USDA Natural Resources
Conservation Service

Ecological site GX070A01X021
Sandy

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

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

Ecological site concept

The Sandy ecological site occurs on plateau summits in the Canadian Plateaus LRU (CP). This LRU occupies the western portion of MLRA 70A and extends from Las Vegas, NM at the southern end to beyond Raton, NM at its northern end. Elevation for the LRU ranges from 5,000 to 7,500 feet.

The ecological site concept for the Sandy site is a soil with a depth no shallower than 30 inches (75 centimeters), and typically over 80 inches (200 centimeters) to lithic contact with Dakota sandstone or paralithic contact with weathered Cretaceous shale. Surface textures range from sand to sandy loam, subsurface textures are sandy clay loams or coarser. These surface textures select for distinct plant communities, and differentiate the Sandy site from all other sites on the plateau summits of the Canadian Plateaus that occur on soils greater than 30 inches (75 centimeters) deep.

Associated sites

GX070A01X005	**Limy** This site occurs where soils surfaces have strong or violent effervescence and ≥ 5% calcareous rock fragments.
GX070A01X003	**Loamy Uplands** This site occurs in soils that have < 50% sand in subsurface horizons.
GX070A01X002	**Clayey Uplands** This site occurs in soils that have high clay and < 50% sand in textures of subsurface horizons. Typically, these soils are on more stable landforms that have resisted erosion, or else they have subsurface horizons derived from shale residuum.
GX070A01X004	**Shallow Loamy** This site occurs where soils have paralithic contact within 50 cm, and their surfaces lack one or both of the following: strong or violent effervescence and = 5% calcareous rock fragments.

GX070A01X012	**Low Terraces** This site occurs on terraces above perennial streams where the flooding frequency interval is ≥ 10 years. This site is often used for hay and small grain production. Adjacent Sandy sites may contribute water to this site via run-on and through-flow.
GX070A01X013	**Lithic Sandstone** This site occurs where soils are ≤ 50 cm to lithic contact with sandstone bedrock, and often supports oneseed juniper savannahs.
GX070A01X014	**Lithic Limestone** This site occurs where soils are ≤ 50 cm to lithic contact with limestone bedrock, and often supports oneseed juniper savannahs.
GX070A01X017	**Playas** This site occurs in playas. Adjacent Sandy sites contribute water to this site via through-flow.

Similar sites

R070AY012NM	**Sandy Plains** The Sandy Plains ecological site are correlated to some soil components from the Sandy Plains site.
R077BY034NM	**Deep Loamy Plains** The Sandy site is correlated to a soil component that is currently correlated to the Deep Loamy Plains (R077BY034NM) site. Being MLRA 77B sites, these sites are lower in elevation, therefore warmer; and further east, therefore moister than MLRA 70A, but should exhibit some similarities to these plant communities, and will serve as useful references.
R077BY035NM	**High Sandy Loam** The Sandy site is correlated to soil components that are currently correlated to the High Sandy Loam (R077BY035NM)site. These sites are lower in elevation, therefore warmer; and further east, therefore moister than MLRA 70A, but should exhibit some similarities to these plant communities, and will serve as useful references.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Legacy ID

R070AA021NM

Physiographic features

The Canadian Plateaus LRU (CP) exists on a plateau unit of the Great Plains Province landscape. The landforms that occur on this landscape include both erosional and depositional surfaces of plateaus and consist of alluvial fans, ridges, benches, playas, breaks, terraces, and floodplains. The Canadian River Valley, primarily to the east, is the base level towards which 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 intact, a testament to their distance from the Canadian River Valley. To the east, the early Cretaceous Dakota sandstone provides a caprock that serves as the plateau rim.

The Sandy ecological site occurs on plateau summits, sand sheets, and sand dunes in the Canadian Plateaus LRU. It typically occurs as sand sheets and dune deposits where sandy materials have been eroded from adjacent river valleys and deposited on the plateau surfaces above by wind. This occurs leeward (generally to the east-northeast) of river valleys such as the Canadian or Cimarron. This site also occurs leeward and adjacent to certain playas, which provide the sandy eolian parent materials for its soils. Note, however, that most playa dunes in the Canadian Plateaus are composed of materials which are much too fine in texture to meet the soils criteria for the Sandy site.

The Sandy site is not extensive, and is by no means the only ecological site that occurs on plateau summits in the Canadian Plateaus LRU. Other ecological sites that occupy this landform position are the Clayey Uplands, Loamy Uplands, Limy, Lithic Sandstone, Lithic Limestone, and Shallow Loamy.

Associated sites that occur on landforms and landform positions adjacent to the Sandy site are the Playas, Ephemeral Drainageways, Low Terraces, Slopes, and Limy Escarpments.

Where the Sandy site grades into steep escarpments that are capped with Dakota sandstone, have historically supported stands of piñon and juniper, and that drain into canyons; the site is associated with the Mesozoic Canyons and Breaks (MCB) LRU of MLRA 70A.

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 Sandy site occurs above each of these formations. Soils form where sandy materials have been deposited by wind, typically on the lee side of playas but also as dunes where sandy materials have blown out of adjacent river valleys and deposited on plateaus above. Typically, the sources of the sand come from the weathering/eroding Dakota sandstone or older Mesozoic sandstones into river channels that is blown back out and deposited on the leeward plateau surfaces.

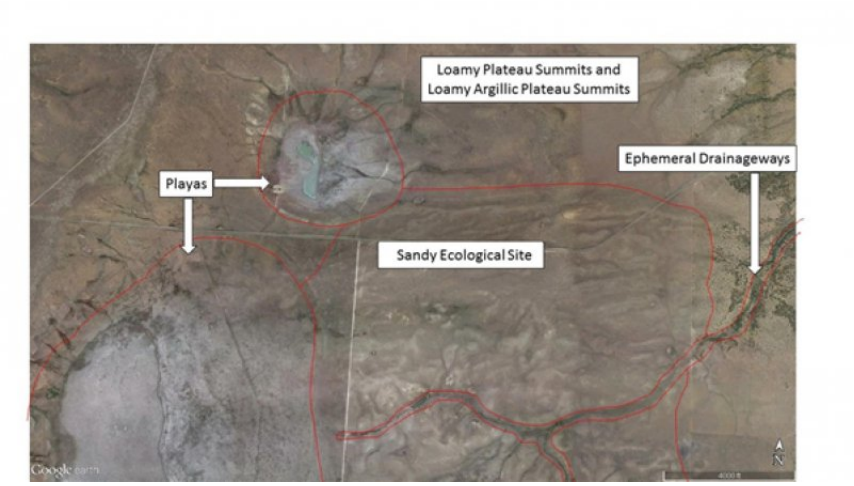


Figure 1. The Sandy site in a typical landscape

Table 2. Representative physiographic features

Landforms	(1) Plateaus or tablelands > Sand sheet (2) Plateaus or tablelands > Dune
Flooding frequency	None
Ponding frequency	None
Elevation	5,000–7,500 ft
Slope	0–10%
Water table depth	80–99 in
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)	15-18 in
Frost-free period (average)	150 days
Freeze-free period (average)	
Precipitation total (average)	16 in

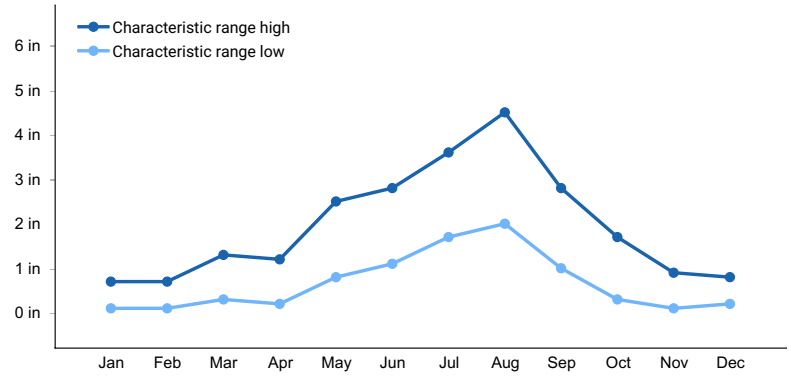


Figure 2. Monthly precipitation range

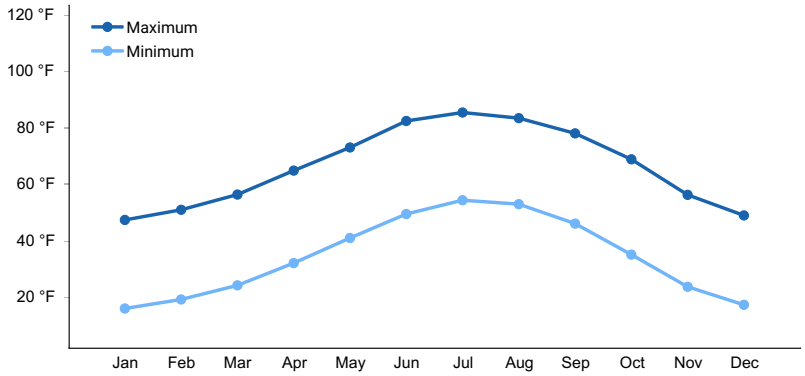


Figure 3. Monthly average minimum and maximum temperature

Climate stations used

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

Influencing water features

Soil Hydrology:
The Sandy ecological site is not associated with a wetland or riparian system; it is an upland ecological site. Because this site occurs on linear or convex portions of plateau summits, it tends to shed water (via through-flow or run-off) to sites lower in the catena. Beyond this, sandier soil textures impede the percolation of water far less than the finer textures of most subsoils within this LRU. Refer to Table 7 below for more information on the sites that receive additional moisture from this 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 for the Sandy ecological site. To learn about the dynamic properties of the soil components tied to this site, refer to the "plant communities" section of this ESD.

The Sandy ecological site currently correlates to the major components of two map units in the Canadian Plateaus LRU of MLRA 70A. These components are currently correlated to phases of the Manter and Dalhart soil series (to be updated to new series local to MLRA 70A). The former correlates to an MLRA local to the areas east of Denver, Colorado; the latter is an MLRA 77 concept that was applied to a small extent in MLRA 70A during initial mapping. These soils form where sandy materials have been deposited by wind, typically on the lee side of river channels or playas. This site also occurs on soils in the Seelez soil series; refer to the Future Work section below for more information.

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

From the description of the Manter soil component in the San Miguel County Soil Survey Manuscript (NM630):

"These soils are greater than 50 cm to root-restrictive layers, and have textures of sandy clay loam or sandier throughout. Free carbonates are typically absent in the topsoil. They are well drained to somewhat excessively-drained, rapid to moderate permeability, with negligible runoff potential at the surface. Surface textures are loamy sands or sandy loams. Textures in subsurface horizons are also sandy, as in sandy loams, loamy sands, sandy clay loams; refer to the Future Work section below for more information. Soil profiles are characterized by more than 50 percent sand in all horizons, colors of 10YR or redder, and low EC values throughout."

TYPICAL PEDON: Typical pedon of Manter loamy fine sand, undulating; about 16 miles east of Las Vegas in the SE1I4 of sec. 33, T. 16 N., R. 19 E. Approx. Lat: 35.59588 Lon:-104929723; Elevation 6,825 feet.

A1-0 to 5 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) moist; weak thin platy structure at the surface, massive below a depth of 2 inches; loose, very friable; many fine and medium roots; mildly alkaline; abrupt smooth boundary.

A2-5 to 11 inches; brown (7.5YR 5/2) fine sandy loam, dark brown (7.5YR 3/2) moist; weak fine and very fine subangular blocky structure; slightly hard, friable, slightly sticky; many fine and medium roots; mildly alkaline; clear smooth boundary.

Bt1-11 to 17 inches; brown (7.5YR 5/2) fine sandy loam, dark brown (7.5YR 3/2) moist; weak fine and very fine subangular blocky structure; slightly hard, friable, slightly sticky; few fine and medium roots; common fine and very fine tubular pores; common thin clay films on faces of peds and in pores; mildly alkaline; abrupt smooth boundary.

Bt2-17 to 33 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak medium prismatic structure; hard, friable, slightly sticky; few fine roots; few fine and very fine tubular pores; common thin clay films on peds; mildly alkaline; abrupt smooth boundary.

Ck-33 to 60 inches; brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) moist; massive; hard, friable; very few very fine roots; common very fine tubular pores; weakly calcareous in lower part; moderately alkaline.

The mollic epipedon is 10 to 20 inches thick. The profile is non-calcareous to a depth of 30 to 40 inches. The A horizon has hue of 7.5YR or 10YR, value of 4 or 5 when dry and 3 when moist, and chroma of 2 or 3. The B horizon has hue of 5YR or 7.5YR, value of 4 or 5 when dry and 3 or 4 when moist, and chroma of 2 to 4. It is fine sandy loam, sandy loam, or loam and is less than 18 percent clay. The C horizon has hue of 7.5YR or 10YR, value of 5 or 6 when dry and 4 or 5 when moist, and chroma of 3 or 4. It is sandy loam or loamy fine sand.

Parent Material Kind: Eolian Sand

Parent Material Origin: Eolian
Surface Texture Group: loamy sand, sandy loam
Subsurface Texture Group: loamy sand, sandy loam, sand

Table 4. Representative soil features

Parent material	(1) Eolian sands
Surface texture	(1) Loamy sand (2) Sandy loam
Family particle size	(1) Sandy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Rapid
Soil depth	20–200 in
Available water capacity (0-60in)	4–10 in
Calcium carbonate equivalent (0-60in)	0–25%
Electrical conductivity (0-60in)	0–2 mmhos/cm
Sodium adsorption ratio (0-60in)	0–2
Soil reaction (1:1 water) (0-60in)	6.6–8.4

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 tables in the Correlation to Current Ecological Sites section below). With respect to the imperfect alignment of such correlations, be aware of these shortcomings in their applicability to conservation planning.

Because this site is not extensive, and because much of the Canadian Plateaus was not accessible during contemporary fieldwork, the dataset used to develop the State and Transition Model (STM) below is quite limited in its extent.

There are numerous variables which affect the range of characteristics for this ecological site. Variables such as elevation, latitude, and orographic effects create a climatic gradient which influence the distribution of C3 and C4 plants. Soil properties such as surface texture, depth to clay layer, parent material, and accumulated salts affect species diversity and composition. Natural disturbances such as drought and wildfire affect species density and cover.

The climate gradient across the CP LRU shows a greater distribution of C3 plants such as western wheatgrass and bottlebrush squirreltail where temperatures are cooler, and moisture is more abundant. Where surface texture trends toward clay loam, western wheatgrass, galleta, and vine mesquite increase. In areas of sandier surface textures, sideoats grama and sand dropseed are more likely to occur.

Grazing pressure will tend to favor grasses such as sand dropseed, blue grama, and purple threeawn, as well as shrubs such as broom snakeweed and fringed sagebrush.

Within this site, the dominant species of short grasses are inherently drought- and grazing-tolerant (Lauenroth, et al., 1994). Across the western parts of the U.S., blue grama is one of the most extensively distributed grasses and occurs in a wide variety of different ecosites ranging from grasslands to shrubland and woodland sites. This grass evolved with grazing by large herbivores and, when grazed continuously, tends to form a short sod. When allowed to grow under lower grazing pressures, the plants develop the upright physiognomy of a bunchgrass. If blue grama is eliminated from an area by extended drought (3-4 years) or disturbance such as plowing, regeneration is slow

because of very slow tillering rates (Samuel, 1985), low and variable seed production, minimal seed storage in the soil (Coffin, 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 or depression positions across the landscape. Buffalograss is less drought-tolerant than blue grama but re-establishes more quickly following disturbance due to higher seed abundance and viability and more effective above-ground tillering (Peters, 2008).

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

Correlation to Legacy Ecological Sites:
The Sandy site has been mostly correlated to legacy soil components from the Deep Loamy Plains (R077BY034NM) site. It was also linked to components correlated to the High Sandy Loam (R077BY035NM) site. Being MLRA 77B sites, these sites are lower in elevation, therefore warmer; and further east, therefore moister than MLRA 70A, but should exhibit some similarities to these plant communities, and will serve as useful references. The Sandy Plains ecological site (R070AY012NM) has many similarities to the new Sandy site.

From Sandy Plains ecological site (R070AY012NM)
This site is suitable for grazing during all seasons of the year and by all classes of livestock. Approximately 95 percent of the total annual yield are from species which provide good feed and good nutrition for livestock. Continuous yearlong grazing or grazing during the period from April through October will result in a plant community of sand dropseed, threeawn, red lovegrass, sand sagebrush, and yucca. A system of deferred grazing, which varies the season of grazing and rest in pastures, is needed to maintain a healthy, well-balanced plant community. Periods of rest during the spring (April-June) will allow cool-season grasses such as New Mexico feathergrass* and various forbs to grow and to reproduce. Rest during this period is also beneficial to allow grasses such as sand bluestem and Indian ricegrass a period of green up before being grazed. Rest during the summer (July-September) is most beneficial to the warm-season grasses and forbs such as sand bluestem, sideoats grama, Indian ricegrass, little bluestem, blue grama, and various forbs.
*New Mexico feathergrass is quite rare on R070AA021NM. However, the statement in question applies to other cool-season grasses such as Western wheatgrass and bottlebrush squirreltail.
Sandy Plains (R070AY012NM) tables
Annual production by plant type
Plant Type----------Low(Lb/Acre) ----------Representative Value(Lb/Acre) ----------High(Lb/Acre)
Grass/Grasslike----------680----------1340----------2500
Forb----------102----------201----------300
Shrub/Vine----------68----------134----------200
Total----------850----------1675----------3000

Community 1.1 plant community composition
Common Name----------Symbol----------Scientific Name----------Annual Production (Lb/Acre)
GRASS/GRASSLIKE
1 little bluestem----------SCSC----------*Schizachyrium scoparium*----------335–419
2 sideoats grama----------BOCU----------*Bouteloua curtipendula*----------251–285
3 sand bluestem----------ANHA----------*Andropogon hallii*----------84–117
4 Indian ricegrass----------ACHY----------*Achnatherum hymenoides*-------84–117
5 blue grama----------BOGR2----------*Bouteloua gracilis*----------251–285
6 New Mexico feathergrass-HENE5-----*Hesperostipa neomexicana*--------84–117

7 sand dropseed----------SPCR----------*Sporobolus cryptandrus*----------84–117
8 red lovegrass----------ERSE----------*Eragrostis secundiflora*----------50–84
9 threeawn----------ARIST----------Aristida----------50–84
10 sand muhly----------MUAR2--------*Muhlenbergia arenicola*----------50–84
FORB
11 globemallow----------SPHAE----------Sphaeralcea----------50–84
12 ragwort----------SENEC----------Senecio----------17–50
13 pigweed----------AMARA----------Amaranthus----------50–84
14 goosefoot----------CHENO----------Chenopodium----------50–84
15 annual buckwheat---ERAN4----------*Eriogonum annuum*----------50–84
16 buckwheat----------ERIOG----------Eriogonum----------50–84
14 golden pricklypoppy-ARAE----------*Argemone aenea*----------0–34
15 bladderpod----------LESQU----------Lesquerella----------17–50
16 lemon scurfpea--------PSLA3----------*Psoralidium lanceolatum*----------0–50
17 Adonis blazingstar-----MEMU3-------*Mentzelia multiflora*----------17–50
18 gilia----------GILIA----------Gilia----------0–34
19 silverleaf nightshade----SOEL---------*Solanum elaeagnifolium*----------0–34
20 aster----------ASTER--------Aster----------17–50
21 goldenweed----------PYRRO--------Pyrrocoma----------0–34
22 sunflower----------HELIA3--------Helianthus----------34–67
SHRUB/VINE
23 sand sagebrush----------ARFI2----------*Artemisia filifolia*----------50–84
24 yucca----------YUCCA--------Yucca----------50–84
25 winterfat----------KRLA2--------*Krascheninnikovia lanata*----------17–50

From High Sandy Loam ecological site (R077BY035NM) – a site outside of the MLRA area and concept*:
Historic Climax Plant Community
This site is a grassland dominated by warm-season short and mid-grasses. Cool-season grasses and forbs make up an important component of the plant community. Woody species are a minor component.
Other grasses that could appear on this site include: sand muhly, buffalograss, silver bluestem, sand bluestem, switchgrass, sand paspalum, and Indiangrass.
Other forbs include: scrufpea, prairie clover, western ragweed, New Mexico thistle, woolly Indianwheat and whorl-leaf milkweed.
*MLRA 77B is warmer than and receives more summer moisture than does 70A, and this is reflected in many of the species described here. While yellow Indiangrass and switchgrass have been observed in trace amounts in the CP, they have not been recorded in areas that correlate the GX070A01X021 site.

High Sandy Loam (R077BY035NM) tables
Annual production by plant type
Plant Type----------Low(Lb/Acre) ----------Representative Value(Lb/Acre) ----------High(Lb/Acre)
Grass/Grasslike----------706----------1100----------1494
Forb----------68----------106----------144
Shrub/Vine----------34----------53----------72
Total----------808----------1259----------1710

Community 1.1 plant community composition
Common Name----------Symbol----------Scientific Name----------Annual Production (Lb/Acre)
GRASS/GRASSLIKE
1----------Blue and Hairy Grama----------265–331
blue grama----------BOGR2----------*Bouteloua gracilis*----------265–331
hairy grama----------BOHI2----------*Bouteloua hirsuta*----------265–331
2----------Sideoats Grama----------199–265
sideoats grama----------BOCU----------*Bouteloua curtipendula*-------199–265
3----------Little Bluestem----------133–199
little bluestem----------SCSC----------*Schizachyrium scoparium*-------133–199
4----------NM feathergrass and Needleandthread----------133–199
needle and thread----------HECO26---------*Hesperostipa comata*----------133–199

New Mexico feathergrass----HENE5----------*Hesperostipa neomexicana*-----133–199
5----------Sand dropseed----------66–133
sand dropseed----------SPCR----------*Sporobolus cryptandrus*----------66–133
6----------red lovegrass and tumble lovegrass----------66–133
red lovegrass----------ERSE----------*Eragrostis secundiflora*----------66–133
tumble lovegrass----------ERSE2----------*Eragrostis sessilispica*----------66–133
7----------Galleta----------40–66
James' galleta----------PLJA----------*Pleuraphis jamesii*----------40–66
8----------Threeawn spp. ----------40–66
threeawn----------ARIST----------Aristida----------40–66
9----------Other grasses----------40–66
Graminoid----------2GRAM----------Graminoid----------40–66
FORB
10----------Sunflower Buckwheat globemallow sensitive briar----------40–66
buckwheat----------ERIOG----------Eriogonum----------40–66
sunflower----------HELIA3----------Helianthus----------40–66
Nuttall's sensitive-briar--------MINU6----------*Mimosa nuttallii*----------40–66
globemallow----------SPHAE----------Sphaeralcea----------40–66
SHRUB/VINE
11----------Sand sage soapweed yucca winterfat groundsel spp.----------40–66
sand sagebrush----------ARFI2----------*Artemisia filifolia*----------40–66
winterfat----------KRLA2----------*Krascheninnikovia lanata*--------40–66
ragwort----------SENEC----------Senecio----------40–66
soapweed yucca----------YUGL----------*Yucca glauca*----------40–66

From Deep Loamy Plains ecological site (R077BY034NM), a site outside of the MLRA area and concept*:
Historic Climax Plant Community
This site is a grassland dominated by warm-season mid-grasses. Tall grasses, cool-season grasses and forbs make up an important component of the plant community. Woody plants make up a minor component
Other grasses that could appear on this site include: red lovegrass, sand muhly, threeawn spp., tumble lovegrass, paspalum, dryland sedge, hooded windmill grass, and silver bluestem.
Other shrubs include: threadleaf groundsel and broom snakeweed.
Other forbs include: silky prairie clover, scurfpea, western ragweed, gilia, silverleaf nightshade, prickly poppy, and bladderpod.

Deep Loamy Plains (R077BY034NM) Tables
Annual production by plant type
Plant Type----------Low(Lb/Acre)----------Representative Value(Lb/Acre) ----------High(Lb/Acre)
Grass/Grasslike----------1095----------1570----------2044
Shrub/Vine----------165----------237----------308
Forb----------120----------172----------244
Total----------1380----------1979----------2596

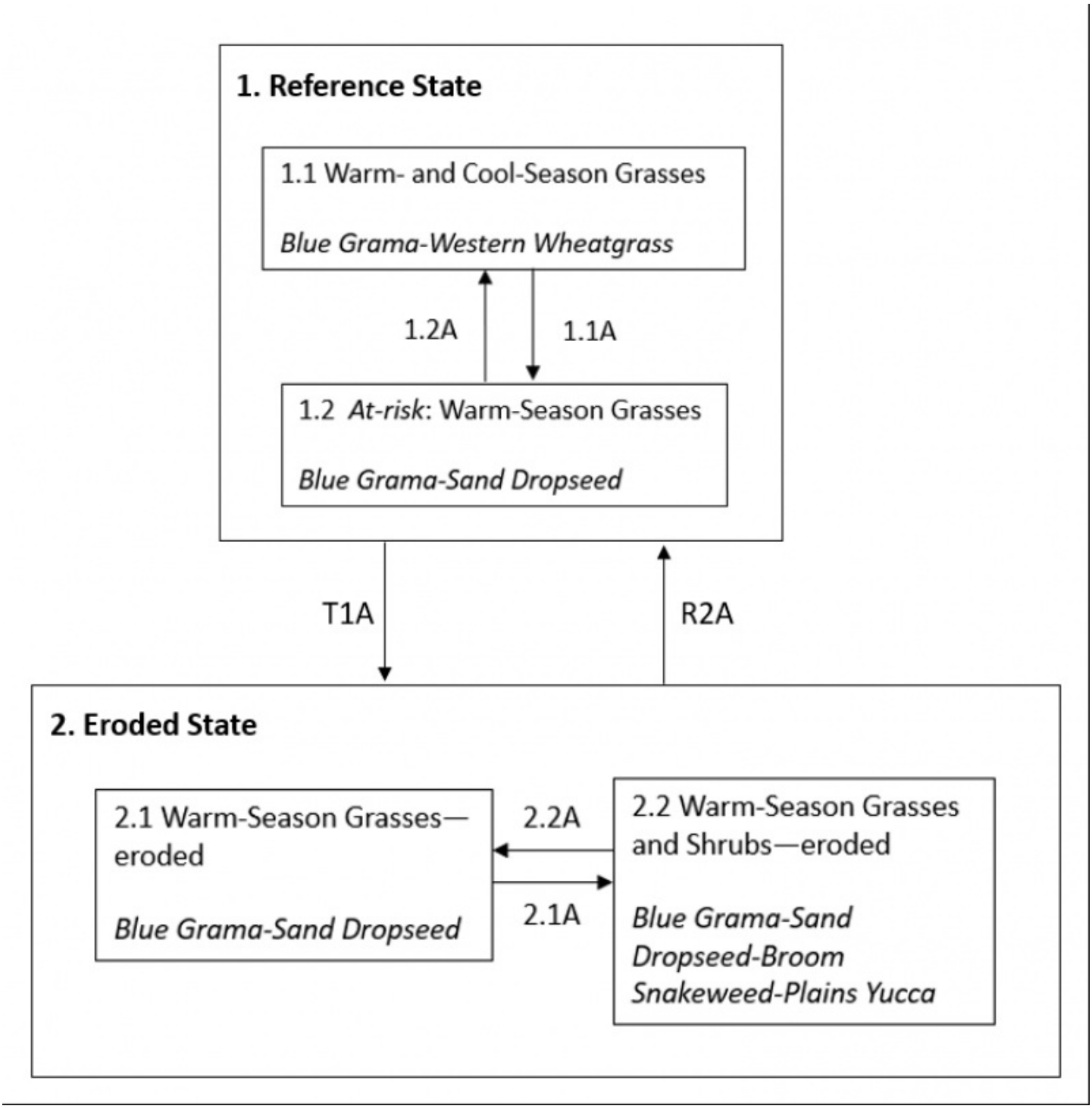
Community 1.1 plant community composition
Common Name----------Symbol----------Scientific Name----------Annual Production (Lb/Acre)
GRASS/GRASSLIKE
1----------Sand Bluestem----------323–430
sand bluestem----------ANHA----------*Andropogon hallii*----------323–430
2----------Little Bluestem----------323–430
little bluestem----------SCSC----------*Schizachyrium scoparium*------323–430
3----------NM Feathergrass, Needleandthread----------323–430
needle and thread--------HECO26---------*Hesperostipa comata*----------323–430
New Mexico feathergrass-HENE5---------*Hesperostipa neomexicana*----323–430
4----------Sideoats grama ----------215–323
sideoats grama----------BOCU----------*Bouteloua curtipendula*--------215–323
5---------- Grama----------108–215
blue grama----------BOGR2----------*Bouteloua gracilis*----------108–215

hairy grama----------BOHI2----------*Bouteloua hirsuta*----------108–215
6----------Indiangrass Switchgrass----------108–215
switchgrass----------PAVI2----------*Panicum virgatum*----------108–215
Indiangrass----------SONU2----------*Sorghastrum nutans*----------108–215
7----------Indian ricegrass----------108–215
Indian ricegrass----------ACHY----------*Achnatherum hymenoides*-----108–215
8----------giant spike sand dropseeds----------65–108
spike dropseed----------SPCO4----------*Sporobolus contractus*----------65–108
sand dropseed----------SPCR----------*Sporobolus cryptandrus*----------65–108
giant dropseed----------SPGI----------*Sporobolus giganteus*----------65–108
9----------other grasses----------65–108
Graminoid (grass or grass-like)-2GRAM---(grass or grass-like)----------65–108
FORB
10----------Buckwheat sunflower globemallow stickleaf----------65–108
buckwheat----------ERIOG----------Eriogonum----------65–108
sunflower----------HELIA3----------Helianthus----------65–108
Adonis blazingstar----------MEMU3---------*Mentzelia multiflora*----------65–108
globemallow----------SPHAE----------Sphaeralcea----------65–108
11----------Other forbs----------65–108
Forb (herbaceous) ----------2FORB----------Forb----------65–108
SHRUB/VINE
12----------Sand sagebrush----------108–215
sand sagebrush----------ARFI2----------*Artemisia filifolia*----------108–215
13----------yucca skunkbush sumac----------65–323
skunkbush sumac----------RHTR----------*Rhus trilobata*----------65–323
yucca----------YUCCA---------Yucca----------65–323
14----------Other shrubs----------65–108
Shrub, deciduous----------2SD---------- *Shrub, deciduous*----------65–108

From San Miguel County NM630 Manuscript – Manter loamy find sand, undulating map unit description:
“The potential plant community in this unit is mainly blue grama, Indian ricegrass, needlegrass, sand dropseed, and western wheatgrass. As the range deteriorates, the proportion of these forage plants decreases and the proportion of sand dropseed, yucca, sand sagebrush, and broom snakeweed increases. Grazing management should be designed to increase the productivity and reproduction of western wheatgrass, Indian ricegrass, New Mexico feathergrass, and blue grama.”

From NM630 Manuscript - Sandy Plains site:*
The approximate species composition of the potential plant community is as follows:
Blue grama----------15
Indian ricegrass----------15
Needlegrass----------10
Sand dropseed----------10
Bottlebrush squirreltail----------7
Western wheatgrass----------7
Little bluestem----------5
Sand sagebrush----------5
Productivity in pounds per acre ranges from 950 to 1,800 with 1,400 being a normal value.
*The Manter component is no longer correlated to the Sandy Plains site. However, this old manuscript plant information appears to fit this ecological site better than the currently correlated site.

State and transition model



State 1
Reference State

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

Community 1.1
Warm- and Cool-Season Grasses (diagnostic plant community)

Figure 4. Community 1.1 in San Miguel County, August 2017. This site had recently experienced relatively heavy grazing.

Figure 5. Community 1.1 in Colfax County, November 2018. This observation likely captures the upper limit of production for this site. It occurred in an interstate right-of-way which had experienced prolonged rest from grazing.

This community is dominated by grasses, but also contains a mix of forbs and shrubs. Foliar cover is between 75 and 90 percent, and bare ground is typically less than 20 percent. Total canopy cover of warm-season grasses is between 40 and 65 percent, and cool-season grass cover typically ranges from 10 to 60 percent. Shrubs and forbs each account for less than 5 percent cover. Annual production averages around 1,300 pounds per acre, but can range between 850 and 2,000 pounds per acre, depending mostly on annual weather patterns. This community typically occurs where season-long grazing has not been practiced in a number of years, or at least where this practice has been periodically deferred. Blue grama is most often the dominant grass, but is typically codominant to Western wheatgrass. Sand dropseed is also a major player. Shrubs are ever present, with broom snakeweed being most dominant, followed by Plains yucca. At the higher/cooler end of the spatial/climatic gradient (along the western fringes of the LRU), fringed sagebrush is often codominant to broom snakeweed. Forb diversity can be relatively high, but varies considerably within this phase. Topsoil remains in-place, and most often meets the criteria for a mollic epipedon. High canopy cover protects the topsoils from wind erosion. Sandy textures and relatively strong soil structure at the surface prevent erosive runoff. While this appears to be the latest-seral community that currently occupies this site, it still exhibits evidence of past disturbance (weedy species and signs of erosion), and is by no means reflective of “pristine” pre-Columbian conditions. During early observations of this plant community, it was considered at-risk of crossing the threshold into State 2. However, later-seral communities have not been identified since. Legacy information from the San Miguel County Soil Survey manuscript suggests that Indian ricegrass should be an important component of Community 1.1, but this species has only been observed in trace amounts on this site during contemporary fieldwork.

Dominant plant species

- broom snakeweed (*Gutierrezia sarothrae*), shrub
- soapweed yucca (*Yucca glauca*), shrub
- prairie sagewort (*Artemisia frigida*), shrub

- blue grama (*Bouteloua gracilis*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass

Community 1.2
At-Risk: Warm-Season Grasses

This community is dominated by grasses, but also contains a mix of forbs and shrubs. Foliar cover is between 65 and 85 percent, and bare ground is typically less than 30 percent. Total canopy cover of warm season grasses is between 60 and 80 percent, and cool-season grass cover is below 5 percent. Shrubs and forbs each account for less than 5 percent cover. Annual production averages around 1,100 pounds per acre, but can range between 800 and 1,400 pounds per acre, depending mostly on annual weather patterns. This community occurs in areas with histories of prolonged, season-long grazing. Blue grama is the dominant grass, and is typically in a sod-bound state. Sand dropseed is also a major player. Shrubs are ever present, with broom snakeweed being most dominant, followed by Plains yucca. At the higher/cooler end of the spatial/climatic gradient (along the western fringes of the LRU), fringed sagebrush is often codominant to broom snakeweed. Forb diversity can be relatively high, but varies considerably within this phase. Topsoil is somewhat degraded, but still typically meets the criteria for a mollic epipedon.

Dominant plant species

- broom snakeweed (*Gutierrezia sarothrae*), shrub
- soapweed yucca (*Yucca glauca*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- blue grama (*Bouteloua gracilis*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass

Pathway P1.1A
Community 1.1 to 1.2

This pathway represents a period of heavy grazing, typically season-long, in which ungulates tend to selectively graze cool-season grasses, particularly Western wheatgrass. While their total abundance does not necessarily increase, the dominance of warm-season grasses (particularly blue grama) does. Early-seral grasses such as purple threeawn also increase under continuous grazing. In contrast to many other sites in the CP, shrubs do not appear to increase in abundance within State 1. Where plant cover is significantly diminished, wind erosion becomes evident.

Pathway P1.2A
Community 1.2 to 1.1

This pathway represents prescribed grazing or rest from grazing. In either case, herbaceous plants that are palatable and/or sensitive to grazing increase in vigor and abundance, and shrubs are at a competitive disadvantage. Since the main difference between communities 1.2 and 1.1 is in the abundance of Western wheatgrass, rest during the seed-set of this species is critical for its recovery.

State 2
Eroded State

This state exists where significant soil loss has occurred. The topsoil generally does not meet color or thickness requirements for a mollic epipedon.

Community 2.1
Warm-Season Grasses—Eroded

Figure 6. Community 2.1 in Colfax County, September 2017. Sod-bound blue grama is dominant here. Note the large patches of bare ground.

Figure 7. Community 2.1 in Colfax County, November 2018. Taller grasses here are mostly sand dropseed.

This plant community occurs on eroded soils—where productive potential and species diversity have been lost with topsoil and the seedbank it held. This community is dominated by grasses, but also contains a mix of forbs and shrubs. Foliar cover is between 65 and 85 percent, and bare ground is typically less than 30 percent. Total canopy cover of warm-season grasses is between 60 and 80 percent. Cool-season grasses are often absent; where present, they account for less than 2 percent. Shrubs and forbs each account for less than 5 percent cover. Oneseed juniper is occasionally present, but not in great numbers. Annual production averages around 900 pounds per acre, but can range between 700 and 1,100 pounds per acre, depending mostly on annual weather patterns. This community occurs in areas with histories of prolonged, season-long grazing. Blue grama is the dominant grass, and is typically in a sod-bound state. Sand dropseed is also a major player. Shrubs are ever present, with broom snakeweed being most dominant, followed by Plains yucca. At the higher/cooler end of the spatial/climatic gradient (along the western fringes of the LRU), fringed sagebrush is often codominant to broom snakeweed. Forb diversity can be significant, but varies considerably within this phase. Topsoil is degraded, rarely meeting the criteria for a mollic epipedon.

Dominant plant species

- broom snakeweed (*Gutierrezia sarothrae*), shrub
- soapweed yucca (*Yucca glauca*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- blue grama (*Bouteloua gracilis*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass

Community 2.2
Warm-Season Grasses and Shrubs—Eroded

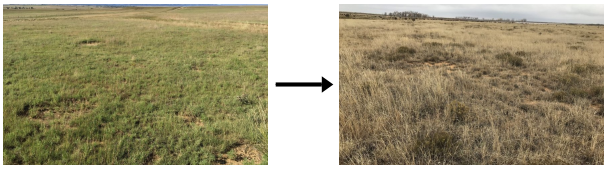
Figure 8. Community 2.2 in Colfax County, November 2018. Note the significant shrub cover and bare ground. Sand dropseed is codominant to blue grama at this location.

This plant community occurs on eroded soils—where productive potential and species diversity have been lost with topsoil and the seedbank it held. This community is dominated by grasses, but also contains a mix of forbs and shrubs. Foliar cover is between 65 and 85 percent, and bare ground is typically less than 30 percent. Total canopy cover of warm-season grasses is between 60 and 80 percent. Cool-season grasses are often absent; where present, they account for less than 2 percent. Shrub cover is at least 5 percent. Forbs generally account for less than 5 percent cover. Oneseed juniper is occasionally present, but not in great numbers. Annual production averages around 900 pounds per acre, but can range between 700 and 1,100 pounds per acre, depending mostly on annual weather patterns. This community occurs in areas with histories of prolonged, season-long grazing, coupled with an absence of fire and chemical treatments. Blue grama either dominant or codominant to sand dropseed. Broom snakeweed is the dominant shrub. Plains yucca and walkingstick cholla are also common. At the higher/cooler end of the spatial/climatic gradient (along the western fringes of the LRU), fringed sagebrush is often codominant to broom snakeweed. Forb diversity can be significant, but varies considerably within this phase. Topsoil is degraded, rarely meeting the criteria for a mollic epipedon.

Dominant plant species

- broom snakeweed (*Gutierrezia sarothrae*), shrub
- tree cholla (*Cylindropuntia imbricata*), shrub
- prairie sagewort (*Artemisia frigida*), shrub
- blue grama (*Bouteloua gracilis*), grass
- sand dropseed (*Sporobolus cryptandrus*), grass

Pathway P2.1A
Community 2.1 to 2.2

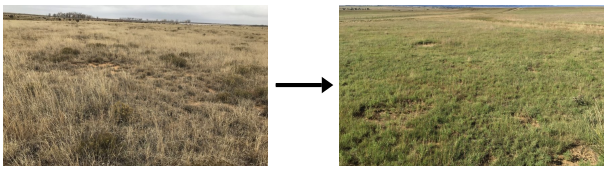


Warm-Season Grasses—Eroded

Warm-Season Grasses and Shrubs—Eroded

This pathway represents conditions which advantage shrubs over grasses: continuous grazing and the absence of fire.

Pathway P2.2A
Community 2.2 to 2.1



Warm-Season Grasses and Shrubs—Eroded

Warm-Season Grasses—Eroded

This pathway represents conditions which advantage grasses over shrubs: prescribed grazing, fire, and/or herbicide application. Since significant fuel loads are required to carry a fire, deferred grazing may be a necessary precursor to prescribed fire.

Transition T1A
State 1 to 2

Slow variables: An extended period with reduced plant cover and heavy pressure on cool-season grasses. This result is an increase in the rate of wind erosion and further diminished abundance and vigor among cool-season grasses—particularly Western wheatgrass. Trigger event: A drought kills already-weakened perennial grasses, resulting in the extirpation of Western wheatgrass. This, in turn, accelerates erosion. The concurrent loss of topsoil depletes the seedbank, further altering plant community composition. Threshold: The vigor and cover of perennial grasses is reduced to a point at which some perennial grasses die.

Restoration pathway R2A
State 2 to 1

An increase in the competitive advantage of various perennial grass species through physical, chemical, and biological management practices. In this process, topsoil is at least somewhat restored in thickness and organic matter content. This restoration pathway will likely require long-term, multifaceted approaches and high-energy inputs. In order to return to State 1, erosion will have to be reversed, grazing will have to be tightly-controlled, and the re-introduction of extirpated plant species such as Western wheatgrass may be required. Favorable weather patterns may also be necessary.

Additional community tables

Animal community

Habitat for Wildlife:
From Sandy Plains R070AY012NM
This site provides habitats which support a resident animal community that is characterized by pronghorn antelope, badger, coyote, desert cottontail, spotted ground squirrel, plains pocket gopher, black-tailed prairie dog, burrowing owl, marsh hawk, scaled quail, horned lark, loggerhead shrike, horned lizard and western spadefoot toad.

The Swainson's hawk may breed in these habitats.

Hydrological functions

The Sandy ecological site is not associated with a wetland or riparian system; it is an upland ecological site. Because this site occurs on linear or convex portions of plateau summits, it tends to shed water (via through-flow or run-off) to sites lower in the catena. Beyond this, sandier soil textures impede the percolation of water far less than the finer textures of most subsoils within this LRU. Refer to Table 7 below for more information on the sites that receive additional moisture from this site.

Wood products

This site does not support trees.

Other information

From Sandy Plains (R070AY012NM)

Grazing:
This site is suitable for grazing during all seasons of the year and by all classes of livestock. Approximately 95 percent of the total annual yield are from species which provide good feed and good nutrition for livestock. Continuous yearlong grazing or grazing during the period from April through October will result in a plant community of sand dropseed, threeawn, red lovegrass, sand sagebrush and yucca. A system of deferred grazing, which varies the season of grazing and rest in pastures, is needed to maintain a healthy, well-balanced plant community. Periods of rest during the spring (April-June) will allow cool-season grasses such as New Mexico feathergrass and various forbs to grow and to reproduce. Rest during this period is also beneficial to allow grasses such as sand bluestem and Indian ricegrass a period of green up before being grazed. Rest during the summer (July-September) is most beneficial to the warm-season grasses and forbs such as sand bluestem, sideoats grama, Indian ricegrass, little bluestem, blue grama and various forbs.

From Deep Loamy Plains ecological site (R077BY034NM), a site outside of the MLRA area and concept*:
Grazing:
This site can be grazed any season of the year by all classes of livestock, generally without regard to age. However, it is most efficiently utilized by cattle. The variety of grasses, forbs and half-shrubs furnishes good nutrition to grazing animals during most seasons of the year.
Approximately 90 percent of the annual production furnishes forage for grazing animals.
Continuous grazing or grazing continually during the period from April through October by cattle will result in a plant community dominated by low forage value species such as sand dropseed, sand sagebrush, yucca and threeawn spp. Sand sagebrush and yucca may increase to the extent that they become the dominant vegetation. A system of deferred grazing, which varies the season of grazing and rest is needed to maintain or improve a healthy well-balanced plant community. Rest in different seasons benefits different plants. Winter rest will benefit all woody species. Spring rest (April-June) encourages forb production and will benefit New Mexico feathergrass and needle and thread. Summer rest (July-September) benefits warm-season grasses such as sand bluestem, sideoats grama, and little bluestem to grow and reproduce. Fall rest allows plants to complete their growth cycle. New Mexico feathergrass and needle and thread is utilized readily by cattle in the spring and fall and least utilized in the summer when the awns interfere with utilization and may injure cattle. Although utilization in June is detrimental to stands of needle and thread and New Mexico feathergrass, a quick, moderate cropping when the heads are in the boot stage of development, can remove the heads and prevent subsequent interference and injury to cattle by the awns. For this purpose, the timing and degree of use must be determined on limited areas, preferably when soil moisture is adequate for regrowth, and should be followed by a period of deferment.
*MLRA 77B is warmer than 70A, and this is reflected in many of the species described here. We have not recorded the presence of red lovegrass, tumble lovegrass, or hooded windmillgrass in areas that correlate the R070AA021NM site.

Future Work:
Soils with fine sandy loam and very fine sandy loam surface textures (correlated to the Seelez series) have been observed to support plant communities that match those observed on the Loamy Uplands site. At present, we lack the data to assess whether these sandy soils truly fit the Loamy Uplands ecological site, or whether their associated plant communities merely resemble the Sandy site when in degraded states. Given data from reference states on the Seelez soils, we might find that these soils are better fits to the Sandy site. It is also possible that fine sandy loams with lower clay percentages produce different reference states (such as that of the Sandy site) than those with higher clay (which might fit the Loamy Uplands site). Future update projects should focus on identifying and comparing reference plant communities on the Manter and Seelez series.

ESD Workgroup:
Logan Peterson, MLRA 70 Soil Scientist, NRCS
Aaron Miller, MLRA 70 Project Leader, NRCS
Robert (Scott) Woodall, Region 8 Ecological Site Specialist, NRCS

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Contributors

Aaron Miller
Logan Peterson

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	05/11/2025
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:**

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17. **Perennial plant reproductive capability:**
