

# Ecological site group DX035X01BESG13

## Circle Cliffs - Sandy Grasslands and Shrublands - mid-elevation, aridic grasslands

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### Key Characteristics

- Circle Cliffs
- Sandy Grasslands and Shrublands
- Mid-elevation, MAST <54 degrees F.
- aridic grasslands and shrublands on sandsheets, dunes, and structural benches

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

The ecological sites in this group occur on dunes, sandsheets, and alluvial fans on structural benches, mesas, plateaus, cuestras, terraces, and toeslopes. Elevations range from 3,700 to 6,700 feet. Slopes are 1 to 30 percent. Runoff is very low to low due to the rapid permeability of the soil and may be influenced by local micro-topography.

### Climate

The climate is characterized by hot summers and cool winters, which can be slightly modified by local topographic conditions, such as aspect. Large fluctuations in daily temperature are common. Mean annual air temperatures range from 48 to 54 degrees Fahrenheit. On the average, February, May, and June are the driest months and August, September, and October are the wettest months, most of the summer precipitation occurs as convection thunderstorms. Precipitation is variable from month to month and from year to year, but averages range between 6-13 inches annually. Snow packs are generally light and not persistent.

### Soil features

The soils are moderately deep to very deep sands and sandy loams formed in eolian deposits and alluvium derived, dominantly from sandstone. Material derived from shale, siltstone and igneous sources may influence the soils locally. Soil drainage ranges from well drained to excessively well drained. Permeability is moderately rapid to rapid. The soils have high potential for erosion by wind and water after disturbance. Rock fragments are generally rare, but may occur in soils influenced by alluvial processes. Soils are typically nonsaline and nonsodic. Biological soil crust cover varies by surface texture and plant community; sandy loams in grass dominated communities being more likely to support biological soil crusts. The more active dunes are generally dominated by shrub communities, supporting sand sagebrush, Cutler's jointfir, and Harvard oak. More stable sites support a higher proportion of grasses. Soil moisture regime is typic aridic or ustic aridic and soil temperature regime is mesic.

### Vegetation dynamics

The ecological sites in this group are typically perennial grasslands consisting of a mixture of cool and warm season grasses. A shrub layer consisting of fourwing saltbush, winterfat, sand sagebrush, Cutler's jointfir, or green Mormon tea is usually present and is the dominant visual aspect of the sites. In areas of recent deposition or soil movement the shrub layer may be more evident.

The natural disturbance regime consisted of fluctuations in precipitation and infrequent fires ignited by both natural causes and by Native Americans. Herbivory by insects and small mammals were localized influences as was use

by native large herbivores.

It is estimated that the historic fire regime was 35-100+ years, depending on fine fuel accumulations (Howard 2003).

These ecological sites have been grazed by domestic livestock since they were first introduced into the area. Before grazing began, fires would often only carry when several good moisture years created sufficient fuels for them to burn. With the introduction of domestic livestock, however, these fuel loads have typically been reduced, lengthening the fire return interval and allowing shrubs to increase at the expense of grasses. Conversely, the introduction of cheatgrass, which accompanied livestock grazing but is not restricted to grazed areas, has led to a shorter fire return interval in some cases, which promotes a cheatgrass dominated state.

## Major Land Resource Area

MLRA 035X  
Colorado Plateau

## Subclasses

- R035XY212UT–Semidesert Sand (Fourwing Saltbush)
- R035XY214UT–Semidesert Sand (Cutler Jointfir)
- R035XY215UT–Semidesert Sandy Loam (4-Wing Saltbush)
- R035XY101UT–Desert Alkali Sandy Loam (Alkali Sacaton)
- R035XY115UT–Desert Sand (Sand Sagebrush)
- R035XY118UT–Desert Sandy Loam (Fourwing Saltbush)

## Correlated Map Unit Components

22966818, 22966817, 22966849, 22966774, 22966775

## Stage

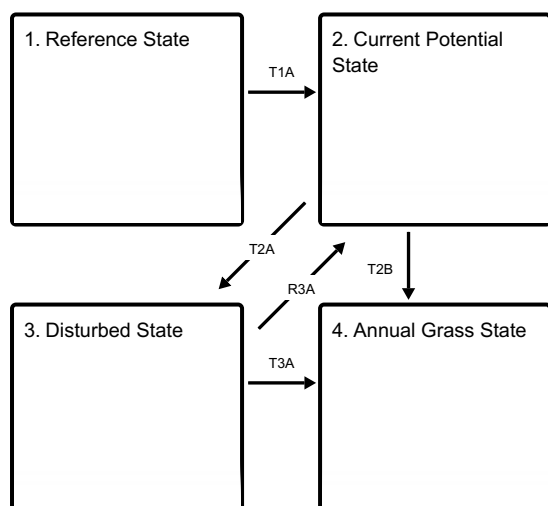
Provisional

## Contributors

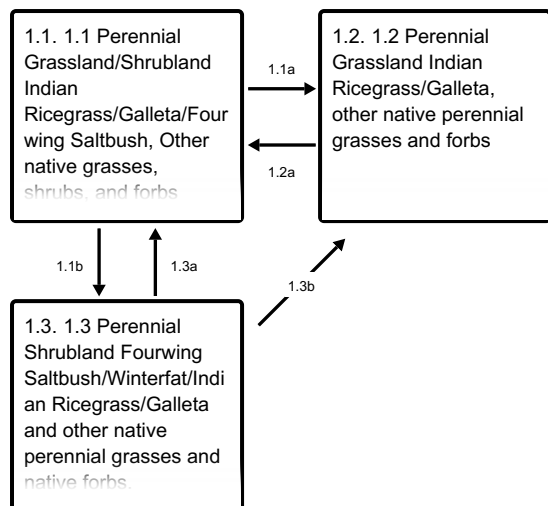
Vic Parslow  
Keith Crossland  
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## State and transition model

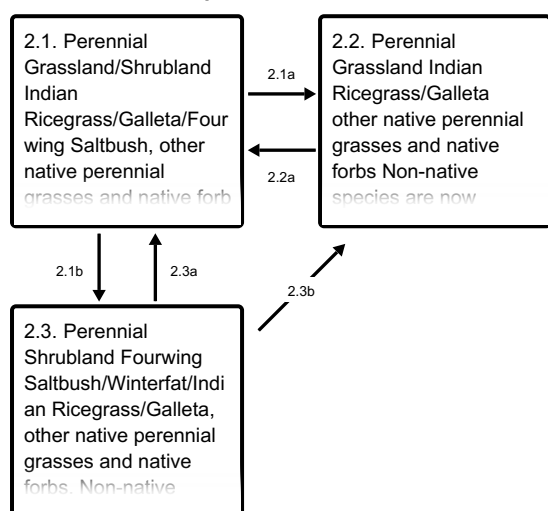
### Ecosystem states



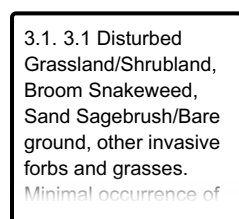
### State 1 submodel, plant communities



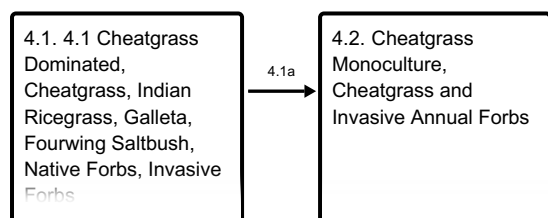
### State 2 submodel, plant communities



### State 3 submodel, plant communities



### State 4 submodel, plant communities



## State 1 Reference State

The reference state for the ecological sites in this group is typically perennial grasslands consisting of a mixture of cool and warm season grasses. A shrub layer consisting of fourwing saltbush, winterfat, sand sagebrush, Cutler's jointfir, or green Mormon tea is usually present and is the dominant visual aspect of the sites. In areas of recent deposition or soil movement the shrub layer may be more evident. The natural disturbance regime consisted of fluctuations in precipitation and infrequent fires ignited by both natural causes and by Native Americans. Herbivory by insects and small mammals were localized influences as was use by native large herbivores. It is estimated that

the historic fire regime was 35-100+ years, depending on fine fuel accumulations (Howard 2003).

## **Community 1.1**

### **1.1 Perennial Grassland/Shrubland Indian Ricegrass/Galleta/Fourwing Saltbush, Other native grasses, shrubs, and forbs**

This community phase is characterized by a shrub overstory, typically fourwing saltbush, with an understory of perennial cool and warm season grasses. Generally, Indian ricegrass is the dominant cool season grass and James galleta is the dominant warm season grass. Other perennial grasses, shrubs, and forbs may or may not be present and cover is variable.

## **Community 1.2**

### **1.2 Perennial Grassland Indian Ricegrass/Galleta, other native perennial grasses and forbs**

This plant community phase is characterized by well developed perennial warm and cool season grassland with occasional scattered fourwing saltbush, depending on disturbance history. Dominant grasses include Indian ricegrass, needle-and-thread, James galleta, and sand dropseed. Other perennial grasses, shrubs, and forbs may or may not be present and cover is variable. This plant community typically is a result of a fire in either plant community 1.2 or 1.3.

## **Community 1.3**

### **1.3 Perennial Shrubland Fourwing Saltbush/Winterfat/Indian Ricegrass/Galleta and other native perennial grasses and native forbs.**

This plant community phase is characterized by a well developed shrub overstory with a minimally developed native perennial grass understory. Dominant shrub species include fourwing saltbush, winterfat, sand sagebrush, and mormontea. Dominant perennial cool and warm season grasses include Indian ricegrass, James galleta and sandhill muhly. Other perennial grasses, shrubs, and forbs may or may not be present and cover is variable. Due to increased bare ground and decreased perennial grass understory this plant community is most at risk for erosion, soil loss, and invasion by introduced species such as cheatgrass, annual mustard, and/or Russian thistle, as well as invasive native species including broom snakeweed.

## **Pathway 1.1a**

### **Community 1.1 to 1.2**

Community 1.1 to 1.2 This pathway occurs when events, such as fire or shrub insect herbivory, favor the establishment of perennial native grasses and a reduction in the shrub canopy.

## **Pathway 1.1b**

### **Community 1.1 to 1.3**

Community 1.1 to 1.3 This pathway occurs when events favor the establishment of native shrubs and a reduction in the perennial grass understory. Events may include time without disturbances, or improper grazing. This is the natural successional pathway from community 1.1 to 1.3.

## **Pathway 1.2a**

### **Community 1.2 to 1.1**

Community 1.2 to 1.1 This pathway occurs when events favor the establishment of native shrubs with minimal loss of the perennial grass understory. Events may include time without disturbances or mild drought.

## **Pathway 1.3a**

### **Community 1.3 to 1.1**

Community 1.3 to 1.1 This pathway occurs when events, such as a cool fire or insect herbivory, favor a minimal decrease in the shrub canopy and the increased establishment of native perennial grasses.

## **Pathway 1.3b**

### **Community 1.3 to 1.2**

This pathway occurs when events, such as a hot fire, favors the establishment of native perennial grasses with a major reduction or removal of the shrub canopy.

## **State 2**

### **Current Potential State**

This state is similar to the reference state in plant community structure and ecological function except non-native invasive plants are established in the understory. This state has lower resistance to disturbances and resilience after disturbance than the reference state due to the occurrence of invasive species and increased bare ground. Community phases are influenced by fire, native herbivore grazing, domestic livestock grazing, insect herbivory cycles, frequency or lack of disturbances, and weather.

## **Community 2.1**

### **Perennial Grassland/Shrubland Indian Ricegrass/Galleta/Fourwing Saltbush, other native perennial grasses and native forb . Non-native species are now present.**

This plant community is characterized by a native perennial bunch grass understory with minimal occurrence of non-native invasive species. Fourwing saltbush forms the dominant shrub overstory. Commonly observed invasive plants include broom snakeweed, Russian thistle, cheatgrass, and annual mustards. Dominant perennial cool and warm season grasses include Indian ricegrass and James galleta. Other grasses, shrubs, and forbs may or may not be present and cover is variable.

## **Community 2.2**

### **Perennial Grassland Indian Ricegrass/Galleta other native perennial grasses and native forbs Non-native species are now present**

This plant community phase is characterized by well developed perennial warm and cool season grassland with occasional scattered fourwing saltbush, depending on when the disturbance history. There is minimal occurrence of non-native invasive species. Grass species present include Indian ricegrass, James galleta, and cheatgrass. Commonly seen invasive forbs and shrubs include Russian thistle, broom snakeweed and annual mustards. Other grasses, shrubs, and forbs may or may not be present and cover is variable. This plant community typically is a result of a cool fire in either plant community 2.1 or 2.3 and thus shrubs may or may not be present depending on when the fire occurred.

## **Community 2.3**

### **Perennial Shrubland Fourwing Saltbush/Winterfat/Indian Ricegrass/Galleta, other native perennial grasses and native forbs. Non-native species are now present.**

This plant community phase is characterized by a well developed shrub overstory with a minimally developed native perennial grass understory. Non-native invasive plants are present. Shrub species include fourwing saltbush, winterfat, broom snakeweed, and various mormontea species, Grasses include Indian ricegrass, cheatgrass, and James galleta. Commonly occurring invasive forbs include annual mustards and Russian thistle. Other grasses, shrubs, and forbs may or may not be present and cover is variable.

## **Pathway 2.1a**

### **Community 2.1 to 2.2**

Community 2.1 to 2.2 this pathway occurs when events favor the establishment of grasses with a complete removal of the shrub component. Events may include fire that allows for the reestablishment of the perennial grasses or grazing livestock in such a way that removes the shrub canopy.

## **Pathway 2.1b**

### **Community 2.1 to 2.3**

Community 2.1 to 2.3 This pathway occurs when events favor the establishment of shrubs with a reduction in the grass understory. Events may include fire suppression, time, or grazing livestock in such a way that reduces the grass understory and allows for increased establishment of the shrub component.

### **Pathway 2.2a**

#### **Community 2.2 to 2.1**

Community 2.2 to 2.1 This pathway occurs when events favor the establishment of shrubs with minimal loss of the grass understory. Events may include time without disturbances, mild drought, or grazing livestock in such a way that allows for the increase of shrubs and decrease of grass species.

### **Pathway 2.3a**

#### **Community 2.3 to 2.1**

Community 2.3 to 2.1 This pathway occurs when events, such as insect herbivory, favor a decrease in shrub canopy.

### **Pathway 2.3b**

#### **Community 2.3 to 2.2**

Community 2.3 to 2.2 This pathway occurs when events favor the establishment of native perennial grasses with a removal of the shrub canopy. Events typically include a cool fire that will significantly reduce or remove the shrubs, but still allow for establishment of native perennial grasses.

## **State 3**

### **Disturbed State**

This state is characterized by a dominance of broom snakeweed, sand sagebrush, Russian thistle, and various jointfir species with minimal occurrence of perennial warm or cool season grasses. The shift in species composition, as well as the increased bare ground, affects the nutrient cycling, soil-water relationships, hydrology, and soil stability of these sites. This state has lower resistance to disturbances and resilience after a disturbance than the previous two states. The primary disturbance mechanism is improperly managed domestic livestock grazing that maintains the broom snakeweed and bare ground.

## **Community 3.1**

### **3.1 Disturbed Grassland/Shrubland, Broom Snakeweed, Sand Sagebrush/Bare ground, other invasive forbs and grasses. Minimal occurrence of native vegetation**

This plant community phase is characterized by a dominance of broom snakeweed and/or sand sagebrush and Russian thistle. The perennial warm and cool season grasses may or may not be present. Fourwing saltbush and Cutler's mormontea also may be present. Cheatgrass is typically present and other invasive forbs are variable. Bare ground is very common. This plant community is most at risk when cheatgrass is present and fine fuel loads are sufficient to carry a fire, causing this community to be at risk of transitioning to an annual grass state.

## **State 4**

### **Annual Grass State**

This state's ecological processes are driven by the dominance of cheatgrass production. Other invasive, and some native plant species may also be present. Cheatgrass dramatically affects the soil/plant/water relationships of a site. Research has shown that it has substantial effects on soil water content and temperature, as well as impacts on the frequency and intensity of disturbance. After a cheatgrass invasion, a site's fundamental nutrient cycling processes, root pores, mycorrhizal associations, microbial species, and soil organic material are changed (Chapin et al. 1997; Belnap and Phillips, 2001). These alterations may eventually create ecologically impoverished sites that are very difficult to restore to functionally. The competitiveness of cheatgrass and its ability to quickly establish after a disturbance make this state extremely resistant to change and resilient after a disturbance. Community phases are maintained, in a self-sustaining manner, by frequent fire.

## **Community 4.1**

### **4.1 Cheatgrass Dominated, Cheatgrass, Indian Ricegrass, Galleta, Fourwing Saltbush, Native Forbs, Invasive Forbs**

This plant community is characterized by dominance of cheatgrass, other native species are present but no longer drive the ecological dynamics of the site. Fire can carry through this community.

## **Community 4.2**

### **Cheatgrass Monoculture, Cheatgrass and Invasive Annual Forbs**

This community is characterized by a complete monoculture of cheatgrass, where other grasses and shrubs do not occur. Invasive annual forbs may or may not be present, depending on current climatic conditions. This plant community is self-enhancing through frequent fire.

## **Pathway 4.1a**

### **Community 4.1 to 4.2**

Community 4.1 to 4.2 This pathway is characterized by frequently occurring fires (every 5-10 years) that allows for establishment of a cheatgrass monoculture.

## **Transition T1A**

### **State 1 to 2**

State 1 to 2 This transition is from the native perennial grass understory in the reference state to a state that contains invasive plants such as cheatgrass, Russian thistle, and annual mustards. Events that may trigger this event include fire, improper domestic livestock grazing, and extended drought that stress the native plants and allow nutrients to become available for more tolerant invasive species. Non-native, invasive species such as cheatgrass, however, have been known to invade into intact perennial plant communities where little to no disturbances have occurred. Once invasive species have established in the understory a threshold has been crossed.

## **Transition T2A**

### **State 2 to 3**

State 2 to 3 This transition from the Current Potential State (State 2) to the Disturbed State (State 3). This transition occurs when events favor broom snakeweed to dominate the site. Bare ground increases and perennial/annual grass production decreases. Events typically include improperly managed domestic livestock grazing for extended periods of time. This transition may occur from any community in the current potential state. Once broom snakeweed and bare ground dominate, and drive the ecological dynamics of a site, a threshold has been crossed.

## **Transition T2B**

### **State 2 to 4**

State 2 to 4 This transition from the Current Potential State (State 2) to the Annual Grass State (State 4). This transition occurs when events allow cheatgrass to dominate the site. Bare ground typically will decrease as cheatgrass increases. A hot, catastrophic fire occurring in any community in the current potential state can cause this transition to occur. This often causes an increase in the fire return interval. Once cheatgrass dominates and drives the ecological dynamics of a site, a threshold has been crossed.

## **Restoration pathway R3A**

### **State 3 to 2**

State 3 to 2 This restoration from the Disturbed State (State 3) to the Current Potential State (State 2). This restoration pathway occurs as native perennial shrubs and grasses are able to reclaim a site over time when improper livestock grazing and other disturbances are removed. For this to occur there must still be a seed source for native grasses and shrubs near or on the site. This restoration pathway may take many decades to complete.

## **Transition T3A**

### **State 3 to 4**

State 3 to 4 This transition is from the Disturbed State (State 3) to the Annual Grass state (State 4). This transition occurs when cheatgrass production is sufficient in the disturbed state for fire to be able to carry through the ecological site. Once cheatgrass drives the ecological dynamics of the site, a threshold has been crossed.

## **Citations**