Ecological site GX070A01X002
Clayey Uplands

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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

Major Land Resource Area (MLRA) 70A, the "High Plateaus of the Southwestern Great Plains", is a high elevation, mostly non-irrigated rangeland subdivision of the Great Plains physiographic province. It is located between the southern Rocky Mountains and the irrigated plains to the east. It is an area in the mesic temperature regime and an aridic-ustic moisture regime with precipitation falling as mostly intense summer rainstorms but with some modest amounts of snow in the winter. 70A is unique from most MLRAs of the Great Plains as it consists primarily of plateau summits and escarpments composed of both sedimentary and volcanic geologic terrain. Fenneman and Johnson (1946) defined the physiographic region as the Raton Section of the Great Plains Physiographic Province of the Interior Plains Division. More specifically, they described it as a “trenched peneplain surmounted by dissected, lava-capped plateaus and buttes”. MLRA 70A exists mostly in northeastern New Mexico but also includes small portions of Colorado and Oklahoma.

LRU notes

This ecological site is a member of the Canadian Plateaus Land Resource Unit (LRU) which occupies the western portion of MLRA 70A extending from Las Vegas, at the southern end, to about Raton at its northern end at an elevation ranging from 5,000 to 7,500 feet. This LRU exists on a structural plateau unit of the Great Plains Province landscape that adjoins the Rocky Mountains Province to its west and drains to lower, warmer river basins to its east and west. The Canadian Plateaus geology consists primarily of Cretaceous rocks: shale, limestone and sandstone of the Dakota, Graneros, Greenhorn, Pierre, and Niobrara formations. Most of the soils in the Canadian Plateaus LRU are formed in alluvium or eolian deposits derived from some fraction of shale parent materials and are in a family texture class of fine-loamy or finer. Total area of this LRU is estimated at just under 1.9 million acres, is entirely within New Mexico, and stretches through Colfax, Mora and San Miguel counties and to a lesser extent, Union and Harding counties.
There are two major delineations within this LRU, one north and one south, and some minor areas to the northeast. Though the difference between their elevation ranges is considerable, the climate does not vary by much between the two areas. The northern polygon is adjacent to higher elevation terrain characteristic of subalpine to alpine regions of the Southern Rocky Mountain Province. Greater amounts of cold air drainage from these mountains cause this lower elevation northern section of 70A to have average annual temperatures closely resembling those of the southern polygon.

LRU Key for MLRA 70A:
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

Hierarchical Classification Relationships
NRCS and BLM: Clayey Uplands - 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 Uplands - Sandy Smooth High Plains Subsection Southern High Plains Section Great Plains-Palouse Dry Steppe Province (Cleland, et al., 2007).

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

Ecological site concept

The Clayey Uplands ecological site occurs on mostly summit positions of Cretaceous plateaus, forming in alluvium and eolian deposits overlying sedimentary bedrock. Soil depths range from at least 20 inches (50 centimeters) to over 80 incehs (200 centimeters) to bedrock or root-restrictive layers. Slope gradient ranges from 0 to 10 percent, but is usually less than 5 percent. Aspect has very little effect on site dynamics.

The central concept for the soils at this site is a surface with loamy or finer textures at least 20 inches (50 centimeters) thick. Productivity generally increases in soils where a surface horizon of "relatively coarser" texture (minimum thickness of 2 inches [5 centimeters]) overlies subsurface horizons with at least slightly finer textures. This transition to higher clay subsurface materials benefits shallow rooting plants by creating a zone (the surface horizon) where water can be temporarily retained, or “perched”, extending the duration that moisture is accessible to shallow rooting plants. Production is also higher in areas where the topsoil has been protected from erosion, either by plant canopy cover or by rock of litter armor on the soil surface. This often results in darker soil colors (higher amounts of organic matter) and favorable soil structure that allow higher rates of rain infiltration, water and nutrient retention, and lower bulk densities. The subsoil materials also have a high water-holding capacity, allowing large amounts of water storage that is not lost through evaporative capillarity. Not all water stored in the clayey subsurface layers is plant-available and may favor the more determined plants, such as shrubs, during extended drought periods. The relatively high clay textures of this site differentiates it from its most common associated site, the Loamy Uplands.

Associated sites

GX070A01X006	**Slopes** This site occurs on escarpments where soils are ≤ 20 inches (50 centimeters) to a root-restrictive layer, and are on slopes > 10 percent.
GX070A01X008	**Ephemeral Drainageways** This site occurs on the channels and floodplains of ephemeral streams. Adjacent Clayey Uplands sites shed water to this site via run-on and through-flow.
GX070A01X005	**Limy** This site occurs where soils surfaces have strong or violent effervescence and ≥ 5 percent calcareous rock fragments.
GX070A01X013	**Lithic Sandstone** This site occurs where soils are ≤ 20 inches (50 centimeters) to lithic contact with sandstone bedrock, and often supports oneseed juniper savannahs.
GX070A01X014	**Lithic Limestone** This site occurs where soils are ≤ 20 inches (50 centimeters) to lithic contact with limestone bedrock, and often supports oneseed juniper savannahs.
GX070A01X017	**Playas** This site occurs in playas. Clayey Uplands sites often shed water to adjacent Playas sites via through-flow and run-on.
GX070A01X019	**Gravelly Terraces** This site occurs on old stream terraces. Soils are skeletal, and may contain well-developed argillic horizons. Gravelly Terrace sites can occur lower on a catena from Clayey Uplands sites.
GX070A01X003	**Loamy Uplands** This site occurs in soils where the textures in the subsoil have < 35 percent clay. Typically, these soils have less developed profiles which is testament to their transitional landform position.
GX070A01X012	**Low Terraces** This site occurs on terraces above perennial streams where the flooding frequency interval is ≥ 10 years. This site is often used for hay and small grain production. Adjacent Clayey Uplands sites shed water to this site via run-on and through-flow.
GX070A01X021	**Sandy** This site occurs in soils that have surface textures of sandy loam or coarser at the surface, and sandy clay loam or sandier textures throughout. Such sites typically occur on sand sheets and dunes leeward from playas or river channels.

Similar sites

R070AY001NM	**Loamy Upland** The new Clayey Uplands ecological site fits many components that are currently correlated to the old Clayey Upland (R070AY002NM) and the old Loamy Upland (R070AY001NM) sites. The former has ≥ 27 percent clay at the surface; the latter has < 27 percent clay at the surface. While the old Clayey Upland site better describes the biotic and abiotic parameters observed on the new Clayey Uplands, the old Loamy Upland site was also applied in areas that correlate to the new Clayey Uplands.

R070AY002NM	**Clayey Upland** The new Clayey Uplands ecological site fits many components that are currently correlated to the old Clayey Upland (R070AY002NM) and the old Loamy Upland (R070AY001NM) sites. The former has ≥ 27 percent clay at the surface; the latter has < 27 percent clay at the surface. While the old Clayey Upland site better describes the biotic and abiotic parameters observed on the new Clayey Uplands, the old Loamy Upland site was also applied in areas that correlate to the new Clayey Uplands.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia frigida* (2) *Krascheninnikovia*
Herbaceous	(1) *Bouteloua gracilis* (2) *Pascopyrum smithii*

Legacy ID

R070AA002NM

Physiographic features

PHYSIOGRAPHIC DESCRIPTION
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 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 Uplands ecological site occurs on plateau summits in the CP LRU. Microfeatures include rises, talfs, and dips across the summit.

The Clayey Uplands site is quite extensive, but is by no means the only ecological site that occurs on plateau summits in the Canadian Plateaus LRU. Other ecological sites that occupy this landform position are the Loamy Uplands, Limy, Lithic Sandstone, Lithic Limestone, Sandy, and Shallow Loamy.

Associated sites that occur on landforms and landform positions adjacent to the Clayey Uplands site are the Playa, Saline Playa, Saline Drainageway Bottom, Ephemeral Drainageway, Low Terrace, Shallow Loamy Slopes, Limy Escarpments, Limy Steep, Gravelly Terraces, and Mountain Front Fans.

Where the Clayey Uplands site grades into steep escarpments that are capped with Dakota Sandstone, the soils have historically supported stands of pinyon and juniper, and drain into canyons. This ecological character is associated with sites in the Mesozoic Canyons and Breaks LRU of MLRA 70A.

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

Geology:
The geology of the CP 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 Uplands site occurs on each of these formations. Soils typically form in one of two settings: where shale is the dominant parent material for subsurface horizons or where argillic horizons have formed in soils derived from sandstone. In either case, surface horizons often developed in loess. 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.

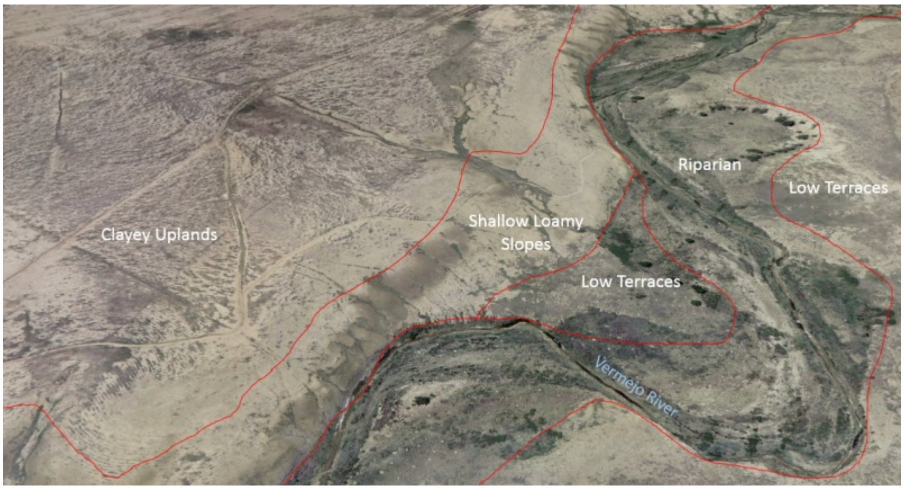


Figure 1.

Table 2. Representative physiographic features

Landforms	(1) Plateau > Plateau
Flooding frequency	None
Ponding frequency	None
Elevation	1,524–2,286 m
Slope	0–10%
Water table depth	203–251 cm
Aspect	W, NW, N, NE, E, SE, S, SW

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)	

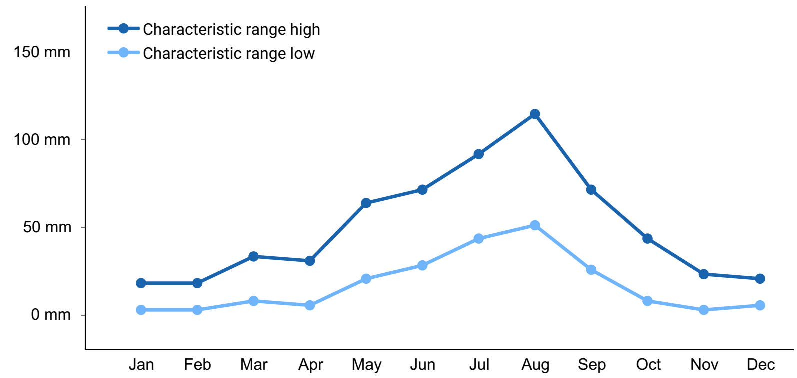


Figure 2. Monthly precipitation range

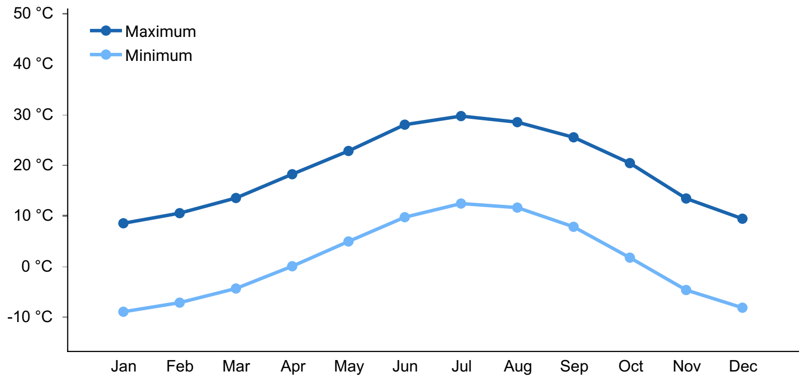


Figure 3. Monthly average minimum and maximum temperature

Climate stations used

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

Influencing water features

The Clayey Uplands ecological site is not associated with a wetland or riparian system; it is an upland ecological site. Because this site occurs on linear or convex portions of plateau summits, it tends to shed water (via through-flow or run-off) to sites lower in the catena.

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 Uplands ecological site. To learn about the dynamic properties of the soil components tied to this site, refer to the "plant communities" section of this ESD.

The Clayey Uplands ecological site is tied to the components of numerous map units in the Canadian Plateaus LRU of 70A. These components are correlated to the following series: Swastika, Partri, Carnero, and Mughouse soils. These soils typically form in loess over residuum derived from shale and sandstone. 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, refer to the Ecological Site Key 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 drained with medium runoff potential at the surface and a slow saturated hydraulic conductivity. They are characterized by loamy surface textures and subsurface horizons with at least 35 percent clay in the fine earth fraction that begins within the upper 20 inches (50 centimeters). Some pedons have clay textures at the surface but are often typified by historically high erosion rates so that some of the loamier surface has been removed. Clayey Upland soils can be distinguished from similar soils of other ecological sites based on their lack of at least one of the following traits: (1) at least strong effervescence with calcareous fragments at the surface; (2) run-on moisture contributions from adjoining landforms; (3) shallow bedrock; or (4) textures in subsurface horizons averaging less than 35 percent clay.

Parent Material Kind: shale, loess, and sandstone
Parent Material Origin: eolian, alluvial, and residual

Surface Textures: loams and sometimes clays
Subsurface Textures: clay, clay loam, and silty clay loam
Surface Fragments

Table 4. Representative soil features

Parent material	(1) Eolian deposits–sandstone and shale (2) Alluvium–sedimentary rock
Surface texture	(1) Silt loam (2) Clay loam (3) Loam
Family particle size	(1) Fine
Drainage class	Well drained
Permeability class	Slow
Depth to restrictive layer	127–508 cm
Soil depth	76–508 cm
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–2%
Available water capacity (0-152.4cm)	17.78–38.1 cm
Calcium carbonate equivalent (0-152.4cm)	0–10%
Clay content (0-48.3cm)	20–50%
Electrical conductivity (0-152.4cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-152.4cm)	0–2
Soil reaction (1:1 water) (0-152.4cm)	6.6–8.6
Subsurface fragment volume <=3" (0-152.4cm)	0–5%
Subsurface fragment volume >3" (0-152.4cm)	0–1%

Ecological dynamics

The Clayey Uplands ecological site contains a mix of grasses, forbs, shrubs, succulents; and, occasionally, trees. Higher-seral communities are grasslands with scattered shrubs, while lower-seral communities are dominated by shrubs or weedy forbs. While warm-season plants dominate this site, the relative abundance of cool-season plants increases in response to moisture in the spring and late fall.

There are numerous variables such as elevation, latitude, hydrology, soil depth, fire frequency, grazing dynamics, and anthropogenic effects that influence plant communities. This site is dominated by warm-season plants. 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 of these 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 become most abundant within this site. Therefore, blue grama and broom snakeweed are particularly abundant in the east; while western wheatgrass, fringed sage, and wormwood increase their presence as one travels west.

Since the Canadian Plateaus LRU is bounded by areas with strongly-contrasting geology and geomorphology, the Clayey Uplands site does not transition smoothly into adjacent ecological sites of other LRUs at its upper and lower elevations. Rather, the landscape transitions at the upper end into the Rocky Mountain Province (MLRAs 49 and 48A) or the Volcanic Plateaus LRU of MLRA 70A, and at the lower end to the Mesozoic Canyons and Breaks LRU of 70A.

While the Clayey Uplands 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 alluvial flats and floodplains are covered by unique ecological sites, swales and small toeslopes are included within the concept of the Clayey Uplands site. In these positions, we find higher total production, and a greater relative abundance of grasses such as western wheatgrass and vine mesquite.

The Clayey Upland site does occur above Dakota Sandstone bedrock in locations, so long as contact with lithic sandstone occurs below 20 inches (50 centimeters). Where the soil depth to a restrictive sandstone layer approaches 20 inches (50 centimeters), a transition occurs to the Lithic Sandstone ecological site. Along this gradient, shrubs generally increase in abundance and trees such as oneseed juniper and twoneedle pinyon often appear, as do sideoats grama and silvery bluestem.

Plant tables have not been developed for this site. Until such time as they can be updated, use the plant tables in the referenced literature that correlates to this concept (refer to the Correlation to Associated Published Sites section below). With respect to the imperfect alignment of such correlations, be aware of these shortcomings in their applicability to conservation planning.

Early work by Kuchler (1964) identified the potential natural vegetation type for the Canadian Plateaus LRU as that of the grama/buffalograss short grass prairie. The Clayey Uplands ecological site is dominated by short grasses, but also contains a mix of shrubs, forbs, and succulents. As is typical of plant communities, pronounced annual variations in precipitation translate to considerable short-term fluctuations in annual production within a given plant community phase.

The climate gradient across the CP LRU shows a greater distribution of C3 plants such as western wheatgrass, green needle grass, bottlebrush squirreltail, and purple prairie clover where temperatures are cooler, and moisture is more abundant. Where surface texture trends toward clay loam, western wheatgrass, galleta, and vine-mesquite grass increase. Where the plateau bedrock is Cretaceous shale and the site trends toward a surface texture of clay loam with an increase in salt in the profile, alkali sacaton and four-wing saltbush increase.

Fire is a disturbance regime that reduces succulents and shrubs while stimulating grasses and forbs. Not all fires are equal. According to Gebow (2001), fire effects in the same location will vary, especially with fire timing, both seasonally and within the scheme of year-to-year moisture variation. Precipitation during seasons before and after fire has a major effect on 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.

Information from Legacy Sites That Correlate to This Concept:

(From clayey upland-RO70AY002NM)This site is grassland dotted with occasional shrubs. Mid-grasses are dominant with short-grasses which can take advantage of the soils with high water-holding capacities. Shrubs and half-shrubs are sparsely scattered. Few woody plants are indigenous to this site. Forbs are a minor component of the potential plant community.

Approximately 95 percent of the annual yield are from species that furnish forage for grazing animals. Continuous grazing during the growing season will cause the more desirable forage plants such as western wheatgrass, vine-mesquite, sideoats grama and fourwing saltbush to decrease. The species most likely to invade this site is sleepygrass. Species most likely to increase are blue grama, alkali sacaton, buffalograss, creeping muhly, ring muhly and broom snakeweed. Cholla cactus may also increase. As the ecological condition deteriorates, it is accompanied by a sharp increase in blue grama. Continuous heavy grazing will cause blue grama to form a low, dense turf, which is low in productivity. The plant community may be dominated either by blue grama/galleta and alkali sacaton/galleta. Continuous heavy grazing will result in a loss of vegetative cover causing a large area of denuded soil and the productivity of this site is greatly reduced. Most of the mid-grasses will disappear as deterioration advances. In some areas there may be large patches of sleepygrass and a variety of annual and perennial forbs. A system of deferred grazing, which varies the time of grazing and rest in a pasture during consecutive years, is needed to maintain or improve the plant community. Spring rest from April through June is needed for western wheatgrass to grow and reproduce. This allows alkali sacaton sufficient time to green up before grazing it intensively.

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

The approximate species composition of the potential plant community is as follows:
Plant--------------------------Percent composition by weight
Western wheatgrass---15
Sideoats grama----------10
Vine-mesquite-------------5
Alkali sacaton--------------25
Spike muhly-----------------5
Blue grama------------------20
Galleta------------------------15
Four-wing saltbush------5

From the San Miguel County (NM630) manuscript: The potential plant community is mainly blue grama, western wheatgrass, galleta, and sideoats grama. As the range deteriorates, the preferred species decrease and a dense, low turf of blue grama and ring muhly that is low in productivity develops. Grazing management should be designed to increase the productivity and reproduction of western wheatgrass, sideoats grama, and winterfat.

Production table as taken from NM630 manuscript with production in lbs./ac and percent species composition by weight.
Production for Partri Soil: Favorable - 1500; normal - 950; unfavorable - 450. Composition: Blue grama - 30; Western wheatgrass - 20; Sideoats grama - 10; Galleta - 10; Winterfat, - 5; Bottlebrush squirreltail - 5; ring muhly - 5; wolfstail - 5

From the Partri component of the PB map unit in the Mora County (NM638) manuscript: The potential natural plant community on this unit is mainly blue grama, western wheatgrass, sideoats grama, and galleta. As the potential natural plant community deteriorates, the western wheatgrass and sideoats grama decrease and a dense, and the blue grama forms a dense, low turf. Grazing management should be designed to increase the productivity and reproduction of western wheatgrass, sideoats grama, and blue grama.

Plants that commonly occur on this site include:
Grasses: blue grama, western wheatgrass, galleta grass, bottlebrush squirreltail, ring muhly, sand dropseed, threeawn, buffalo grass, vine mesquitegrass, and alkali sacaton.
Forbs: penstemon, fleabane daisy, scarlet globemallow, gaura, wooly indianwheat, purple prairie clover, dotted gayfeather, prairie coneflower, and slimflower scurfpea.
Shrubs/succulents: fringed sage, broom snakeweed, winterfat, fourwing saltbush, and prickly pear.

State and transition model

Figure 4. A typical plant community

State 1
Reference State

This state represents the most ecologically stable state in terms of resistance to erosion. Moreover, this state has the highest potential for productivity and plant diversity.

Community 1.1
Diverse Grasses and Shrubs Blue Grama-Western Wheatgrass-Sand Dropseed-Vine Mesquite/Alkali Sacaton

Figure 5. Community 1.1 on the Las Vegas National Wildlife Refuge in June of 2015. Note the high production and abundance of western wheatgrass.

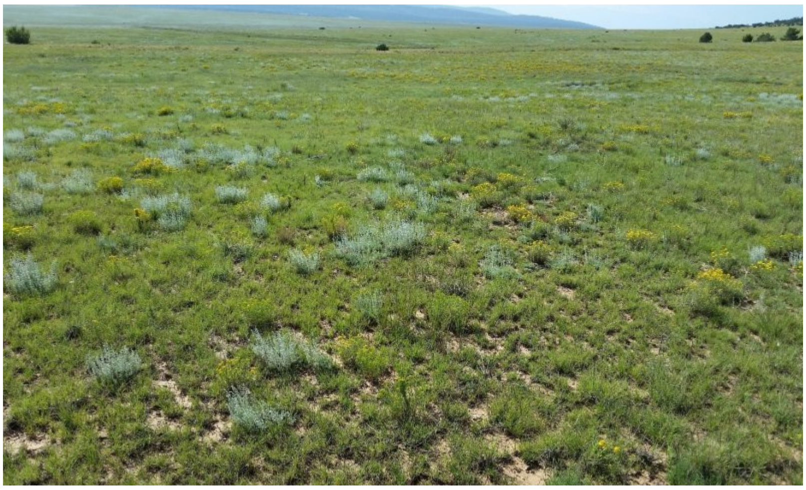
This community is dominated by grasses, but also contains a number of forb species and the occasional shrub. Foliar cover is between 75 and 90 percent, and bare ground is typically less than 15 percent. Total canopy cover of warm season grasses is between 50 and 75 percent, and cool-season grass cover can be as high as 30 percent. Forbs and shrubs account for up to 10 percent and 3 percent cover, respectively. Annual production averages around 1,300 pounds per acre, but can range between 1,000 and 1,800 lbs/ac, depending mostly on annual weather patterns. This community exists where season-long grazing has not been practiced in a number of years. Blue grama is the dominant grass, but western wheatgrass and alkali sacaton are major players—the latter being more common on soils developed from the marine shales of the Carlisle and Pierre Formations. While forbs represent a small percentage of foliar cover, their species richness is quite high—leading to colorful displays following major rain events. Shrubs are a very minor component—with broom snakeweed being 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 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 and fire, decomposition is active, creating soil organic matter, which enhances “plant available water” needed for plant vigor.

Community 1.2
Diverse Grasses and Shrubs Blue Grama-Broom Snakeweed-Fringed Sage-Western Wheatgrass-Sand Dropseed-Vine Mesquite/Alkali Sacaton

Figure 6. Community 1.2. Note the high percentage of herbaceous cover and the relatively low percentage of shrubs. While difficult to see in this image, there is a considerable amount of western wheatgrass across this area. Springer area; 9-18-17

This community is dominated by grasses, but also contains a number of forb species and the occasional shrub. Foliar cover is between 75 and 90 percent, and bare ground is typically less than 15 percent. Total canopy cover of warm season grasses is between 50 and 75 percent, and cool-season grass cover can be as high as 30 percent. Forbs and shrubs account for up to 10 percent and 3 percent cover, respectively. Annual production averages around 1,300 pounds per acre, but can range between 1,000 and 1,800 lbs/ac, depending mostly on annual weather patterns. This community exists where season-long grazing has not been practiced in a number of years. Blue grama is the dominant grass, but western wheatgrass and alkali sacaton are major players—the latter being more common on soils developed from the marine shales of the Carlisle and Pierre Formations. While forbs represent a small percentage of foliar cover, their species richness is quite high—leading to colorful displays following major rain events. Shrubs are a very minor component—with broom snakeweed being 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 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 and fire, decomposition is active, creating soil organic matter, which enhances “plant available water” needed for plant vigor.

Community 1.3
At-Risk: Sod-bound blue grama /shrubs Blue Grama-Broom Snakeweed-Fringed Sage-Ring Muhly-Galleta-Threeawn Shrubs >10%



This community is dominated by low-growing blue grama, but also contains abundant shrubs. Highly palatable and grazing-sensitive grasses are almost entirely confined to run-on microsites or sheltered in the understories of woody species. Lower-seral grasses such as galleta and threeawn are common. The combined canopy cover of broom snakeweed and fringed sage is ≥ 10%. Foliar cover is typically between 60 and 80 percent, and bare ground ranges from 10 to 35 percent. Annual production averages around 1,000 lbs/ac, but can span between 800 and 1,250 lbs/ac, depending mostly on annual weather patterns. This community exists where season-long grazing has been practiced long enough that species composition has been markedly altered, and species richness and total productivity have been reduced considerably. Blue grama is usually the dominant grass. It generally occurs in sod-bound form, but does not form a monoculture. In response to prolonged herbivory, grazing-tolerant grasses such as galleta, threeawn, and ring muhly have increased in abundance; while those most sensitive to herbivory have been all but extirpated. Shrubs are a major component—with broom snakeweed being more common at lower elevations and eastern latitudes and fringed sage is more common toward the higher/cooler end of the spatial/climatic gradient. Low-seral forbs such as kochia, annual sunflower, purple tansyaster, hairy false goldenaster, and trailing fleabane are also quite abundant. This plant community has developed due to an increase in shrub vigor and a decrease in grass vigor. Under heavy, continuous herbivory, the depth of grass roots decreases—giving shrubs a competitive advantage in acquiring water and nutrients. As the turnover of grass roots diminishes, energy flow begins to lessen due to a decrease in soil organic matter. While prolonged grazing would have been uncommon prior to the introduction of livestock, fire was an important factor in keeping shrub species from gaining a competitive advantage and stimulating the growth of grasses.

Community 1.4
At-risk: Sod-bound blue grama Blue Grama-Broom Snakeweed-Fringed Sage-Ring Muhly-Galleta-Threeawn Shrubs <10%

Figure 7. Community 1.4 in San Miguel County—October of 2017. While shrubs are poorly-represented and grass cover is considerable, species richness is quite low. Palatable and grazing-sensitive species have been all but extirpated.

This community is dominated by sod-bound blue grama, and also contains significant amounts of shrubs. Highly palatable and grazing-sensitive grasses are almost entirely absent, and confined to run-on microsites or sheltered in the understories of woody species. Lower-seral grasses such as galleta and threeawn are common. The combined canopy cover of broom snakeweed and fringed sage is < 10%. Foliar cover is typically between 65 and 90 percent, and bare ground ranges from 5 to 30 percent. Annual production averages around 1,150 lbs/ac, but can span between 900 and 1,400 lbs/ac, depending mostly on annual weather patterns. This community exists in areas where season-long grazing has been practiced long enough that species composition has been markedly altered, and species richness and total productivity have been reduced considerably. These areas have subsequently experienced fire and/or herbicide treatments. Blue grama is either dominant grass, or is codominant with galleta. In response to prolonged herbivory, grazing-tolerant grasses such as galleta, threeawn, and ring muhly have increased in abundance; while those sensitive to herbivory have been all but extirpated. Shrubs are an important component—with broom snakeweed being more common at lower elevations and eastern latitudes and fringed sage is more common toward the higher/cooler end of the spatial/climatic gradient. However, the abundance of shrubs has diminished in response to chemical treatments and/or fire. Low-seral forbs such as kochia, annual sunflower, purple tansyaster, hairy false goldenaster, and trailing fleabane are quite abundant.

Pathway P-1.1A
Community 1.1 to 1.2

Diverse Grasses and Shrubs Blue Grama-Western Wheatgrass-Sand Dropseed-Vine Mesquite/Alkali Sacaton

Diverse Grasses and Shrubs Blue Grama-Broom Snakeweed-Fringed Sage-Western Wheatgrass-Sand Dropseed-Vine Mesquite/Alkali Sacaton

This pathway represents a period of heavy grazing, typically season-long, which advantages the growth and reproduction of shrubs and suppresses herbaceous species that are more palatable and/or less resilient under grazing pressure. Under a continuous grazing regime, and in the absence of fire and/or chemical treatments, broom snakeweed and fringed sage increase in abundance and vigor. Conversely, western wheatgrass, vine mesquite, and alkali sacaton will diminish unless given significant periods of rest during their growing seasons.

Pathway P-1.2A
Community 1.2 to 1.1

Diverse Grasses and Shrubs Blue Grama-Broom Snakeweed-Fringed Sage-Western Wheatgrass-Sand Dropseed-Vine Mesquite/Alkali Sacaton

Diverse Grasses and Shrubs Blue Grama-Western Wheatgrass-Sand Dropseed-Vine Mesquite/Alkali Sacaton

This pathway represents prescribed grazing and/or rest from stocking. 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 community pathway is facilitated by wetter-than-average growing seasons and by fire. 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 P-1.2B
Community 1.2 to 1.3

Diverse Grasses and Shrubs Blue Grama-Broom Snakeweed-Fringed Sage-Western Wheatgrass-Sand Dropseed-Vine Mesquite/Alkali Sacaton

At-Risk: Sod-bound blue grama /shrubs Blue Grama-Broom Snakeweed-Fringed Sage-Ring Muhly-Galleta-Threeawn Shrubs >10%

This pathway represents an extended period of season-long grazing, which advantages the growth and reproduction of shrubs and suppresses herbaceous species—particularly those that are more palatable and/or less resilient under grazing pressure. In this process, growth rates and biomass of grasses are reduced. Western wheatgrass, alkali sacaton, and vine mesquite are affected to a disproportionately high degree—often only surviving in run-on microsites and under the canopies of larger shrubs.

Pathway P-1.3A
Community 1.3 to 1.4

At-Risk: Sod-bound blue grama /shrubs Blue Grama-Broom Snakeweed-Fringed Sage-Ring Muhly-Galleta-Threeawn Shrubs >10%

At-risk: Sod-bound blue grama Blue Grama-Broom Snakeweed-Fringed Sage-Ring Muhly-Galleta-Threeawn Shrubs <10%

This pathway represents fire and/or chemical treatment. In either case, shrubs are suppressed, giving a competitive advantage to herbaceous species.

Pathway P-1.4A
Community 1.4 to 1.1

At-risk: Sod-bound blue grama Blue Grama-Broom Snakeweed-Fringed Sage-Ring Muhly-Galleta-Threeawn Shrubs <10%

Diverse Grasses and Shrubs Blue Grama-Western Wheatgrass-Sand Dropseed-Vine Mesquite/Alkali Sacaton

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. If not absolutely necessary, wetter-than-average growing seasons facilitate this transition. More than one occurrence of fire or application of herbicide may be required to favor this pathway over 1.4B. 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 P-1.4B
Community 1.4 to 1.3

At-risk: Sod-bound blue grama Blue Grama-Broom Snakeweed-Fringed Sage-Ring Muhly-Galleta-Threeawn Shrubs <10%

At-Risk: Sod-bound blue grama /shrubs Blue Grama-Broom Snakeweed-Fringed Sage-Ring Muhly-Galleta-Threeawn Shrubs >10%

This pathway represents an extended period of season-long grazing, which advantages the growth and reproduction of shrubs and suppresses herbaceous species. This pathway may also occur in response to drought.

Context dependence. Extended Period of Grazing or Drought

State 2
Degraded State

Community 2.1
2.1 Shrubs, sod-bound blue grama, low-seral grasses, and annual forbs. Broom Snakeweed-Fringed Sage-Blue Grama-Threeawn-Ring Muhly with Annual Forbs

Community 2.2
2.2 Sod-bound blue grama, low-seral grasses, and annual forbs. Blue Grama-Ring Muhly-Threeawn with Annual Forbs

Figure 8. Community 2.2 in Colfax County in September of 2017. This community is transitioning toward State 1, and exhibits unusually high grass production.

Figure 9. Community 2.2 in San Miguel County in September of 2017. This community is transitioning toward community 2.1, as evidenced by poor grass production and shrub cover near 10 percent.

Shrubs, sod-bound blue grama, low seral grasses, and annual forbs. Broom Snakeweed-Fringed Sage-Blue Grama-Threeawn-Ring Muhly with Annual Forbs This is a grass-dominated plant community that lacks the diversity found in State 1. Blue grama is the dominant grass, but its vigor and rooting depth are significantly reduced—leaving it highly vulnerable to drought stress. Low seral grasses such as ring muhly and threeawn are well-represented, as are “weedy” forbs such as kochia, annual sunflower, trailing fleabane, and purple tansyaster. The combined canopy cover of broom snakeweed and fringed sage is < 10%. Foliar cover is typically between 50 and 80 percent, and bare ground ranges from 15 to 45 percent. Annual production averages around 850 lbs/ac, but can span between 600 and 1150 lbs/ac, depending mostly on annual weather patterns.

Pathway P-2.1A
Community 2.1 to 2.2

2.1 Shrubs, sod-bound blue grama, low-seral grasses, and annual forbs. Broom Snakeweed-Fringed Sage-Blue Grama-Threeawn-Ring Muhly with Annual Forbs

2.2 Sod-bound blue grama, low-seral grasses, and annual forbs. Blue Grama-Ring Muhly-Threeawn with Annual Forbs

This pathway represents fire, chemical treatment, or a late summer drought. In either case, shrubs are suppressed, giving a competitive advantage to herbaceous species. In the latter case, drought stress kills broom snakeweed.

Context dependence. Shrub Suppression

Pathway P-2.2A
Community 2.2 to 2.1

2.2 Sod-bound blue grama, low-seral grasses, and annual forbs. Blue Grama-Ring Muhly-Threeawn with Annual Forbs

2.1 Shrubs, sod-bound blue grama, low-seral grasses, and annual forbs. Broom Snakeweed-Fringed Sage-Blue Grama-Threeawn-Ring Muhly with Annual Forbs

This pathway represents an interval following fire or chemical treatment, during which shrubs re-establish their dominance. Once the site has crossed into State 2, this reversion to shrub-dominance appears to be the path of least resistance.

State 3
Post-Cropped State

Community 3.1
Post-Cropped Various Annual and Perennial Forbs

Figure 10. Community 3.1 in Colfax County in September of 2017. While production is at the upper end for this phase, both grasses and shrubs are entirely absent. Field bindweed, Russian thistle, and pigweed are codominant here.

This plant community is typically seen following a period of planting of dryland, or in some rare cases, irrigated crops with regular episodes of plowing. Other possible vectors for this state could include heavy land use activities such as areas former cattle watering or corral sites. The disturbance events may have occurred several years to decades ago, and were not successfully replanted into native grassland following abandonment. Efforts to replanting may have failed due to lack of favorable precipitation timing or failure to include some type of irrigation to ensure success. The existing plant community is dominated by low-seral forbs—many of which are annuals. Species composition depends on which pioneer species were present in the seedbank prior to plowing and which were transported via wind or animals. Grasses are either poorly represented or entirely absent. Foliar cover is typically between 50 and 85 percent, and bare ground ranges from 15 to 45 percent. Annual production averages around 800 lbs/ac, but can span between 600 and 1200 lbs/ac, depending mostly on annual weather patterns.

Resilience management. No management needed to maintain this state.

Dominant plant species

- broom snakeweed (*Gutierrezia sarothrae*), shrub
- threeawn (*Aristida*), grass
- blue grama (*Bouteloua gracilis*), grass

Transition T1A
State 1 to 2

Slow variables: Continued encroachment by shrubs, coupled with the loss of herbaceous plant production, leads to decreases in total canopy cover and exposure to erosion events which will reduce topsoil and its high soil organic matter content. 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: History of fire management, removal of large predators, and heavy grazing set the stage for transition mechanism. This might be in the form of a severe drought which can weaken or kill perennial grasses, resulting in a loss in canopy cover. Threshold: The vigor and cover of perennial grasses is reduced to a point at which perennial grasses die and soil surfaces become highly susceptible to erosion.

Constraints to recovery. Moisture, flexibility in the grazing program, as well as potential to implement fire management can all have an impact in ability for recovery.

Context dependence. Seasonal and annual patterns of moisture delivery with regards to the rate and amounts of precipitation. Prolonged dry periods, especially during the growing season, can prevent recovery or encourage the transition. When coupled with continued, undisciplined grazing program, transition will be enhanced.

Transition T1B
State 1 to 3

Trigger event(s): Mechanical soil surface disturbance, such as plowing activities or vehicle traffic causes the disruption of soil structure at the surface and kills perennial plants. The structure disturbance has an immediate effect of decomposing humus thereby diminishing the soil organic matter content that may have taken decades or centuries to develop. The soil surface is 100% bare ground for a period of time where its exposure can make it susceptible to wind and water erosion. Each successive disturbance event further diminishes these soil surface properties and may cause a dense plow layer to form in the subsurface which prevents air and water from entering the soil, thereby reducing its ability to support plant life and furthering its vulnerability to erosion. 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.

Constraints to recovery. Loss of topsoil (usually entire "A" horizon) such that soil properties are severely degraded. This includes: 1. loss of organic matter which is important for processes such as nutrient cycling, moisture infiltration and retention, decreased bulk density; 2. impaired soil hydrology where coarser surface textures had allowed better infiltration of precipitation. This moisture would then become retained at the boundary to a higher-clay subsurface horizon therefore providing better soil moisture storage for shallow rooting plants such as grasses. 3. exposure of existing plant roots to the atmosphere where desiccation can weaken and cause mortality in perennial grasses.

Context dependence. Seasonal and annual patterns of moisture delivery with regards to the rate and amounts of precipitation can greatly affect the severity of soil degradation following periods of plowing. Soil disturbance during prolonged dry periods, especially during the growing season, will encourage this transition. When coupled with a continued, undisciplined grazing program, transition will be enhanced.

Restoration pathway R2A
State 2 to 1

Restoration is dependent on techniques that focus on increased plant canopy cover from perennial grasses, increased species biodiversity, shrub control, and managed grazing. The goal is to focus on 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 may require some high-energy inputs. In order to return to State 1: 1. erosion needs to be halted, this may be directly tied to increases in plant canopy 2. grazing is managed to optimize perennial grass recovery and increase plant canopy (may be requirement to initiate the recovery) 3. some re-introduction of extirpated plant species may be required 4. period favorable weather patterns may be necessary to initiate recovery 5. time

Context dependence. Seasonal and annual patterns of moisture delivery with regards to the rate and amounts of precipitation are critical to the success of any restoration program. Flexibility in timing needs to be built into the restoration strategy. Prolonged dry periods, especially during the growing season, can prevent recovery of plant species and set the stage for failure. Flexibility in livestock grazing program is needed to allow plant community to recover without added animal stressors.

Transition T2A
State 2 to 3

Trigger event(s): Mechanical soil surface disturbance, such as plowing activities or vehicle traffic causes the disruption of soil structure at the surface and kills perennial plants. The structure disturbance has an immediate effect of decomposing humus thereby diminishing the soil organic matter content that may have taken decades or centuries to develop. The soil surface is 100% bare ground for a period of time where its exposure can make it susceptible to wind and water erosion. Each successive disturbance event further diminishes these soil surface properties and may cause a dense plow layer to form in the subsurface which prevents air and water from entering the soil, thereby reducing its ability to support plant life and furthering its vulnerability to erosion. 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.

Constraints to recovery. Loss of topsoil (usually entire "A" horizon) such that soil properties are severely degraded. This includes: 1. loss of organic matter which is important for processes such as nutrient cycling, moisture infiltration and retention, decreased bulk density; 2. impaired soil hydrology where coarser surface textures had allowed better infiltration of precipitation. This moisture would then become retained at the boundary to a higher-clay subsurface horizon therefore providing better soil moisture storage for shallow rooting plants such as grasses. 3. exposure of existing plant roots to the atmosphere where desiccation can weaken and cause mortality in perennial grasses.

Context dependence. Seasonal and annual patterns of moisture delivery with regards to the rate and amounts of precipitation can greatly affect the severity of soil degradation following periods of plowing. Soil disturbance during prolonged dry periods, especially during the growing season, will encourage this transition. When coupled with a continued, undisciplined grazing program, transition will be enhanced.

Restoration pathway R3A
State 3 to 1

The native plant community is re-established

Context dependence. Restoration activities will require a large investment in resources to revert a former cropland back into a functioning shortgrass prairie. The restoration will need to be tailored to the specific needs of a particular field or pasture and the expectations for the desired outcome. The possible list of restoration activities includes: 1. reseeding - applying a desired seedbank to recover plant biodiversity 2. irrigation - ensuring the success of seeding activities, without which a low probability of recovery is expected. 3. return of topsoil material - it is possible that any recovery in the ecosystem will be hindered without some return of topsoil properties, which will include organic matter and may also require application a coarser textured medium to improve soil hydrology. 4. Maintenance of the recovery process - multiple attempts at seeding may be necessary as not all species will see success per any application. Weed-control practices will also be necessary. 5. favorable weather patterns 6. time

Restoration pathway R3B
State 3 to 2

Restoring native grasslands.

Context dependence. Restoration activities will require a large investment in resources to revert a former cropland back into a functioning shortgrass prairie. The restoration will need to be tailored to the specific needs of a particular field or pasture and the expectations for the desired outcome. The possible list of restoration activities includes: 1. reseeding - applying a desired seedbank to recover plant biodiversity 2. irrigation - ensuring the success of seeding activities, without which a low probability of recovery is expected. 3. return of topsoil material - it is possible that any recovery in the ecosystem will be hindered without some return of topsoil properties, which will include organic matter and may also require application a coarser textured medium to improve soil hydrology. 4. Maintenance of the recovery process - multiple attempts at seeding may be necessary as not all species will see success per any application. Weed-control practices will also be necessary. 5. favorable weather patterns 6. time

Additional community tables

Animal community

(From Clayey Upland-RO70AY002NM) 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 Uplands ecological site is not associated with a wetland or riparian system; it is an upland ecological site. Because this site occurs on linear or convex portions of plateau summits, it tends to shed water (via through-flow or run-off) to sites lower in the catena.

Wood products

This site rarely produces trees.

Other information

Future Work:
Where parent materials of Createceous marine shale exist, there is a potential for periodic accumulation of salts in the profile. 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. This split will help to distinguish alkali sacaton habitat from areas that will not support this grass. Alkali sacaton seems to prefer soils within the current Clayey Uplands concept that have surface textures higher in clay and have visible salts more soluble than calcium carbonate within the profile. However, additional data would be needed in order to validate this hypothesis and to find criteria that consistently differentiate these two ecosystems. It is also possible that alkali sacaton represents a distinct plant community phase or state. In either case, this site is likely to be subdivided based on surface texture.

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Other references

References:
Cleland, D.T.; Freeouf, J.A.; Keys, J.E., Jr.; Nowacki, G.J.; Carpenter, C; McNab, W.H. 2007. Ecological Subregions: Sections and Subsections of the Conterminous United States.[1:3,500,000], Sloan, A.M., cartog. Gen. Tech. Report WO-76. Washington, DC: U.S. Department of Agriculture, Forest Service.

Gebow, B. S., 2001. Search, Compile, and Analyze Fire Literature and Research Associated with Chihuahuan Desert Uplands, Tuscon: The University of Arizona.

Griffith, G.E.; Omernik, J.M.; McGraw, M.M.; Jacobi, G.Z.; Canavan, C.M.; Schrader, T.S.; Mercer, D.; Hill, R.; and Moran, B.C., 2006. Ecoregions of New Mexico (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,400,000).

Kuchler, A.W. 1964. Potential Natural Vegetation of the Conterminous United States. American Geographical Society, Special Publication

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Approval

Curtis Talbot, 10/05/2021

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	05/15/2024

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:

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

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

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

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
