Final Report
USDA Ecological Site Description
State-and-Transition Models
Major Land Resource Area 28A and 28B Nevada
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Disturbance Response Group 26AB

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MLRA 28A
Group 26

Disturbance Response Group (DRG) 26 consists of three ecological sites. The precipitation ranges from 5 to 8 inches. Slopes range from 0 to 4 percent but slope gradients of less than 2 percent are typical. Elevations range from 4500 to 5500 feet. The sites occur on the edges of barren playas or lake plains. The soils are very deep and poorly drained or very poorly drained. The soils are formed in lacustrine deposits and alluvium derived from limestone, shale and quartzite. The soil temperature regime is mesic and the soil moisture regime is aquic during seasonal periods of saturation and reduction. Common plant species include iodinebush (*Allenrolfea occidentalis*), inland saltgrass (*Distichlis spicata*), alkali sacaton (*Sporobolus airoides*) and basin wildrye (*Leymus cinereus*). Other species include black greasewood (*Sarcobatus vermiculatus*), and Mojave seablite (*Suaeda moquinii*). Production ranges from 25 to 450 pounds per acre.

**Modal Site:**
The Saline Flat (R028AY009NV) is the ecological site that represents this DRG; as it has the most acres mapped. This site occurs on lake plains. Slopes range from 0 to 4 percent, but slope gradients of 0 to 2 percent are most typical. Elevations are 4300 to 4400 feet. The soils of this site are very deep and poorly drained to very poorly drained. The soils are formed in lacustrine deposits and alluvium derived from limestone, shale and quartzite. The surface layer of these soils is flocculated due to the extremely high salt concentration (mostly sodium chloride) which potentially improves infiltration rates. High salt concentrations reduce the available water capacity of these soils and adversely affect seed viability and germination. Capillary moisture from a shallow water table enhances soil moisture in that part of the soil profile below the surface layer. The soils have an ochric epipedon and a salic horizon which occurs from the soil surface to 60 inches. Soil textures are silt loams and silty clay loams. The soil temperature regime is mesic and the soil moisture regime is aquic during seasonal periods of saturation and reduction. Runoff is negligible if ponded. Wind erosion may be severe if this site is disturbed by off-road vehicles. The Reference State is dominated by iodinebush and saltgrass. Production ranges from 75 to 150 pounds per acre.

**Disturbance Response Group 26 Ecological Site:**
Saline Flat (Modal) 028AY009NV

**Ecological Dynamics and Disturbance Response**

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 invasives. 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 Great Basin shrub communities have high spatial and temporal variability in precipitation, both among years and within growing seasons. Nutrient availability is typically low but increases with elevation and closely follows moisture availability. The moisture resource supporting the greatest
amount of plant growth is usually the water stored in the soil profile during the winter. The invasibility of plant communities is often linked to resource availability. Disturbance can decrease resource uptake due to damage or mortality of the native species and depressed competition or can increase resource pools by the decomposition of dead plant material following disturbance.

These salt-desert shrub communities are dominated by phreatophytes that depend for their water supply upon ground water that lies within reach of their roots. The Saline Flat site is characterized by unvegetated playa areas interspersed with small vegetated mounds dominated by iodinebush and inland saltgrass. The plants on this site are halophytes, meaning they are highly tolerant of saline soil conditions. Halophytes tend to be smaller in size in areas with concentrated salt, and larger in less saline conditions (Flowers 1934). Halophyte seeds remain viable for long periods of time under saline conditions and tend to germinate in the spring when salt concentrations are reduced due to precipitation (Unger 1982, Gul and Weber 1999, Khan et al 2000). Blank et al (1998) studied an area with iodinebush on mounds similar to the ones in this DRG and found that the mounds seemed to form periodically; mounds had mature vegetation but were too saline to allow for recruitment. It was hypothesized that when mature plants die, mounds tend to erode. Only upon new mound formation would these species be able to germinate.

Iodinebush is a chenopod and a C3 halophytic plant that grows in the arid environment of the Western United States where halomorphic soil induces extreme osmotic stress with erratic and low precipitation during the growing period. Iodinebush is generally found on eolian mounds at the margins of salt marshes and salt playas (Trent et al 1997, Gul and Weber 1999). These mounds average 0.3 meters in height and appear to be favorable for plant recruitment and survivorship, however this value is lost after a number of years because of accumulation of salts (Blank et al 1998). Iodinebush grows well in soils with 6% sodium chloride (NaCl). It is one of the most salt tolerant species in salt playas of the Great Basin. The dry summer season allows for salt to accumulate on the soil surface which prevents most plants from growing, except for iodinebush (Weber et al. 2002). Iodinebush roots were extracted from a mound and found that roots extended over 10 meters into the unvegetated playa (Blank et al 1998). The diameter of larger roots was over 5 cm, and many had between 90 and 120 growth rings, indicating that iodinebush is quite long-lived. Iodinebush relies on a persistent seedbank that can remain dormant until salinity stress is alleviated (Gul and Weber 2001). The large taproot of iodinebush can reach water table depths to 25 feet (Meinzer 1927).

Saltgrass is a C4-pathway dioecious warm-season rhizomatous grass that is highly adapted to saline areas (Comstock and Eleringer 1992, Newman and Gates 2000). Marcum and Kopec (1997) found saltgrass more tolerant of increased levels of salinity than alkaline sacaton, therefore dewatering and/or long-term drought causing increased levels of salinity would create environmental conditions more favorable to saltgrass over alkali sacaton. Saltgrass is classified as a phreatophyte and a facultative wetland species. It occurs where water table depths are from the soil surface to 10 or more feet (Meinzer 1927).

Alkali sacaton is a long-lived, warm-season, densely tufted perennial bunchgrass. It is considered a phreatophyte and a facultative wetland species in this region (USDA, NRCS 2015). Alkali sacaton has deep, coarse roots allowing it reach water tables at depths from 4 to 27 feet (Meinzer 1927). It reproduces from seeds and tillers and is a prolific seed producer. The seeds remain viable for several years because of the hard, waxy seed coats (USDA-Forest Service 1988).

The ecological sites in this DRG have low resilience to disturbance and resistance to invasion. Fire is not a typical disturbance in these sparsely vegetated communities. Changes in hydrology will affect plant communities; for example, lowering of the water table will decrease the herbaceous understory and
eventually affect shrub species as well. If the soils in this DRG are excessively disturbed, soil blowouts followed by ponding may lead to the formation of small playettes and loss of vegetation for a time. There is a greater risk of this occurring in areas with high off-highway vehicle (OHV) use. It has been observed that soil disturbance appeared to enable vegetation recruitment (Blank et al. 1998), but no further research has verified this. In the presence of non-native invasive weeds, soil disturbance could allow for further invasion. The introduction of annual weedy species, like halogeton, may cause an increase in fire frequency and eventually lead to an annual state. Two possible alternative stable states have been identified for this DRG.

**Fire Ecology:**
Historically, salt-desert shrub communities had sparse understories and bare soil in intershrub spaces, making these communities somewhat resistant to fire (Young 1983, Paysen et al. 2000). They may burn only during high fire hazard conditions; for example, years with high precipitation can result in almost continuous fine fuels, increasing fire hazard (West 1994, Paysen et al. 2000).

Loren and Kadlec (1985) found that fire followed by flooding one week later eliminated saltgrass from a Utah salt marsh; they found that although fire did not kill the plant’s rhizomes, the grass was not able to recover after flooding. Without immediate flooding, saltgrass may actually increase in cover after fire (de Szalay and Resh 1997).

Alkali sacaton is tolerant of fire, but can be killed by severe fire. Summer fires are more detrimental than winter fires. Recovery is typically two to four years (Newman and Gates 2000).

**Livestock/Wildlife Grazing Interpretations:**
Kovalev and Krylova (1992) found that iodinebush is a possible feed for animals if mixed with other forage plants. Saltgrass is an important forage species and is relatively high in crude protein (Hanson et al. 1976). It is grazed by both cattle and horses and it has a forage value of fair to good because it remains green when most other grasses are dry during periods of drought as well as being resistant to grazing and trampling (Skaradek and Miller 2010, Kartesz 1988).

Alkali sacaton provides valuable forage in the Southwest. Alkali sacaton has been found to be sensitive to early growing season defoliation whereas late growing season and/or dormant season use allowed recovery of depleted stands (Hickey and Springfield 1966).

Salt-desert shrub communities are relatively simple in terms of structure and species diversity but they serve as habitat for several wildlife species including reptiles, small mammals, birds and large herbivores (pronghorn) (Blaisdell and Holmgren 1984).

**STM Narrative Group 26**

**Reference State 1.0:** The Reference State 1.0 is representative of the natural range of variability under pristine conditions. The Reference State has two general community phases; a shrub-grass dominant phase and a shrub dominant phase. State dynamics are maintained by interactions between climatic patterns and disturbance regimes. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These include the presence of all structural and functional groups, low fine fuel loads, and retention of organic matter and nutrients. This site is very stable, with little variation in plant community composition. Plant community changes would occur in response to precipitation, long-term
drought, or abusive grazing and would be reflected in annual production. Wet years will increase grass production, while normal dry conditions will reduce grass production and shrubs will dominate.

**Community Phase 1.1:**
This community is dominated by iodinebush. Saltgrass may be codominant or subdominant. Mojave seablite, black greasewood, alkali sacaton, and basin wildrye make up minor components.

**Saline Flat (028AY009NV) Phase 1.1. T. Stringham, May 2012.**

**Community Phase Pathway 1.1a:** Abnormally high precipitation will cause ponding on the soil surface, leading to an increase in saltgrass.

**Community Phase 1.2:**
Saltgrass increases, iodinebush may decrease. Other perennial bunchgrasses such as alkali sacaton and basin wildrye may increase.

**Community Phase Pathway 1.2a:** Dry conditions cause salts to accumulate at the soil surface, which allows iodinebush to become dominant. Perennial bunchgrasses will be reduced.

**T1A: Transition from Reference State 1.0 to Current Potential State 2.0:**
**Trigger:** This transition is caused by the introduction of non-native annual plants such as halogeton, Russian thistle, cheatgrass, or salt cedar.
**Slow variables:** Over time the annual non-native species will increase within the community.
**Threshold:** The presence 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 two similar community phases. Ecological function has not changed, however the resiliency of the state has been reduced by the presence of invasive weeds. Non-natives may increase in abundance but will not become dominant within this state. These non-natives can be highly flammable and can promote fire where historically fire had been infrequent. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These feedbacks include the presence of all structural and functional groups, low fine fuel
loads, and retention of organic matter and nutrients. Positive feedbacks reduce ecosystem resilience and stability of the state. These include the non-natives’ high seed output, persistent seed bank, rapid growth rate, ability to cross pollinate, and adaptations for seed dispersal.

**Community Phase 2.1:**
This community is dominated by iodinebush and saltgrass. Mojave seablite, black greasewood, alkali sacaton, and basin wildrye make up minor components. Annual non-native species such as halogeton and Russian thistle are present and may be increasing within the community. Salt cedar may occur in disturbed areas where water has ponded.

![Image of community phase 2.1](image)

**Saline Flat (028AY009NV) Phase 2.1. T. Stringham, May 2012.**

**Community Phase Pathway 2.1a:** Abnormally high precipitation will cause ponding on the soil surface, leading to an increase in saltgrass.

**Community Phase 2.2:**
Saltgrass increases, iodinebush may decrease. Other perennial bunchgrasses such as alkali sacaton and basin wildrye may increase. Annual non-native species present and may increase with spring precipitation.

![Image of community phase 2.2](image)

**Saline Flat (028AY009NV) Phase 2.2. T. Stringham, May 2012.**
**Community Phase Pathway 2.2a:** Dry conditions cause salts to accumulate at the soil surface, which allows iodinebush to become dominant. Perennial bunchgrasses will be reduced.
1.1
Iodine bush dominates
Saltgrass subdominant

1.2
Saltgrass increases
Iodine bush decreases
Other shrubs decrease
Other perennial grasses may increase

2.1
Iodine bush dominates
Saltgrass subdominant
Annual non-native species such as Russian thistle and halogeton are present

2.2
Saltgrass increases
Iodine bush decreases
Other shrubs decrease
Other perennial grasses may increase
Annual non-native species are present
Reference State 1.0 Community Phase Pathways
1.1a: Abnormally high precipitation causes ponding on soil surface; increases saltgrass.
1.2a: Dry conditions increases soil surface salt content and allows iodinebush to dominate.

Transition T1A: Introduction of non-native species such as halogeton and Russian thistle.

Current Potential State 2.0 Community Phase Pathways
2.1a: Abnormally high precipitation causes ponding on soil surface; increases saltgrass.
2.2a: Dry conditions increases soil surface salt content and allows iodinebush to dominate.
References


