

# Ecological site group DX035X01GESG22

## Chinle Valley Sandstone Shallow, MAST < 54 degrees F

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### Key Characteristics

- Chinle Valley
- Sandstone or sandy loam
- Shallow
- MAST < 54 degrees F

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.

### Physiography

This group occurs in an upland position on treads of high stream terraces, fan remnants of undulating plateaus, pediments, summits of structural benches, and cuestas. Slopes on rolling mesa tops are from 0 to 15%. On the rocky escarpments slopes can reach up to 50%. It neither benefits significantly from run-in moisture nor is greatly affected by excess runoff. Elevations range from 4,700 to 6,100 feet. It occurs on all exposures. It is associated with sandstone rock outcrops.

### Climate

Mean annual precipitation varies from 6 to 14 inches. About 60% of this moisture comes as rain from April through October. May and June are the driest months. Most of the moisture from November through March comes as snow. Long periods with little or no effective moisture are relatively common.

The mean annual temperature ranges from 53 to 56 degrees Fahrenheit (F). Extreme temperatures of 105 degrees F and -26 degrees F have been recorded. Extreme temperatures of 104 degrees F and -17 degrees F have been recorded. The frost-free period ranges from 135 to 160 days.

Winds of high velocity during late winter and early spring are common.

Cool season plants begin growth in early spring and mature in the early summer. Warm season plants take advantage of the summer rains and grow from July through September.

### Soil features

Soils are very shallow and shallow to sandstone with sometimes some fractured shale bedrock. Surface horizon textures typically range from loamy sand to fine sandy loam with about 1 to 4 inches surface thickness. Subsurface horizon textures range from sandy loam to light clay loam with gravel and cobble contents less than 35% by volume. Soil reaction is mildly to strongly alkaline (pH 7.4 to 9.0) and soluble salt accumulations are low. Shallow depth to bedrock restricts the movement of both plant roots and moisture. These soils have low available moisture capacity due to shallow depth. Runoff is medium to very high and the hazard of water erosion is moderate to severe. The hazard of soil blowing is severe. Surfaces readily disperse and seal over during heavy rains which increases runoff, erosion and loss of moisture. Soils are typic aridic and ustic aridic. Biological crust cover is characterized as a weak crust, with light cyanobacteria and/or isolated moss clumps with no continuity.

### Vegetation dynamics

This group developed under the Colorado Plateau climatic conditions and included the natural influences of herbivory and climate. The group is dominated by shadscale, Torrey's jointfir is also commonly present. Cool season grasses, such as Indian ricegrass, are more prevalent in sites found on soils with more structural development. For example sites mapped on Lime Ridge, near Bluff, UT, found on Limeridge soils, which have more development, are dominated by Indian ricegrass, James galleta, and shadscale. Conversely, sites mapped on the White Rim of Canyonlands National Park, near Moab, UT, found on Moenkopie and Tsaya soils, which are very weakly developed, are dominated by James galleta and shadscale. Indian ricegrass may or may not be present. The desert shallow sandy loam shadscale site is exposed to fairly harsh conditions and soils with more development generally have higher water holding capacities, which enable vegetation to be more productive.

The most prominent disturbance regime associated with this site is weather. During periods of drought perennial warm and cool season grasses decrease, while periods of normal and above average precipitation result in an increase in perennial warm and cool season grasses. Shrub cover is generally similar under both climatic conditions; however, annual production decreases during drought. There is little natural herbivory on the site due to the lack of cover available to wildlife species.

This ecological site has been grazed by domestic livestock since they were first introduced into the area. This livestock introduction, and the use of fencing and reliable water sources, has influenced the disturbance regime historically associated with this ecological site. This site often serves as important wintering pastures for sheep and cattle. Improperly managed livestock grazing (continuous season long grazing, heavy stocking rates, etc.) may cause this site to depart from the reference plant community. When this occurs, any native perennial grasses present can decrease while invasive forbs, annual grasses, rabbitbrush and broom snakeweed can increase. Shadscale, due to its spinescent nature, is resistant to moderate browsing pressures, however, improper grazing may stress this species and allow nutrients to become available for invasive species to utilize (Simonin, 2001). Timing of grazing also affects the sites ecological dynamics, for example, spring grazing can result in a decline of cool season grasses, while heavy summer/early fall grazing can result in a decline of warm season grasses.

When vegetation communities respond to changes in management or to natural influences which move them to different ecological states, a return to previous states may not be possible. The amount of energy needed to affect vegetative shifts depends on present biotic and abiotic features and the desired results.

Drought and insect damage appear to be the main driving factors in many pinyon/juniper communities. Betancourt et al. (1993), noted that pinyon and juniper woodlands in the southwest appear to be more susceptible to large die-offs during droughts, than at other locations. If a severe drought persists, two-needle pinyon being more susceptible to drought and insect damage than Utah juniper, appears to die out first, while the Utah juniper may survive. This event could allow for an increase in shrubs and herbaceous species during periods when wetter years return.

Pinyon/Juniper communities throughout the West have received a lot of attention because many areas have experienced increases in the spatial extent and density of the trees (Miller and Wigand, 1994). on this site, however, pinyon/juniper do not encroach and become dominant. Rather the blackbrush remains a major component of this site.

## **Major Land Resource Area**

MLRA 035X  
Colorado Plateau

## **Subclasses**

- DX035X04B204–Sandstone Upland 6-10" p.z.
- DX035X04B314–Sandstone Upland 10-14" p.z.
- R035XA115AZ–Sandstone Upland 10-14" p.z.
- R035XB030NM–Sandy Loam Upland 6-10"
- R035XY130UT–Desert Shallow Sandy Loam (Shadscale)
- R035XY236UT–Semidesert Shallow Sandy Loam (Utah Juniper, Blackbrush)

## **Correlated Map Unit Components**

22353986, 22397530, 22397318, 22397534, 22397467, 22397368, 22397523, 22397538, 22397358, 22397454, 22397634, 22397505, 22397609, 22397269, 22397590, 22397322, 22397314, 22397604, 22397293, 22397563, 22397560, 22397199, 22999421, 22999431, 22999456, 22999496, 22999519, 22999520, 22999547, 22999639, 22999708, 22999785, 23000032, 22999829, 22999888

## Stage

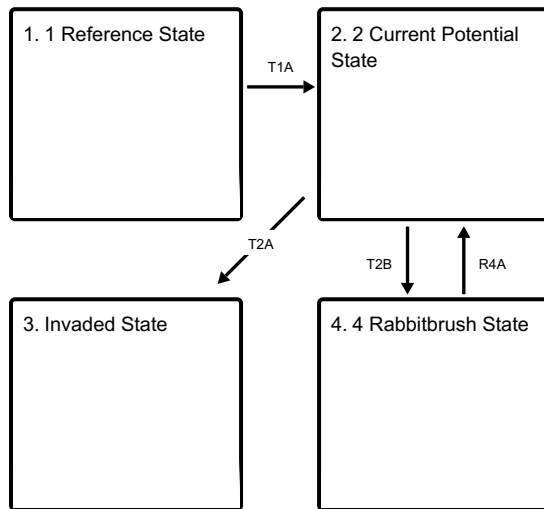
Provisional

## Contributors

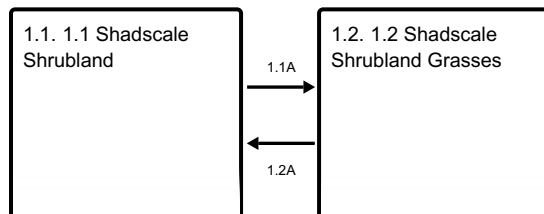
Curtis Talbot

## State and transition model

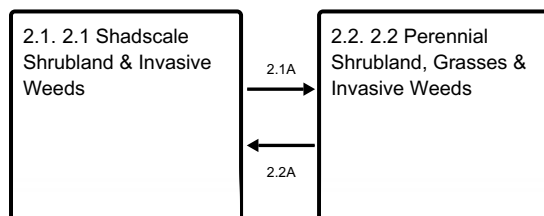
### Ecosystem states



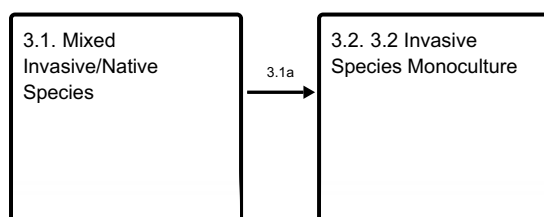
### State 1 submodel, plant communities



### State 2 submodel, plant communities



### State 3 submodel, plant communities



## State 4 submodel, plant communities

4.1. 4.1 Rabbitbrush  
Shrubland

## State 1

### 1 Reference State

The reference state was determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under land use influences, such as grazing and recreation. Literature reviews, trends in plant community dynamics, and historical accounts are also considered. The reference state represents the historic plant communities and natural ecological dynamics of the desert shallow sandy loam, shadscale site. This state includes the biotic communities that become established on the ecological site if all successional sequences are completed under current climatic conditions; natural disturbances are inherent in its development. This state is dominated by warm season perennial grasses and shadscale. Perennial cool season grasses may or may not be present depending on soil development. The primary disturbance mechanism is weather fluctuations. The reference state is self sustaining and resistant to change due to high resistance to natural disturbances and high resilience following natural disturbances. When natural disturbances occur, the rate of recovery is relatively rapid due to niches being filled with highly adapted native vegetation. Reference State: Community phases disturbed by climate fluctuations. Indicators: A site dominated by shadscale and galleta, where Indian ricegrass and sand dropseed may or may not be present. Feedbacks: Extended drought resulting in a reduction of native perennial plant vigor. Normal fluctuations in weather allowing for the maintenance of both shrubs and perennial grasses. At-risk Community Phase: All communities are at risk when nutrients are available for invasive plants to establish. Plant community 1.1 is especially at risk due to limited production and cover of understory grasses. Trigger: Introduction of invasive plants to fill available niches.

## Community 1.1

### 1.1 Shadscale Shrubland

This plant community phase is dominated by shadscale and Torrey's jointfir, warm and cool season perennial grasses are present in varying amounts. Grasses may include but are not limited to, Indian ricegrass, James galleta, and sand dropseed. James galleta is typically the dominant species in this plant community phase. Desert trumpet is typically the dominant forb present. Other perennial grasses, shrubs, and forbs may also be present and cover is variable. Bare ground is (10-30%) and biological crusts (0-5%), when present, are characterized by light cyanobacteria in the interspaces, with an occasional moss or lichen pinnacle. Surface rock fragments (20-60%) are very prevalent and are characterized by gravels, cobbles, and/or channers.

## Community 1.2

### 1.2 Shadscale Shrubland Grasses

This plant community phase is dominated by shadscale, Torrey's jointfir, and perennial grasses. Grasses may include, but are not limited to, Indian ricegrass, James galleta, and sand dropseed. James galleta is typically the dominant species in this plant community phase. Other perennial grasses may also be present depending on harshness of the soil conditions. Desert trumpet is typically the dominant forb; however, other perennial shrubs, and forbs may be present and cover is variable. Bare ground is (10-30%) and biological crusts (0-5%), when present, are characterized by light cyanobacteria in the interspaces, with an occasional moss or lichen pinnacle. Surface rock fragments (20-60%) can be very prevalent and are characterized by gravels, cobbles, and/or channers.

## Pathway 1.1A

### Community 1.1 to 1.2

This pathway occurs on properly managed sites when positive weather events, such as years with normal to above average precipitation favor the establishment of perennial grasses.

## **Pathway 1.2A**

### **Community 1.2 to 1.1**

This pathway occurs when drought coupled with improper livestock grazing and/or other surface disturbance reduces the percentage of perennial herbaceous vegetation growing on the site.

## **State 2**

### **2 Current Potential State**

This state is similar to state one, however there are now non-native invasive species established in the understory—cheatgrass and halogeton being the most common. The primary disturbance mechanism is weather fluctuation; however livestock grazing now may influence the ecological dynamics of the site. The current potential state has less ability resist change and less resilience following disturbances. Current Potential State: Plant communities disturbed by fluctuating weather conditions and livestock grazing. Indicators: Site dominated by shadscale and galleta, Indian ricegrass and sand dropseed may also be present. Invasive species are now present. Feedbacks: Extended drought, improper livestock grazing, and fire, resulting in a reduction of native perennial plant vigor. Normal fluctuations in weather and proper livestock grazing, allowing for the maintenance of both shrubs and perennial grasses. At-risk Community Phase: All communities are at risk when nutrients are available for invasive plants to flourish. Community phase 2.1 is particularly at risk due to the decreased native perennial grass understory associated with this phase. Trigger: Increased occurrence of invasive plants to fill available niches.

## **Community 2.1**

### **2.1 Shadscale Shrubland & Invasive Weeds**

This plant community phase is dominated by shadscale and Torrey's jointfir, warm and cool season perennial grasses are minimally present. Grasses may include but are not limited to, Indian ricegrass, James galleta, and sand dropseed. James galleta is typically the dominant species in this plant community phase. Cheatgrass is now present. Other perennial or invasive grasses, shrubs, and forbs may also be present and cover is variable. This plant community is very similar to plant community 1.1 in production and cover. The main difference is the non-native invasive species now present. Bare ground is (10-50%) and biological crusts (0-5%), when present, are characterized by light cyanobacteria in the interspaces with an occasional moss or lichen pinnacle. Surface rock fragments (20-60%) are very prevalent and are characterized by gravels, cobbles, and/or channers.

## **Community 2.2**

### **2.2 Perennial Shrubland, Grasses & Invasive Weeds**

This plant community phase is dominated by shadscale, Torrey's jointfir, and perennial grasses. Grasses may include Indian ricegrass, James galleta, and sand dropseed. James galleta is typically the dominant species in this plant community phase. Cheatgrass is now present. Other perennial or invasive grasses, shrubs, and forbs may also be present and cover is variable. This plant community is very similar to plant community 1.2 in production and cover. The main difference is that there are now non-native, invasive species present. Bare ground is (10-30%) and biological crusts (0-5%), when present, are characterized by light cyanobacteria in the interspaces, with an occasional moss or lichen pinnacle. Surface rock fragments (20-60%) are very prevalent and are characterized by gravels, cobbles, and/or channers.

## **Pathway 2.1A**

### **Community 2.1 to 2.2**

This pathway occurs when events, such as years with normal to above average precipitation, and properly managed livestock grazing favor the establishment of perennial grasses.

## **Pathway 2.2A**

### **Community 2.2 to 2.1**

This pathway occurs when events, such as surface disturbance, drought and/or improper livestock grazing, decrease the amount of perennial grasses present on the site.

## **State 3**

### **Invaded State**

This state is dominated by invasive species—cheatgrass, halogeton, and Russian thistle being the most common. The primary disturbance mechanisms are fire, improper livestock grazing and drought. One or more invasive species has increased to a point where they influence or drive the disturbance regime and nutrient cycle. Research has shown that plant species differ substantially in the effects on soil water content and temperature, and in their effects on the frequency and intensity of disturbance. After invasive plants have established, a site's fundamental nutrient cycling processes, root pores, mycorrhizal associations, microbial species, and soil organic material changes (Chapin et al. 1997; Belnap and Phillips, 2001). These alterations can eventually create ecologically impoverished sites that are very difficult to restore to functionally diverse perennial herbaceous and woody communities. The competitiveness of the annual forbs and/or grasses, and the ability of these species to quickly establish after a disturbance, make this state extremely resistant to change and resilient after a disturbance. Current Potential State: Plant communities disturbed by improper livestock grazing and drought. Indicators: A site dominated by invasive plant species, such as cheatgrass and halogeton. Feedbacks: Time without disturbance which may enable some native vegetation to reestablish. Natural fluctuations in weather and fire if fine fuel accumulation is adequate, which allow for the continued dominance of invasive plant species. At-risk Community Phase: Plant community 3.1 is most at risk because of declining native perennial vegetation.

### **Community 3.1**

#### **Mixed Invasive/Native Species**

This plant community phase is characterized by a dominance of invasive species, with a minimal occurrence of shadscale, Torrey's jointfir, James galleta, and other native perennial grasses, shrubs, and forbs. Invasive species include cheatgrass, halogeton, and Russian thistle. Other grasses, forbs, or shrubs may also be present and cover is variable. Bare ground is (10-30%) and biological crusts (0-5%), when present, are characterized by light cyanobacteria in the interspaces, with an occasional moss or lichen pinnacle. Surface rock fragments (20-60%) are very prevalent and are characterized by gravels, cobbles, and/or channers.

### **Community 3.2**

#### **3.2 Invasive Species Monoculture**

This plant community phase is characterized by a monoculture of invasive species, which may include cheatgrass, halogeton, and Russian thistle. Evidence of dead shadscale and Torrey's jointfir can be found in this plant community phase. Bare ground is (20-50%) and biological crusts (0-5%), when present, are characterized by light cyanobacteria in the interspaces, with an occasional moss or lichen pinnacle. Surface rock fragments (20-60%) are very prevalent and are characterized by gravels, cobbles, and channers.

### **Pathway 3.1a**

#### **Community 3.1 to 3.2**

This pathway occurs when events such as drought and improper livestock grazing further reduce the site's vigor. When this now at-risk community receives sufficient moisture for invasive annuals to flourish, fire can convert site to one dominated by cheatgrass and non-native forbs.

## **State 4**

### **4 Rabbitbrush State**

This state is dominated by rubber rabbitbrush and broom snakeweed, with minimal occurrence of shadscale, Torrey mormonella, galleta, and other native perennial shrubs, grasses, and forbs. The primary disturbance mechanisms are improper livestock grazing, weather fluctuations, and mining or other surface disturbances. Rubber rabbitbrush and broom snakeweed have increased to a point where they influence or drive the disturbance regime and nutrient cycle. These alterations can eventually create ecologically impoverished sites that are very difficult to restore to functionally diverse perennial herbaceous and woody communities. The competitiveness of rubber rabbitbrush and broom snakeweed and the ability of these species to quickly establish after a disturbance make this state extremely resistant to change and resilient after a disturbance. Rabbitbrush State: Plant communities disturbed by improper livestock grazing, mining disturbances, and other continued surface disturbances, such as road development, etc. Indicators: A site dominated by broom snakeweed and rabbitbrush. Feedbacks: Time without disturbance which may

enable limited native vegetation to reestablish. Natural fluctuations in climate, improper livestock grazing or continued surface disturbances which allow for the continued dominance of broom snakeweed and rubber rabbitbrush. Restoration Pathway: Fall livestock grazing and insects may be used to control the establishment and dominance of rubber rabbitbrush. Time without surface disturbances and livestock grazing may allow for the reestablishment of native perennial shrubs and grasses without an increase in broom snakeweed; however this may take many years to accomplish.

## **Community 4.1**

### **4.1 Rabbitbrush Shrubland**

This plant community phases is characterized by a dominance of rubber rabbitbrush and broom snakeweed, where native grasses shrubs, grasses, and forbs may also be present. Bare ground is (10-30%) and biological crusts (0-5%), when present, are characterized by light cyanobacteria in the interspaces, with an occasional moss or lichen pinnacle. Surface rock fragments (20-60%) are very prevalent and are characterized by gravels, cobbles, and/or channers.

### **Transition T1A**

#### **State 1 to 2**

This transition occurs as non-native invasive species become established in the plant community. Common non-native invasive species include cheatgrass, halogeton, and Russian thistle. Disturbances that may accelerate this transition include improper livestock grazing, surface disturbance and/or extended drought. Invasive species such as cheatgrass have also been known to invade an intact perennial plant community, however, where no disturbance has occurred.

### **Transition T2A**

#### **State 2 to 3**

This transition occurs as events favor the dominance of invasives species such as cheatgrass, Russian thistle, and halogeton. Events include drought and possibly fire; if fine fuel accumulation increases to a point where fire can carry through the current potential state. That fire could cause a transition into the invaded state.

### **Transition T2B**

#### **State 2 to 4**

Transition from Current Potential State (State 2) to Rabbitbrush State (State 4). This transition occurs as events favor the increased dominance of rabbitbrush and broom snakeweed. Events typically include improper livestock grazing, mining or other large surface disturbance.

### **Restoration pathway R4A**

#### **State 4 to 2**

This restoration pathway occurs as events favor the reestablishment of native grasses, shrubs, and forbs. Fall livestock grazing and insects may be used to control the establishment and dominance of rubber rabbitbrush (Tirmenstein, 1999a); however care must be taken to allow for the reestablishment of native perennial shrub, grass, and forb species, without an increase in broom snakeweed which is enhanced by grazing pressures (Tirmenstein, 1999b). Time without surface disturbances and livestock grazing may allow for the reestablishment of native perennial shrubs and grasses without an increase in broom snakeweed; however this may take many years to accomplish.

## **Citations**