USDA Natural Resources Conservation Service

Ecological site R042CY005NM
Loamy Terrace

Accessed: 05/02/2024

General information

Approved. An approved ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model, enough information to identify the ecological site, and full documentation for all ecosystem states contained in the state and transition model.

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 042C–Central New Mexico Highlands

To view this ESD in its most complete form refer to the PDF Version found in the New Mexico NRCS Field Office Technical Guide, section 2.

The Loamy Terrace Ecological Site predominantly occurs in LRU 42.8, which is a subunit of MLRA 42 (Southern Desertic Basins, Plains, and Mountains)

It is possible, though very rare, that the Loamy Terrace Ecological Site may occur outside of this proposed LRU boundary.

To identify locations where this ESD has been mapped, refer to the most current natural resource soil survey data on Web Soil Survey or contact your local NRCS Conservation District field office.

Classification relationships

NRCS & BLM: NRCS & BLM: Loamy Terrace Ecological Site < LRU 42.8 Northeastern Chihuahuan Desert Hills< Major Land Resource Area 42, Southern Desertic Basins, Plains, and Mountains < Land Resource Region D, Western Range and Irrigated Region (United States Department of Agriculture, Natural Resources Conservation Service, 2006).

USFS: Loamy Terrace Ecological Site < Artesia Plains Desert Grass-Shrubland Subsection < Pecos Valley Section < Southwest Plateau and Plains Dry Steppe and Shrub Province (Cleland, et al., 2007).

EPA: Loamy Terrace Ecological Site<24b Chihuahuan Desert Grasslands<24 Chihuahuan Deserts (Griffith, et al., 2006).

Ecological site concept

The Loamy Terrace site occurs along stream terraces along the Guadalupe Ridge. The soils are non-skeletal and are deep to a petrocalcic horizon.

Associated sites

R042CY902NM	**Limestone Hills** This site has slopes > 25% which make up hillsides above the shallow ecological site and occasionally the Loamy Terrace. It is very shallow to bedrock.
R042CY003NM	**Shallow** This site is associated with the Loamy Terrace on hillsides above. It is shallow to a petrocalcic horizon.
R042CY004NM	**Gravelly** This site can form in a complex with the Loamy Terrace along streams. The heavy presence of black grama will show when you move onto the Gravelly.
R042CY007NM	**Draw** This site is associated with the Loamy Terrace along stream systems. The Loamy Terrace site occupies stream terraces above the Draw.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

The Loamy Terrace Ecological Site is positioned on treads of stream terraces and alluvial fans, within the LRU 42.8. Elevation ranges from 4000 to 5500 feet. Soil depth is deep to very deep (>100 cm) over a petrocalcic horizon. Slopes range from 1 to 10 percent. Aspect plays a minor role on this site.

The Loamy Terrace Ecological Site consists of deep, well drained soils that formed in alluvium derived from limestone and sandstone sources. The Loamy Terrace Ecological Site is most closely associated with the Gravelly, Shallow, Limestone Hills, and Draw Ecological Sites. The Shallow Ecological site occurs on associated areas where a root restricting petrocalcic horizon is less than one meter deep. The Draw Ecological site is situated in an active floodplain. The Gravelly Ecological Site is sometimes interspersed with the Loamy Terrace Ecological Site on terrace tread positions.

Geology: The primary geologic formations that make up the parent material for the Loamy Terrace Ecological Site include the Seven Rivers, Tansil, Yates, and to a lesser extent, the Capitan Limestone. During Guadalupian time of the Permian Period, dynamic sedimentation of carbonate and evaproite rocks occurred around the rim of the Delaware Basin creating an ideal environment for the development of a large coral reef. The rim was topographically high; the waters were shallow, well-ventilated, agitated, and warm. In this excellent marine-life environment the great Capitan Reef began to form. The Capitan Reef grew rapidly and flourished throughout Guadalupian time, surrounding the Delaware basin, controlling environments and influencing sedimentation (Kelley, 1971).

On the landward side of the reef (the backreef) the Seven Rivers, Yates, and Tansil formations formed. The first was the Seven Rivers Formation. The sediments of the Seven Rivers deposited at a time when conditions became drier, and the basin tended toward hypersalinity. The Seven Rivers contain gray to white dolomitic limestone, white to red gypsum, orange-red siltstone, and shale. Within the LRU, the Seven Rivers Formation is considered the surface layer on Azotea Mesa, Seven Rivers Hills, and West Hess Hills.

Deposited above the Seven Rivers during a quiet period within an unrestricted lagoon is the Yates Formation. The Yates is characterized by layers of very pale orange to yellowish-gray fine-grained, laminated dolomite, alternating with grayish-orange to pale yellowish-orange, calcareous quartz siltstone or very fine-grained sandstone. The Yates is the surface formation over much of Carlsbad Caverns National Park, starting at Walnut Canyon and extending North through the Cueva Escarpment and up to Living Desert State Park.

Landward of the unrestricted lagoon was a restricted lagoon, (the Tansil Formation). Here freshwater mixed with seawater. Large amounts of sediments were carried in by streams causing a hostile environment for marine organisms. Like the Yates, the Tansil is characterized by clastic sediments such as siltstone and sandstone as well

as layers of dolomite. Unlike the Yates, however, the Tansill contains many thin clay layers (Burger, 2007). The Tansil Formation is the surface layer at the Carlsbad Caverns Visitor Center.

About 15 million years ago, the ancient reef rock that had been buried by younger layers of rock began to rise, creating the Guadalupe Ridge and Mountains while exposing the Seven Rivers, Tansil, and Yates Formations. Over the years, especially during the glacial periods of the Pleistocene, alluvial fan construction occurred as material from mountain drainages formed a semi conical deposit of variously sorted and stratified alluvium (Peterson, 1981). Over time, ephemeral streams have wound themselves through the Guadalupe hills and mountains, depositing alluvium and building stream terraces. The Loamy Terrace Ecological Site occurs where alluvial deposits have formed deep soils over a petrocalcic horizon.

Ecological Site Key for LRU 42.8 and 42.9, Northwestern Chihuahuan Hills and Mountains

1. Site is within LRU 42.8, which is within the ustic-aridic soil moisture regime, and the thermic soil temperature regime. (Often contains the presence of red berry juniper)
2. Soils are loamy and not skeletal, and reside in low areas that are stream terraces and fan remnants. - Loamy Terrace ESD
2. Soils are skeletal (Greater than 35% by volume rock fragments greater than 2mm.)
3. Soils are deep to very deep. (Greater than 100cm to root restrictive layer)
4. Site exists in an active floodplain.-Draw ESD
4. Site exists on a stream terrace or alluvial fan-Gravelly ESD
4. Site exists on steep slopes on limestone colluvium over gypsum.-Limy Gyp Escarpment
3. Soils are very shallow to moderately deep (5-100cm).
5. Root restrictive layer is a petrocalcic horizon.-Shallow ESD
5. Root restrictive layer is bedrock.
6. Slopes are less than 25%-Very Shallow ESD
6. Slopes are greater than 25%- Limestone Hills ESD
1. Site is located within LRU 42.9, and is represented by the aridic-ustic soil moisture regime, and the mesic soil temperature regime. (It often contains the presence of alligator juniper and pinon pine.)
7. Slopes are less than 25%- Shallow Limestone ESD
7. Slopes are greater than 25%- Limestone Mountains ESD

Glossary:

Colluvium: “Unconsolidated, unsorted earth material being transported or deposited on side slopes and/or at the base of slopes by mass movement (e.g. direct gravitational action) and by local, concentrated runoff” (Schoenberger, et al., 2012).

Petrocalcic Horizon: The petrocalcic horizon is an illuvial horizon in which secondary calcium carbonate or other carbonates have accumulated to the extent that the horizon is cemented or indurated (Keys to Soil Taxonomy, 2010).

Residuum: “Unconsolidated, weathered, or partly weathered mineral material that accumulates by disintegration of bedrock in place” (Schoenberger, et al., 2012).

Soil moisture regime: Refers to the presence or absence either of ground water or of water held at a tension of less than 1500 kPa in the soil or in specific horizons during periods of the year. Water held at a tension of 1500 kPa or more is not available to keep most mesophytic plants alive. Major differences in soil moisture are often reflected in different vegetative communities. The two major soil moisture regimes for the Guadalupe Mountains are Aridic and Ustic (Keys to Soil Taxonomy, 2010).

Soil Temperature Regime: This is the range of temperatures experienced by a soil at a depth of 50 cm. When the average temperature of a soil falls between 46 degrees F and 59 degrees, it falls into the mesic soil temperature regime. The thermic soil temperature regime falls between 59 degrees F and 72 degrees (Keys to Soil Taxonomy, 2010).

Table 2. Representative physiographic features

Landforms	(1) Stream terrace (2) Fan remnant
Flooding frequency	None
Elevation	1,219–1,676 m
Slope	1–15%
Aspect	Aspect is not a significant factor

Climatic features

The mean annual precipitation is 10.4 inches to 18.3 inches, occurring mostly as high intensity, short-duration afternoon thunderstorms from July through September. Mean annual air temperature is 55 to 70 degrees F, and the frost-free season is 207 to 243 days.

Annual weather patterns, influenced by global climate events, such as El Niño and La Nina, affect and alter production and composition across the Loamy Terrace Ecological Site. In general, because precipitation is minimal through the winter but increases during the summer, warm-season (C4) plants dominate the landscape. However, from year to year the production and composition can greatly shift due to variable weather patterns. The years that produce the most species richness and production are those that get slow, steady moisture through the months of May, June, and July. Late summer thunderstorms may induce heavy runoff on this site, creating flash-flooding in the draws, drainages, and canyons below.

The climate trend of the area is one toward warmer temperatures and lower precipitation. According to the Carlsbad Caverns Climate Station, during the years 2001-2011, five years received less than 10 inches or rain. Three of those years, (2003, 2005, and 2011) were below 5 inches of rain. And 2011 was both the lowest rainfall and hottest year on record. Similarly, in 1947-1957, 6 out of 11 years were below the mean low of 10.4 inches. But in that stretch, only one year, 1951, was below 5 inches. To put this in perspective, in the dry 1930’s only 2 years were below the mean low of 10.4 and none were below 5 inches. The 2001-2011 decade has been much warmer and drier than any in recorded history. In addition, during the two years of 2010 and 2011, Carlsbad Caverns National Park (CCNP) experienced extreme events of drought, wildfire, and flash flooding which have led to shifts in plant communities.

Table 3. Representative climatic features

Frost-free period (average)	243 days
Freeze-free period (average)	263 days
Precipitation total (average)	457 mm

Influencing water features

The Loamy Terrace Ecological Site is not associated with a wetland or riparian system; it is an upland ecological site.

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. To learn about the dynamic processes of the soil component, refer to the "plant communities" section of the ESD.

The Loamy Terrace Ecological Site is tied to the Mudgetts component of map units CC3 and MU1 within LRU 42.8. The CC3 and MU1 map units are almost identical, each consisting of a complex of soil components which is dominated by about 80% Mudgetts and similar soils.

In normal years this soil is driest during the winter and moist in the upper part for greater than 90 cumulative days, but fewer than 90 consecutive days during the growing season. The soil moisture regime is aridic bordering on ustic. The mean annual soil temperature: is 62 to 66 degrees F, which is classified as the thermic temperature regime.

The Mudgetts component is well drained, with low to negligible surface runoff. The soils are on treads of stream terraces and alluvial fans. They formed in alluvium derived from Permian aged limestone and sandstone. The Mudgetts taxonomic class is: Fine-loamy mixed, superactive, thermic Ustic Petrocambids. The Mudgetts component has about .2-1.0% % organic matter in the A1 horizon and .8-1.5% in the A2. Surface horizons lack effervescence.

The Loamy Terrace Ecological Site is often situated in high traffic areas, and is prone to erosion due to the fine particle size of its soil. Roads, recreation, and livestock handling facilities often occur on this site. It is important to keep healthy vegetation communities present, so water erosion is held in check. This site has historically lost large quantities of soil in many locations. In areas where soil loss has historically been minimized, and a thick topsoil layer exists, plant communities are extremely productive, sometimes producing over 2500 lbs/acre.

TYPICAL PEDON: Mudgetts very fine sandy loam--on a stream terrace sloping 1 to 2 percent to the south east at 4,513 feet elevation-National Parkland. (Colors are for dry soil unless otherwise noted. When described on April 6th, 2011, the soil was dry from 0 to 19 inches and slightly moist throughout the rest of the profile to bedrock.)

A1--0 to 3 cm, (0 to 1.2 in); yellowish red (5YR 5/6) very fine sandy loam, dark reddish brown (5YR 3/3) moist; moderate medium platy structure; soft, very friable, slightly sticky and slightly plastic; common fine and very fine roots; few very fine irregularly shaped pores and few fine tubular pores; non effervescent (about1 percent calcium carbonate equivalent); five percent gravel; neutral (pH 7.3); clear smooth boundary. (1 to 3 inches thick)

A2--3 to 15 cm, (1.2 to 5.9 in); reddish brown (5YR 5/3) silt loam, dark reddish brown (5YR 3/3) moist; moderate coarse subangular blocky structure; very hard, friable, moderately sticky and moderately plastic; few fine and very fine roots; few medium and common fine tubular pores; non effervescent (about1 percent calcium carbonate equivalent); three percent gravel; neutral (pH 7.0); gradual smooth boundary. (3 to 8 inches thick)

Bw1--15 to 48 cm, (5.9 to 18.9 in); reddish brown (5YR 4/4) silt loam, dark reddish brown (5YR 3/4) moist; moderate medium prismatic structure parting to moderate fine wedge-shaped aggregates; very hard, friable, moderately sticky and moderately plastic; few fine and common very fine roots; few fine and medium tubular pores; many discontinuous, distinct pressure faces on vertical faces of peds; 3 reversible trans-horizon cracks per meter; non effervescent (about1 percent calcium carbonate equivalent); three percent gravel; neutral (pH 7.2); diffuse smooth boundary. (10 to 15 inches thick)

Bw2--48 to 108 cm, (18.9 to 42.2 in); red (2.5YR 4/6) silty clay loam, dark reddish brown (2.5YR 3/4) moist; moderate medium prismatic structure parting to moderate fine wedge-shaped aggregates; extremely hard, friable, very sticky and very plastic; very few fine and common very fine roots; few fine and medium irregularly shaped pores along vertical ped faces; very many discontinuous, distinct pressure faces on vertical faces of peds; 3 reversible trans-horizon cracks per meter; non effervescent (about1 percent calcium carbonate equivalent); seven percent gravel; slightly alkaline (pH 7.4); abrupt smooth boundary. (20 to 30 inches thick)

Bkkm--108 to 200 cm, (42.5 to 78.7 in); very strongly cemented petrocalcic horizon consisting of cemented calcium carbonate with embedded rock fragments.

Total Average Available Water Capacity (cm H2O/cm soil): 18.42 cm

Figure 4. Mudgetts very fine sandy loam

Table 4. Representative soil features

Parent material	(1) Alluvium–calcareous sandstone
Surface texture	(1) Very fine sandy loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow to rapid
Soil depth	203–343 cm
Surface fragment cover <=3"	2–6%
Surface fragment cover >3"	0–4%
Available water capacity (0-101.6cm)	17.78–19.05 cm
Calcium carbonate equivalent (0-101.6cm)	0–2%
Electrical conductivity (0-101.6cm)	0 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–1
Soil reaction (1:1 water) (0-101.6cm)	6.9–7.8
Subsurface fragment volume <=3" (Depth not specified)	1–5%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

There are only a couple of variables that historically affect plant communities on the Loamy Terrace Ecological Site: elevation and fire frequency. At the lower end of the range, (about 4000 feet) temperatures are warmest and driest and tend to promote more Chihuahuan Desert species, such as creosote. Below 4,000 feet, this site transitions into the 42.3 Loamy Ecological Site. For the most part, this site should be heavy grassland with abundant amounts of cane bluestem, vine mesquite, sideoats grama, and blue grama. Black grama seems to increase where gravels increase. Vine Mesquite will be thicker in minor swale areas throughout the site.

This site has the potential to be very productive, and in places where historic erosion has been minor, this site can produce over 2500 lbs/acre and produce a thick topsoil layer resembling a mollic epipedon. The petrocalcic horizon probably aids as an impediment to loss of deep moisture thus keeping plant available moisture more accessible

through drought years.

Fire is a consistent disturbance regime that reduces succulents and a few shrubs while stimulating grasses and forbs. During intervals between fires, shrubs encroach on the site, slowly spreading and out-competing grasses and forbs for water and nutrients. Fire re-balances the system by providing a boost for grass and forb colonization. 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 researchers in the area and region suggest a 10-to-15-year fire regime is common.” (Gebow, 2001)

Small and more frequent fires were more common before the mid-1800’s, with the Apache likely responsible for many small burns. With Europeans, intervals between fires have lengthened and the average fire size has increased (Ahlstrand, 1981). Small fires are important for creating a patchy mosaic across the landscape, which is beneficial for many habitat requirements.

Human caused disturbance such as recreation, livestock grazing, and infrastructure for oil and gas production has recently (over the last 100 years), promoted a species shift to favor the colonization of nitrogen fixing shrubs, especially catclaw mimosa and mesquite. These nitrogen fixing shrubs affect soil chemistry and hydrology, altering the dynamics of the site.

State and transition model

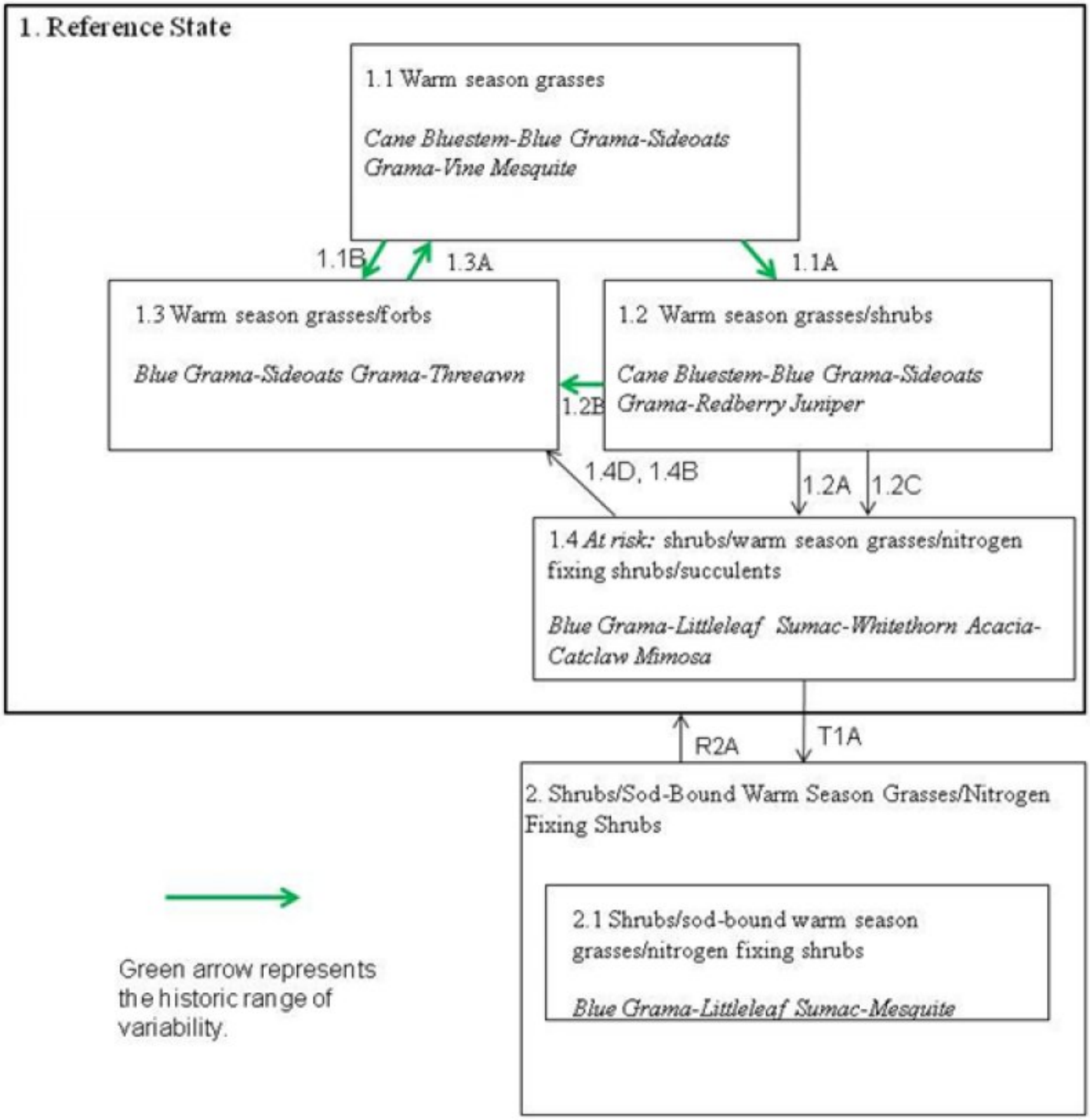


Figure 5. Loamy Terrace State and Transition Model

State 1
Reference State

1.1 Warm season grasses (diagnostic plant community) A mix of warm season grasses, and a few scattered forbs and shrubs are present. Total foliar cover is > 85%. 1.1A Community Pathway: This pathway represents intervals between fires during which natural processes increase shrub and succulent vigor and decrease grass production and composition. 1.1B Community Pathway: This pathway represents fire. Fire suppresses succulents and many shrubs, giving grass a competitive advantage. 1.2 Warm season grasses/shrubs: Over time, foliar cover of shrubs increase and warm season grasses decrease. 1.2A Community Pathway: This pathway represents intervals between fires, which are longer than the historic range of variability. Fire suppression, whether through loss of fuel load due to herbivory or from fighting natural wildfires, has increased shrub and succulent vigor and decreased grass species production and composition. 1.2B Community Pathway: This pathway represents fire. Fire

suppresses succulents and many shrubs, giving grasses a competitive advantage. 1.2C Community Pathway: This pathway represents a growing competitive advantage for nitrogen fixing shrubs due to slow changes in soil chemistry and hydrology. 1.3 Warm season grasses/forbs: This site exists after fire. Grasses, respond well to fire, while many shrubs and succulents are suppressed. 1.3A Community Pathway: This pathway represents intervals between fires; during which natural processes increase shrub and succulent vigor and decrease grass production and composition. Over time, plant community 1.3 shifts to 1.1. 1.4 At risk: shrubs/warm season grasses/nitrogen fixing shrubs/succulents: Due to a gradual change in hydrologic function and soil chemistry, succulents and shrubs increase over time. The increased abundance of native nitrogen fixing shrubs such as whitethorn and catclaw mimosa is a key indicator that this community phase is “at risk.” 1.4B Community Pathway: This pathway represents fire. Fire sets back succulents and many shrubs, giving grasses a competitive advantage. 1.4D Community Pathway: A change in livestock grazing management to allow for decreased shrub competition. This accelerates the turnover of fine roots, causing an increase in labile carbon, acceleration in decomposition, and a resulting increase in plant available water. T1A Transition one: Slow variables: Increased soil erosion; sod-bound blue grama; continued encroachment by nitrogen fixing shrubs; and the loss of the herbaceous plant community due to a decrease in soil organic matter, leading to a decrease in plant available water. Trigger event: A severe drought, causing a loss of organic carbon. Threshold: A hydrologic function/soil chemistry threshold was crossed. 2.0 Shrubs/sod-bound warm season grasses/nitrogen fixing shrubs state 2.1 Shrubs/sod-bound warm season grasses/nitrogen fixing shrubs: Blue Grama is sod bound and erosion is extensive. Nitrogen fixing shrubs have become prominent plants on the site. Foliar cover has decreased to < 40%. A higher Nitrogen turnover rate increases the invasiveness and stability of whitethorn and various leguminous shrubs. This community has a mix of shrubs, succulents, and warm season grasses. R2A Restoration Process: An increase in the competitive advantage of non-nitrogen fixing species through physical, chemical, and biological management practices.

Community 1.1
Warm season grasses (diagnostic plant community)

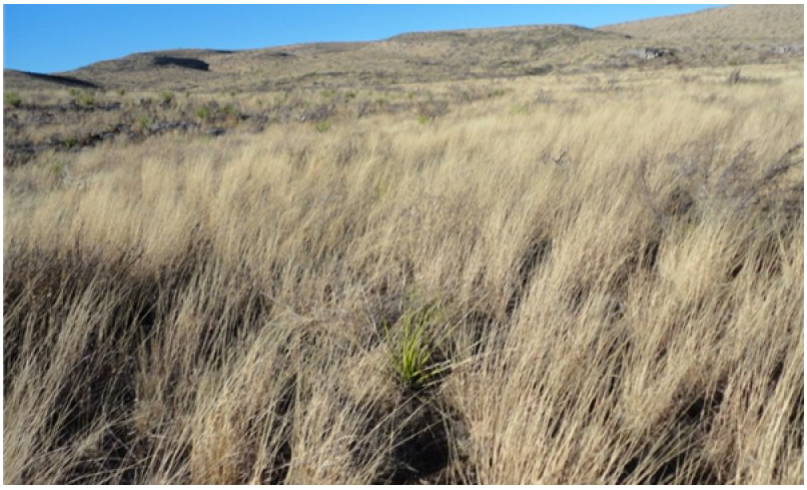


Figure 6. Community 1.1; Upper Walnut Canyon; Carlsbad Caver

This community phase is dominated by a mix of warm season grasses, especially cane bluestem, blue grama, sideoats grama, and vine mesquite. Foliar cover is between 85 and 95 percent; basal cover is between 15 and 25 percent; and bare ground is around 2 percent. Warm season grasses make up about 80 percent foliar cover; forbs 5 percent; succulents 2 percent; and scattered shrubs, about 5 percent. The average surface soil stability rating (Herrick, et al., 2001) is 5.3 under the canopy and 4 in the interspaces. Annual production averages around 2500 lbs/ac, but can span between 1500 and 3000 lbs/ac, depending on annual weather patterns. This community exists approximately 5 to 7 years after low intensity fire. Scattered shrubs and forbs are common, although their distributions are influenced by seasonal weather. Scarlet globemallow and desert verbena are common forbs, and redberry juniper is a common shrub. This plant community phase 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 deep in the profile. Decomposition is active, creating soil organic matter, which enhances plant available water needed for plant vigor.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1463	2438	2925
Shrub/Vine	135	224	269
Forb	84	140	168
Total	**1682**	**2802**	**3362**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	5-9%
Grass/grasslike foliar cover	75-85%
Forb foliar cover	3-7%
Non-vascular plants	1%
Biological crusts	1-3%
Litter	80-90%
Surface fragments >0.25" and <=3"	2-6%
Surface fragments >3"	1%
Bedrock	0%
Water	0%
Bare ground	1-3%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	0%	0%	10-20%	1-3%
>0.15 <= 0.3	–	1-2%	20-30%	1-3%
>0.3 <= 0.6	–	1-3%	20-30%	1-2%
>0.6 <= 1.4	–	2-6%	10-20%	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Figure 8. Plant community growth curve (percent production by month). NM4285, Loamy Terrace Reference State.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	3	8	7	10	27	25	15	5	0	0

Community 1.2
Warm season grasses/shrubs

Figure 9. Community 1.2; Upper Walnut Canyon; CCNP; 3-16-11

This community phase combines a mix of warm season grasses and shrubs. Foliar cover is between 70 and 90 percent, basal cover is between 20 and 40 percent, and bare ground is around 3 to 6 percent. Warm season grasses make up about 60 percent foliar cover; shrubs, 15 percent; forbs 5 percent; and succulents, 3 percent. The average surface soil stability rating is 5 under canopy and 4 in the interspaces. Annual production averages around 1800 lbs/ac, but can span between 1100 and 2500 lbs/ac. This community exists approximately 14-18 years after fire. Cane bluestem, blue grama and vine mesquite are the dominant grasses. Shrub diversity is mixed with mariola being more abundant at the lowest elevations, and redberry juniper being more abundant at the highest elevations. This plant community has evolved due to an increase in shrub vigor and a decrease in grass vigor. As shrubs increase they gain a competitive advantage, primarily by out-competing the grass for water and nutrients. As shrubs increase, energy flow begins to lessen and, fine-root turnover decreases, causing a decrease in decomposition, labile carbon and soil organic matter. Fire is the natural event that keeps shrub species from gaining a competitive advantage and facilitates colonization by grasses.

Community 1.3
Warm season grasses/forbs

Figure 10. Community 1.3; Upper Walnut Canyon; CCNP; 4-6-12

This community phase combines a mix of warm season grasses, forbs, and shrubs. This plant phase exists after fire has recently burned the site, suppressing succulents and shrubs while creating a competitive advantage for grasses. Foliar cover is between 60 and 80 percent, depending on how recent and how severe the fire had been and if adequate precipitation had followed. Basal cover is between 10 and 15 percent, and bare ground is around 5 to 10 percent. Warm season grasses make up about 55 percent foliar cover; shrubs, 5 percent; forbs 8 percent; and succulents, 2 percent. The average surface soil stability rating is 5 under canopy and 4 in the interspaces. Annual production averages around 1500 lbs/ac, but can span between 1000 and 2000 lbs/ac, depending on annual weather patterns. This community exists approximately 1-6 years after fire. It is a grass dominated site, with basal sprouting shrubs scattered across the site. Blue grama, threeawn, and sideoats grama are the dominant grasses in this community phase. Redberry juniper re-grows quickly after fire and tends to be the dominant shrub. Common forbs include: chocolate flower, desert verbena, scarlet globemallow, blanket flower, and scapose bitterweed. This

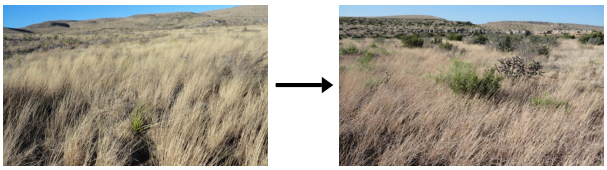
plant community is the ecological site's response to fire within the reference state. Fire is the natural event that keeps shrub species from gaining a competitive advantage and stimulates colonization by grasses. As grasses respond with greater density following fire, decomposition speeds up, creating greater soil organic matter, infiltration, and plant available water. Over time shrubs and succulents move back onto the site.

Community 1.4
At risk: shrubs/warm season grasses/nitrogen fixing shrubs/succulents

Figure 11. Community 1.4; Dark Canyon; 7-13-11

This community phase consists of a mix of shrubs, succulents and warm season grasses along with an increase in nitrogen fixing shrubs. It is no longer within the "historic range of variability" as management has created an "at risk" community phase. However, it is still within the reference state, meaning it has not crossed a threshold, and that intensive management (i.e., accelerating practices) are not yet required to push the system back into the historic range of variability (Bestelmeyer, et al., 2010). Foliar cover is between 35 and 65 percent, basal cover is between 5 and 15 percent, and bare ground is around 15to 25 percent. Warm season grasses make up about 27 percent foliar cover; shrubs, 20 percent; and succulents, 5 percent. The average surface soil stability rating is 4.0 below canopy and 3.5 in the interspaces. Annual production averages around 1200 lbs/ac, but can span between 800 and 1600 lbs/ac. This community exists due to past management and disturbance: primarily fire suppression coupled with loosely managed livestock grazing over many years. The shorter warm season grasses and sod-bound blue grama tend to occur in this community phase, along with a greater percentage of nitrogen fixing shrubs such as whitethorn acacia, honey mesquite, and catclaw mimosa. This plant community phase has developed over time due to a number of slow ecological variables. One management practice that influences ecology is fire suppression. Shrubs gain a competitive advantage as a result of fire suppression. Because of their deeper root systems, shrubs can take advantage of moisture stored deep into the soil, while grasses struggle with the slow decline of soil organic matter and the decrease of plant available water. Also, due to the decrease in soil organic matter, aggregate stability diminishes, creating a decrease in infiltration and an increase in runoff. Livestock contribute to the distribution of nitrogen fixing shrub seed and can lessen plant vigor and soil organic matter through continuous grazing and over-utilization. As the vigor of grasses and some shrubs decreases, nitrogen fixing shrubs start to increase and begin to change the chemistry and hydrology of the site. This site is "at risk" of crossing a threshold into state two. Non-native invasive species can spread throughout this community phase. Lehmann's lovegrass (*Eragrostis lehmanniana*) has spread through areas in the lower elevation range of this ecological site. Places such as Dark Canyon show invasion by this species. Invasive species control (chemical, biological, and/or mechanical) can be options to control this invasive species. Lehmann's lovegrass can be grazed in the spring by cattle when palatability is high. An invasive species threshold can be crossed with high concentrations of Lehmann's lovegrass. Indicator species for this community phase are nitrogen fixing shrubs: mesquite, whitethorn acacia, catclaw mimosa, roemers acacia, and catclaw acacia. Other shrub species which serve as indicators of this phase are little-leaf sumac and broom snakeweed. The tall warm season grasses are hard to find, and the blue grama becomes more sod-bound, with evidence of sheet erosion occurring.

Pathway 1.1A
Community 1.1 to 1.2

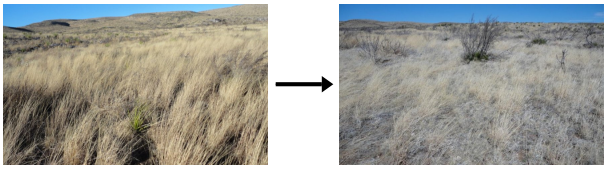


Warm season grasses (diagnostic plant community)

Warm season grasses/shrubs

This pathway is the slow movement, from Community 1.1 to Community 1.2. This pathway represents intervals between fires within the historic range of variability, as it will take 10 to 14 years, after fire, for shrubs and succulents to achieve foliar cover > 10%. The vigor of shrubs and succulents increases as grass vigor decreases due to various ecological processes. The first is through direct competition for resources. Shrubs have greater access to moisture deep in cracks and fissures within the petrocalcic strata. The second is a slow decrease in labile carbon, thus decreasing soil organic matter which leads to a decrease in water-holding capacity and a resulting decrease in grass vigor.

Pathway 1.1B
Community 1.1 to 1.3



Warm season grasses (diagnostic plant community)

Warm season grasses/forbs

This pathway represents a single fire event driving plant Community 1.1 to 1.3. Grasses respond fairly quickly after fire, while shrubs and succulents are suppressed. This pathway occurs within the range of historic variability. Many shrubs and succulents take a while to respond after a fire event. They must either re-grow from below ground root systems, or else come back from seed. Grasses can colonize quickly after a fire event via tillering, especially when precipitation follows closely after fire.

Pathway 1.2B
Community 1.2 to 1.3

Warm season grasses/shrubs

Warm season grasses/forbs

This pathway represents a single fire event driving plant Community 1.2 to 1.3. Grasses respond fairly quickly after fire, while shrubs and succulents are suppressed. This pathway occurs within the range of historic variability. Many shrubs and succulents take a while to respond after a fire event. They must either re-grow from root systems or else come back from seed. Grasses can colonize quickly after a fire event via tillering, especially when precipitation follows closely after fire.

Pathway 1.2C
Community 1.2 to 1.4

Warm season grasses/shrubs

At risk: shrubs/warm season grasses/nitrogen fixing shrubs/succulents

This pathway represents a growing competitive advantage to nitrogen fixing shrubs due to slow changes in soil chemistry and hydrology. Nitrogen fixing shrubs such as whitethorn acacia, catclaw acacia, and catclaw mimosa will

start to increase in vigor, creating immediate competition with grasses and other shrubs.

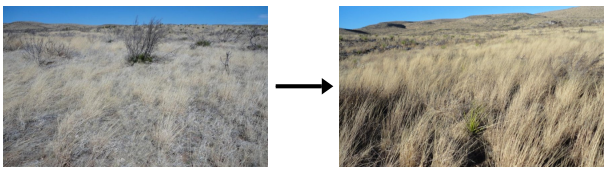
Pathway 1.2A
Community 1.2 to 1.4

Warm season grasses/shrubs

At risk: shrubs/warm season grasses/nitrogen fixing shrubs/succulents

This pathway is the slow movement from Community 1.2 to Community 1.4. This pathway represents intervals between fires, which have exceeded the range of historic variability. Shrub and succulent vigor increases as grass vigor decreases due to various ecological processes. One such process is direct competition for resources. Shrubs have greater access to moisture deep within the soil horizon and into cracks and fissures within the petrocalcic layer. Another process is a slow decrease in labile carbon, thus decreasing soil organic matter which leads to a decrease in water-holding capacity and a consequential decrease in grass vigor.

Pathway 1.3A
Community 1.3 to 1.1



Warm season grasses/forbs

Warm season grasses (diagnostic plant community)

This pathway is the slow movement from Community 1.3 to Community 1.1. This pathway represents intervals between fires where natural processes increase shrub and succulent vigor, and decreases grass species production and composition. The vigor of shrubs and succulents increases as grass vigor decreases due to various ecological processes. The first is through direct competition for resources. Shrubs have greater access to moisture deep within the soil profile and into cracks and fissures within the petrocalcic horizon. The second is a slow decrease in labile carbon, thus decreasing soil organic matter which leads to a decrease in grass vigor.

Pathway 1.4B
Community 1.4 to 1.3

At risk: shrubs/warm season grasses/nitrogen fixing shrubs/succulents

Warm season grasses/forbs

This pathway represents a single fire event driving plant Community 1.4 to 1.3. Grasses respond fairly quickly after fire, while shrubs and succulents are suppressed. This pathway coupled with a change in livestock grazing will lead back to the historic range of variability.

Pathway 1.4D
Community 1.4 to 1.3

At risk: shrubs/warm season grasses/nitrogen fixing shrubs/succulents

Warm season grasses/forbs

A change in livestock grazing management promotes grass vigor and decreases shrub competition. This accelerates the turnover of fine roots, causing an increase in labile carbon, acceleration in decomposition, and an increase in plant available water. Note: This species list reflects the model concept of the diagnostic plant phase. Inventory data from multiple plots and sources were used to compile this list. Note: Ranges reflect variability based on soils, temperature and moisture caused by factors such as elevation, and based on average moisture year conditions. Note: Species annual production is given in pounds per acre. Note: A zero in the species production column indicates that the species does not occur at the high or low elevation range of the ecological site.

State 2
Shrubs/sod-bound warm season grasses/nitrogen fixing shrubs state

Blue Grama is sod bound and erosion is extensive. Nitrogen fixing shrubs have become prominent plants on the site. Foliar cover has decreased to < 40%. A higher Nitrogen turnover rate increases the invasiveness and stability of whitethorn and various leguminous shrubs. This community has a mix of shrubs, succulents, and warm season grasses.

Community 2.1
Shrubs/sod-bound warm season grasses/nitrogen fixing shrubs state

Figure 12. Community 2.1; West Hess Hills; 7-13-11

This community phase combines a mix of sod bound blue grama, shrubs and nitrogen fixing shrubs. Sheet, rill, and gully erosion are all present at this phase. It is no longer within the reference state as the site has crossed a threshold into a degraded state. Because the site has crossed a threshold, intensive management (i.e., accelerating practices) is required to restore the system. Foliar cover is between 30 and 50 percent, basal cover is between 3 and 12 percent, and bare ground is around 30 to 60 percent. Warm season grasses make up about 20 percent foliar cover; shrubs, 20 percent; and forbs, 5 percent. The average surface soil stability rating is 3.0 under canopy and 2.5 in the interspaces. Annual production averages around 500 lbs/ac, but can span between 200 and 800 lbs/ac, depending on annual weather patterns. This community exists due to past management and disturbance: primarily fire suppression coupled with grazing management that decreases grass vigor, along with abusive motorized recreation/traffic. After many years of slow retrogression, a trigger event such as a severe drought could cause this site to cross a threshold where ecological processes and soil properties keep it in a degraded state. During intervals of fire suppression, shrubs gain a competitive advantage due to both deeper and lateral root systems. Grasses struggle with the slow decline of soil organic matter and the resulting decrease in plant available water. Also, due to the decrease in soil organic matter, aggregate stability diminishes, creating a decrease in infiltration and an increase in runoff. Livestock contribute to the distribution of nitrogen fixing shrub seed and can lessen plant vigor and soil organic matter through continuous grazing and over-stocking. As grass vigor decreases, shrubs gain a

competitive advantage. As nitrogen fixing shrubs, especially whitethorn, increase, changes in the chemistry and hydrology of the system occur. This site suffers from low labile carbon and high nitrogen turnover, ultimately slowing the nutrient cycle and reducing plant available water. Over time, without a change in management, it is possible for this plant community to further degrade to a community phase where only whitethorn, a few scattered shrubs and fluffgrass exist. Lehmann's lovegrass is an introduced species that has found a niche on this degraded site. This grass species can be grazed through spring and early summer with cattle. It often spreads when brush control practices are implemented.

Transition T1A
State 1 to 2

This transition moves the site across a threshold to state two. Slow variables: excessive soil erosion along with sod-bound blue grama; continued encroachment by nitrogen fixing shrubs; and the loss of the herbaceous plant community. Both chemical and hydrological shifts occur as the C: N decreases, creating an increase in the nitrogen turnover rate and creating an on-going competitive advantage for nitrogen fixing shrubs. Trigger event: A severe drought, causing a loss of organic carbon. Threshold: A hydrologic function/soil chemistry threshold is crossed.

Restoration pathway R2A
State 2 to 1

An increase in the competitive advantage of non-nitrogen fixing species through physical, chemical, and biological management practices. Various facilitating and management practices can be used to restore this ecological site back to reference. Chemical, mechanical, and biological practices can all be used to suppress whitethorn and other leguminous shrubs in the plant community. Also, range seeding, winter feeding, and high intensity-short duration livestock grazing can help bring grass seed and organic matter back into the system and start restoring soil carbon and microbial levels. Eventually, prescribed burning, once fuel loads are adequate, will also help reduce shrub competition and improve grass vigor. Fencing off motorized recreation would also be an important reclamation practice. Monitoring foliar cover by species along with bare ground will help inform the land manager if plant composition is responding to management.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Warm Season Tallgrasses**			353–706	
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	280–616	10–20
	silver beardgrass	BOLA2	*Bothriochloa laguroides*	56–224	1–9
2	**Warm Season Midgrasses**			588–1177	
	sideoats grama	BOCU	*Bouteloua curtipendula*	280–560	6–20
	vine mesquite	PAOB	*Panicum obtusum*	140–420	3–17
	plains lovegrass	ERIN	*Eragrostis intermedia*	56–224	1–7
	purple threeawn	ARPU9	*Aristida purpurea*	56–112	1–5
	sand dropseed	SPCR	*Sporobolus cryptandrus*	28–84	1–4
3	**Warm Season Shortgrasses**			504–1009	
	blue grama	BOGR2	*Bouteloua gracilis*	336–560	10–18
	tobosagrass	PLMU3	*Pleuraphis mutica*	28–252	2–10
	black grama	BOER4	*Bouteloua eriopoda*	28–140	1–5
	Hall's panicgrass	PAHA	*Panicum hallii*	28–84	1–3
	streambed bristlegrass	SELE6	*Setaria leucopila*	15–43	1–4
	sand muhly	MUAR2	*Muhlenbergia arenicola*	15–43	1

	bush muhly	MUPO2	*Muhlenbergia porteri*	15–43	1
	slender muhly	MUTE4	*Muhlenbergia tenuifolia*	15–43	1
	low woollygrass	DAPU7	*Dasyochloa pulchella*	1	1
4	**Cool Season Grasses**			17–34	
	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	15–43	1
Forb					
5	**Perennial Forbs**			50–101	
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	28–84	1–4
	Davis Mountain mock vervain	GLBIC	*Glandularia bipinnatifida var. ciliata*	28–84	1–4
	croton	CROTO	*Croton*	15–43	1–2
	spreading fleabane	ERDI4	*Erigeron divergens*	1–28	1
	hawkweed buckwheat	ERHI3	*Eriogonum hieraciifolium*	1–28	1
	twinleaf senna	SEBA3	*Senna bauhinioides*	1–28	1
	lyreleaf greeneyes	BELY	*Berlandiera lyrata*	1–28	1
6	**Annual Forbs**			1	
Shrub/Vine					
7	**Shrub**			67–135	
	Pinchot's juniper	JUPI	*Juniperus pinchotii*	28–84	1–4
	algerita	MATR3	*Mahonia trifoliolata*	15–43	1–2
	mariola	PAIN2	*Parthenium incanum*	15–43	1–2
	javelina bush	COER5	*Condalia ericoides*	1–28	1
	Wright's beebrush	ALWR	*Aloysia wrightii*	1–28	1
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–1	0–1
	whitethorn acacia	ACCO2	*Acacia constricta*	0–1	0–1
	catclaw acacia	ACGR	*Acacia greggii*	0–1	0–1
	roundflower catclaw	ACRO	*Acacia roemeriana*	0–1	0–1
	honey mesquite	PRGL2	*Prosopis glandulosa*	0–1	0–1
	littleleaf sumac	RHMI3	*Rhus microphylla*	0–1	0–1
	skunkbush sumac	RHTRT	*Rhus trilobata var. trilobata*	0–1	0–1
	lotebush	ZIOB	*Ziziphus obtusifolia*	0–1	0–1
	catclaw mimosa	MIACB	*Mimosa aculeaticarpa var. biuncifera*	0–1	0–1
	allthorn	KOEBE	*Koeberlinia*	0–1	0–1
8	**Half-Shrubs**			17–34	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	15–43	1–2
9	**Cactus**			50–101	
	tree cholla	CYIMI	*Cylindropuntia imbricata var. imbricata*	15–43	1–2
	tulip pricklypear	OPPH	*Opuntia phaeacantha*	15–43	1–2
	cactus apple	OPEN3	*Opuntia engelmannii*	1–28	1
	purple pricklypear	OPMAM	*Opuntia macrocentra var. macrocentra*	1–28	1
10	**Yucca**			1	
	soaptree yucca	YUEL	*Yucca elata*	0–1	0–1

11	**Yucca-like plants**			1	
	green sotol	DALE2	*Dasylirion leiophyllum*	0–1	0–1

Animal community

Part I: Wildlife

The Loamy Terrace ecological site lies at the northern extent of the Chihuahuan Desert and provides home for many different wildlife species.

Species of Special Interest:

These are species of special interest that have habitat needs associated with the Loamy Terrace ecological site.

Rock Rattlesnake: The rare mottled rock rattlesnake is found only in New Mexico, Texas, and Chihuahua, Mexico. In New Mexico, the rattlesnake is limited to the southern Guadalupe Mountains and exists within all canyons throughout the Guadalupe Ridge. It is the most frequently encountered rattlesnake in CCNP and is found around exposed bedrock where it feeds on lizards, snakes, and small mammals (SWCA Environmental Consultants, 2007).

Texas Horned Lizard: Texas horned lizards have habitat needs that require healthy harvester ant communities. Harvester ants are the preferred food of horned lizards and when this food resource declines due to shifts to a degraded plant community, or through infrastructure development, lizard numbers will also decline (Henke & Fair, 1998). Feeding may occur at nest entrances or on ant foraging trails and mature lizards are capable of eating 70 to 100 ants per day. Although ants comprise a majority of the diet, Texas horned lizards are opportunistic predators and will consume crickets, grasshoppers, beetles, centipedes, bees and caterpillars. The diagnostic plant community phase (1.1) is best for providing a wide range of plant and insect species needed for Texas horned lizard habit.

Gray Vireo: The gray vireo is species that is found in the desert Southwest. Over 80 percent of the Gray Vireo territories in New Mexico are found in 12 sites, with the largest site being found in the Guadalupe Mountains (Pierce, 2007). The Gray Vireo appears to not winter in New Mexico but move down to the Big Bend area where it is associated with various shrubs and cacti. Summer habitat in the Guadalupes seems to be linked to juniper and oak plant communities. During breeding season, (April-July) the Gray Vireo are insectivorous, taking grasshoppers, stinkbugs, crickets, moths, and caterpillars for food. In New Mexico, nests are primarily in Juniper trees (Pierce, 2007). Plant communities within the historic range of variability are important for the Gray Vireo to find nesting, breeding, and brood-rearing cover. The birds will find nesting cover in plant communities 1.1 and 1.2, while moving to community phase 1.3 to find food.

Peregrine Falcon: The Peregrine Falcon is a species of concern that occurs throughout the west. According to experts at the “Living Desert Zoo and Gardens State park” in Carlsbad New Mexico, the peregrine falcon has only been spotted on rare occasions in the fall or winter.

Common hog-nosed skunk: Hog-nosed skunks are distinguished from striped skunks primarily by the pelage, with a characteristic broad white marking beginning at the top of the head and extending down the back and tail. They make their dens in rocky areas, but probably utilize the Loamy Terrace ecological site for hunting. They are omnivorous, and they eat differently according to the season. They mainly eat insects and grubs but also eat fruit, small mammals, snakes and carrion. Because rattlesnakes react to skunk musk with an alarm reaction, it is believed that skunks may feed extensively on rattlesnakes. In search of food, this skunk can turn over large areas of earth with its bare nose and front claws as it searches for food (Buie, 2003).

Mountain Lion: The mountain lion is an excellent stalk-and-ambush predator, pursuing a wide variety prey. Deer make up its primary food source, but they will also hunt species as small as insects and rodents. The mountain lion stalks through shrubs and across ledges before delivering a powerful leap onto the back of its prey with a suffocating neck bite. The mountain lion is capable of breaking the neck of its prey with a strong bite and momentum bearing the animal to the ground. Kills are generally estimated at around one large ungulate every two weeks. This period shrinks for females raising young, and may be as short as one kill every three days when cubs are nearly mature at around 15 months.

Only females are involved in parenting. Females are fiercely protective of their cubs, and have been seen to successfully fight off animals as large as black bears in their defense. Caves and other alcoves that offer protection are used as litter dens (Cougar, 2013).

The Very Shallow and Limestone Hills ecological sites provide the best habitat for the mountain lion life cycle. Mountain lions can work the edge of hill summits and position themselves above prey where they can pounce with a killing blow.

Eastern White-throated Wood Rat: This large rat is often called a packrat because of the large nest of sticks and other material that it incorporates into nests. The nocturnal rat feeds on a wide variety of plants and finds shelter around dense stands of cacti such as cholla and prickly pear. Plant communities 1.1 and 1.2 are ideal for nesting white-throated wood rats.

Other species associated with the Loamy Terrace ecological site:

Birds:
Turkey Vulture
Mississippi Kite
Red-tailed Hawk
American Kestrel
Great Horned Owl
Spotted Towhee
Canyon Towhee
Cassin’s Sparrow
Brewer’s Sparrow
Black-throated Sparrow
White-crowned Sparrow
Dark-eyed Junco
Scaled Quail
White-winged Dove
Mourning Dove
Eurasian Collared Dove (introduced)
Lesser Nighthawk
Common Nighthawk
Black-chinned Hummingbird
Ladder-backed Woodpecker
Western Kingbird
Cliff Swallow
Barn Swallow
Verdin
Cactus Wren
Rock Wren
Northern Mockingbird
Curved-billed Thrasher
House Finch
House Sparrow

Mammals:
Mexican Ground Squirrel
Yellow-faced Pocket Gopher
Merriam’s Kangaroo Rat
Merriam’s Pocket Mouse
Western Harvest Mouse
Southern Plains Woodrat
Cactus Mouse
White-footed Mouse
White-ankled Mouse
Hispid Cotton Rat

North American Porcupine
Black-tailed Jackrabbit
Desert Cottontail
American Badger
Striped Skunk
Grey Fox
Coyote
Bobcat
Mule Deer
Collared Peccary
Ringtail

Reptiles:
Green Toad
Red-spotted toad
Rio-Grande Leopard Frog
Eastern Collared Lizard
Greater Earless Lizard
Round Tailed Horned Lizard
Crevice Spiny Lizard
Prairie Lizard
Common Side-blotched Lizard
Texas Banded Gecko
Chihuahuan Spotted Whiptail
Common Checkered Whiptail
Ring-necked Snake
Striped Whip Snake
Western Ground Snake

Note: This species list was composed with help from the Living Desert Zoo and Gardens State Park, Carlsbad, New Mexico.

Part II Livestock

The Loamy Terrace ecological site has traditionally been grazed by all kinds and classes of livestock, during all seasons of the year. In the early part of the 20th century, goats and sheep were used extensively along the Guadalupe Ridge, taking advantage of browse species. Currently though, there are very few goat and sheep operations in the area due to many market factors. Cattle numbers are down due to drought and extensive wildfire from 2001-2011.

With a planned livestock grazing system, the Loamy Terrace Ecological Site could be managed for sustained agriculture while maintaining the historic range of variability. Also, prescribed fire may be a part of the management mix to move the system to community phase 1.3, which is primarily a grassland plant community. The loss of goat production probably plays a role in the overall increase in shrub production, especially in nitrogen fixing shrubs.

This ecological site has been used extensively in the past for loading and handling. High traffic coupled with high density of grazing animals often quickly degrades this site and causes high amounts of erosion. Once erosion becomes extensive, this site crosses a threshold and loses its forage potential. Great care and management must take place for the Loamy Terrace to retain its excellent forage productivity.

Hydrological functions

The Mudgetts soil component is in hydrologic group C. The soils in this group have moderately high runoff potential when thoroughly wet. Water transmission through the soil is somewhat restricted.

Plant diversity is important on this site, as various types of root systems help sustain plant communities through drought. Deep rooted shrubs take advantage of water and nutrients deep in the profile. Fibrous and tap root systems take advantage of moisture and nutrients in the top meter of the soil.

This ecological site has the ability to retain moisture throughout the year due to the presence of a deep petrocalcic horizon. This horizon can store moisture and slowly release moisture over time to deep root systems. Deep, tap root systems tend to take advantage of the petrocalcic horizon.

The Loamy Terrace may also receive overland flow from adjacent areas. That extra moisture, plus the presence of the petrocalcic horizon that acts as a barrier from deep percolation, creates a very productive substrate for grassland systems. In places, where a slight swale occurs, vine mesquite grows extremely thick.

Recreational uses

The Loamy Terrace ecological site provides limited recreational use due to its lack of drinking water. Hiking is limited to day trips and should not be attempted without adequate water and a large hat. Hunting can be good on this site as deer can be hunted where permitted.

Often this site is used for camping, because it is relatively flat and there is usually a road or trail going through it. Care must be given to monitor the motorized recreational use of this site, so that erosion will not degrade the site across a threshold.

Other information

Inventory data references

Data was collected during the years of 2011 and 2012. For all tier one data points, ocular methods were used to collect estimates of production, ground cover, and canopy cover. The Doman-Krajina method was used for canopy cover estimates. Soil pits were dug for verification on many tier one plots. Tier two and three protocols always were verified and analyzed with soil pits. Other methods used were line-point-intercept (LPI), double-sampling (DS), canopy gap (CG), and soil stability (SS). This ecological site had a number of tier one and tier two plots, with one tier three at the diagnostic plant community. Historic data from BLM monitoring points were used as well.

Type locality

Location 1: Eddy County, NM	
UTM zone	N
UTM northing	545882
UTM easting	3560434
General legal description	The type locality is at the tier 3 sampling area along the Guadalupe Ridge Trail in Carlsbad Caverns N.P.

Other references

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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	
Approved by	
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:**
