbrush is top-killed by fire, but can resprout after fire and can also establish from seed (Young 1983).

The grass most likely to invade this site is cheatgrass. This invasive grass displaces desirable perennial grasses, reduces livestock forage, and accumulates large fuel loads that foster frequent fires (Davies and Svejcar 2008). Invasion by annual grasses can alter the fire cycle by increasing fire size, fire season length, rate of spread, numbers of individual fires, and likelihood of fires spreading into native or managed ecosystems (D’Antonio and Vitousek 1992, Brooks et al. 2004). Areas dominated with cheatgrass are estimated to have a fire return interval of

3-5 years (Whisenant 1990). The mechanisms by which invasive annual grasses alter fire regimes likely interact with climate. For example, cheatgrass cover and biomass vary with climate (Chambers et al. 2007) and are promoted by wet and warm conditions during the fall and spring. Invasive annual species have been shown able to take advantage of high N availability following fire through higher growth rates and increased seedling establishment relative to native perennial grasses (Monaco et al. 2003).

Livestock/ Wildlife Grazing Interpretations:
Big sagebrush is browsed in the winter by native ungulates. Personius et al. (1987) found Wyoming big sagebrush and basin big sagebrush to be intermediately palatable to mule deer when compared to mountain big sagebrush (most palatable) and black sagebrush (least palatable).

Fourwing saltbush is one of the most important forage shrubs in arid sites. Its importance is due to its abundance, accessibility, size, large volume of forage, evergreen habit, high palatability and nutritive value. The palatability rates from fairly good to good for cattle, and as good for sheep and goats, deer usually relish it as a winter browse (USDA 1988). It has similar protein, fat, and carbohydrate levels as alfalfa (*Medicago sativa*) (Catlin, 1925). It is especially valuable as winter forage. It was noted in a study by Otsyina et al. (1982) that sheep readily grazed fourwing saltbush when introduced into a new pasture.

During settlement, many of the cattle in the Great Basin were wintered on extensive basin wildrye stands, however, due to sensitivity to spring use, many stands were decimated by early in the 20th century (Young et al. 1976). Less palatable species such as big sagebrush and rabbitbrush increased in dominance along with invasive non-native species such as Russian thistle (*Salsola tragus*), mustards, and cheatgrass (Roundy 1985). The early growth and abundant production of basin wildrye make it a valuable source of forage for livestock. It is important forage for cattle and is readily grazed by cattle and horses in early spring and fall. Though coarse-textured during the winter, basin wildrye may be utilized more frequently by livestock and wildlife when snow has covered low shrubs and other grasses. Basin wildrye is used often as a winter feed for livestock and wildlife; not only providing roughage above the snow but also cover in the early spring months (Majerus 1992). Inadequate rest and recovery from defoliation causes a decrease in basin wildrye and an increase in basin big sagebrush and rubber rabbitbrush (Young et al. 1976, Roundy 1985). Spring defoliation of basin wildrye and/or consistent, heavy grazing during the growing season has been found to significantly reduce basin wildrye production and density (Krall et al. 1971). Additionally, native basin wildrye suffers from low seed viability and low seedling vigor (Young and Evans 1981). Roundy (1985) found that although basin wildrye is adapted to seasonally dry saline soils, high and frequent spring precipitation is necessary to establish it from seed. This suggests that establishment of basin wildrye seedlings occurs only during years of unusually high precipitation. Therefore, reestablishment of a stand may be episodic.

Western wheatgrass is a preferred feed for livestock and wildlife, but is not a very productive plant (Enevoldsen and Lewis 1978, Hafenrichter et al. 1968). It is short in stature and has sparse growth in low-water conditions. Compared to native bunchgrasses, western wheatgrass is not as palatable (Hafenrichter et al. 1968).

Overgrazing leads to an increase in big sagebrush and a decline in understory plants like basin wildrye. Reduced bunchgrass vigor or density provides an opportunity for cheatgrass and other invasive species to occupy interspaces. Reduced bunchgrass vigor or density provides an opportunity for cheatgrass and other invasive species to occupy interspaces, leading to increased fire frequency and potentially an annual plant community. This site is likely to see an increase in shrubs and will have significant bare ground in the interspaces as few native perennial species are able to recolonize the sandy soil surfaces.

Urban/Agricultural Use:
Sites in this group exist in flat, accessible areas near water in western Nevada that have been developed for agriculture production and housing developments. The Deep Sodic Fan site, as mapped, no longer exists in a natural condition outside of these developed areas, but we have included it in our assessment in case inclusions exist elsewhere.

Seasonally high water tables have been found to be necessary for maintenance of site productivity and reestablishment of basin wildrye stands following disturbances such as fire, drought or excessive herbivory (Eckert et al. 1973). The sensitivity of basin wildrye seedling establishment to reduced soil water availability is increased as soil pH increases (Stuart et al. 1971). Lowering of the water table through extended drought, channel incision or groundwater pumping will decrease basin wildrye production and establishment, while sagebrush, rabbitbrush, and invasive weeds increase. Farming and abandonment may facilitate the creation of vesicular crust on the soil surface, increased surface ponding, and decreased infiltration; which leads to dominance by sprouting shrubs and an annual understory. While sites exhibiting significant hydrologic alteration were not seen during field visits for this project, this dynamic is included in the STM narrative since it has been seen on similar sites in other MLRAs.

State and Transition Model Narrative for Group 11
This is a text description of the states, phases, transitions, and community pathways possible in the State and Transition model for the MLRA 26 Disturbance Response Group 11.

Reference State 1.0:
The Reference State 1.0 is a representation of the natural range of variability under pristine conditions. The reference state has three general community phases: a shrub-grass dominant phase, a perennial 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. Plant community phase changes are primarily driven by fire, periodic drought and/or insect or disease attack.

Community Phase 1.1:
Basin wildrye and basin big sagebrush dominate the plant community. Forbs and other grasses make up smaller components.

Community Phase Pathway 1.1a, from phase 1.1 to 1.2:
Fire would decrease or eliminate the overstory of sagebrush and allow the perennial bunchgrasses and forbs to dominate the site. Fires would typically be small and patchy due to low or moist fuel loads.

Community Phase Pathway 1.1b, from phase 1.1 to 1.3:
Time and lack of disturbance such as fire allows sagebrush to increase and become dominant. Long-term drought, herbivory, or combinations of these would cause a decline in basin wildrye and fine fuels, leading to a reduced fire frequency allowing big sagebrush to dominate the site.

Community Phase 1.2:
This community phase is characteristic of a post-disturbance, early- to mid-seral community. Basin wildrye, western wheatgrass, and other perennial bunchgrasses dominate. Depending on fire severity or intensity of Aroga moth infestation, patches of intact sagebrush may remain. Rabbitbrush may be sprouting and may be a significant component of the plant community.

Community Phase Pathway 1.2a, from phase 1.2 to 1.1:
Time and lack of disturbance allows sagebrush to reestablish.

Community Phase 1.3:
Big sagebrush dominates in the absence of disturbance. Mature sagebrush may be decadent. The deep-rooted perennial bunchgrasses in the understory are reduced either from competition with shrubs and/or from herbivory. Basin wildrye is a minor component.

Community Phase Pathway 1.3a, from phase 1.3 to 1.2:
Fire would decrease or eliminate the overstory of sagebrush and allow the perennial bunchgrasses to dominate the site. Fires would typically be low severity resulting in a mosaic pattern due to low fine fuel loads. A fire following an unusually wet spring or a change in management favoring an increase in fine fuels, may be more severe and reduce sagebrush cover to trace amounts. A severe infestation of Aroga moth could also cause a large decrease in sagebrush within the community, giving a competitive advantage to the perennial grasses and forbs.

Community Phase Pathway 1.3b, from phase 1.3 to 1.1:
Low severity fire, Aroga moth, or a combination of both will reduce some of the sagebrush overstory and allow grass species to increase.

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 weeds, such as cheatgrass, mustard and Russian thistle.

Slow variables: Over time, the annual non-native plants 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:
This state is similar to the Reference State 1.0 with the addition of one community phase. Ecological function has not changed, however the resiliency of the state has been reduced by the presence of invasive weeds. This state has the same three general community phases. 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. 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. Additionally, the presence of highly flammable non-native species reduces State resilience because these species can promote fire where historically fire has been infrequent leading to positive feedbacks that further the degradation of the system. Seeded species may be present in all phases of this group. This site was not seen in a seeded state, however crested wheatgrass was found, likely from nearby seedings.

Community Phase 2.1:
This community phase is similar to Reference State Community Phase 1.1, with the presence of non-native annual species present. Basin wildrye and basin big sagebrush dominate the plant community. Forbs and other grasses make up smaller components.

Community Phase Pathway 2.1a, from phase 2.1 to 2.2:
Fire would decrease or eliminate the overstory of sagebrush and allow the perennial bunchgrasses and forbs to dominate the site. Fires would typically be small and patchy due to low or moist fuel loads.

Community Phase Pathway 2.1b, from phase 2.1 to 2.3:
Time without disturbance, long-term drought, grazing management that favors shrubs, or combinations of these would allow the sagebrush overstory to increase and dominate the site.

Community Phase 2.2:
This community phase is characteristic of a post-disturbance, early- to mid-seral community. Basin wildrye, western wheatgrass, and other perennial bunchgrasses dominate. Depending on fire severity or intensity of Aroga moth infestation, patches of intact sagebrush may remain. Rabbitbrush may be sprouting and may be a significant component of the plant community. Annual non-native species are stable or increasing within the community.

Community Phase Pathway 2.2a, from phase 2.2 to 2.1:
Absence of disturbance over time allows sagebrush to recover. This may be combined with grazing management that favors shrubs.

Community Phase Pathway 2.2b, from phase 2.2. to 2.4:
Fall and spring growing conditions that favor the germination and production of non-native, annual grasses cause these species to codominate with bunchgrasses in the understory. This pathway typically occurs three to five years post fire and phase 2.4 may be a transitory plant community.

Community Phase 2.3:
Big sagebrush dominates in the absence of disturbance. Mature sagebrush may be decadent. The deep-rooted perennial bunchgrasses in the understory are reduced either from competition with shrubs and/or from herbivory. Basin wildrye is a minor component. Rabbitbrush may be a significant component. Annual non-natives species may be stable or increasing due to lack of competition with perennial bunchgrasses. This site is susceptible to further degradation from grazing, drought, and fire.

Community Phase Pathway 2.3a, from phase 2.3 to 2.2:
Fire would decrease or eliminate the overstory of sagebrush and allow the perennial bunchgrasses to dominate the site. Fires would typically be low severity resulting in a mosaic pattern due to low fine fuel loads. A fire following an unusually wet spring or a change in management favoring an increase in fine fuels, may be more severe and reduce sagebrush cover to trace amounts. A severe infestation of Aroga moth could also cause a large decrease in

sagebrush within the community, giving a competitive advantage to the perennial grasses and forbs. Annual non-native species respond well to fire and may increase post-burn. Brush management with minimal soil disturbance and/or late-fall/winter grazing that causes mechanical damage to sagebrush may also cause this change.

Community Phase Pathway 2.3b, from phase 2.3 to 2.1:
A change in grazing management that decreases shrubs will allow for the perennial bunchgrasses in the understory to increase. Heavy late-fall/winter grazing will reduce sagebrush and increase the herbaceous understory. A moderate infestation of Aroga moth may reduce some sagebrush overstory and allow perennial grasses to increase in the community. Brush treatments with minimal soil disturbance will also decrease sagebrush and release the perennial understory. Annual non-native species are present in the community.

Community Phase Pathway 2.3c, from phase 2.3 to 2.4:
Fall and spring growing season conditions that favor the germination and production of non-native annual grasses cause these species to become dominant. This phase may be a transitory plant community.

Community Phase 2.4:
This community is at risk of crossing to an annual state. Native bunchgrasses and forbs still comprise 50% or more of the understory annual production, however, non-native annual grasses are nearly codominant. If this site originated from phase 2.3 there may be significant shrub cover as well. Annual production and abundance of these annuals may increase drastically in years with heavy spring precipitation. Seeded species may be present. This site is susceptible to further degradation from grazing, drought and fire.

Community Phase Pathway 2.4a, from phase 2.4 to 2.3:
Growing season conditions that favor perennial bunchgrass production and reduce cheatgrass production.

Community Phase Pathway 2.4b, from phase 2.4 to 2.2:
Growing season conditions that favor perennial bunchgrass production and reduce cheatgrass production. May occur as site recovers from fire.

T2A: Transition from Current Potential State 2.0 to Shrub State 3.0:
Trigger: Inappropriate, long-term grazing of perennial bunchgrasses during growing season favors shrubs and initiates the transition to Phase 3.1 from Phase 2.3. May be exacerbated by a lowered seasonal water table. Fire causes a transition to Community Phase 3.2.
Slow variables: Long term reduction in deep-rooted perennial grass density results in a decrease in organic matter inputs and subsequent soil water decline.
Threshold: Loss of deep-rooted perennial bunchgrasses spatially and temporally changes nutrient cycling and redistribution, and reduces soil organic matter. Loss of high seasonal water table prevents regeneration of basin wildrye.

T2B: Transition from Current Potential State 2.0 to Annual State 4.0:
Trigger: Severe fire or multiple fires, long term inappropriate grazing, and/or soil disturbing treatments such as plowing.
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.

Shrub State 3.0:
This state is a product of many years of heavy grazing during time periods harmful to perennial bunchgrasses. Sagebrush dominates the overstory and rabbitbrush may be a significant component. Sagebrush cover exceeds 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.

Community Phase 3.1:
Sagebrush and/or rabbitbrush dominates the overstory and other shrubs may be a significant component. Perennial bunchgrasses are a minor component. Annual non-native species are present to increasing. Understory may be sparse, with bare ground increasing.

Community Phase Pathway 3.1a, from phase 3.1 to 3.2:
Fire or heavy fall grazing reduces or eliminates the overstory of sagebrush to trace amounts and allows bunchgrasses to dominate the site. Brush treatments causing minimal soil disturbance causing mechanical damage to shrubs may also cause this change.

Community Phase 3.2:
Rabbitbrush dominates the overstory. Annual non-native species may be present in the understory but are not dominant. Perennial bunchgrasses may be a minor component. Bare ground may be increasing.

Community Phase Pathway 3.2a, from phase 3.2 to 3.1:
Time and lack of disturbance over time and/or grazing management that favors the establishment and growth of sagebrush allows sagebrush to recover.

T3A: Transition from Shrub State 3.0 to Annual State 4.0:
Trigger: Fire or inappropriate grazing management can eliminate the perennial community and transition to community phase 4.1 or 4.2. This may be coupled with gullying and loss of seasonally high water table that maintains basin wildrye.
Slow variable: Increased seed production and cover of annual non-native 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 and impact the nutrient cycling and distribution.

R3A: Restoration from Shrub State 3.0 to Current Potential State 2.0:
Brush management coupled with seeding of desired perennial bunchgrass. Concurrent herbicide treatment may be needed to avoid an increase in annual invasive species. If changes in vegetation were caused by altered hydrology, restoration of associated channels will be needed to achieve success.

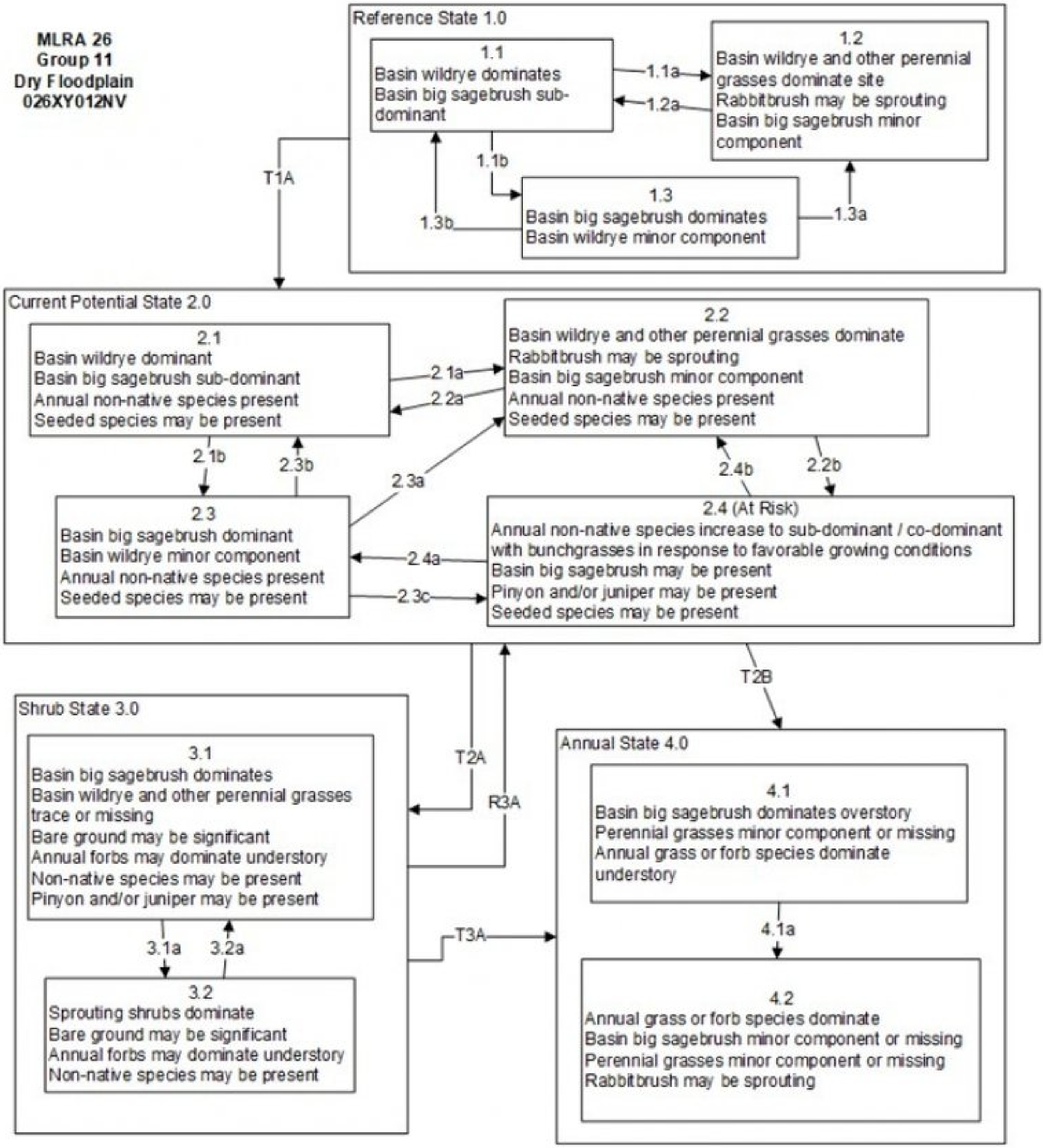
Annual State 4.0:
An abiotic threshold has been crossed and state dynamics are driven by fire and time. The herbaceous understory is dominated by annual non-native species such as cheatgrass and mustards. Resiliency has declined and further degradation from fire facilitates a cheatgrass and sprouting shrub plant community. 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:
Big sagebrush dominates the overstory, with non-native annual grasses and forb species in the understory. Perennial grasses are a minor component and may be missing entirely.

Community Phase pathway 4.1a, from phase 4.1 to 4.2:
Fire and/or a failed brush treatment or seeding eliminates the shrub overstory. Annuals such as cheatgrass increase after fire and dominate the site.

Community Phase 4.2:
Annual non-native plants such as cheatgrass dominate the site. This phase may have seeded species present if resulting from a failed seeding attempt. Perennial bunchgrasses and forbs may still be present in trace amounts. Rabbitbrush may be sprouting Surface erosion may increase with summer convection storms; increased pedestalling of plants, rill formation, or extensive water flow paths identify these events.

## State and transition model


MLRA 26
Group 11
Dry Floodplain
026XY012NV
Reference State 1.0
1.1
Basin wildrye dominates
Basin big sagebrush sub-dominant
1.1a
1.2a
1.2
Basin wildrye and other perennial grasses dominate site
Rabbitbrush may be sprouting
Basin big sagebrush minor component
1.1b
1.3b
1.3
Basin big sagebrush dominates
Basin wildrye minor component
1.3a
T1A
Current Potential State 2.0
2.1
Basin wildrye dominant
Basin big sagebrush sub-dominant
Annual non-native species present
Seeded species may be present
2.1a
2.2a
2.2
Basin wildrye and other perennial grasses dominate
Rabbitbrush may be sprouting
Basin big sagebrush minor component
Annual non-native species present
Seeded species may be present
2.1b
2.3b
2.3a
2.4b
2.2b
2.3
Basin big sagebrush dominant
Basin wildrye minor component
Annual non-native species present
Seeded species may be present
2.4a
2.3c
2.4 (At Risk)
Annual non-native species increase to sub-dominant / co-dominant with bunchgrasses in response to favorable growing conditions
Basin big sagebrush may be present
Pinyon and/or juniper may be present
Seeded species may be present
T2B
Shrub State 3.0
3.1
Basin big sagebrush dominates
Basin wildrye and other perennial grasses trace or missing
Bare ground may be significant
Annual forbs may dominate understory
Non-native species may be present
Pinyon and/or juniper may be present
3.1a
3.2a
3.2
Sprouting shrubs dominate
Bare ground may be significant
Annual forbs may dominate understory
Non-native species may be present
T2A
R3A
T3A
Annual State 4.0
4.1
Basin big sagebrush dominates overstory
Perennial grasses minor component or missing
Annual grass or forb species dominate understory
4.1a
4.2
Annual grass or forb species dominate
Basin big sagebrush minor component or missing
Perennial grasses minor component or missing
Rabbitbrush may be sprouting

Group 11
Dry Floodplain
026XY012NV
KEY

Reference State 1.0 Community Phase Pathways.
1.1a: Fire significantly reduces sagebrush cover and leads to early/mid-seral community, dominated by grasses and forbs. Aroga moth may cause a large die-off in sagebrush resulting in a mosaic of grass and sagebrush.
1.1b: Time and lack of disturbance such as fire. Excessive herbivory, chronic drought or combinations may also decrease perennial understory.
1.2a: Time and lack of disturbance allows for shrub regeneration.
1.3a: Fire significantly reduces sagebrush cover and leads to early/mid-seral community, dominated by grasses and forbs. Aroga moth may cause a large die-off in sagebrush resulting in a mosaic of grass and sagebrush.
1.3b: A low severity fire, Aroga moth, or combinations will reduce some of the sagebrush overstory and allow grass species to increase.

Transition T1A: Introduction of non-native species such as cheatgrass.

Current Potential State 2.0 Community Phase Pathways.
2.1a: Low severity fire creates grass/sagebrush mosaic; high severity fire significantly reduces sagebrush and leads to early/mid-seral community, dominated by grasses and forbs: non-native annual species present.
2.1b: Time and lack of disturbance such as fire. Inappropriate grazing management may also reduce perennial understory.
2.2a: Time and lack of disturbance allows for shrub reestablishment.
2.2b: Fall and spring growing conditions that favors the germination and production of non-native, annual grasses. Pathway typically occurs 3 to 5 years post-fire and 2.4 may be a transitory plant community.
2.3a: High severity fire significantly reduces sagebrush cover and allows grass species to dominate.
2.3b: A low severity fire, Aroga moth, or combinations will reduce some of the sagebrush overstory and allow grass species to increase.
2.3c: Fall and spring growing season conditions that favors the germination and production of non-native annual grasses. 2.4 may be a transitory plant community.
2.4a: Growing season conditions favoring perennial bunchgrass production and reduced cheatgrass production.
2.4b: Growing season conditions favoring perennial bunchgrass production and reduced cheatgrass production.

Transition T2A: Hydrologic alteration (lowering of water table i.e. gullying of associated channel), inappropriate grazing management or combinations of these lead to 3.1. Fire can lead to phase 3.2.
Transition T2B: Inappropriate grazing management in the presence of non-native annual species leads to 4.1. Fire in the presence of annual species leads to 4.2.

Shrub State 3.0 Community Phase Pathways.
3.1a: Fire and/or brush management with minimal soil disturbance.
3.2a: Time and lack of disturbance (not likely to occur).

Transition T3A: Continual inappropriate grazing management and/or hydrologic alteration (i.e. gullying of associated channel) (4.1). Severe fire, and/or failed brush management and seeding (4.2).

Restoration R3A: Brush management and seeding of desired perennial bunchgrass, may be coupled with restoration of channel (2.2).

Annual State 4.0 Community Phase Pathways.
4.1a: Severe fire or failed brush treatment and seeding.

## State 1
## Reference Plant Community

## Community 1.1
## Reference Plant Community

The reference plant community is dominated by basin big sagebrush and basin wildrye. Potential vegetative composition is about 75% grasses, 5% forbs and 20% shrubs. Approximate ground cover (basal and crown) is 15 to 25 percent.

**Table 5. Annual production by plant type**

| Plant Type | Low (Lb/Acre) | Representative Value (Lb/Acre) | High (Lb/Acre) |
|---|---:|---:|---:|
| Grass/Grasslike | 675 | 900 | 1275 |
| Shrub/Vine | 180 | 240 | 340 |
| Forb | 45 | 60 | 85 |
| **Total** | **900** | **1200** | **1700** |

## 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** | | | 648–972 | |
| | basin wildrye | LECI4 | *Leymus cinereus* | 600–720 | – |
| | beardless wildrye | LETR5 | *Leymus triticoides* | 24–96 | – |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 24–96 | – |
| | saltgrass | DISP | *Distichlis spicata* | 0–60 | – |
| 2 | **Secondary Perennial Grasses** | | | 24–96 | |
| | Indian ricegrass | ACHY | *Achnatherum hymenoides* | 6–24 | – |
| | squirreltail | ELEL5 | *Elymus elymoides* | 6–24 | – |
| | bluegrass | POA | *Poa* | 6–24 | – |
| **Forb** | | | | | |
| 3 | **Perennial** | | | 24–96 | |
| | beardless wildrye | LETR5 | *Leymus triticoides* | 24–96 | – |
| | western wheatgrass | PASM | *Pascopyrum smithii* | 24–96 | – |
| 4 | **Annual** | | | 12–36 | |
| | saltgrass | DISP | *Distichlis spicata* | 1–60 | – |
| **Shrub/Vine** | | | | | |
| 5 | **Primary Shrubs** | | | 84–300 | |
| | basin wildrye | LECI4 | *Leymus cinereus* | 600–720 | – |
| | basin big sagebrush | ARTRT | *Artemisia tridentata ssp. tridentata* | 60–180 | – |
| | rubber rabbitbrush | ERNAN5 | *Ericameria nauseosa ssp. nauseosa var. nauseosa* | 24–60 | – |
| | greasewood | SAVE4 | *Sarcobatus vermiculatus* | 0–60 | – |
| 6 | **Secondary Shrubs** | | | 24–96 | |
| | fourwing saltbush | ATCA2 | *Atriplex canescens* | 6–24 | – |
| | shadscale saltbush | ATCO | *Atriplex confertifolia* | 6–24 | – |
| | Torrey's saltbush | ATTO | *Atriplex torreyi* | 6–24 | – |
| | spiny hopsage | GRSP | *Grayia spinosa* | 6–24 | – |
| | bud sagebrush | PIDE4 | *Picrothamnus desertorum* | 6–24 | – |
| | currant | RIBES | *Ribes* | 6–24 | – |

## Animal community

Livestock Interpretations:
This site is suitable for livestock grazing. Grazing management should be keyed to basin wildrye, western wheatgrass, creeping wildrye, and inland saltgrass production. The early growth and abundant production of basin wildrye make it a valuable source of forage for livestock. It is important forage for cattle and is readily grazed by cattle and horses in early spring and fall. Though coarse-textured during the winter, basin wildrye may be utilized more frequently by livestock and wildlife when snow has covered low shrubs and other grasses. Western wheatgrass provides important forage for domestic sheep. Fall regrowth cures well on the stem, so western wheatgrass is good winter forage for domestic livestock. Creeping wildrye can be used for forage and is very

palatable to all livestock. Once established it is very rhizomatous and maintains stands for many years. Saltgrass's value as forage depends primarily on the relative availability of other grasses of higher nutritional value and palatability. It can be an especially important late summer grass in arid environments after other forage grasses have deceased. Saltgrass is rated as a fair to good forage species only because it stays green after most other grasses dry. Livestock generally avoid saltgrass due to its coarse foliage. Saltgrass is described as an “increaser” under grazing pressure. Big sagebrush is eaten by domestic sheep and cattle, but has long been considered to be of low palatability to domestic livestock, a competitor with more desirable species, and a physical impediment to grazing. In general, livestock forage only lightly on this species during the summer, but winter use can be heavy in some locations. Fall use is variable, but flowers are often used by livestock. A few leaves and the more tender stems may also be used. 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.

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:
This site is used by mule deer throughout the year. Quail is the most common gamebird found on this site. Big sagebrush is highly preferred and nutritious winter forage for mule deer. Sagebrush-grassland communities provide critical sage-grouse breeding and nesting habitats. Open Wyoming sagebrush communities are preferred nesting habitat. Meadows surrounded by sagebrush may be used as feeding and strutting grounds. Sagebrush is a crucial component of their diet year-round, and sage-grouse select sagebrush almost exclusively for cover. Leks are often located on low sagebrush sites, grassy openings, dry meadows, ridgetops, and disturbed sites. Sage-grouse prefer mountain big sagebrush and Wyoming big sagebrush communities to basin big sagebrush communities. Basin wildrye provides winter forage for mule deer, though use is often low compared to other native grasses. Basin wildrye provides summer forage for black-tailed jackrabbits. Wildlife forage only lightly on rubber rabbitbrush during the summer, but winter use can be heavy in some locations. Fall use is variable, but flowers are often used by wildlife. A few leaves and the more tender stems may also be used. The forage value of rubber rabbitbrush varies greatly among subspecies and ecotypes. 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. Basin wildrye provides winter forage for mule deer, though use is often low compared to other native grasses. Basin wildrye provides summer forage for black-tailed jackrabbits. Because basin wildrye remains green throughout early summer, it remains available for small mammal forage for longer time than other grasses. Elk consume western wheatgrass during the fall, winter, spring, and summer. Western wheatgrass is used by various small mammals. Creeping wildrye is used for forage for many wildlife species and is often used for cover. Saltgrass provides cover for a variety of bird species, small mammals, and arthropods and is on occasion used as forage for several big game wildlife species.

## Hydrological functions

Runoff is variable, ranging from very low to very high. There are no rills, water flow patterns or pedestals on this site. Gullies are rare to common depending on severity of associated stream channel entrenchment. Gullies and head cuts are healing or stable. Where this site is not associated with perennial or ephemeral channels gullies are none. Fine litter (foliage of grasses and annual & perennial forbs) is only expected to move during occasional periods of flooding by nearby streams. Persistent litter (large woody material) will remain in place except during catastrophic flooding events. Deep-rooted perennial herbaceous bunchgrasses (basin wildrye) slow runoff and increase infiltration. Tall stature and relatively coarse foliage and litter of basin wildrye and sparse canopy of big sagebrush break raindrop impact and provide opportunity for snow catch and accumulation on site.

## Recreational uses

Deer and quail hunting is the sole recreational value of this site.

## Wood products

This site has no potential for naturally occurring woodland species.

### Other products

Some Native American peoples used the bark of basin big sagebrush to make rope and baskets.
Basin wildrye was used as bedding for various Native American ceremonies, providing a cool place for dancers to stand.

### Other information

Basin big sagebrush shows high potential for range restoration and soil stabilization. Basin big sagebrush grows rapidly and spreads readily from seed. Basin wildrye is useful in mine reclamation, fire rehabilitation and stabilizing disturbed areas. Its usefulness in range seeding, however, may be limited by initially weak stand establishment. Western wheatgrass is a good soil binder and is well suited for reclamation of disturbed sites such as erosion control and soil stabilization. Creeping wildrye is primarily used for reclamation of wet, saline soils. Given its extensive system of rhizomes and roots which form a dense sod, saltgrass is considered a suitable species for controlling wind and water erosion.

### Type locality

| Location 1: Churchill County, NV | |
| --- | --- |
| Township/Range/Section | T19N R27E S34 |
| General legal description | Approximately 150 feet east of the pole-line road between the 26 foot Drop Powerhouse and Lahontan Reservoir. This site also occurs in Carson City, Douglas, Lyon, Mineral, Storey, and Washoe counties, Nevada. |

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### Approval

Kendra Moseley, 4/10/2024

### 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) | GK Brackley |
| Contact for lead author | State Rangeland Management Specialist |
| Date | 06/01/1979 |
| Approved by | Kendra Moseley |
| Approval date | |
| Composition (Indicators 10 and 12) based on | Annual Production |

### Indicators

1. **Number and extent of rills:** None

2. **Presence of water flow patterns:** None

3. **Number and height of erosional pedestals or terracettes:** None

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is approximately 35%; surface rock fragments less than 5%; shrub canopy is less than 15%; foliar cover of perennial herbaceous plants is approximately 40%.

5. **Number of gullies and erosion associated with gullies:** Gullies are rare to common depending on severity of associated stream channel entrenchment. Gullies and head cuts are healing or stable. Where this site is not associated with perennial or ephemeral channels gullies are none.

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

7. **Amount of litter movement (describe size and distance expected to travel):** Fine litter (foliage of grasses and annual & perennial forbs) is only expected to move during occasional periods of flooding by nearby streams. Persistent litter (large woody material) will remain in place except during catastrophic flooding events.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil stability values will range from 4 to 6. (This will be field tested.)

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface structure is platy, sub-angular blocky, or granular. Soil surface colors are light and the soils are typified by an ochric epipedon. Organic carbon of the surface 2 to 3 inches is typically 1 to 1.5 percent dropping off quickly below.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Deep-rooted perennial herbaceous bunchgrasses (basin wildrye) slow runoff and increase infiltration. Tall stature and relatively coarse foliage and litter of basin wildrye and sparse canopy of big sagebrush break raindrop impact and provide opportunity for snow catch and accumulation on site.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None - Platy subsurface layers are not to be interpreted as compaction.

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: Reference Plant Community: Tall statured, deep-rooted, cool season, perennial bunchgrasses >> tall shrubs. (By above ground production)

    Sub-dominant: Rhizomatous, cool season, perennial grasses >shallow-rooted, cool season, perennial bunchgrasses and grass-like plants > deep-rooted, cool season, perennial forbs>fibrous, shallow-rooted, cool season, perennial forbs. (By above ground production)

    Other:

    Additional:

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

**decadence):** Dead branches within individual shrubs are common and standing dead shrub canopy material may be as much as 25% of total woody canopy.

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14. **Average percent litter cover (%) and depth ( in):** Between plant interspaces (± 35%) and depth (± 1 in.)

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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 (September thru May) ± 1200 lbs/ac; Winter moisture significantly affects total 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:** Tall whitetop, knapweed, annual kochia, annual mustards, povertyweed, thistle and pigweed are invaders on this site. Black greasewood and rubber rabbitbrush are increasers on this site.

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17. **Perennial plant reproductive capability:** All functional groups should reproduce in average (or normal) and above average growing season years.

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