Ecological site GX070A01X008
Ephemeral Drainageways

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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 is only applicable to the Canadian Plateaus LRU of MLRA 70A (LRU 70A.1).

LRU notes

This site is only applicable to the Canadian Plateaus LRU of MLRA 70A (LRU 70A.1). Please refer to the following key:

Land Resource Unit (LRU) Key for MLRA 70A
– High Plateaus of the Southwestern Great Plains
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: Ephemeral Drainageways 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: Ephemeral Drainageways Sandy Smooth High Plains Subsection Southern High Plains Section Great Plains-Palouse Dry Steppe Province (Cleland, et al., 2007).

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

Ecological site concept

Landforms that collect water are important ecological refuges within semi-arid climates. In severe drought years, they can serve as critical vestiges of viable feed for foraging wildlife. And they are typically the last good opportunity to retain moisture in the local landscape during significant rain events before being lost to surface water networks. Therefore, it is important that these areas are properly recognized and conserved in as high a functioning condition as possible.

The Ephemeral Drainageways ecological site occurs on concave drainageways or swales in the Canadian Plateaus (CP) LRU. The CP 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 CP LRU ranges from 5,000 to 7,500 feet.

The central concept for the Ephemeral Drainageways site is the subtle patterns of dendritic drainages that extend across the plateaus concentrating moisture from uplands and conveying it to lower terrain. The enhanced moisture in these sites extends the period of available plant moisture during dryer periods of the growing season. The Ephemeral Drainageways site occurs in alluvial deposits in concave positions that typically have a high water holding capacity that allow them to efficiently store the extra moisture they receive. During heavy rainfall events which typically happen during intense summer storms, these intermittent drainageways act as broad channels and may experience flooding for brief periods. These sites are also important contributors to regional water table recharge.

Soil depth for the Ephemeral Drainageways is over 78 inches (200 centimeters) to root-restrictive layers. Slope gradient ranges from 0 to 5 percent causing aspect to have very little effect on site dynamics. Surface texture ranges from silty clay loam to silty clay, with some areas having sandy clay loams with mostly fine and very fine sands.

During early stages of ESD development on the CP, two ecosites were proposed for ephemeral drainageways—one with significant accumulations of moderately to highly soluble salts, and the other generally lacking salts. However, extensive reconnaissance showed saline conditions to be quite rare—occurring only where the hydrology of drainageways (or stretches thereof) has been significantly altered by the addition of irrigation water to landforms above. For example, diversion of water into a given playa to promote waterfowl habitat can lead to elevated salinity in both drainageways and playas lower on the landscape. Thus, it was deemed most appropriate to represent saline conditions as a management-induced ecological state rather than a distinct ecological site.

Associated sites

GX070A01X006	**Slopes** This site occurs on escarpments where soils are ≤ 50 cm to a root-restrictive layer, and have slopes >10%.
GX070A01X008	**Ephemeral Drainageways** Playa sites may be hydrologically connected to some drainageways via subsurface-flow.
GX070A01X014	**Lithic Limestone** This site occurs where soils are ≤ 50 cm to lithic contact with limestone bedrock, and often supports oneseed juniper savannahs.
GX070A01X007	**Limy Escarpments** This site occurs on escarpments where soils are ≤ 50 cm to a root-restrictive layer, and have at least one of the following properties at the soil surface: 1) strong or violent effervescence (HCl, 1N); or 2) ≥ 5% calcareous surface fragments.
GX070A01X002	**Clayey Uplands** This site occurs in soils that have high clay in subsurface horizons and contribute moisture to Ephemeral Drainageways.
GX070A01X003	**Loamy Uplands** This site occurs in soils on plateau uplands and contribute moisture to Ephemeral Drainageways.
GX070A01X004	**Shallow Loamy** This site occurs where soils have paralithic contact within 50 cm, and contribute moisture to Ephemeral Drainageways.
GX070A01X005	**Limy** This site occurs where soils surfaces have strong or violent effervescence and ≥ 5% calcareous rock fragments.
GX070A01X013	**Lithic Sandstone** This site occurs where soils are ≤ 50 cm to lithic contact with sandstone bedrock, and often supports oneseed juniper savannahs.

Similar sites

R070AY002NM	**Clayey Upland** This site was developed for a broad range of soils that occur on upland fans, plains, hillslopes, and some depressions. The Ephemeral Drainageways site is specifically intended to target the plant communities that occur in run-on sites that are not depressions.
R070AY006NM	**Swale** This site was written for a broad range of soil types that include low lying drainageways, playas and other depressions. Though close in concept, the Ephemeral Drainageway site specifically separates this type of ecology from that of a playa, which has ponding rather than flooding, accumulates more salts, and therefore has unique plant and wildlife interpretations.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Legacy ID

R070AA008NM

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, drainageways, breaks, terraces, and floodplains. The Canadian River Valley, primarily to the east, is the base level towards which the entire LRU is eroding and draining. As plateaus grade towards the Canadian River, the elevation drops from above 7,500 feet to below 5,000 feet over a distance of 30 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, the younger rocks, such as the late Cretaceous shales and limestones, remain somewhat intact, attributed to their distance from the Canadian River Valley. To the east, the early Cretaceous Dakota sandstone serves as a resilient caprock that serves as the plateau rim.

The Ephemeral Drainageways site occurs as dendritic swale features on plateau surfaces across the Canadian Plateaus LRU. This site is not extensive in terms of acreage, but it can be found scattered across all portions of the Canadian Plateaus where the plateau is not deeply dissected. This site is considered a run-on landform which receives additional moisture from surrounding uplands. The enhanced moisture is expressed by plant community dynamics that might be observed in a similar but wetter climate than expected based on rainfall alone.

Drainageway development can appear in a continuum of possible stages, ranging from a subtle swale in a plateau upland to a nearly perennial stream. The defining characteristic that combines these stages is the fact that moisture from upland positions collects in these channeled swales, the drainage is not closed (water can drain out) and that surface water does not flow in this channel most months of any year. However, as implied, there is a wide range of “wetness” or moisture collection between these stages based on the channel order and watershed acreage, which leads to a wide range of plant community dynamics.

The Ephemeral Drainageways site is characterized by a few distinct landform features that can vary based on the hydrology of the system. Where watersheds are minimal, the drainageway will appear as a subtle swale in otherwise upland plateau terrain. As you move downstream, and the watershed area is increased, and possibly the stream channel order increases, a separate floodplain and stream terrace can be distinguished. Even further downstream, where some amount of seasonal flow occurs in normal years, the drainageway appears more as an ephemeral stream system with defined channel, floodplain, and terrace components. Since channel incision resulting from degraded conditions can have the appearance of the latter stage, one should look for discontinuous channel development as evidence of erosional degradation. Furthermore, entrenchment of historic channels is a rampant issue in this LRU that leads to bank destabilization and further erosion and gully formation as laterals from the main channel.

Associated sites that occur on landforms and landform positions adjacent to the Ephemeral Drainageways site are the Sandy, Loamy Uplands, Clayey Uplands, Lithic Limestone, Lithic Sandstone, Limy, Shallow Loamy, and Playas. Adjacent sites that contribute moisture to Ephemeral Drainageways include Shallow Loamy Slopes, Loamy Slopes, and Limy Escarpments.

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

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 Ephemeral Drainageways site occurs on each of these formations. The drainageways are composed of deep deposits of alluvium from the surrounding uplands which are typically composed of sedimentary rocks but may favor the shale, limestone or sandstone depending on the surface geology of the nearest plateau surface.

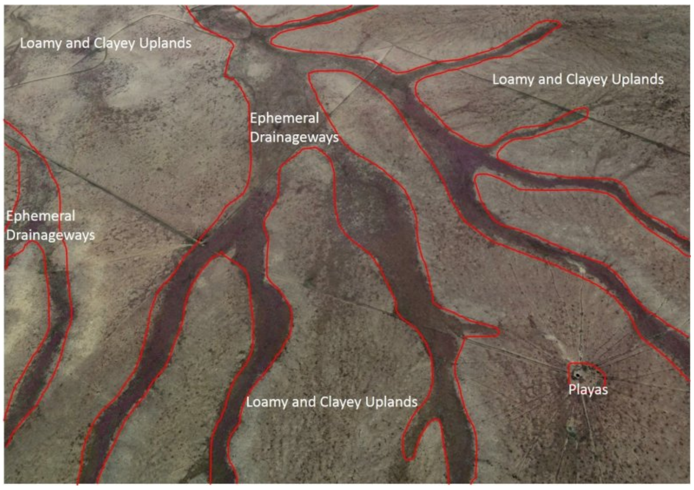


Figure 1. A diagram showing the Ephemeral Drainageways site in plateau landscape. Notice the variety of drainageway orders, demonstrating differing degrees of run-on class that can occur on this site.

Table 2. Representative physiographic features

Landforms	(1) Plateaus or tablelands > Swale (2) Plateaus or tablelands > Drainageway
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Very rare to occasional
Ponding frequency	None
Elevation	1,524–2,286 m
Slope	0–5%
Water table depth	30–102 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

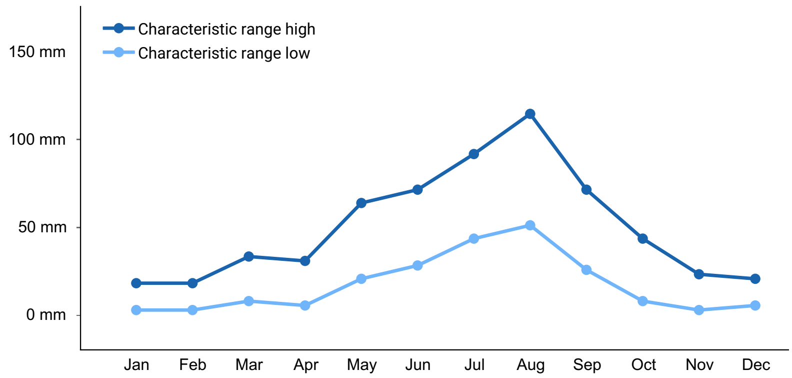


Figure 2. Monthly precipitation range

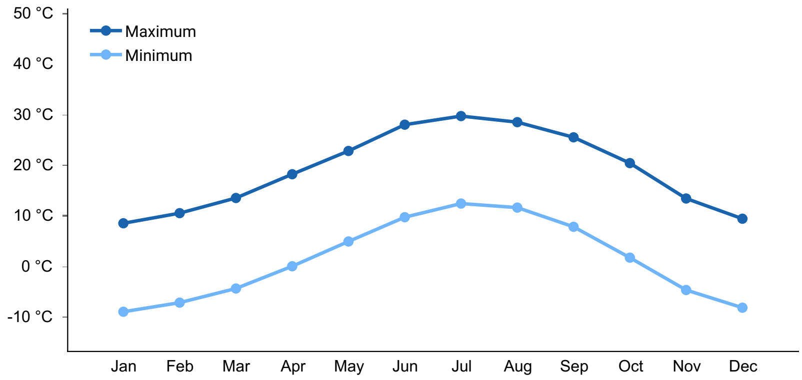


Figure 3. Monthly average minimum and maximum temperature

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) CIMARRON 4 SW [USC00291813], Cimarron, NM
- (7) MAXWELL 3 NW [USC00295490], Maxwell, NM
- (8) DES MOINES [USC00292453], Des Moines, NM

Influencing water features

Ephemeral Drainageways are intermittent waterways that receive run-on water from surrounding uplands by means of overland flow but also through discharge from uplands. These positions are also important vectors for recharge to the regional water table. During wetter years, the drainageway systems may experience brief periods of flooding or at least some overland flow. In drier years, there may be no surface water activity.

Some of these landforms are more like ephemeral streams in that they have developed channels, floodplains and terraces. In these situations, the hydrology has often been altered from historic conditions when the stream may have flowed more frequently. Where the watershed is simply not large enough to support a perennial stream, there may be seasons or months where some base flow is expected in normal years.

The Ephemeral Drainageways ecological site is not associated with large wetlands systems; but small, isolated wetlands can occur in areas where water is backed-up by micro-topography, or where wetlands have been created where roads and other anthropogenic structures impound water. Hydrophytic plant species, though intermittent with alternating wet and dry periods, inhabit these sites.

Landscape hydrology can influence the salinity of drainageway soils in rather complex ways. Both surface water and groundwater contain measurable concentrations of dissolved salts, which precipitate into drainageway soils during evapotranspiration. In most cases, these salts are effectively leached from soil profiles by percolating rainwater during subsequent rain and flooding events. However, the rate of salt accumulation can exceed the rate of leaching when one or both of the following occur: 1) the water table below a channel/swale is elevated near the surface for a prolonged period, thus inhibiting percolation. 2) An elevated water table below adjacent uplands leads to a prolonged period of discharge into the drainageway, thus increasing the rate of salt accumulations in drainageway soils.

Both of the conditions described above can occur when significant amounts of irrigation water are diverted to a given landscape. The most common example is the addition of water to playas in order to convert them to perennial lakes. Saline drainageway conditions are frequently found below such irrigated playas.

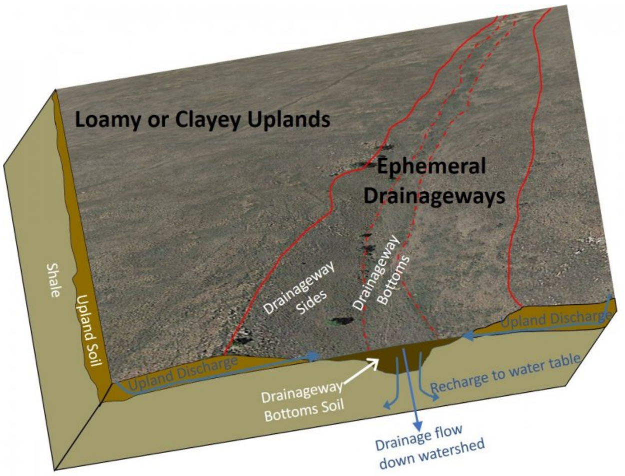


Figure 4. Diagram demonstrating the soil geomorphic and hydrologic relationships of the Ephemeral Drainageways Site.

Soil features

The soils of Ephemeral Drainageway sites are located in low, concave positions of the landscape and therefore are highly influenced by the erosion of local upland soils. Historically, the organic-rich topsoil is lost during drought or high rainfall periods and deposited as parent material into these swale features by gravity. These organic-rich particles are typically silt and clay sized that can become partially suspended in thin, weak, water bands of overland flow during intense rain events. Therefore, the soils are characterized by depositional parent materials that can be stratified layers of alternating textures such as silt loams and sandy loams or even clay loams and gravelly sandy loams. The materials are dark colored, usually a value of 3 or less, due to their high organic matter contents that are derived from both their fertile positions in the landscape and their inherited topsoil materials.

Typically, the soil surface is a bit coarser textured than subsurface layers due to the propensity of fine sands to be deposited in these swales during wind erosion events. Below this, a range of possible textures from cobbly loamy sands to clay loams may exist depending on the historic alluvial environment. Very minimal soil development is expected, perhaps some secondary carbonates or some subtle amounts of clay illuviation may exist.

In normal years these soils are driest during the winter. They may be 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 effect of run-on water to this site is significant and increases the available water in both amounts and duration. The soil moisture regime is ustic bordering on aridic, but plant-available moisture is often much more available than what falls as precipitation alone. The mean annual soil temperature is 49 to 55 degrees F; this range falls within the mesic soil temperature regime.

The soils of Ephemeral Drainageways sites are deep with subsurface horizons of at least 30 percent clay in the fine-earth fraction, and few to no rock fragments. They typically have a mollic epipedon. In rare cases, these soils contain significant accumulations of salts—particularly gypsum. See the "Water Features" section for more information on salinity dynamics. The following soil profile information is a description of those unique soil properties for the Ephemeral Drainageways ecological site. To learn about the dynamic properties of the soil components tied to this site, refer to the "Plant Communities" section. The Ephemeral Drainageways ecological site is tied to the components of numerous map units in the Canadian Plateaus LRU of 70A. These components are correlated to the La Brier series with some areas using Vermejo and Partri soil series.

TYPICAL PEDON:
Typical pedon of La Brier silty clay loam, 0 to 3 percent slopes from the Mora County soil survey manuscript (NM638); about 0.25 mile north of True Farms headquarters; 13S 514789 3962429; Elevation 6,248 feet (in sec. 8, T. 18 N., R. 20 E.; in the Mora Land Grant)

A1-0 to 6 inches; brown (7.5YR 5/2) silty clay loam, dark brown (7.5YR 3/2) moist; weak medium subangular blocky structure parting to moderate coarse granular; slightly hard, very friable, slightly sticky and slightly plastic; many fine roots; many fine tubular pores; moderately alkaline; clear wavy boundary.

Bt1-6 to 18 inches; brown (7.5YR 5/2) clay, dark brown (7.5YR 3/2) moist; weak medium and coarse subangular blocky structure; very hard, very firm, sticky and plastic; common fine roots; many very fine tubular pores; few very thin clay films on faces of peds; moderately alkaline; clear wavy boundary.

Bt2-18 to 36 inches; brown (7.5YR 5/2) clay, dark brown (7.5YR 3/2) moist; weak coarse subangular blocky structure; very hard, very firm, sticky and plastic; few fine roots; common very fine tubular pores; common thin clay films on faces of peds; moderately alkaline; clear smooth boundary.

Bk-36 to 50 inches; pinkish gray (7.5YR 7/2) clay loam, brown (7.5YR 5/2) moist; weak coarse subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few fine roots; common fine tubular pores; violently effervescent; disseminated lime throughout; 10 percent calcium carbonate equivalent; moderately alkaline; clear wavy boundary.

Ck-50 to 60 inches; pinkish gray (7.5YR 7/2) clay loam, brown (7.5YR 5/2) moist; massive; very hard, firm, slightly sticky and slightly plastic; violently effervescent; lime segregated in few fine filaments and soft nodules; less than 10 percent calcium carbonate equivalent; moderately alkaline.

The solum is 31 to 60 inches thick or more. Bedrock is at a depth of more than 60 inches.
The A horizon has hue of 7.5YR or 10YR, value of 3 to 5 when dry and 2 or 3 when moist, and chroma of 1 to 3 when dry or moist. The Bt horizons have hue of 7.5YR or 10YR, values of 4 or 5 when dry and 2 to 4 when moist, and chromas of 2 or 3 when dry or moist. The textures are silty clay or clay. It typically is slightly effervescent to strongly effervescent in the lower part. The Bk horizons have hues of 7.5YR or 10YR, values of 5 to 7 when dry and 4 to 6 when moist, and chromas of 2 to 4 when dry or moist. It is clay loam, silty clay loam, or silty clay. The C horizons have hue of 7.5YR or 10YR, and have chromas of 3 or less to a depth of 60 inches or more. It is clay loam or silty clay loam.

Saturated Hydraulic Conductivity (Ksat): 0.01-1 μm/second.
Available Water Capacity (cm H20/cm soil):
A: .19 to .21
B: .15 to .17
C: .15 to .17
Average total AWC in upper 152 cm: 24.9 cm

Table 4. Representative soil features

Parent material	(1) Alluvium–shale (2) Alluvium–limestone (3) Alluvium–sandstone
Surface texture	(1) Very fine sandy loam (2) Sandy clay loam (3) Clay loam
Family particle size	(1) Fine (2) Fine-loamy
Drainage class	Somewhat poorly drained to poorly drained
Permeability class	Very slow to slow

Soil depth	152–508 cm
Surface fragment cover <=3"	0–1%
Available water capacity (0-152.4cm)	20.32–30.48 cm
Calcium carbonate equivalent (0-152.4cm)	0–10%
Electrical conductivity (0-152.4cm)	0–1 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" (Depth not specified)	0–3%

Table 5. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Soil depth	Not specified
Surface fragment cover <=3"	Not specified
Available water capacity (0-152.4cm)	Not specified
Calcium carbonate equivalent (0-152.4cm)	Not specified
Electrical conductivity (0-152.4cm)	0–8 mmhos/cm
Sodium adsorption ratio (0-152.4cm)	0–8
Soil reaction (1:1 water) (0-152.4cm)	Not specified
Subsurface fragment volume <=3" (Depth not specified)	Not specified

Ecological dynamics

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 plant tables below in this section for related legacy sites). 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 Ephemeral Drainageways ecological site is dominated by short grasses, but also contains a mix of shrubs, forbs, and succulents. As is typical of plant communities, annual variability in precipitation translates to considerable short-term fluctuations in annual production within a given plant community phase.

Within this site, the dominant species of short grasses are inherently drought- and grazing-tolerant (Lauenroth, 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 to 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, 1989) and limited seedling germination and establishment due to particular temperature and extended soil moisture requirements for successful seedling establishment (Briske, 1978). Buffalograss, which is more abundant at warmer, lower elevations of this site, is often found occupying swale positions, such as drainageway bottoms, 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).

There are numerous variables such as elevation, latitude, hydrology, soil depth, fire frequency, grazing dynamics, and anthropogenic effects that influence plant communities. As the plateaus gently climb to the west, elevation increases along with its orographic moisture. To the east, proximity to greater warm-season moisture from the Gulf of Mexico increases. As elevation approaches its upper extreme (about 7,500 feet) near the foot of the Rocky Mountains, cool-season plants become most abundant. Therefore, blue grama and broom snakeweed are more common in the east; while western wheatgrass, bottlebrush squirreltail, fringed sage, and common sagewort increase their presence to the west. Where the surrounding plateaus are dominated by shale, surface textures of clay loam are common, and salts may accumulate in the profile; here, alkali sacaton and four-wing saltbush increase within drainageway sites. Another variable in this site is the relative stage of “wetness”, or moisture harvested from upland positions. In places where greater run-on occurs, such as in steeper and larger valley watersheds, expect to see some carex and juncus and, where higher salinity occurs, possibly inland saltgrass.

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, 1989). Fire is a natural disturbance regime that suppresses succulents and shrubs while stimulating grasses and forbs, however, in contrast to midgrass and tall-grass prairie sites, fire is less important (Wright, 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. Due to higher vegetative production potentials within the drainageway site, fuel loads sufficient to carry an effective fire may be attained in shorter periods of grazing deferment relative to adjacent, upland sites.

Correlation to Current Ecological Sites:

Swale- R070AY006NM: This site was written for a broad range of soil types that include low lying drainageways, playas and other depressions. Though close in concept, the Ephemeral Drainageway site specifically separates this type of ecology from that of a playa, which has ponding rather than flooding, accumulates more salts, and therefore has unique plant and wildlife interpretations.

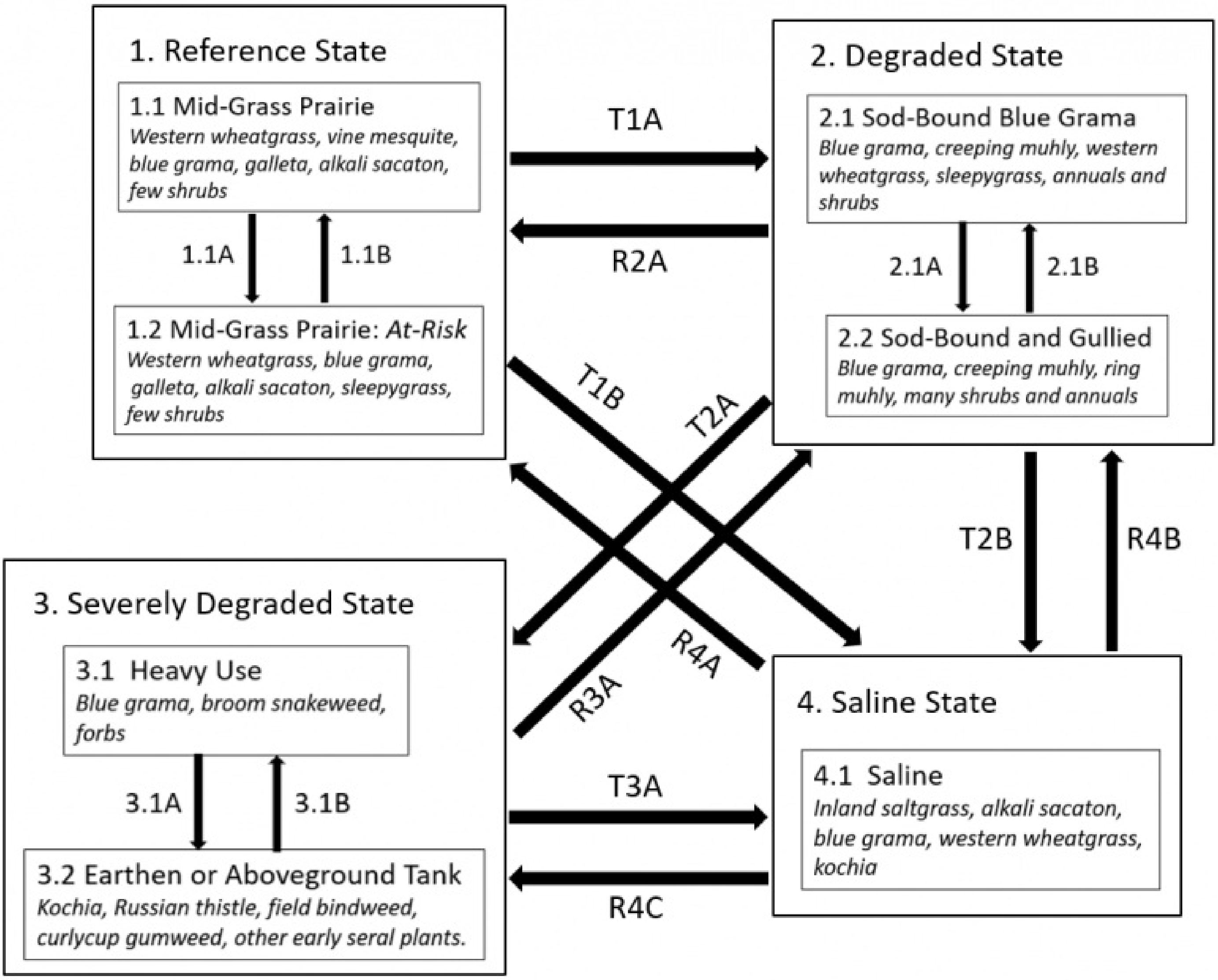
From Swale (R070AY006NM) Tables:
Annual production by plant type
Plant Type Low (Lb/Acre) Representative Value (Lb/Acre) High (Lb/Acre)
Grass/Grasslike---------935----------------------1530---------------------------------2125
Forb-----------------------110----------------------180----------------------------------250
Shrub/Vine--------------55------------------------90-----------------------------------125
Total----------------------1100---------------------1800---------------------------------2500

Community 1.1 plant community composition
Common Name----------Symbol----------Scientific Name----------Annual Production (Lb/Acre)
GRASS/GRASSLIKE
1 western wheatgrass------PASM-----------*Pascopyrum smithii*--------------360–450
2 blue grama-----------------BOGR2----------*Bouteloua gracilis*----------------360–450
3 vine mesquite-------------PAOB-----------*Panicum obtusum*----------------360–450

4 James' galleta--------------PLJA-----------*Pleuraphis jamesii*----------------90–270
5 alkali sacaton---------------SPAI------------*Sporobolus airoides*--------------90–270
6 sideoats grama-------------BOCU----------*Bouteloua curtipendula*----------90–270
8 saltgrass---------------------DISP-----------*Distichlis spicata*-------------------18–54
9 mat muhly-------------------MURI----------*Muhlenbergia richardsonis*-------18–54
10 threeawn-------------------ARIST----------Aristida------------------------------18–54
11 squirreltail------------------ELEL5----------*Elymus elymoides*-----------------36–90
12 creeping muhly-------------MURE---------*Muhlenbergia repens*--------------0–36
FORB
13 upright prairie coneflower-RACO3-------*Ratibida columnifera*-------------18–90
14 Cuman ragweed-------------AMPS---------*Ambrosia psilostachya*------------18–90
15 New Mexico thistle---------CINE----------*Cirsium neomexicanum*----------18–90
16 prairie clover-----------------DALEA-------Dalea---------------------------------18–90
17 *Forb, annual*------------------2FA----------- *Forb, annual*------------------------36–90
18 *Forb, perennial*---------------2FP----------- *Forb, perennial*--------------------36–90
SHRUB/VINE
19 fourwing saltbush-------------ATCA2-------*Atriplex canescens*----------------0–90
20 broom snakeweed------------GUSA2--------*Gutierrezia sarothrae*------------0–54
21 ragweed sagebrush-----------ARFR3---------*Artemisia franserioides*---------0–54
22 winterfat-----------------------KRLA2----------*Krascheninnikovia lanata*-------0–54

Clayey Upland- R070AY002NM: This site was developed for a broad range of soils that occur on upland fans, plains, hillslopes, and some depressions. The Ephemeral Drainageways site is specifically intended to target the plant communities that occur in run-on sites that are not depressions. Though upland sites may have been correlated to soil components mapped in drainageways in the past, they are specifically ignored here due to their improper conceptual application.

State and transition model



State 1
Reference State

Grasses are the primary plant species in the reference state. The main species are western wheatgrass, blue grama, vine mesquite, galleta, alkali sacaton, ring muhly and creeping muhly. The typical shrubs likely encountered in this state include fourwing saltbush, fringed sage, and broom snakeweed. A temperature gradient across the LRU also plays a role in the presence or abundance of some species, and is generally seen as an eastward trend of lowering elevation with rising average annual temperatures. In the easternmost part of this LRU, a greater presence of warm-season plants such as buffalograss is expected. Western parts of this LRU will have a higher prevalence of cool-season grasses such as western wheatgrass and bottlebrush squirreltail as well as fringed sage.

Dominant plant species

- fourwing saltbush (*Atriplex canescens*), shrub
- broom snakeweed (*Gutierrezia sarothrae*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- western wheatgrass (*Pascopyrum smithii*), grass
- blue grama (*Bouteloua gracilis*), grass
- vine mesquite (*Panicum obtusum*), grass
- creeping muhly (*Muhlenbergia repens*), grass

Community 1.1
1.1 Mid-Grass Prairie Grassland with Occasional Shrubs

This phase of the reference state has nearly 100 percent canopy cover and consists of mostly grasses with 5 to 15 percent shrubs and 5 to 20 percent forbs. Annual production averages around 1,800 to 2,500 pounds per acre and can range from 1,000 pounds per acre in poor years to over 3,500 pounds per acre in favorable years.

Community 1.2
1.2 Mid-Grass Prairie: At Risk

This phase of the reference state has nearly 100 percent canopy cover and consists of mostly grasses with 10 to 25 percent shrubs and 10 to 30 percent forbs, and succulents. In addition, some species are expected to be reduced or missing from this site due to grazing pressure by stock or wildlife. These decreasers include vine mesquite, sideoats grama, western wheatgrass and fourwing saltbush.

Pathway P1.1A
Community 1.1 to 1.2

This pathway represents period of time following fires or drought where the ecosystem is relying on the seed bank tc reestablish the plant community. Some erosion could occur, delaying the process, but plentiful nutrient availability awaits some moisture to jumpstart plant growth. In the meantime, annuals might find the opportunity to gain some ground. The process can be also by some frequent grazing activity, either wildlife and/or livestock. Grazing reduces fuels which decreases fire return intervals, and allows shrubs to gain an advantage.

Pathway P1.2A
Community 1.2 to 1.1

This pathway represents a longer period since drought or fire, with maybe a favorable precipitation year or two in the recent past. Though opportunistic annuals may have taken advantage of the open area following the disturbance, they are soon outcompeted by grasses as they revegetate, increasing in coverage over a few successive years. The pathway could also represent a rest period or significant decrease in grazing pressure in both frequency and intensity, or deferred grazing management planning.

State 2
Degraded State

This site has been grazed continuously for several years, if not decades or longer. Annuals and shrub species have increased in coverage, while several grass species including vine mesquite, western wheatgrass, sideoats grama and the shrub fourwing saltbush have decreased or are no longer present. Blue grama, buffalograss, mat (creeping) muhly, ring muhly and sleepygrass will dominate the grass species while shrubs and succulents such as plains pricklypear, stick cholla, broom snakeweed, fringed sage, and rubber rabbitbrush will increase. In warmer, easterly parts of this site’s range, cholla, buffalograss, and silver bluestem are more likely to increase whereas, in the west, plains pricklypear, ring muhly and fringed sage will be more prominent. As shrubs and forbs increase, they gain a competitive advantage, primarily by out-competing the grass for water and nutrients, especially during periods of short- and long-duration drought. Fire had been the natural event in the Great Plains that thwarts shrub species from gaining a competitive advantage and facilitates greater colonization by grasses. Historic continuous grazing has prevented the fuel loads in these grasslands from being able to carry a fire, therefore giving shrubs and annuals their advantage. As shrubs increase, root density and turnover in the soil begins to lessen causing a decrease in decomposition rates which are a source of nutrient supply to plants. In return, storage of labile and sequestered carbon pools decline causing a decrease in soil organic matter. Soil organic matter decline coincides with lower infiltration capacity, water holding capacity, and higher bulk density, all which lead to decreased resiliency to drought and heat stress. It also increases erosion rates and may lead to gully formation.

Community 2.1
Sod-bound blue grama

Sites are significantly covered by blue grama and/or creeping muhly. Foliar coverage remains high, from 75 to 100 percent with 0 to 15 percent bare ground, and annuals and shrubs composing a minimum of 10 percent of this canopy and ranging up to 40 percent.

Community 2.2
Sod-bound and gullied

Figure 5. Area below cut represents phase 3.1. Area above cut represents phase 2.2.

These sites are hydrologically impaired due to entrenchment of the drainage bottom via gully erosion. This site is especially vulnerable to gully erosion due to its concave position in the landscape subject to concentrated flow from runoff during heavy rain events. Gully formation tends to self-perpetuate as it provides a weakness as a topographic nickpoint in otherwise unreinforced and highly erodible materials. Gullies act to provide unwanted drainage to formerly wetter parts of the landscape, causing a loss in acreage of this limited but important ecological corridor of highly productive land. This process renders most of the acreage of the former bottomland as drier upland, and expect to see a plant community that resembles more upland ecosites. The new “true” bottom is now the gully floor which may or may not be vegetated, based on how recent it was scoured. In some locations, this new bottom is well established and vegetated, and may have access to the water table and therefore hydric. In these situations, some rushes or sedges might be present. Foliar cover ranges from 75 to 95 percent on the remnant bottoms (now terraced or elevated and well drained) with 0 to 15 percent bare ground and annuals and shrubs ranging from 10 to 50 percent cover. The new bottom, or gully floor, can vary in plant cover from 0 to 100 percent.

Pathway P2.1A
Community 2.1 to 2.2

This pathway represents an increase in grazing intensity coupled with periods of drought. Specifically, year-round grazing, without significant periods of rest can cause a loss in species diversity, which can result in several negative feedback dynamics. These are primarily expressed as a function of increased compaction, which destroys soil surface structure and decreases infiltration, and expansion of bare-ground patches. Together, these processes cause the ground to become susceptible to first: rain splash effects, or loosening of soil surface particles from their former structure units, and second: along with decreased infiltration, the tendency for surface overland flow to initiate. As the flow increases, the detached particles are suspended and transported, increasing the cutting power of the water and causing erosion to accelerate. At some threshold, the cutting power will have the ability to start a gully headcut.

Pathway P2.2A
Community 2.2 to 2.1

This pathway represents an implementation of deferred grazing or rested periods so that species diversity and density can recover. In situations where the gully formation is minor, natural rates of sedimentation may cause the channel to fill on its own naturally as long as the area stays well vegetated. In cases where the gully is deeper, and not fully vegetated, some channel restoration techniques may need to be employed. Several types of grade-control structures that use the local processes and resources of sediment redistribution can be used to help fill and stabilize these eroded areas (Zeedyke, 2009).

State 3
Severely Degraded State

The degradation in this state is severe, with significant damage to the soil profile that alters its ability to produce a viable plant community for wildlife or agricultural uses on its own. The grass component is dominated by sod-bound blue grama and/or creeping muhly with minor amounts of western wheatgrass, bottlebrush squirreltail, and buffalograss. This condition usually results in a compromised soil surface that is highly susceptible to gully erosion.

Community 3.1
Heavy Use

Figure 6. Area below cut represents phase 3.1. Area above cut represents phase 2.2.

This phase of the Severely Degraded state can be brought upon through a variety of different mechanisms: plowing for dryland cropping; stock trails leading to resource; two-track road; proximity to high runoff area. These impacts can result in a loss in the anchoring of topsoil by plants, exposing the surface to erosive runoff events. Severe gullying results in reshaping of the drainageway landform characterized by a change in the local hydrology. The result is a decrease in water infiltration and storage as well as its residence time on the landscape. It is common for annuals and shrubs to compose greater than 50 percent of foliar cover with bare ground composing 30 to 60 percent of the site. The remnant portion of the drainageway bottoms will now resemble plant community compositions of nearby uplands, but usually retains the denser canopy associated with run-on sites. The new drainageway bottom is the gully floor which may contain anywhere from 0 to 100 percent canopy cover ranging from sedges and rushes to kochia.

Community 3.2
Earthen or aboveground tank

Typically, the land has been converted to alternative uses to grazing such as for watering or corralling livestock, or other industrious purposes. These areas are often limited in their extent with a radius of 50 to 100 meters of the activity but have an impact at a greater radius. Adjacent areas, both up and downstream from these heaviest impacted locations, can have conditions characterized by the Sod-Bound and Gullied phase (2.2) but can also be in a Heavy Use phase (3.1). Severity is determined by connectedness and proximity due to the heightened runoff or head-cutting from the compacted and bare ground.

Pathway P3.1A
Community 3.1 to 3.2

Installation of a fixed location stock tank that draws animals regularly to the same location. Their repetitive, and continual traffic causes severe trampling, compaction, and denuding of the vegetation and soil surface. The compacted soil does not allow water or roots to penetrate, causing runoff to accelerate to surrounding areas and maintaining the bare ground status. In summer months, the bare ground can cause heat to build in the thermal mass of the soil surface which can accelerate drying of the soil, expose it to wind erosion, which can then be an air pollution hazard.

Pathway P3.2A

Community 3.2 to 3.1

Typically, the land has been converted to alternative uses to grazing such as for watering or corralling livestock, or other industrious purposes. These areas are often limited in their extent with a radius of 50 to 100 meters of the activity but have an impact at a greater radius. Adjacent areas, both upstream and downstream from these heaviest impacted locations, can have conditions characterized by the Sod-Bound and Gullied phase (2.2) but can also be in a Heavy Use phase (3.1). Severity is determined by connectedness and proximity due to the heightened runoff or head-cutting from the compacted and bare ground.

State 4
Saline State

This state occurs where significant salts (particularly gypsum) have accumulated in soils as a result of the net upward movement of water into a given Playa (see Water Features above). Given enough data, this state could probably be divided into multiple phases, as plant communities and channel morphology vary widely in response to grazing regime, hydrology, and construction activities.

Community 4.1
Saline

Soils in this phase range from very slightly saline to slightly saline (EC of 2-8 dS/m), and contain significant amounts of gypsum concentrations (often nests of crystals). The plant community contains a preponderance of salt-tolerant species such as inland saltgrass, alkali sacaton, and kochia. Blue grama and western wheatgrass are often abundant, as well. Production and community composition vary widely within this phase, depending on recent grazing regime and weather patterns. Total annual production ranges from 1,000 to 2,200 pounds per acre. Alkali sacaton and western wheatgrass generally decrease under continuous grazing.

Dominant plant species

- saltgrass (*Distichlis spicata*), grass
- alkali sacaton (*Sporobolus airoides*), grass
- burningbush (*Bassia scoparia*), grass
- blue grama (*Bouteloua gracilis*), grass
- western wheatgrass (*Pascopyrum smithii*), grass

Transition T1A
State 1 to 2

Grazing pressure, or severe flooding events, coupled with or following a single drought event, can cause a state shift to the degraded condition.

Transition T1B
State 1 to 4

Landscape hydrology is altered such that the drainageway becomes a site of elevated groundwater discharge. This is most often the result of the addition of irrigation water to landforms above the stretch of drainageway in question, but could theoretically occur in response to changes in weather patterns. Slow variables: In periods between flooding events, capillary action draws groundwater to the surface of the soil. Evapotranspiration leaves behind the salts (particularly gypsum) that were dissolved in the groundwater. Since the water table is elevated, flooding no longer flushes these salts from soils. Thus, over a number of years under the new hydrologic regime, significant amounts of salts accumulate in the drainageway soils.

Restoration pathway R2A
State 2 to 1

Where the condition of the range is degraded without significant formation of gullies, a simple changing of management strategies may lead to restoration. This involves relying on techniques that value plant production and diversity over herd size, using systems such as deferred grazing with periods of rest, especially during drought periods. Use of burning strategies, following a period that allows fuels to accumulate, may be necessary to allow grasses to re-dominate. Some reseeding or shrub removal measures may need to accompany this management shift. Where gully formation is present and significant, more intensive restoration techniques need to be employed. The installation of small rock grade control structures, or other engineered methods (Zeedyke, 2009), along with brush control and, depending on viability of seedbank, reseeding. Burning can be a useful tactic to control shrubs and possibly exotic species. Since the production is generally higher in this site compared to surrounding uplands, a shorter period of grazing rest, relative to adjacent upland sites, may be sufficient to build the fuel load required to carry a fire hot enough to kill snakeweed and cholla.

Transition T2A
State 2 to 3

Installation of a watering facility, either in ground or above ground, magnifies the trampling traffic in the area. Corrals or other high use structures can have the same effect. These areas typically have a preponderance of bare ground, with only small patches of grass and annuals. They now act as a source for concentrated overland flow and this will impact areas downstream by applying great erosive cutting power to the bottomland, usually to the effect of significant gully formation.

Transition T2B
State 2 to 4

Landscape hydrology is altered such that the drainageway becomes a site of elevated groundwater discharge. This is most often the result of the addition of irrigation water to landforms above the stretch of drainageway in question, but could theoretically occur in response to changes in weather patterns. Slow variables: In periods between flooding events, capillary action draws groundwater to the surface of the soil. Evapotranspiration leaves behind the salts (particularly gypsum) that were dissolved in the groundwater. Since the water table is elevated, flooding no longer flushes these salts from soils. Thus, over a number of years under the new hydrologic regime, significant amounts of salts accumulate in the drainageway soils.

Restoration pathway R3A
State 3 to 2

The goal here is to increase the residence time of water on the landscape following a precipitation event. The focus should be on areas where water is concentrating, and methods that will work to spread the runoff over the largest extent of bottomland as possible. Success will be determined by whether the areas can be simultaneously revegetated, and all before the next significant erosive event. It would also be wise to guarantee appropriate amounts of moisture are available to ensure success of plant establishment under any possible weather condition. Intensive remediation of the site via landform restoration techniques will be required following the removal of tanks, filling in of pits, or reclaiming gullies. It might be strategic to first address compaction of surrounding upland areas by encouraging annuals that deploy penetrating taproots. Eventually the site can be seeded with a more native blend of grasses and forbs. In cases of severe compaction, where plants cannot establish on their own, an initial deep plowing may be required to break up the dense surface. Other methods such as adding amendments like mulch or gravel may be required to help restore infiltration and root penetrability. Following this, gullies can be treated using methods to encourage sediment aggradation in smaller incremental steps. Additional sediment retention steps can be added sequentially over time to elevate the grade of the gullies to a level even with the historic bottomland. Many techniques and methods exist to handle a variety of restoration situations (Zeedyke, 2009).

Transition T3A
State 3 to 4

Landscape hydrology is altered such that the drainageway becomes a site of elevated groundwater discharge. This is most often the result of the addition of irrigation water to landforms above the stretch of drainageway in question, but could theoretically occur in response to changes in weather patterns. Slow variables: In periods between flooding events, capillary action draws groundwater to the surface of the soil. Evapotranspiration leaves behind the salts (particularly gypsum) that were dissolved in the groundwater. Since the water table is elevated, flooding no longer flushes these salts from soils. Thus, over a number of years under the new hydrologic regime, significant amounts of salts accumulate in the drainageway soils.

Restoration pathway R4A
State 4 to 1

R4A, R4B, R4C: Each restoration pathway from State 4 will necessarily involve a change in landscape hydrology which effectively lowers the water table below the stretch of drainageway in question. In most cases, this will involve a reduction or cessation of irrigation activities higher in the watershed. The result is that water effectively percolates through the soils of the floodplains and drainageway bottoms. Highly soluble salts such as sodium chloride and sodium bicarbonate are removed rapidly—perhaps in a matter of years. Gypsum, having only moderate solubility and often being quite concentrated in State 4, will require decades to be markedly reduced, and perhaps centuries to be removed entirely. Which of the three restoration pathways the plant community takes will depend on a number of factors. R4A will occur if the stream channel is not incised, and the area lacks head-cuts or lateral gullies. Re-introduction of plants may require the initial removal of salts (a slow process), followed by seeding activities.

Restoration pathway R4B
State 4 to 2

R4A, R4B, R4C: Each restoration pathway from State 4 will necessarily involve a change in landscape hydrology which effectively lowers the water table below the stretch of drainageway in question. In most cases, this will involve a reduction or cessation of irrigation activities higher in the watershed. The result is that water effectively percolates through the soils of the floodplains and drainageway bottoms. Highly soluble salts such as sodium chloride and sodium bicarbonate are removed rapidly—perhaps in a matter of years. Gypsum, having only moderate solubility and often being quite concentrated in State 4, will require decades to be markedly reduced, and perhaps centuries to be removed entirely. Which of the three restoration pathways the plant community takes will depend on a number of factors. R4B will occur in stretches containing head-cuts or radiating gullies. Again, re-introduction of plants may require the initial removal of salts (a slow process), followed by seeding activities.

Restoration pathway R4C
State 4 to 3

R4A, R4B, R4C: Each restoration pathway from State 4 will necessarily involve a change in landscape hydrology which effectively lowers the water table below the stretch of drainageway in question. In most cases, this will involve a reduction or cessation of irrigation activities higher in the watershed. The result is that water effectively percolates through the soils of the floodplains and drainageway bottoms. Highly soluble salts such as sodium chloride and sodium bicarbonate are removed rapidly—perhaps in a matter of years. Gypsum, having only moderate solubility and often being quite concentrated in State 4, will require decades to be markedly reduced, and perhaps centuries to be removed entirely. Which of the three restoration pathways the plant community takes will depend on a number of factors. R4C will occur in areas that remain affected by heavy use, such as corrals, stock tanks, 2-tracks; and nearby stretches of the drainageway.

Additional community tables

Animal community

Habitat for Wildlife:
(From Clayey Upland-R070AY002NM)* This site provides habitats which support a resident animal community that includes 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.
*Note that this list comes from an upland site, which is merely the closest fit among existing sites.
Sandy, Loamy, Loamy Argillic, Lithic Limestone, Lithic Sandstone, Limy, Shallow Loamy, and the Playas.

Hydrological functions

Soil Hydrology and Influencing Water Features:
Ephemeral Drainageways are intermittent waterways that receive run-on water from surrounding uplands by means of overland flow but also through discharge from uplands. These positions are also important vectors for recharge to the regional water table. During wetter years, the drainageway systems may experience brief periods of flooding

or at least some overland flow. In drier years, there may be no surface water activity.

Some of these landforms are more like ephemeral streams in that they have developed channels, floodplains and terraces. In these situations, the hydrology has often been altered from historic conditions when the stream may have flowed more frequently. Where the watershed is simply not large enough to support a perennial stream, there may be seasons or months where some base flow is expected in normal years.

The Ephemeral Drainageways ecological site is not associated with large wetlands systems; but small, isolated wetlands can occur in areas where water is backed-up by micro-topography, or where wetlands have been created where roads and other anthropogenic structures impound water. Hydrophytic plant species, though intermittent with alternating wet and dry periods, inhabit these sites.

Landscape hydrology can influence the salinity of drainageway soils in rather complex ways. Both surface water and groundwater contain measurable concentrations of dissolved salts, which precipitate into drainageway soils during evapotranspiration. In most cases, these salts are effectively leached from soil profiles by percolating rainwater during subsequent rain and flooding events. However, the rate of salt accumulation can exceed the rate of leaching when one or both of the following occur: 1) the water table below a channel/swale is elevated near the surface for a prolonged period, thus inhibiting percolation. 2) An elevated water table below adjacent uplands leads to a prolonged period of discharge into the drainageway, thus increasing the rate of salt accumulations in drainageway soils.

Both of the conditions described above can occur when significant amounts of irrigation water are diverted to a given landscape. The most common example is the addition of water to playas in order to convert them to perennial lakes. Saline drainageway conditions are frequently found below such irrigated playas.

Recreational uses

Flooding makes this site quite inappropriate for most recreational developments.

Wood products

This site rarely supports trees.

Other information

Future Work:
In order to meet requirements for status beyond “Provisional”, data collection required to complete tier 2 sampling and data analysis before tier 3 development can begin. A complete pedon for this ecological site needs to be collected and used for the representative.

ESD Workgroup:

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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	05/16/2024

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:**