USDA Natural Resources Conservation Service

Ecological site R086AY005TX
Sandy Loam

Last updated: 9/21/2023
Accessed: 05/11/2025

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.

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): 086A–Texas Blackland Prairie, Northern Part

MLRA 86A, The Northern Part of Texas Blackland Prairie is entirely in Texas. It makes up about 15,110 square miles (39,150 square kilometers). The cities of Austin, Dallas, San Antonio, San Marcos, Temple, and Waco are located within the boundaries. Interstate 35, a major thoroughfare for commerce and travel, traverses the length of the MLRA from San Antonio to Dallas. The area supports tall and midgrass prairies, but improved pasture, croplands, and urban development account for the majority of the acreage.

Classification relationships

USDA-Natural Resources Conservation Service, 2006.
-Major Land Resource Area (MLRA) 86A

Ecological site concept

The Sandy Loam ecological site is a tallgrass prairie. The soils moderately deep to deep and characterized by their sandy loam textures.

Associated sites

R086AY006TX	**Northern Clay Loam** Sites have heavier textured soils.
R086AY007TX	**Southern Clay Loam** Sites have heavier textured soils.

Similar sites

R086AY007TX	**Southern Clay Loam** Sites have heavier textured soils.
R086AY006TX	**Northern Clay Loam** Sites have heavier textured soils.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Schizachyrium scoparium* (2) *Andropogon gerardii*

Physiographic features

These are uplands with nearly level to moderate slopes. Slope gradients range from 0 to 8, but are usually less than 5 percent. There is no flooding or ponding associated with the sites.

Table 2. Representative physiographic features

Landforms	(1) Plains > Terrace
Runoff class	Low to high
Elevation	350–1,500 ft
Slope	0–5%
Water table depth	36–80 in
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Elevation	Not specified
Slope	0–8%
Water table depth	Not specified

Climatic features

The climate for MLRA 86A is humid subtropical and is characterized by hot summers, especially in July and August, and relatively mild winters. Tropical maritime air controls the climate during spring, summer and fall. In winter and early spring, frequent surges of Polar Canadian air cause sudden drops in temperatures and add considerable variety to the daily weather. When these cold air masses stagnate and are overrun by moist air from the south, several days of cold, cloudy, and rainy weather follow. Generally, these occasional cold spells are of short duration with rapid clearing following cold frontal passages. The summer months have little variation in day-to-day weather except for occasional thunderstorms that dissipate the afternoon heat. The moderate temperatures in spring and fall are characterized by long periods of sunny skies, mild days, and cool nights. The average relative humidity in mid-afternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 75 percent of the time during the summer and 50 percent in winter. The prevailing wind direction is from the

south and highest wind speeds occur during the spring months. Rainfall during the spring and summer months generally falls during thunderstorms, and fairly large amounts of rain may fall in a short time. High-intensity rains of short duration are likely to produce rapid runoff almost anytime during the year. The predominantly anticyclonic atmospheric circulation over Texas in summer and the exclusion of cold fronts from North Central Texas result in a decrease in rainfall during midsummer. The amount of rain that falls varies considerably from month-to-month and from year-to-year.

Table 4. Representative climatic features

Frost-free period (average)	232 days
Freeze-free period (average)	265 days
Precipitation total (average)	40 in

Climate stations used

- (1) RED ROCK [USC00417497], Red Rock, TX
- (2) AUSTIN BERGSTROM AP [USW00013904], Austin, TX
- (3) GRANGER DAM [USC00413686], Granger, TX
- (4) KAUFMAN 3 SE [USC00414705], Kaufman, TX
- (5) MEXIA [USC00415869], Mexia, TX
- (6) WAXAHACHIE [USC00419522], Waxahachie, TX
- (7) CORSICANA [USC00412019], Corsicana, TX
- (8) GREENVILLE KGVL RADIO [USC00413734], Greenville, TX
- (9) MARLIN 3 NE [USC00415611], Marlin, TX
- (10) SHERMAN [USC00418274], Denison, TX
- (11) DALLAS LOVE FLD [USW00013960], Dallas, TX
- (12) HILLSBORO [USC00414182], Hillsboro, TX
- (13) LULING [USC00415429], Luling, TX
- (14) TEMPLE [USC00418910], Temple, TX

Influencing water features

Some soils may have a water table at 36 inches. Otherwise, water does not affect this site.

Wetland description

Wetlands are not associated with this site.

Soil features

The site consists of moderately deep to very deep, moderately well to well drained soils that moderately slow to very slowly permeable. The upland soils formed from residuum and alluvium of mixed sources. The majority of areas are used for cropland or pasture, but some is still in native rangeland.

The associated soil series for the site include: Bastsil, Chaney, Chazos, Chickasha, Hardeman, Karma, Okay, Silawa, and Smithville.

Table 5. Representative soil features

Parent material	(1) Alluvium–sandstone and shale
Surface texture	(1) Fine sandy loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow to very slow

Soil depth	30–80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	5–6 in
Calcium carbonate equivalent (0-40in)	0–15%
Electrical conductivity (0-40in)	0–4 mmhos/cm
Sodium adsorption ratio (0-40in)	0–10
Soil reaction (1:1 water) (0-40in)	4.5–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–15%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

Introduction – The Northern Blackland Prairies are a temperate grassland ecoregion contained wholly in Texas, running from the Red River in North Texas to San Antonio in the south. The region was historically a true tallgrass prairie named after the rich dark soils it was formed in. Other vegetation included deciduous bottomland woodlands along rivers and creeks.

Background – Natural vegetation on the uplands is predominantly tall warm-season perennial bunchgrasses with lesser amounts of midgrasses. This tallgrass prairie was historically dominated by big bluestem (*Andropogon gerardii*), Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), eastern gamagrass (*Tripsacum dactyloides*), and little bluestem (*Schizachyrium scoparium*). Midgrasses such as sideoats grama (*Bouteloua curtipendula*), Virginia wildrye (*Elymus virginicus*), Florida paspalum (*Paspalum floridanum*), Texas wintergrass (*Nassella leucotricha*), hairy grama (*Bouteloua hirsuta*), and dropseeds (Sporobolus spp.) are also abundant in the region. A wide variety of forbs add to the diverse native plant community. Mottes of live oak (*Quercus virginiana*) and hackberry (Celtis spp.) trees are also native to the region. In some areas, cedar elm (*Ulmus crassifolia*), eastern red cedar (*Juniperus virginiana*), and honey locust (*Gleditsia triacanthos*) are abundant. In the Northern Blackland Prairie oaks (Quercus spp.) are common increasers, but in the Southern Blackland Prairie oaks are less prevalent. Junipers are common invaders, particularly in the northern part of the region.

During the first half of the nineteenth century, row crop agriculture lead to over 80 percent of the original vegetation lost. During the second half, urban development has caused even an even greater decline in the remaining prairie. Today, less than one percent of the original tallgrass prairie remains. The known remaining blocks of intact prairie range from 10 to 2,400 acres. Some areas are public, but many are privately owned and have conservation easements.

Current State – Much of the area is classified as prime farmland and has been converted to cropland. Most areas where native prairie remains have histories of long-term management as native hay pastures. Tallgrasses remain dominant when haying of warm-season grasses is done during the dormant season or before growing points are elevated, meadows are not cut more than once, and the cut area is deferred from grazing until frost.

Due to the current-widespread farming, the Northern Blackland Prairie is still relatively free from the invasion of brush that has occurred in other parts of Texas. In contrast, many of the more sloping have experienced heavy brush encroachment, and the continued increase of brush encroachment is a concern. The shrink-swell and soil cracking characteristics of the soils favor brush species with tolerance for soil movement.

Current Management – Rangeland and pastureland are grazed primarily by beef cattle. Horse numbers are increasing rapidly in the region, and in recent years goat numbers have increased significantly. There are some

areas where dairy cattle, poultry, goats, and sheep are locally important. Whitetail deer, wild turkey, bobwhite quail, and dove are the major wildlife species, and hunting leases are a major source of income for many landowners in this area.

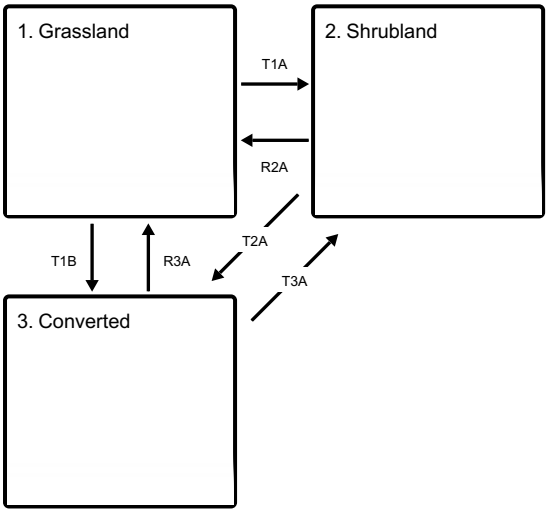
Introduced pasture has been established on many acres of old cropland and in areas with deeper soils. Coastal bermudagrass (*Cynodon dactylon*) and kleingrass (*Panicum coloratum*) are by far the most frequently used introduced grasses for forage and hay. Hay has also been harvested from a majority of the prairie remnants, where long-term mowing at the same time of year has possibly changed the relationships of the native species. Cropland is found in the valleys, bottomlands, and deeper upland soils. Wheat (Triticum spp.), oats (Avena spp.), forage and grain sorghum (Sorghum spp.), cotton (Gossypium spp.), and corn (*Zea mays*) are the major crops in the region.

Fire Regimes – The prairies were a disturbance-maintained system. Prior to European settlement (pre-1825), fire and infrequent, but intense, short-duration grazing by large herbivores (mainly bison and to a lesser extent pronghorn antelope) were important natural landscape-scale disturbances that suppressed woody species and invigorated herbaceous species (Eidson and Smeins 1999). The herbaceous prairie species adapted to fire and grazing disturbances by maintaining below-ground penetrating tissues. Wright and Bailey (1982) report that there are no reliable records of fire frequency occurring in the Great Plains grasslands because there are no trees to carry fire scars from which to estimate fire frequency. Because prairie grassland is typically of level or rolling topography, a natural fire frequency of 5 to 10 years seems reasonable.

Disturbance Regimes - Precipitation patterns are highly variable. Long-term droughts, occurring three to four times per century, cause shifts in species composition by causing die-off of seedlings, less drought-tolerant species, and some woody species. Droughts also reduce biomass production and create open space, which is colonized by opportunistic species when precipitation increases. Wet periods allow tallgrasses to increase in dominance. These natural disturbances cause shifts in the states and communities of the ecological sites.

State and transition model

Ecosystem states



T1A - No fire, no brush management, improper grazing management, drought

T1B - Brush management, crop cultivation, pasture planting, nutrient management, pest management

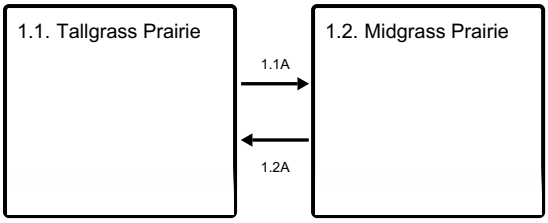
R2A - Fire, brush management, proper grazing, range planting

T2A - Brush management, crop cultivation, pasture planting, nutrient management, pest management

R3A - Fire, brush management, proper grazing, range planting

T3A - No fire, no brush management, heavy continuous grazing, no pest management

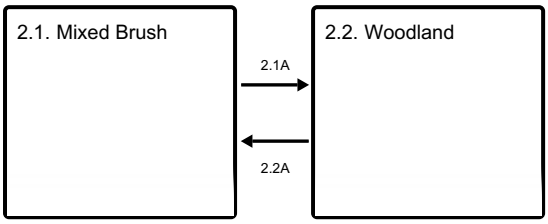
State 1 submodel, plant communities



1.1A - No fire, no brush management, improper grazing management, drought

1.2A - Fire, brush management, proper grazing

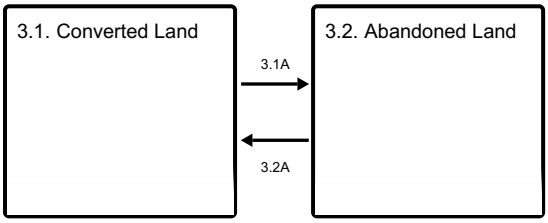
State 2 submodel, plant communities



2.1A - No fire, no brush management, improper grazing management, drought

2.2A - Fire, brush management, proper grazing

State 3 submodel, plant communities



3.1A - No fire, no brush management, heavy continuous grazing, no pest management

3.2A - Fire, brush management, proper grazing, pest management

State 1
Grassland

Two communities exist in the Grassland State: the 1.1 Tallgrass Prairie Community and the 1.2 Midgrass Prairie Community. Community 1.1 is characterized by tallgrasses dominating the understory and woody species cover less than 10 percent of the area. Community 1.2 is characterized by my midgrass dominance, but the woody species cover is 10 to 20 percent, with some species attaining heights of three feet.

Community 1.1
Tallgrass Prairie

The Tallgrass Prairie Community (1.1) reference community is a true prairie. It is dominated by warm-season, perennial tallgrasses, with warm-season perennial midgrasses filling most of the remaining species composition. The warm-season, perennial forb component is present and amounts vary depending on climatic patterns and local precipitiation. Woody species make up a minor component of the community, and increase with absence of fire (two to five years). The reference prairie community will transition to a midgrass-dominated community under the stresses of improper grazing management. The first species to decrease in dominance will be the most palatable and/or least grazing tolerant grasses and forbs (i.e. eastern gamagrass, switchgrass, Indiangrass, and big bluestem). This will initially result in an increase in composition of little bluestem and sideoats grama. If improper grazing management continues, little bluestem and Florida paspalum will decrease and midgrasses such as silver bluestem and Texas wintergrass will increase in composition. Less palatable forbs will increase at this stage. Because the woody species that dominate in the Woodland State are native species that occur as part of the Prairie

State, the transition is a linear process with shrubs starting to increase soon after fire or brush control. Unless some form of brush control takes place, woody species will increase to the 20 percent canopy cover level that indicates a state change. This is a continual process that is always in effect. Managers need to detect the increase in woody species when canopy is less than 20 percent and take management action before the state change occurs. There is not a 10-year window before shrubs begin to increase followed by a rapid transition to the Woodland State. The drivers of the transition (lack of fire and lack of brush control) constantly pressure the system towards the Woodland State.

Community 1.2
Midgrass Prairie

The Midgrass Community Phase (1.2) is the result of long-term improper cattle grazing management. Tallgrasses in the reference prairie community decrease in vigor and production, allowing midgrasses and forbs to increase to the point that they make up more than 50 percent of species composition. Indigenous or invading woody species may increase on the site depending on fire and brush control methods. In the Tallgrass Prairie Community (1.1), repeated fires and competition from a vigorous grass component keep woody canopy cover low. When the Midgrass Community (1.2) is continually overgrazed and fire is excluded, the community crosses a threshold to a state that is dominated by woody plants, the Mixed-Brush Community (2.1). Some of the reference community perennial forbs persist, but less palatable forbs will increase. Woody canopy may be as high as 20 percent, depending on the type of grazing animal, fire interval, brush control, and/or availability of increaser shrub species. Numerous shrub and tree species will encroach because overgrazing by livestock has reduced grass cover, exposed more soil, and reduced grass fuel for fire. Typically, trees such will increase in size, but some woody species will increase in density. Aggressive, introduced pasture species may begin to invade the Midgrass Prairie Community, particularly if they have been seeded in nearby pastures. These include introduced paspalums, such as bahiagrass (*Paspalum notatum*), Old World bluestems (Bothriochloa spp.), and Bermudagrass. Heavy continuous grazing will reduce plant cover, litter, and mulch. Bare ground will increase and expose the soil to crusting and erosion. Some mulch and litter movement may occur during rainstorms, but little soil movement occurs due to gentle slopes in this vegetation type. Litter and mulch will move off site as plant cover declines. Once shrubs reach a height of about three feet, they become more resistant to being killed by fires. When woody species exceed 20 percent canopy cover, the site crosses a threshold (T1A) into the Shrubland State (2) and the Grass/Mixed-Brush Plant Community (2.1). Until the Midgrass Prairie Community (1.2) crosses the threshold into the Mixed-Brush Community (2.1), this community can be managed back toward the reference community (1.1) through the use of prescribed grazing, prescribed burning, and strategic brush control. It may take several years to achieve this state, depending upon climate and the aggressiveness of management. Once woody species begin to establish, returning fully to the reference is difficult, but it is possible to return to a similar plant community. If improper grazing management continues but shrubs are held in check through fire, brush control, browsing, or mowing, the Midgrass Plant Community will continue to degrade. Tallgrasses will continue to decrease in species composition, and midgrasses will begin to decrease. Grazing-resistant shortgrasses, annuals, and forbs will represent more of species composition. These species may increase in relative composition due to the loss of tall and midgrasses. The site will have reduced production and poor ecological processes. Brush control in this community will be more cost effective than after the transition has been made to the Shrubland State.

Pathway 1.1A
Community 1.1 to 1.2

The Tallgrass Prairie Plant Community will shift to the Midgrass Prairie Plant Community when there is continued growing season stress on reference grass species. These stresses include insufficient critical growing season deferment, excess defoliation intensity, repeated long-term growing season defoliation, and/or long-term drought. Increaser species (midgrasses and woody species) are generally endemic species released from competition. Woody species canopy exceeding five percent and/or dominance of tallgrasses falling below 50 percent of species composition indicate a transition to the Midgrass Plant Community. Implementation of managed grazing that provides adequate growing season deferment to allow establishment of tallgrass propagules and/or the recovery of vigor of stressed individual plants. Proper grazing management may be combined with fire and/or brush management to create a shift towards or maintain the reference community.

Pathway 1.2A
Community 1.2 to 1.1

The Midgrass Prairie Community will return to the Tallgrass Prairie Community under grazing management that provides sufficient critical growing season deferment in combination with proper grazing intensity as long as the seedbank or seed source is still present. Favorable moisture conditions will facilitate or accelerate this transition. The understory component may return to dominance by tallgrasses in the absence of fire. However, reduction of the woody component to reference conditions of five percent or less canopy cover will require inputs of fire or brush control.

State 2
Shrubland

The Woodland State has two communities: 2.1 Mixed-Brush Community and 2.2 Mixed-Woodland Community. The 2.1 community has a woody species overstory canopy of 20 to 40 percent and the 2.2 community has a woody canopy cover over 40 percent. As tree and brush canopy increases, the herbaceous understory production decreases due to lack of light availability.

Community 2.1
Mixed Brush

The Mixed-Brush Community (2.1) presents 20 to 40 percent canopy with oak, mesquite, hackberry, elm, or juniper as dominant woody species. This community can occur as a result of continuous improper grazing management combined with lack of fire or brush control. It can also occur where there has been proper grazing management without brush control or fire. Improper grazing management speeds the process. Although it is rarely found, it is possible for the herbaceous component to include substantial production from tallgrasses. Palatable woody species tend to decrease and unpalatable woody species tend to increase, particularly where there is heavy browsing from deer or goats. Honey mesquite (*Prosopis glandulosa*) is an early invader throughout the MLRA, particularly where there is heavy browsing from deer or goats. Ashe juniper (*Juniperus ashei*) invaded from the south, and eastern red cedar is found more frequently in the northern portion of the MLRA. Many of the tallgrass community shrubs are still present. Sideoats grama and other midgrasses decrease, but still remain the dominant component of composition, while shortgrasses such as buffalograss (*Bouteloua dactyloides*) increase. Remnants of the reference (1.1) grasses and forbs along with unpalatable invaders occupy the interspaces between shrubs. Cool-season species such as Texas wintergrass and sedges (Carex spp.), plus other grazing resistant reference (1.1) species, can be found under, and around, woody plants. Plant vigor and productivity of the grassland component is reduced due to grazing pressure and competition for sunlight, nutrients, and water from woody plants. This community can be dominated by a mix of forbs and shrubs when there is continued growing season stress on reference and midgrass species. This transition usually results from heavy, long-term continuous grazing and is often associated with farm lots and horse pastures. Invasive species often dominate the site, including invasive forbs, shrubs, and grasses. As the grassland vegetation declines, more soil is exposed, leading to crusting and erosion. In this vegetation type, erosion can be severe. Higher rainfall interception losses by the increasing woody canopy combined with evaporation and runoff can reduce the effectiveness of rainfall. Soil organic matter and soil structure decline within the interspaces, but soil conditions improve under the woody plant cover. Some soil loss can occur during rainfall events. In this plant community, annual production is balanced between herbaceous plants and woody species, with herbaceous production still the dominant component of annual production. Browsing animals can find fair food value if browse plants have not been grazed excessively. Forage quantity and quality for cattle is low. Unless brush management and good grazing management are applied at this stage, woody species will exceed 40 percent, causing the community to convert to the Woodland Community (2.2). The trend cannot be reversed with proper grazing management alone. Grazing management alone will not allow the site to move back to the Tallgrass Community. Extensive brush management and range planting may be needed to manage the site towards the Prairie State. Soil erosion may prevent the site from recovering. Brush control and range planting can help restore fuel loads to provide the option of reintroducing prescribed fire into the ecosystem. Without fire, the manager will need to be diligent in the use of individual plant treatment of woody species.

Community 2.2
Woodland

The Woodland Community (2.2) has greater than 40 percent canopy stems and is the result of many years of improper grazing, lack of periodic fires, and/or a lack of proper brush management. Reference woody species or increasers, such as juniper, dominate the Woodland Community (2.2). The site can now have the appearance of a

dense woodland. Common understory shrubs are pricklypear (Opuntia spp.) and sumac (Rhus spp.). Woody shrubs seem to increase more rapidly in the southern portion of the MLRA. Remnant midgrasses and opportunistic shortgrasses, annuals, and perennial forbs occupy the woody plant interspaces. The shrub canopy acts to intercept rainfall and increase evapotranspiration losses, creating a more xeric microclimate. Soil fauna and organic mulch are reduced, exposing more of the soil surface to erosion in interspaces. The exposed soil crusts readily. However, within the woody canopy, hydrologic processes stabilize and soil organic matter and mulch begin to increase and eventually stabilize under the shrub canopy. The Woodland Community (2.2) can provide good cover habitat for wildlife, but only limited forage or browse is available for livestock or wildlife. At this stage, highly intensive restoration practices are needed to return the Woodland Community to the Grassland Community. Alternatives for restoration include brush control and range planting with proper stocking, prescribed grazing, and prescribed burning following restoration to maintain the desired community.

Pathway 2.1A
Community 2.1 to 2.2

Without some form of brush control, woody density and canopy cover will increase in the Mixed-Brush Community (2.1) until it converts into the Woodland Community (2.2). Improper grazing management and/or long-term drought (or other growing season stress) will accelerate this transition. Woody canopy cover greater than 40 percent indicates this transition. Herbaceous understory will shift to cool-season and/or shade-tolerant species. Improper grazing or other long-term growing season stress can increase the composition of less productive grasses and low-growing (or unpalatable) forbs in the herbaceous component. Even with proper grazing, in the absence of fire the woody component will increase to the point that the herbaceous component will decline in production and shift in composition toward sedges, grasses, and forbs suited to growing in shaded conditions with reduced available soil moisture. The driver for community shift 2.1A is lack of fire and/or brush control.

Pathway 2.2A
Community 2.2 to 2.1

Brush management and/or fire can reduce the woody component of the Woodland Community (2.2) to below the transition level of less 40 percent canopy cover. Continued fire and/or brush management will be required to maintain the less than 40 percent level. It may be difficult to shift back to the Mixed-Brush Community (2.1) with fire alone. Once woody species become tall enough to not be killed by understory fires, fire is likely to only remove small woody plants. This will increase the savannah effect and leave the site in the Woodland Community. It will be dominated by large trees over an herbaceous understory. This is amplified if the understory transitions to cool-season grasses, which reduce opportunity for prescribed fire. If the woody component has been invaded by juniper, fire remains an option to create transition 2.2A. If the herbaceous component has transitioned to shortgrasses and low forbs, proper grazing management (combined with favorable moisture conditions and adequate seed source) will be necessary to facilitate the shift of the understory component in the Mixed- Brush Plant Community (2.2) to the midgrass dominated Mixed-Brush Plant Community (2.1). Transition 2.2A is difficult to create with management. Due to the large size of trees present, brush control may require selective removal of large trees along with brush. Range planting may accelerate the transition of the herbaceous community, particularly when combined with favorable growing conditions. Range planting is more commonly associated with restoration efforts associated with Restoration Pathway R2A. The driver for community shift 2.2A is fire and/or brush control.

State 3
Converted

Two communities exist in the Converted State: 3.1 Converted Land Community and the 3.2 Abandoned Land Community. The 3.1 Community is characterized by agricultural production. The site may be planted to improved pasture for hay or grazing. The site may otherwise be planted to row crops. The 3.2 community represents an agricultural state that has not been managed. The land is colonized by first successional species.

Community 3.1
Converted Land

The Converted State (3) occurs when the prairie, either the Grassland State (1) or Shrubland State (2), is plowed for planting to cropland, hayland, tame pasture, or use as non-agricultural land. The Converted State includes

cropland, tame pasture, and go-back land. Agronomic practices are used to convert rangeland to the Converted State and to make changes between the communities in the Converted State. Many or all native species are replaced by seeding crops or introduced species into the plowed soil. The native component of the prairie is usually lost in this state, and even with reseeding, the ecological processes defining the past states of the site can be permanently changed. Common introduced species include coastal Bermudagrass and kleingrass, which are used in hayland and tame pastures. Wheat, oats, forage sorghum, grain sorghum, cotton, and corn are the major crop species. Cropland and tame pasture require repeated and continual inputs of fertilizer and weed control to maintain the Converted State. Without agronomic inputs, the site will eventually return to either the Grassland or Shrubland State. Weed and shrub control will be required because seeds remain in the soil or are transported to the site. Return to native prairie communities in the Grassland State is more likely to be successful if soil chemistry and structure have not been severely altered. Preservation of favorable soil microbes increases the likelihood of a return to reference conditions. Restoration to native prairie will require seedbed preparation and seeding of native species. Without active restoration the site is not likely to return to reference conditions due to the presence of introduced forbs and grasses. Protocols and plant materials for restoring prairie communities is a developing portion of restoration science.

Community 3.2
Abandoned Land

Without agronomic inputs, the site will eventually return to either the Grassland or Shrubland State. The site is considered go-back land when active management for pasture ceases. Heavily disturbed soils usually return to the Shrubland State but could return to a Grassland State if shrub seeds are not present. Long-term cropping creates changes in soil chemistry, microflora and structure that make restoration to the reference state very difficult and/or expensive. Moreover, the residual seedbank is usually depleted, depending upon the length of time the site has been in the converted state. Restoration to near native prairie is possible. It will nearly always require seedbed preparation, suppression of shrubs and seeding of native species. Otherwise, it would take a very long time to re-establish from natural processes. Protocols and plant materials for restoring prairie communities is a developing portion of restoration science.

Pathway 3.1A
Community 3.1 to 3.2

The driver for this transition is lack of agricultural management. Without practices to suppress forbs and woody species, the land will eventually grow first successional species. Annual forbs and grasses are common colonizers and first provide ground cover and soil stability. Eventually, woody species will encroach and begin rapid expansion.

Pathway 3.2A
Community 3.2 to 3.1

The driver for this transition is a reestablishment of agricultural management. Proper grazing, brush management, herbicides, and/or fire are all potential practices the landowner can use to create more agricultural production on the site.

Transition T1A
State 1 to 2

The Grassland State is resistant to shrub dominance. However, shrubs make up a portion of the plant community in the Grassland State, indicating propagules are present. Even with proper grazing and favorable climate conditions, lack of fire for 25 to 50 years will allow woody species to increase in canopy to reach the 20 percent threshold level. Improper grazing, prolonged drought, and warming climate will provide a competitive advantage to shrubs which will accelerate this process. Tallgrasses will decrease to less than five percent species composition.

Transition T1B
State 1 to 3

The transition to the Converted State from the Grassland State occurs when the prairie is plowed for planting to cropland or hayland. The threshold for this transition is the plowing of the prairie soil and removal of the prairie plant

community.

Restoration pathway R2A
State 2 to 1

Restoration of the Woodland State to the Prairie State requires substantial energy input. Mechanical or herbicidal brush control treatments can be used to remove woody species. A long-term prescribed fire program may sufficiently reduce brush density to a level below the threshold of the Prairie State, particularly if the woody component is dominated by species that are not re-sprouters following top removal. However, fire may not be sufficient to remove mature trees. A mixed program consisting of mechanical, chemical, and fire measures may be used. Brush control in combination with prescribed fire, proper grazing management, and favorable growing conditions may be the most economical means of creating and maintaining the desired plant community. Proper grazing management will be required to promote recovery of the understory towards a tallgrass community. If remnant populations of tallgrasses, midgrasses, and desirable forbs are not present at sufficient levels, range planting will be necessary to restore the prairie plant community. Depending on the understory community and inputs of seed, the restoration pathway can result in return to any of the Prairie State Communities.

Transition T2A
State 2 to 3

The transition to the Converted State from either the Woodland State (T2A) occurs when the prairie is plowed for planting to cropland or hayland. The size and density of brush in the Shrubland State will require heavy equipment and energy-intensive practices (e.g. rootplowing, raking, rollerchopping, or heavy disking) to prepare a seedbed. The threshold for this transition is the plowing of the prairie soil and removal of the prairie plant community. The Converted State includes cropland, tame pasture, and go-back land. The site is considered “go-back land” during the period between cessation of active cropping, fertilization, and weed control and the return to the “native” states. Agronomic practices are used to convert rangeland to the Converted State and to make changes between the communities in the Converted State. The driver for these transitions is management’s decision to farm the site.

Restoration pathway R3A
State 3 to 1

Restoration from the Converted State can occur in the short-term through active restoration or over the long-term due to cessation of agronomic practices. Cropland and tame pasture require repeated and continual inputs of fertilizer and weed control to maintain the Converted State. If the soil chemistry and structure have not been overly disturbed (which is most likely to occur with tame pasture) the site can be restored to the Prairie State. Heavily disturbed soils are more likely to return to the Woodland State. Without continued disturbance from agriculture the site can eventually return to either the Prairie or Woodland State. The level of disturbance while in the converted state determines whether the site restoration pathway is likely to be R3A (a return to the Prairie State) or T3A (a return to the Woodland State). Return to native prairie communities in the Prairie State is more likely to be successful if soil chemistry and structure are not heavily disturbed. Preservation of favorable soil microbes increases the likelihood of a return to reference conditions. Converted sites can be returned to the Prairie State through active restoration, including seedbed preparation and seeding of native grass and forb species. Protocols and plant materials for restoring prairie communities are a developing part of restoration science. The driver for both of these restoration pathways is the cessation of agricultural disturbances.

Transition T3A
State 3 to 2

Transition to the Woodland State (2) occurs with the cessation of agronomic practices. The site will move from the Go-Back Land Community when woody species begin to invade. After shrubs and trees have established over 20 percent, and reached a height greater than three feet, the threshold has been crossed. The driver for the change is lack of agronomic inputs, improper grazing, no brush management, and no fire.

Additional community tables

Animal community

The animal community differs depending on what state the site is currently in. Northern Bobwhite prefer the reference state. They require dense bunchgrasses for nesting and cover. As the site transitions into State 2, white-tailed deer will become more prevalent. Deer are woodland and edge species, with their primary diet consisting of browse. Mourning dove need open areas with semi-clear ground and forbs with desirable seed sources. Go-back land and communities with shortgrasses and forbs provide the best habitat for dove.

Recreational uses

Recreational uses include recreational hunting, hiking, camping, equestrian, and bird watching.

Wood products

Honey mesquite, eastern red cedar, and some oak are used for posts, firewood, charcoal, and other specialty wood products.

Other products

Jams and jellies are made from many fruit-bearing species, such as agarito. Seeds are harvested from many reference plants for commercial sale. Many grasses and forbs are harvested by the dried-plant industry for sale in dried flower arrangements. Honeybees are utilized to harvest honey from many flowering plants.

Inventory data references

These site descriptions were developed as part a Provisional Ecological Site project using historic soil survey manuscripts, available site descriptions, and low intensity field traverse sampling. Future work to validate the information is needed. This will include field activities to collect low, medium, and high-intensity sampling, soil correlations, and analysis of that data. A final field review, peer review, quality control, and quality assurance review of the will be needed to produce the final document.

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Approval

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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	09/03/2021
Approved by	Bryan Christensen
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:**

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

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

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

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

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

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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:**
