Ecological site GX070A01X015
Clayey Flats

Last updated: 10/01/2021
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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): 070A–High Plateaus of the Southwestern Great Plains

This site only applies to MLRA 70A.

LRU notes

This ecological site is a member of the Canadian Plateaus Land Resource Unit (CP-LRU) of MLRA 70A. Its concepts do not extend beyond the boundary of this LRU. Proper application of this ecological site requires first that the site be identified within the concept of this LRU by using the following key:

1a. The site exists on a landform of volcanic origin, such as a basalt plateau, or is part of an escarpment system that rises directly to a volcanic structure. These escarpments are included if they have volcanic alluvium or colluvium (i.e. basalt, rhyolite, tuff, cinders) overlying non-volcanic residuum or bedrock (i.e. sandstone, shale). → VOLCANIC PLATEAUS LRU (VP)
User tip: Other alluvial or colluvial landform features extending below the escarpments are not included unless they have a predominance of volcanic fragments at the surface. Also, note that playas atop volcanic plateaus are included within the VP-LRU.
1b. All other sites. → 2
2a. The site exists in the annulus or floor of a playa. → CANADIAN PLATEAUS LRU (CP)
User tip: Small islands of playas occur within large areas of HP-LRU. These sites may be far from the nearest CP landform but will still key-out to the CP-LRU. The playa rim components, however, may key out to either LRU, so it is important to properly identify their soil properties.
2b All other sites. → 3
3a. The site is part of an escarpment landscape complex (defined below) or is within a canyon, valley, or small basin confined by such escarpments. At the upper boundary of the LRU, the soil surface meets at least 4 of the following 5 criteria:
I. Shallow or very shallow soils are present in at least 50% of the landform area;
II. Soils are underlain by sandstone bedrock of the Cretaceous Dakota Formation or older;
III. Presence or historical evidence of a conifer stand (≥ 2% canopy cover);
IV. The ground surface has a slope of at least 10%;
V. The landforms drain towards steep-walled escarpments or canyons below the Dakota sandstone (older Jurassic and Triassic Formations underlie this sandstone mesa cap).
→ MESOZOIC CANYONS AND BREAKS LRU (MCB)
User tip: The MCB sites also occur on any colluvial or alluvial bottomlands confined within escarpments or canyons. Some valleys transition from CP to MCB, or back to CP, and the turning point can be difficult to determine. Generally, the landforms are part of the MCB when confined between Dakota sandstone breaks or escarpments on both sides. Much of the acreage in the MCB is aproned by colluvial debris fans—composed of sandy materials with large sandstone fragments visible on the soil surface, including large stones or boulders. The soils in the bottoms of these confined valleys will also be in the MCB. When the valley opens, or there is only a single escarpment opening to the plains, the landforms below the steeper, rockier escarpments will be members of the CP-LRU.

3b. Fewer than 4 of the above criteria are met. → 4
4a. The soil is on a plateau summit position (tread) and is within 50 cm to contact with either plateau bedrock (non-soil bedrock of cemented sandstone, limestone, or shale) or strath terrace cobbles, but not a petrocalcic contact (caprock or caliche of cemented calcium carbonate). → CANADIAN PLATEAUS LRU (CP)
4b. No plateau bedrock or strath terrace cobbles within 50 cm. → 5
5a. Fragments (>2 mm) are visible within the soil profile and/or on the surface. If fragments cannot be found in the profile, it is acceptable to look nearby on ant mounds or around burrows. If site is in a drainageway, one can look for fragments on landforms immediately upslope.→ 6
5b. Fragments are entirely absent. → 7
6a. Fragments are mostly petronodes or High Plains gravels. → HIGH PLAINS LRU (HP)
6b. Fragments are mostly plateau bedrock fragments. → CANADIAN PLATEAUS LRU
7a. All horizons in the upper 100 cm of soil have textures of sandy clay loam or sandier.
→ CANADIAN PLATEAUS LRU (CP)
7b. At least one horizon in the upper 100 cm of soil has a texture that is less sandy than sandy clay loam. → HIGH PLAINS LRU (HP)

Classification relationships

NRCS and BLM: Clayey Flats Canadian Plateaus LRU Major Land Resource Area 70A, High Plateaus of the Southwestern Great Plains Land Resource Region G, Western Great Plains Range and Irrigated Region (United States Department of Agriculture, Natural Resources Conservation Service, 2006).

USFS: Clayey Flats Sandy Smooth High Plains Subsection Southern High Plains Section Great Plains-Palouse Dry Steppe Province (Cleland, et al., 2007).

EPA: Clayey Flats <26l Upper Canadian Plateau<26 Southwestern Tablelands (Griffith, et al. 2006).

Ecological site concept

The Clayey Flats ecological site occurs on alluvial landforms such as flats or fans, in the Canadian Plateaus LRU. This LRU occupies the western portion of MLRA 70A and extends from Las Vegas, NM at the southern end to beyond Raton, NM at its northern end. Elevation for the LRU ranges from 5,000 to 7,500 feet.

The central concept for the Clayey Flats ecological site is a soil on alluvial flats with a depth over 79 inches (200 centimeters) to root-restrictive layers, and with very high clay contents derived from clay-rich Cretaceous shale parent materials. Slopes are less than 1 percent. Surface texture ranges from silty clay to clay. This high clay concentration in the profile affects the infiltration rates of water and, although the clays are typically “active” rather than “superactive”, still cause a significant amount of shrink-swell action due to alternating severe wet and drying periods. This action can break plant roots, and is a factor in suppressing the growth of woody species. The soils also have a high water-holding capacity, allowing them to store large amounts of water, although much of this water is not plant-available. As is laid out in the ESD key, this site can be distinguished from those on similar landforms based on hydrology and surface texture.

Associated sites

GX070A01X005	**Limy** This site occurs where soils surfaces have strong or violent effervescence and ≥ 5% calcareous rock fragments. These sites are typically found up-slope from the Clayey Flats sites.
GX070A01X006	**Slopes** This site occurs on escarpments where soils are ≤ 50 cm to a root-restrictive layer, and have slopes >10%. Adjacent Clayey Flats sites receive material and run on from these slopes.
GX070A01X007	**Limy Escarpments** This site occurs on escarpments with slopes > 10%, with some amount of rock outcrop. Adjacent Clayey Flats receive material and run on from these sites.
GX070A01X008	**Ephemeral Drainageways** This site occurs on the channels and floodplains of ephemeral streams. Adjacent Clayey Flats sites contribute water to this site via run-on and through-flow.

GX070A01X014	**Lithic Limestone** This site occurs where soils are ≤ 50 cm to lithic contact with limestone bedrock, and often supports oneseed juniper savannah. These sites are typically found up-slope from the Clayey Flats sites.
R070AA018NM	**Mountain Front Fans** This site occurs on alluvial fans emanating from the foothills of the Rocky Mountains in MLRA 49. They have an increase in clay in subsurface horizons but lower clay contents overall.

Similar sites

R070AY002NM	**Clayey Upland** The Clay Alluvium ecological site fits many components that are currently correlated to the Clayey Upland (R070AY002NM) sites. This concept is too broad and does not account for the character of deeper alluvial soils which have a more specific hydrology, soil properties, and landscape character than soils on upland plateau landforms.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Legacy ID

R070AA015NM

Physiographic features

The Canadian Plateaus LRU exists on a plateau unit of the Great Plains Province landscape. The landforms that occur on this landscape include both erosional and depositional surfaces of plateaus and consist of alluvial fans, ridges, benches, playas, breaks, terraces, and floodplains. The Canadian River Valley, primarily to the east, is the base level towards which much of the LRU is eroding and draining. As the plateau grades towards the Canadian River, the elevation drops from heights as much as 7,500 feet to below 5,000 feet over a distance ranging from 20 to 40 miles. Because of this erosional gradient, the exposed strata are generally older as you move from west to east across this LRU. In the west younger bedrock, such as the late Cretaceous shales and limestones, remain intact, a testament to their distance from the Canadian River Valley. To the east, the early Cretaceous Dakota sandstone serves as a caprock that forms the plateau rim.

The Clayey Flats ecological site occurs on fan remnants and alluvial flats, and in some areas can be quite extensive. Other ecological sites in this LRU that occur on alluvial landforms include the Limy and Loamy Slopes. Associated sites that occur on landforms and landform positions adjacent to the Clayey Flats site are the Ephemeral Drainageways, Lithic Limestone, Slopes, Limy, and Limy Escarpments.

Because of its position in the landscape, the Clayey Flats site receives periodic run-on moisture from overlying landforms—particularly shale escarpments. Since run-off most frequently occurs in this part of the world in response to high intensity rain events, most of the run-on to the Clayey Flats site occurs during the summer monsoon season. This dynamic likely explains the dominance of warm season plants here.

For more detail on how the Clayey Flats site contrasts with and relates to other sites in the Canadian Plateaus, see the Ecological Site Key and Associated Sites section.

Geology:
The geology of the Canadian Plateaus consists primarily of Cretaceous rocks: shale, limestone, and sandstone of the Dakota, Graneros, Greenhorn, Pierre, and Niobrara Formations. Being widely distributed across this LRU, the Clayey Flats site occurs on each of these formations. Soils typically form in alluvium derived from shale parent materials but may have both eolian contributions at the surface or some residuum shale bedrock in the subsurface that contribute to the profile. The shales are of marine origin and 1:1 phyllosilicate minerals are common in the clay fraction. Limestone is generally not a major parent material, as evidenced by both the site's lack of calcareous

fragments and lack of a strong effervescence (HCl, 1N) at the surface.

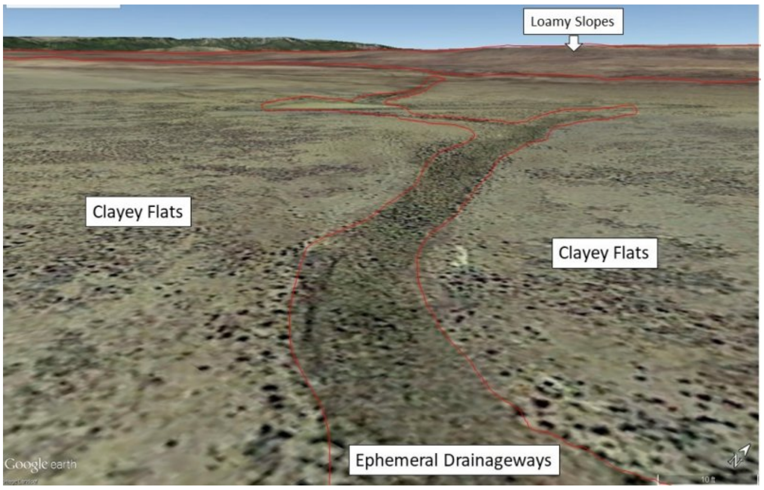


Figure 1. Clayey Flats site in a typical landscape. Note that true drainageways key to the Ephemeral Drainageways site.

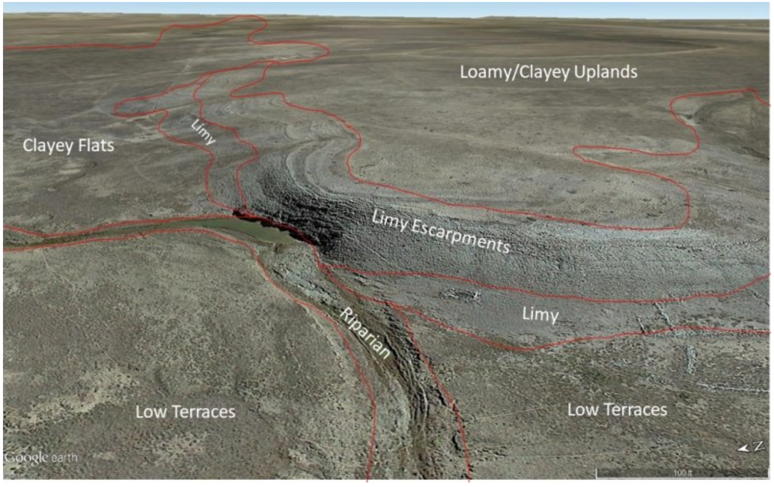


Figure 2. Clayey Flats site in a typical landscape.

Table 2. Representative physiographic features

Landforms	(1) Plateaus or tablelands > Alluvial flat (2) Plateaus or tablelands > Alluvial fan (3) Plateaus or tablelands > Fan remnant
Flooding frequency	None
Ponding frequency	None
Elevation	1,524–2,286 m
Slope	0–1%
Water table depth	152–508 cm
Aspect	Aspect is not a significant factor

Climatic features

The Canadian Plateaus are currently described as having an aridic-ustic and mesic soil climate regime. The estimated average annual soil temperature ranges from 49 to 58 F, supported by soil temperature measurements taken from May 2014 to July 2015. Rainfall occurs mostly during the summer months and ranges from 15 to 18 inches annually. An annual average range of 130 to 170 cumulative frost free days is common, with 150 days or fewer occurring above 7,000 feet.

Table 3. Representative climatic features

Frost-free period (characteristic range)	130-170 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	381-457 mm
Frost-free period (average)	150 days
Freeze-free period (average)	
Precipitation total (average)	406 mm

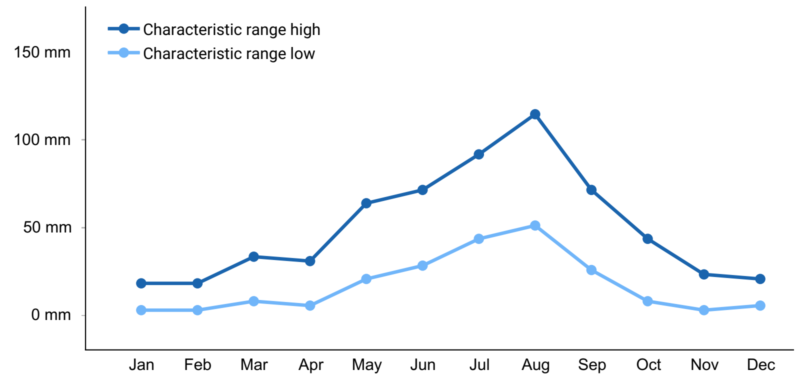


Figure 3. Monthly precipitation range

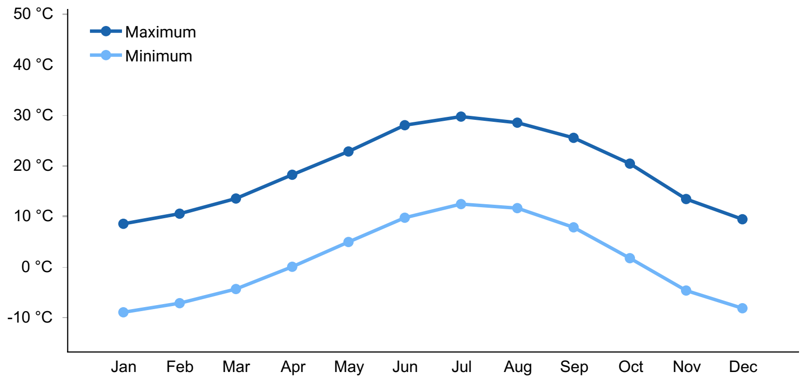


Figure 4. Monthly average minimum and maximum temperature

Climate stations used

- (1) MAXWELL 3 NW [USC00295490], Maxwell, NM
- (2) LAS VEGAS MUNI AP [USW00023054], Las Vegas, NM
- (3) CIMARRON 4 SW [USC00291813], Cimarron, NM
- (4) DES MOINES [USC00292453], Des Moines, NM
- (5) SPRINGER [USC00298501], Springer, NM
- (6) VALMORA [USC00299330], Valmora, NM
- (7) LAS VEGAS WWTP [USC00294862], Las Vegas, NM
- (8) ROY [USC00297638], Roy, NM

Influencing water features

The Clayey Flats ecological site is not associated with a wetland or riparian system. While alluvial flats are considered lowlands, they are dissected by gullies and channels such that they can also behave as upland in some localized areas. However, these locations receive additional water via run-on or flow-through from adjacent upland sites. This additional moisture is most expressed at the footslope positions directly below an escarpment, and often the plant communities reflect higher moisture availability. Where the alluvial flat or fan steepens as it approaches a gully or incised channel, the site appears drier.

Soil features

Every ecological site and associated soil component has static soil properties that help define the physical, chemical, and biological characteristics that make the site unique. The following soil profile information is a description of those unique soil properties for the Clayey Flats ecological site.

The Clayey Flats ecological site is tied to the components of numerous map units in the Canadian Plateaus LRU of 70A. These components are correlated to soils of the Vermejo series. These soils typically form in alluvium derived from shale. This ecological site is not limited to this soil series, nor is its extent limited to areas that are mapped with fitting soil properties in the soil survey. In order to address limitations in the soil mapping, an Ecological Site Key is provided for site-specific use.

In normal years these soils are driest during the winter. They are dry in some or all parts for over 90 cumulative days, but are moist in some or all parts for either 180 cumulative days or 90 consecutive days, during the growing season. The soil moisture regime is ustic bordering on aridic. The mean annual soil temperature is 49 to 55 degrees F; this range falls in the mesic soil temperature regime.

These soils are well to moderately well-drained with medium to high runoff potential at the surface and a slow to very slow rates of surface infiltration. They are characterized by subsurface horizons with at least 40 percent clay in the fine earth fraction, and typically have low EC values though salts can accumulate in some areas. They can be distinguished from similar soils of other ecological sites based on their high clay content at the surface.

TYPICAL PEDON: Typical pedon of Vermejo silty clay loam, 0 to 3 percent slopes; San Miguel County (NM630), about 15 miles north of Las Vegas, in the NW1/4 of sec. 24, T. 17 N., R. 17 E.
Location: -105.201 W, 35.687 N; Elevation 6,660 feet.

Fine, kaolinitic, nonacid, Mesic Ustic Torriorthents

A1-0 to 2 inches; grayish brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate fine granular structure; hard, firm, sticky and very plastic; many fine and very fine roots; few fine interstitial pores; calcareous; moderately alkaline; abrupt smooth boundary.

AC-2 to 10 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak medium prismatic structure that parts to weak medium subangular blocky; very hard, very firm, sticky and very plastic; many fine roots; few fine interstitial pores; calcareous; moderately alkaline; abrupt smooth boundary.

C1-10 to 24 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure that parts to medium subangular blocky; very hard, very firm, sticky and very plastic; common fine roots; few fine tubular pores; few pressure faces; few fine mycelia and crystals of salt; calcareous; moderately alkaline; clear wavy boundary.

C2-24 to 60 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; massive; very hard, very firm, sticky, and very plastic; few fine roots; few fine mycelia and crystals of salt; strongly calcareous; moderately alkaline.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 when dry, 3 or 4 when moist, and chroma of 2 or 3. The C horizon has hue of 10YR or 2.5Y, value of 4 to 5 when dry, and chroma of 2 or 3.

Parent Material Kind: shale
Parent Material Origin: alluvial and residual
Surface Texture Group: silty clay loam, silty clay, and clay
Subsurface Texture Group: silty clay loam, silty clay, and clay
Surface Fragments: 0 to 5 percent

Table 4. Representative soil features

Parent material	(1) Alluvium–shale (2) Alluvium–limestone, sandstone, and shale

Surface texture	(1) Silty clay loam (2) Silty clay (3) Clay
Family particle size	(1) Fine
Drainage class	Well drained
Permeability class	Very slow
Soil depth	152–508 cm
Surface fragment cover <=3"	0–5%
Available water capacity (0-101.6cm)	10.16–22.86 cm
Calcium carbonate equivalent (0-101.6cm)	0–10%
Electrical conductivity (0-101.6cm)	0–8 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–10
Soil reaction (1:1 water) (0-101.6cm)	6.6–8.6
Subsurface fragment volume <=3" (Depth not specified)	0–1%
Subsurface fragment volume >3" (Depth not specified)	0–1%

Ecological dynamics

The Clayey Flats ecological site contains a mix of grasses, forbs, shrubs, and succulents. Late-seral communities are grasslands with sparsely scattered shrubs, while certain early-seral communities harbor codominant shrub communities. While warm-season plants dominate this site, cool-season grasses are quite abundant in the reference community. Within a given plant community phase, the relative abundance of cool-season plants increases in response to moisture in the spring and late fall. High temporal variation in the amount and timing of precipitation across this site strongly influences the relative cover of cool- and warm-season herbaceous species.

There are numerous variables such as elevation, latitude, hydrology, soil depth, fire frequency, grazing dynamics, and anthropogenic effects that influence plant communities. Elevation generally increases as the plateaus gently climb to the west, and proximity to greater warm-season moisture from the Gulf of Mexico increases toward the east. Thus, both factors result in an increase in the relative amount of warm-season moisture to the east. As elevation increases toward its upper extreme (about 7,500 feet) near the foot of the Rocky Mountains, cool-season plants within this site become most abundant. Therefore, blue grama and broom snakeweed are particularly abundant in the east; while western wheatgrass, fringed sage, and common sagewort increase their presence to the west.

Since the Clayey Flats ecological site occurs on alluvial landforms that are bounded by other Canadian Plateaus landforms, this site does not transition into ecological sites of other LRUs at its upper and lower elevations. Rather, it is typically bounded by the Ephemeral Drainageways and Low Terraces sites at the bottom of the landform; and by the Limy, Limy Escarpments, and Clayey Uplands at the upper end of the landform.

While the Clayey Flats site occupies rather subdued geomorphic positions, even gentle undulations cause certain landform positions to receive run-on moisture from adjacent positions. While major run-on-landforms such as drainageways and playas are covered by unique ecological sites, small concavities are included within the concept of the Clayey Flats site. In these positions, we find patches with higher total production, and a greater relative abundance of western wheatgrass.

Within this site, the dominant species of short grasses are inherently drought- and grazing-tolerant (Lauenroth et al., 1994). Across the western parts of the U.S., blue grama is one of the most extensively distributed grasses and occurs in a wide variety of different ecosites ranging from grasslands to shrubland and woodland sites. This grass evolved with grazing by large herbivores and, when grazed continuously, tends to form a short sod. When allowed to grow under lower grazing pressures, the plants develop the upright physiognomy of a bunchgrass. If blue grama is eliminated from an area by extended drought (3-4 years) or disturbance such as plowing, regeneration is slow because of very slow tillering rates (Samuel, 1985), low and variable seed production, minimal seed storage in the soil (Coffin and Lauenroth, 1989) and limited seedling germination and establishment due to particular temperature and extended soil moisture requirements for successful seedling establishment (Briske and Wilson, 1978). Buffalograss, which is more abundant at warmer, lower elevations of this site, is often found occupying swale or depression positions across the landscape. Buffalograss is less drought-tolerant than blue grama but re-establishes more quickly following disturbance due to higher seed abundance and viability and more effective above-ground tillering (Peters, 2008).

Large-scale processes such as climate, fire, and grazing influence this site. During years with favorable growing seasons, the effects of grazing may be mitigated. During years of low precipitation, grazing can magnify degradation of the site (Milchunas et al., 1989). Fire is a natural disturbance regime that suppresses succulents and shrubs while stimulating grasses and forbs, however, in contrast to mid and tall grass prairie sites, fire is less important (Wright and Bailey, 1982). This is because the drier conditions produce less vegetation/fuel load, lowering the relative fire frequency. However, historically, fires that did occur were often very expansive, especially after a series of years where above average precipitation built enough litter/fine fuels. Currently, fire suppression and more extensive grazing in the region have decreased the fire frequency, and it is unlikely that these processes could occur at a natural scale (USNVC, 2017)-G144. According to (Gebow, 2001), fire effects in the same location will vary, especially with fire timing, where seasonality can either hinder or benefit plants depending on their growing stage. Precipitation events occurring before and after fire will also influence the recovery of plants. Fire promotes rhizomatous plant species, such as western wheatgrass, that can take advantage of below-ground rhizomes from which tillering is rapidly initiated.

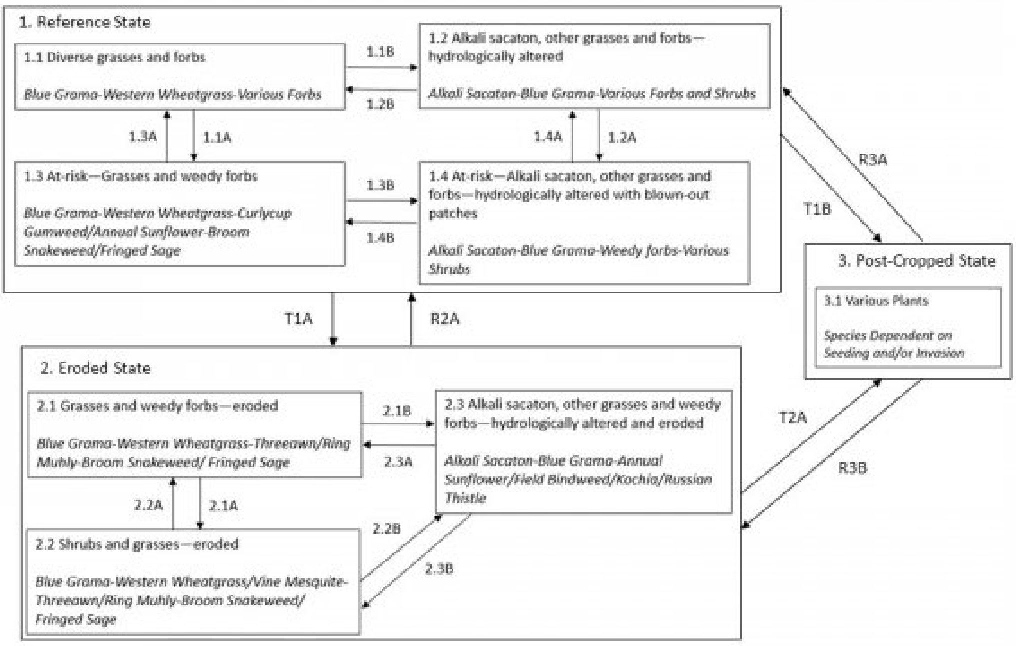
Correlation to Current Ecological Sites:
The Clayey Flats ecological site fits many components that are currently correlated to the Clayey Upland (R070AY002NM) sites. The latter concept is too broad and does not account for the character of deeper alluvial soils which have a more specific hydrology, soil properties, and landscape character than soils on upland plateau landforms.

Clayey Upland Legacy Tables (R070AY002NM)
Annual production by plant type
Plant Type------------------Low (Lb/Acre)------RV (Lb/Acre)------High(Lb/Acre)
Grass/Grasslike---------330---------------------660---------------------1000
Shrub/Vine-----------------30-----------------------60----------------------100
Forb--------------------------10----------------------20-----------------------40
Total--------------------------370--------------------740--------------------1140

Community 1.1 plant community composition
Common Name-------------Symbol--------Scientific Name-------Annual Production (Lb/Acre)
GRASS/GRASSLIKE
1 blue grama-----------------BOGR2---------*Bouteloua gracilis*--------------200–240
2 western wheatgrass---PASM-----------*Pascopyrum smithii*----------160–200
3 alkali sacaton-------------SPAI------------*Sporobolus airoides*----------160–200
4 James' galleta------------PLJA------------*Pleuraphis jamesii*-------------80–120
5 vine mesquite-------------PAOB-----------*Panicum obtusum*-------------40–80
6 sideoats grama----------BOCU-----------*Bouteloua curtipendula*------8–40
7 buffalograss--------------BODA2----------*Bouteloua dactyloides*-------8–40
8 New Jersey muhly-----MUTO-----------*Muhlenbergia torreyana*-----8–40
FORB
9 ragweed--------------------AMBRO---------Ambrosia-------------------------8–24
10 *Forb, perennial*----------2FP-------------- *Forb, perennial*-------------------8–24
11 *Forb, annual*--------------2FA-------------- *Forb, annual*----------------------8–24
SHRUB/VINE
12 fourwing saltbush------ATCA2----------*Atriplex canescens*------------16–48
13 pale desert-thorn-------LYPA-------------*Lycium pallidum*-----------------16–48

14 winterfat-------------------KRLA2-----------*Krascheninnikovia lanata*----8–24

State and transition model



State 1
Reference State

This state represents the most ecologically stable conditions in terms of resistance to erosion. Moreover, this state has the highest potential for productivity and plant diversity. See related community phases for more information.

Community 1.1
1.1 Diverse grasses and forbs (diagnostic plant community)

Figure 5. Community 1.1 in San Miguel County, October 2017. Grasses are both dominant and diverse, canopy cover is very high, and the soil is rich with organic matter throughout. The line of cottonwoods in the background occurs in the Riparian site.

This community is dominated by grasses, but contains a number of forb species and scattered shrubs. Foliar cover is between 85 and 95 percent, and bare ground is typically less than 10 percent. Total canopy cover of warm-season grasses is above 75 percent, while cool-season grasses account for less than 10 percent. Foliar cover of forbs is often less than 5 percent, but can range as high as 15 percent. Shrub cover is less than 2 percent. Annual production averages around 1,400 pounds per acre, but can range between 1,000 and 1,800 pounds per acre, depending mostly on annual weather patterns. This community generally occurs where season-long grazing has not been practiced in a number of years. Blue grama is the dominant species, and western wheatgrass is generally well-represented. Early-seral grasses such as sleepygrass and galleta are generally absent. Although forbs are quite secondary in total cover, they can be diverse. Shrubs such as broom snakeweed and fringed sage are present, but in small amounts. Broom snakeweed is more common at lower elevations and eastern latitudes and fringed sage is more common toward the higher/cooler end of the spatial/climatic gradient. This plant community optimizes energy flow, hydrologic function, and nutrient cycling. The diverse root systems of various grasses take advantage of moisture from both close to the surface as well as deeper in the soil profile. High canopy cover protects the soil surface from raindrop impact; fibrous roots of grasses and good soil structure also promote infiltration of rainwater and prevent erosion. With periodic herbivory, decomposition is active, creating soil organic matter (SOM), which enhances “plant available water” needed for plant vigor. While this is the most late-seral community observed during reconnaissance, it exhibits some evidence of past degradation, and likely does not reflect pre-Colombian conditions.

Dominant plant species

- broom snakeweed (*Gutierrezia sarothrae*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- blue grama (*Bouteloua gracilis*), grass
- western wheatgrass (*Pascopyrum smithii*), grass

Community 1.2
1.2 Alkali sacaton, other grasses and forbs—hydrologically altered

Figure 6. Community 1.2 in Colfax County, September 2017. Alkali sacaton and blue grama have similar canopy cover here, but sacaton—with its larger growth form—accounts for significantly more biomass.

This community is dominated by alkali sacaton and blue grama, but also contains a number of forbs and shrubs. Foliar cover is between 85 and 95 percent, and bare ground is typically less than 10 percent. Total canopy cover of warm-season grasses is above 80 percent, while cool-season grasses account for less than 5 percent. Foliar cover of forbs is typically below 5 percent. Shrub cover is also less than 5 percent. Annual production averages around 1,800 pounds per acre, but can range between 1,400 and 2,500 pounds per acre, depending mostly on annual weather patterns. This community generally occurs where season-long grazing has not been practiced in a number of years. Additionally, hydrology has been altered such that a relatively high water table provides extra moisture at times. This increases plant-available water, but can also lead to increases in salinity. Alkali sacaton is the dominant species, but blue grama is abundant and often rivals the former in terms of canopy cover. Early-seral grasses such as sleepygrass and galleta are generally absent. Although forbs are quite secondary in total cover, they can be diverse. Weedy forbs such as kochia, annual sunflower, and Russian thistle are often present, but their total cover is low. Shrubs such as broom snakeweed, fringed sage, and wolfberry are present, but in small amounts. Broom snakeweed is more common at lower elevations and eastern latitudes and fringed sage is more common toward the higher/cooler end of the spatial/climatic gradient. The upward wicking of salt-laden groundwater into the soil and subsequent evapotranspiration of this water causes salts to deposit in the soils. However, significant additions of water from above (in the form of rain and run-on) dissolve these salts and flush them through/from the soil profile. Thus, salinity is a dynamic soil property, and is not always measurable in this community phase. This plant community optimizes energy flow, hydrologic function, and nutrient cycling. The diverse root systems of various grasses take advantage of moisture from both close to the surface as well as deeper in the soil profile. High canopy cover protects the soil surface from raindrop impact; fibrous roots of grasses and good soil structure also promote infiltration of rainwater and prevent erosion. With periodic herbivory, decomposition is active, creating soil organic matter (SOM), which enhances "plant available water" needed for plant vigor. While this is a late-seral community by today's standards, it exhibits some evidence of past degradation, and likely does not reflect pre-Colombian conditions.

Dominant plant species

- alkali sacaton (*Sporobolus airoides*), grass
- blue grama (*Bouteloua gracilis*), grass

Community 1.3
3 At risk: Grasses and weedy forbs

Figure 7. Community 1.3 in Colfax County, June 2015. While total foliar cover and production are relatively high and western wheatgrass is codominant, annual sunflower and curlycup gumweed rival grasses in terms of foliar cover.

This community is dominated by blue grama, but also contains significant amounts other grasses and early-seral forbs. Western wheatgrass is often quite abundant in this phase. While this community shows abundant evidence of disturbance, a significant amount of topsoil remains here. Total foliar cover averages 75 percent, and ranges from 65 to 85 percent. Bare ground ranges from 10 to 25 percent. Total canopy cover of grasses is roughly 50 percent, with warm-season species being at least modestly dominant. Foliar cover of forbs ranges from 10 to over 25 percent. Shrub cover is generally less than 5 percent. Annual production averages around 1,300 pounds per acre, but can range between 1,000 and 1,700 pounds per acre, depending mostly on annual weather patterns. This community generally occurs where season-long grazing has been practiced long and recently enough to be reflected strongly in the plant community. Early-seral forbs such as curlycup gumweed, annual sunflower, kochia, and Russian thistle account for a significant share of total production. Bare ground is much higher than in phase 1.1, and recent wind and water erosion are often apparent. However, neither the topsoil nor the seedbank it bears have been entirely lost. Compared to phase 1.1, several important ecosystem functions are diminished here. While roots are as diverse in terms of type and depth, total biomass and production—aboveground and below—are lower. This translates to diminished rates of nutrient cycling. Reduced production of herbaceous species translates to reduced rates of decomposition—leading in the long term to lower amounts of SOM. Where SOM has decreased in situ, or significant topsoil has been lost, soil fertility and water-holding capacity have decreased. The combination of greater bare ground and lower amounts of fibrous grass roots accelerates erosion.

Dominant plant species

- blue grama (*Bouteloua gracilis*), grass
- western wheatgrass (*Pascopyrum smithii*), grass

Community 1.4
At risk: Alkali sacaton, other grasses and forbs—hydrologically altered with blown-out patches

Figure 8. Community 1.4 in Colfax County, September 2017. While much of the original topsoil remains, bare spots account for a significant amount of area. These have been subsequently colonized by rather sparse stands of early seral forbs.

This community is dominated by alkali sacaton and blue grama, but also contains significant amounts shrubs and forbs. While total canopy cover is relatively high, there are large patches of bare ground that are actively eroding. Although this community shows abundant evidence of disturbance, a significant amount of topsoil remains here. Total foliar cover averages 80 percent, and ranges from 70 to 90 percent. Bare ground ranges from 5 to 25 percent. Total canopy cover of grasses is over 60 percent, with warm-season species being quite dominant. Foliar cover of shrubs ranges from 5 to over 15 percent. Forb cover is generally less than 10 percent. Annual production averages around 1,400 pounds per acre, but can range between 1,000 and 2,000 pounds per acre, depending mostly on annual weather patterns. This community generally occurs where season-long grazing has been practiced long and recently enough to be reflected strongly in the plant community. Early-seral forbs such as kochia, Russian thistle, field bindweed, and pigweed account for a significant share of total production. Bare ground is much higher than in phase 1.2, and recent wind erosion is quite apparent. However, neither the topsoil nor the seedbank it bears have been entirely lost. Compared to phase 1.2, several important ecosystem functions are diminished here. While roots are at least as diverse in terms of type and depth (note the increase in shrub cover), total biomass and production—aboveground and below—are lower. This translates to diminished rates of nutrient cycling. Reduced production of herbaceous species translates to reduced rates of decomposition—leading in the long term to lower amounts of SOM. Where SOM has decreased in situ, or significant topsoil has been lost, soil fertility and water-holding capacity have decreased. The combination of greater bare ground and lower amounts of fibrous grass roots accelerates erosion. Additionally, since evaporation rates are very high on patches of bare ground, salts are wicked to the surfaces of these patches when water tables and temperatures are high. This, in-turn, further reduces productivity, discourages germination, and leads to further erosion.

Dominant plant species

- fourwing saltbush (*Atriplex canescens*), shrub
- alkali sacaton (*Sporobolus airoides*), grass
- blue grama (*Bouteloua gracilis*), grass

Pathway P1.1B
Community 1.1 to 1.2

1.1 Diverse grasses and forbs (diagnostic plant community)

1.2 Alkali sacaton, other grasses and forbs—hydrologically altered

This pathway represents a change in hydrology which elevates the water table to the point where capillary action draws groundwater into the soil profile. This leads to periods of elevated salinity. Such a change in hydrology is often human-caused, as in adding water to playas and stock tanks. However, this can also occur when natural playas fill during particularly wet periods.

Pathway P1.1A
Community 1.1 to 1.3

1.1 Diverse grasses and forbs (diagnostic plant community)

3 At risk: Grasses and weedy forbs

This pathway represents a period of heavy grazing, typically season-long, which advantages the growth and reproduction of weedy forbs and shrubs, and suppresses herbaceous species that are more palatable and/or less resilient under grazing pressure.

Pathway P1.2B
Community 1.2 to 1.1

1.2 Alkali sacaton, other grasses and forbs—hydrologically altered

1.1 Diverse grasses and forbs (diagnostic plant community)

This pathway represents a change in hydrology which causes the water table to drop such that capillary action no longer draws groundwater into the soil profile. This eliminates periods of elevated salinity and, thus, removes the competitive advantage to salt-adapted species such as alkali sacaton and fourwing saltbush.

Pathway P1.2A
Community 1.2 to 1.4

1.2 Alkali sacaton, other grasses and forbs—hydrologically altered

At risk: Alkali sacaton, other grasses and forbs—hydrologically altered with blown-out patches

This pathway represents a prolonged period of heavy grazing, typically season-long, which advantages the growth and reproduction of weedy forbs and shrubs, and suppresses herbaceous species that are more palatable and/or less resilient under grazing pressure. As this management regime persists, bare patches increase in size and number. These patches are subsequently invaded by early-seral forbs such as kochia, Russian thistle, field bindweed, and pigweed.

Pathway P1.3A
Community 1.3 to 1.1

3 At risk: Grasses and weedy forbs

1.1 Diverse grasses and forbs (diagnostic plant community)

This pathway represents prescribed grazing or rest from grazing. In either case, herbaceous plants that are palatable and/or sensitive to grazing increase in vigor and abundance, and weedy forbs are at a competitive disadvantage.

Pathway P1.3B
Community 1.3 to 1.4

3 At risk: Grasses and weedy forbs

At risk: Alkali sacaton, other grasses and forbs—hydrologically altered with blown-out patches

This pathway represents a change in hydrology which elevates the water table to the point where capillary action draws groundwater into the soil profile. This leads to periods of elevated salinity.

Pathway P1.4A
Community 1.4 to 1.2

At risk: Alkali sacaton, other grasses and forbs—hydrologically altered with blown-out patches

1.2 Alkali sacaton, other grasses and forbs—hydrologically altered

This pathway represents prescribed grazing or rest from grazing. In either case, herbaceous plants that are palatable and/or sensitive to grazing increase in vigor and abundance, and weedy forbs and certain shrubs are at a competitive disadvantage. Promoting herbivory of fourwing saltbush over that of grasses will require carefully-timed grazing.

Pathway P1.4B
Community 1.4 to 1.3

At risk: Alkali sacaton, other grasses and forbs—hydrologically altered with blown-out patches

3 At risk: Grasses and weedy forbs

This pathway represents a change in hydrology which causes the water table to drop such that capillary action no longer draws groundwater into the soil profile. This eliminates periods of elevated salinity and, thus, removes the competitive advantage to salt-adapted species such as alkali sacaton and fourwing saltbush.

State 2

Eroded State

Soils significantly eroded. See related community phases for more information.

Community 2.1
Grasses and weedy forbs—eroded

Figure 9. Community 2.1 in San Miguel County, October 2017. Note the sod-bound habit of the blue grama.

In this plant community, blue grama is the dominant grass, but its vigor and rooting depth are significantly reduced—leaving it highly vulnerable to drought stress. Early-seral grasses such as ring muhly and threeawn are well-represented, as are "weedy" forbs such as purple tansyaster and curlycup gumweed. Shrubs—namely broom snakeweed and fringed sage—may also be a significant component, but do not rival herbaceous species in terms of foliar cover. Topsoil, if present, has been severely diminished. Total foliar cover averages 75 percent, and ranges from 60 to 90 percent. Bare ground ranges from 5 to 30 percent. Total canopy cover of grasses is generally above 50 percent, with warm-season species being dominant. Foliar cover of forbs ranges from 2 to 5 percent. Shrub cover is generally less than 10 percent. Annual production averages around 850 pounds per acre, but can range between 700 and 1,200 pounds per acre, depending mostly on annual weather patterns. This community generally occurs where season-long grazing has been practiced long enough to be reflected strongly in both the plant community and the soils. However, recent rest or prescribed grazing may have occurred—causing a shift from Community 2.2. Blue grama—often sod-bound—is the dominant plant; galleta, ring muhly, and threeawn are often well-represented, too. Early-seral forbs such as curlycup gumweed and purple tansyaster account for a measurable share of total production. Small amounts of western wheatgrass, vine mesquite, and/or alkali sacaton may be present, indicating recent rest. Bare ground is generally higher than in the reference state, and recent wind and water erosion are often apparent. Topsoil is either missing or else severely diminished in quality and thickness, and much of the seedbank has been entirely lost. Compared to the reference state, several important ecosystem functions are diminished here. Because species diversity is lower and plant vigor is diminished, root systems are less diverse and generally shallower. This translates to diminished rates of water uptake and nutrient cycling. Reduced production of herbaceous species translates to reduced rates of decomposition—leading in the long term to lower amounts of SOM. Where SOM has decreased in situ, or significant topsoil has been lost, soil fertility and water-holding capacity have decreased. The combination of greater bare ground and lower amounts of fibrous grass roots accelerates erosion.

Dominant plant species

- broom snakeweed (*Gutierrezia sarothrae*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- blue grama (*Bouteloua gracilis*), grass
- James' galleta (*Pleuraphis jamesii*), grass
- ring muhly (*Muhlenbergia torreyi*), grass
- threeawn (*Aristida*), grass

Community 2.2
Shrubs and grasses—eroded

Figure 10. Community 2.2 in Mora County, October 2017. This is an extreme example of both degradation and shrub-dominance.

In this plant community, shrubs rival herbaceous plants in terms of foliar cover, and are sometimes the dominant group. Early-seral species are well-represented among grasses and forbs. Examples are threeawn, ring muhly, and purple tansyaster. Topsoil, if present, has been severely diminished. Total foliar cover averages 70 percent, and ranges from 55 to 85 percent. Bare ground ranges from 10 to 35 percent. Total canopy cover of grasses is generally below 50 percent, with warm-season species being dominant. Foliar cover of forbs ranges from 2 to 10 percent. Shrub cover ranges from 25 to 50 percent. Annual production averages around 800 pounds per acre, but can range between 600 and 1,100 pounds per acre, depending mostly on annual weather patterns. This community generally occurs where season-long grazing has been practiced long enough to be reflected strongly in both the plant community and the soils. Broom snakeweed and fringed sage are the dominant shrubs, and blue grama—often sod-bound—is the dominant grass. Early-seral forbs such as purple tansyaster account for a measurable share of total production. Small amounts of western wheatgrass, vine mesquite, and/or alkali sacaton may be present, indicating recent rest. Bare ground is generally higher than in the reference state, and recent wind and water erosion are often apparent. Topsoil is either missing or else severely diminished in quality and thickness, and much of the seedbank has been entirely lost. Compared to the reference state, several important ecosystem functions are diminished here. Because species diversity is lower and plant vigor is diminished, root systems are less diverse and generally shallower. The latter phenomenon appears to apply to shrubs here, as the shrink-swell action of these clay rich soils tends to break roots. Regardless, a paucity of roots, especially at depth, translates to diminished rates of water uptake and nutrient cycling. Reduced production of herbaceous species translates to reduced rates of decomposition—leading in the long term to lower amounts of SOM. Where SOM has decreased in situ, or significant topsoil has been lost, soil fertility and water-holding capacity have decreased. The combination of greater bare ground and lower amounts of fibrous grass roots accelerates erosion.

Dominant plant species

- broom snakeweed (*Gutierrezia sarothrae*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- blue grama (*Bouteloua gracilis*), grass

Community 2.3
Alkali sacaton, other grasses and forbs—hydrologically altered and eroded

Figure 11. Community 2.3 in Colfax County, December 2017. Note the sizeable patch in the foreground that was recently bare, but has been invaded by kochia, Russian thistle, and field bindweed.

Figure 12. A patch of bare ground in Community 2.3. A thin veneer of salts has been deposited at the surface here. Such deposits discourage germination and, thus, perpetuate the very types of erosion that created them.

In this community, alkali sacaton is typically codominant with other grasses. Topsoil, if present, has been severely diminished, and there are typically large patches of bare ground. In some cases, these patches have been invaded by early-seral forbs. In others, they remain bare and develop salt crusts (usually fairly subtle) at the surface. Total foliar cover averages 70 percent, and ranges from 55 to 90 percent. Bare ground ranges from 10 to 40 percent. Total canopy cover of grasses is over 50 percent, with warm-season species being quite dominant. Foliar cover of shrubs ranges from trace to 10 percent. Forb cover also varies widely, but is generally less than 20 percent. Annual production averages around 1,250 pounds per acre, but can range between 900 and 1,600 pounds per acre, depending mostly on annual weather patterns. This community generally occurs where season-long grazing has been practiced long and recently enough to be reflected strongly in the plant community. Early-seral forbs such as kochia, Russian thistle, field bindweed, and pigweed account for a significant share of total production. Bare ground is much higher than in the reference state, and recent wind erosion is quite apparent. Topsoil is either missing or else severely diminished in quality and thickness, and much of the seedbank has been entirely lost. Compared to the reference state, several important ecosystem functions are diminished here. Because species diversity is lower and plant vigor is diminished, root systems are less diverse and generally shallower. This translates to diminished rates of nutrient cycling. Reduced production of herbaceous species translates to reduced rates of decomposition—leading in the long term to lower amounts of SOM. Where SOM has decreased in situ, or significant topsoil has been lost, soil fertility and water-holding capacity have decreased. The combination of greater bare ground and lower amounts of fibrous grass roots accelerates erosion. Additionally, since evaporation rates are very high on patches of bare ground, salts are wicked to the surfaces of these patches when water tables and temperatures are high. This, in-turn, further reduces productivity, discourages germination, and accelerates erosion.

Dominant plant species

- blue grama (*Bouteloua gracilis*), grass
- alkali sacaton (*Sporobolus airoides*), grass

Pathway P2.1A
Community 2.1 to 2.2

Grasses and weedy forbs—eroded

Shrubs and grasses—eroded

This pathway represents a prolonged period of heavy grazing, typically season-long, which advantages the growth and reproduction of shrubs and weedy forbs, while suppressing herbaceous species that are more palatable and/or less resilient under grazing pressure.

Pathway P2.1B
Community 2.1 to 2.3

Grasses and weedy forbs—eroded

Alkali sacaton, other grasses and forbs—hydrologically altered and eroded

This pathway represents a change in hydrology which elevates the water table to the point where capillary action draws groundwater into the soil profile. This leads to periods of elevated salinity.

Pathway P2.2A
Community 2.2 to 2.1

Shrubs and grasses—eroded

Grasses and weedy forbs—eroded

This pathway represents prescribed grazing or rest from grazing. In either case, herbaceous plants that are palatable and/or sensitive to grazing increase in vigor and abundance, and shrubs are at a competitive disadvantage. This pathway, which expresses itself an increase in herbaceous cover at the expense of shrubs, can also involve a late summer drought which kills broom snakeweed.

Pathway P2.2B
Community 2.2 to 2.3

Shrubs and grasses—eroded

Alkali sacaton, other grasses and forbs—hydrologically altered and eroded

This pathway represents a change in hydrology which elevates the water table to the point where capillary action draws groundwater into the soil profile. This leads to periods of elevated salinity.

Pathway P2.3A
Community 2.3 to 2.1

Alkali sacaton, other grasses and forbs—hydrologically altered and eroded

Grasses and weedy forbs—eroded

This pathway represents a change in hydrology which causes the water table to drop such that capillary action no longer draws groundwater into the soil profile. This eliminates periods of elevated salinity and, thus, removes the competitive advantage to salt-adapted species such as alkali sacaton and fourwing saltbush. Concurrently, prescribed grazing or rest from grazing allows herbaceous plants that are palatable and/or sensitive to grazing increase in vigor and abundance, while shrubs and forbs are at a competitive disadvantage.

Pathway P2.3B
Community 2.3 to 2.2

Alkali sacaton, other grasses and forbs—hydrologically altered and eroded

Shrubs and grasses—eroded

This pathway represents a change in hydrology which causes the water table to drop such that capillary action no longer draws groundwater into the soil profile. This eliminates periods of elevated salinity and, thus, removes the competitive advantage to salt-adapted species such as alkali sacaton and fourwing saltbush. Concurrent prolonged grazing pushes blue grama into a sod-bound state, and suppresses species that are more palatable or grazing-sensitive. This gives shrubs a competitive advantage.

State 3
Post-Cropped State

This state occurs where rangeland was plowed and, at some point, crop cultivation was abandoned.

Community 3.1
Various Plants

Figure 13. Community 3.1 in Colfax County, November 2017. Cropping has been abandoned at this location, leaving remnants of the alfalfa crop to compete with invading Russian thistle and field bindweed.

Figure 14. Community 3.1 in San Miguel County, June 2015. This field was seeded with western wheatgrass following the cessation of cropping practices. While this seeding was at least modestly successful, species richness and total production remain low.

Given a more robust dataset, this community could clearly be divided into several phases. Within community 3.1 as currently defined, species composition varies widely based on which species were seeded and which species invaded following the cessation of cropping activities. Where seeding either did not occur or was unsuccessful after crop abandonment, communities of early-seral forbs such as Russian thistle, kochia, field bindweed, pigweed, and annual sunflower exist. Where successful seeding has occurred, grass-dominated stands of low diversity exist. Given low production and species richness, ecosystem functions are generally poor in this phase. Low root diversity and reduced plant vigor translate to diminished rates of nutrient cycling. Reduced production of herbaceous species translates to reduced rates of decomposition—leading in the long term to lower amounts of SOM. Where SOM has decreased in situ, or significant topsoil has been lost, soil fertility and water-holding capacity have decreased. The combination of greater bare ground and lower amounts of fibrous grass roots accelerates erosion. Where water tables are high enough for capillary action to draw groundwater into the soil profile, salts are wicked to the surfaces of these patches when water tables and temperatures are high. This, in-turn, further reduces productivity, discourages germination, and accelerates erosion.

Transition T1A
State 1 to 2

Slow variables: Continued encroachment by early-seral species, coupled with the loss of herbaceous plant production, leads to decreases in total canopy cover and soil organic matter. The result is an increase in the rate of wind and water erosion—leading to the loss of topsoil and an associated decrease in available water and nutrients. Trigger event: A severe drought kills already-weakened perennial grasses, resulting in a major loss in canopy cover. This die-off is followed by accelerated erosion, which further depletes soil fertility, water-holding capacity, and the seedbank. Threshold: The vigor and cover of perennial grasses is reduced to a point at which some perennial grasses die, and soil surfaces become highly susceptible to erosion.

Transition T1B
State 1 to 3

Trigger event(s): Plowing kills perennial plants. Slow variables: Once crop planting ceases, pioneer species (mostly annual forbs) establish and their abundance gradually increases. Threshold: After repeated cycles of plowing and/or applications of herbicides, the native seedbank is exhausted.

Restoration pathway R2A
State 2 to 1

An increase in the competitive advantage of various perennial grass species through physical, chemical, and biological management practices. This restoration pathway will likely require long-term, multifaceted approaches and high-energy inputs. In order to return to State 1, erosion will have to be reversed, grazing will have to be tightly-controlled, and the re-introduction of extirpated plant species may be required. Favorable weather patterns may also be necessary.

Transition T2A
State 2 to 3

Trigger event(s): Plowing kills perennial plants. Slow variables: Once crop planting ceases, pioneer species (mostly annual forbs) establish and their abundance gradually increases. Threshold: After repeated cycles and/or the applications of herbicides, the native seedbank is exhausted.

Restoration pathway R3A
State 3 to 1

The native plant community is re-established via seeding. In order for this to be successful, irrigation and/or favorable weather patterns will be required, Weed-control practices will also be necessary. Whether it is possible to transition into State 1 will depend—in part—on whether topsoil of adequate richness and thickness remains (or is restored).

Conservation practices

Range Planting

Restoration pathway R3B
State 3 to 2

The native plant community is re-established via seeding. In order for this to be successful, irrigation and/or favorable weather patterns will be required. Weed-control practices will also be necessary. This restoration process occurs where topsoil is either degraded or absent.

Conservation practices

Range Planting

Additional community tables

Animal community

Habitat for Wildlife:
From Clayey Upland-R070AY002NM:
This site provides habitats which support a resident animal community that is characterized by pronghorn antelope, coyote, black-tailed jackrabbit, black-tailed prairie dog, thirteen-lined ground squirrel, marsh hawk, horned lark, meadowlark, scaled quail, bullsnake, Great Plains skunk and prairie rattlesnake.

Hydrological functions

The Clayey Flats ecological site is not associated with a wetland or riparian system; though alluvial flats are considered lowlands, they are dissected by gullies and channels such that they can also behave as upland in some localized areas. However, these locations receive additional water via run-on or flow-through from adjacent upland sites. This additional moisture is most expressed at the footslope positions directly below an escarpment, and often the plant communities reflect higher moisture availability. Where the alluvial flat or fan steepens as it approaches a gully or incised channel, the site appears drier.

Recreational uses

The high shrink/swell capacity and low permeability of the soils at this site pose severe limitations on most recreational uses.

Wood products

This site does not support trees.

Other information

Future Work:
Where parent materials of Cretaceous marine shale exist, there is a potential for periodic accumulation of salts in the profile (refer to the hydrologically-altered phases in the Ecological Dynamics section above). The concept for this ecological site may benefit from separating out locations with these parent materials from other sites with less potential for accumulation of salts. The alluvial flat landforms tend to accumulate more salts than the alluvial fan landforms due to slope and discharge vs. recharge zones associated with their positions. Future work may help to distinguish these two landforms into separate sites. This split will help to separate alkali sacaton-prone habitat from areas that will not favor this grass. Alkali sacaton seems to prefer alluvial flats that have visible salts more soluble than calcium carbonate within the profile. If, indeed, fan landforms consistently lack the hydrology which leads to elevated salinity, then such landforms would house a different ecological site. A more robust dataset would be needed in order to test this hypothesis.

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Contributors

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Approval

Curtis Talbot, 10/01/2021

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)	
Contact for lead author	
Date	05/18/2024
Approved by	Curtis Talbot
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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:

    Sub-dominant:

    Other:

    Additional:

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

14. **Average percent litter cover (%) and depth (in):**

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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:**

17. **Perennial plant reproductive capability:**