USDA Natural Resources
Conservation Service

Ecological site R082AY568TX
Red Savannah 25-32 PZ

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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.

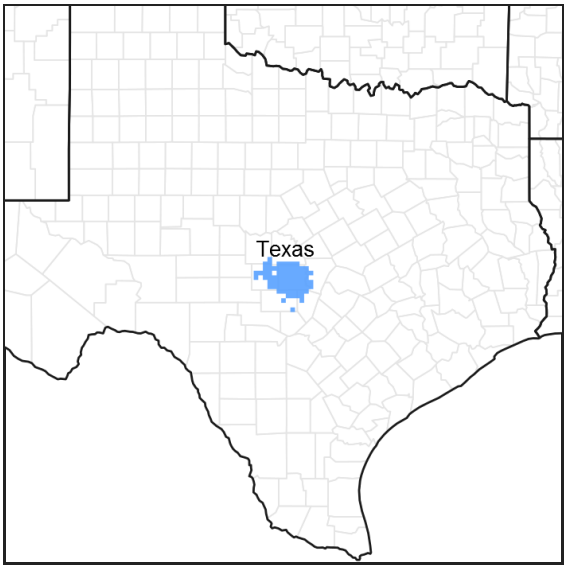


Figure 1. Mapped extent

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): 082A–Texas Central Basin

The 82A MLRA is underlain primarily by igneous, metamorphic, and sedimentary rocks. Igneous and metamorphic outcrops include the Valley Spring Gneiss, Packsaddle Schist, and Town Mountain Granite of Precambrian age. Sedimentary rocks include the Hickory Sandstone and Lion Mountain Sandstone of Cambrian Age and the Hensel Sand of Cretaceous age. Holocene alluvium is on flood plains.

Classification relationships

Major Land Resource Area (MLRA) and Land Resource Unit (LRU) (USDA-Natural Resources Conservation Service, 2006)

Ecological site concept

The Red Savannah ecological site has moderately deep, well drained, moderately slowly permeable soils formed in residuum over schist or schistose gneiss of Pre-Cambrian Age. These soils are on gently sloping to moderately sloping uplands. No ponding or flooding is expected for this site. Slopes range from 1 to 8 percent.

The reference vegetation on this site is a mixed grass savannah. The site is composed of three vegetative States:

the Grassland, Woodland, and Converted State.

Associated sites

R082AY367TX	**Loamy Bottomland 25-32 PZ** The Loamy Bottomland site is lower in the landscape on floodplains.
R082AY576TX	**Shallow Ridge 25-32 PZ** The Shallow Ridge site has a clay loam or loamy surface.
R082AY365TX	**Granite Gravel 25-32 PZ** The Granite Gravel site has an argillic that is more loamy and has more gravels.
R082AY375TX	**Serpentine 25-32 PZ** The Serpentine site is shallow over serpentine bedrock.
R082AY600TX	**Gravelly Sandy Loam 25-32 PZ** The Gravelly Sandy Loam site has more gravels and is deeper.

Similar sites

R082AY373TX	**Sandy Loam 25-32 PZ** The Sandy Loam site has a loamy argillic horizon over sandstone or gneiss.
R082AY369TX	**Red Sandy Loam 25-32 PZ** The Red Sandy Loam site has a loamy argillic horizon over sandstone.

Table 1. Dominant plant species

Tree	(1) *Quercus stellata* (2) *Quercus virginiana*
Shrub	Not specified
Herbaceous	(1) *Schizachyrium scoparium* (2) *Bouteloua curtipendula*

Physiographic features

These soils are on gently sloping to moderately sloping uplands. No ponding or flooding is expected for this site. Slopes range from 1 to 8 percent. Elevation ranges from 1000 to 2000 feet.

Table 2. Representative physiographic features

Geomorphic position, hills	(1) Base Slope
Hillslope profile	(1) Footslope
Landforms	(1) Plateau > Ridge (2) Hills > Hillslope
Runoff class	Low to high
Flooding frequency	None
Ponding frequency	None
Elevation	305–610 m
Slope	1–8%
Aspect	Aspect is not a significant factor

Climatic features

The climate for MLRA 82A is humid subtropical and is characterized by hot summers and relatively mild winters. The average first frost should occur around November 11 and the last freeze of the season should occur around March 21.

The average relative humidity in mid-afternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible during the summer and 50 percent in winter. The prevailing wind direction is from the south.

Approximately two-thirds of the annual rainfall occurs during the April to September period. Rainfall during this period generally falls as thunderstorms, and fairly large amounts of rain may fall in localized areas for a short period of time.

Table 3. Representative climatic features

Frost-free period (characteristic range)	210-240 days
Freeze-free period (characteristic range)	240-280 days
Precipitation total (characteristic range)	635-813 mm
Frost-free period (actual range)	210-240 days
Freeze-free period (actual range)	240-280 days
Precipitation total (actual range)	635-813 mm
Frost-free period (average)	225 days
Freeze-free period (average)	260 days
Precipitation total (average)	711 mm

Climate stations used

- (1) MASON [USC00415650], Mason, TX
- (2) LLANO [USC00415272], Llano, TX

Influencing water features

These upland sites may shed some water via runoff during heavy rain events. The presence of good ground cover and deep-rooted grasses can help facilitate infiltration and reduce sediment loss.

Wetland description

N/A

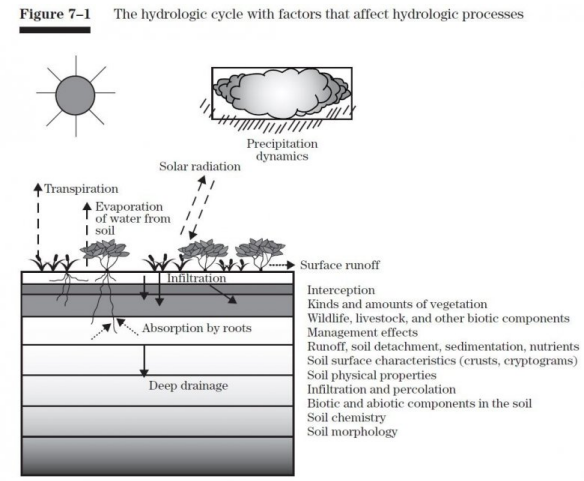


Figure 8.

Soil features

The Red Savannah ecological site has moderately deep, well drained, moderately slowly permeable soils formed in

slope alluvium over schist or schistose gneiss of Precambrian Age.

The soil series associated with the Red Savannah ecological site include Katemcy.

Table 4. Representative soil features

Parent material	(1) Slope alluvium–gneiss (2) Slope alluvium–schist
Surface texture	(1) Fine sandy loam (2) Sandy loam (3) Loam
Family particle size	(1) Fine
Drainage class	Well drained
Permeability class	Slow to moderately slow
Depth to restrictive layer	51–102 cm
Soil depth	51–102 cm
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–1%
Available water capacity (0-101.6cm)	9.14–14.99 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5.6–7.8
Subsurface fragment volume <=3" (10.2-101.6cm)	0–15%
Subsurface fragment volume >3" (10.2-101.6cm)	0–2%

Ecological dynamics

The vegetation of the Red Savannah Ecological Site developed under a humid sub-tropical climate on plains or terraces on hills. Periodic long droughts, frequent fire and grazing or browsing by endemic and nomadic wildlife helped shape the reference plant community as found by pioneers in the Texas Central Basin. The sub-tropical humid climate, coming primarily as convective storms during the warm season, favored deep-rooted vegetation. Trees, tallgrasses and shrubs were scattered along draws and deeper soil areas where soil moisture conditions are above average. Midgrasses dominated the plain and hill slope areas. The resulting reference plant community of the Red Savannah Ecological Site is a Mixed-grass Savannah Community (1.1) with tallgrasses, midgrasses, shortgrasses, perennial forbs and scattered trees.

Little bluestem is dominant along draws and deeper soils. Sideoats grama is abundant throughout. Midgrasses include Arizona cottontop, green sprangletop, plains lovegrass, vine-mesquite, and pinhole and cane bluestem. Velvet bundleflower, Engelmann’s daisy, western indigo and orange zexmania are some of many forbs found in the reference state. Shrubs include kidneywood, colubrina, bumelia, Hercules’ club pricklyash and pricklypear. The trees, primarily post oaks, shade less than five percent of the soil surface, either as small mottes or individual trees. The woody species were either resistant to fire or occupied areas where fires were less frequent or intense.

Much change in vegetation physiognomy and composition of the Red Savannah ecological site has taken place since Euro-American settlement in the mid-1800s. The ecological dynamics of the vegetation on the site has

changed considerably since the beginning of livestock husbandry and cessation of periodic intense fires. Recent climatic warming trends and increases in atmospheric carbon dioxide may be enhancing vegetation change. However, the major forces influencing the transition from the reference plant community to a woodland state on the site are heavy continuous grazing by livestock and the decrease in frequency and intensity of fire. Intense grazing by cattle, sheep and goats in the mid to late 1800s began a transition in physiognomy towards a woodland state (2.0) with increasing tree cover and woody species. Persistent dry weather also hastened the changes in plant communities. Many woody species were noted to increase following drought. Quite possibly, they had the opportunity to germinate and establish prior to the recovery of the grasses. This effect was much more pronounced on improperly grazed ranges.

As livestock and wildlife numbers increase and grazing use exceed the vegetations ability to sustain defoliation, the more palatable and generally more productive species give way to less palatable or more grazing resistant species. The more palatable mid and tallgrasses, such as little bluestem, Canada wildrye and sideoats grama, decrease and are replaced by buffalograss, plains lovegrass, curly-mesquite, cane bluestem and Texas wintergrass. The better quality forbs are replaced with less palatable species such as orange zexmenia, bluebonnet, slender verbena, purple aster and annuals. The woody species that had been kept in check by fire and grass competition increase in size and density. The plant community changes into a Midgrass Savannah Community (1.2) with invading woody species. In the Midgrass Savannah Community (1.2), ecological processes begin a change towards the woodland state. The change can be halted or reversed with proper grazing and prescribed burning. With continued overgrazing, however, the site becomes open to the invasion of woody species from adjacent sites or from increases of species that were of minor occurrence historically. Common woody invaders/increasers are mesquite, Texas colubrina, Texas persimmon, whitebrush, tasajillo, catclaw acacia and lotebush. The composition and structure change brings about a new plant community, the Shortgrass/Mixed-brush Community (2.1). The vegetation type shifts toward a woodland as shortgrasses and woody plants replace the mid and tallgrasses. This phase was recognized by ranchers for its advantage to browsers so historically, goat and sheep husbandry increased along with cattle and white-tailed deer. This continued overgrazing and the accompanying decrease in frequency and intensity of fires caused the plant community to continue the transition toward a dense woodland plant community.

If the combination of heavy continuous grazing and decrease in fires continue as it generally did, oaks and mesquite along with unpalatable shrubs become dominant to the detriment of the herbaceous plants. Understory shrubs, such as catclaw acacia, colubrina, whitebrush and pricklypear increase. Buffalograss, curly-mesquite, threeawns, tridens and Texas wintergrass replace the midgrasses and less preferred forbs replace the palatable climax forbs.

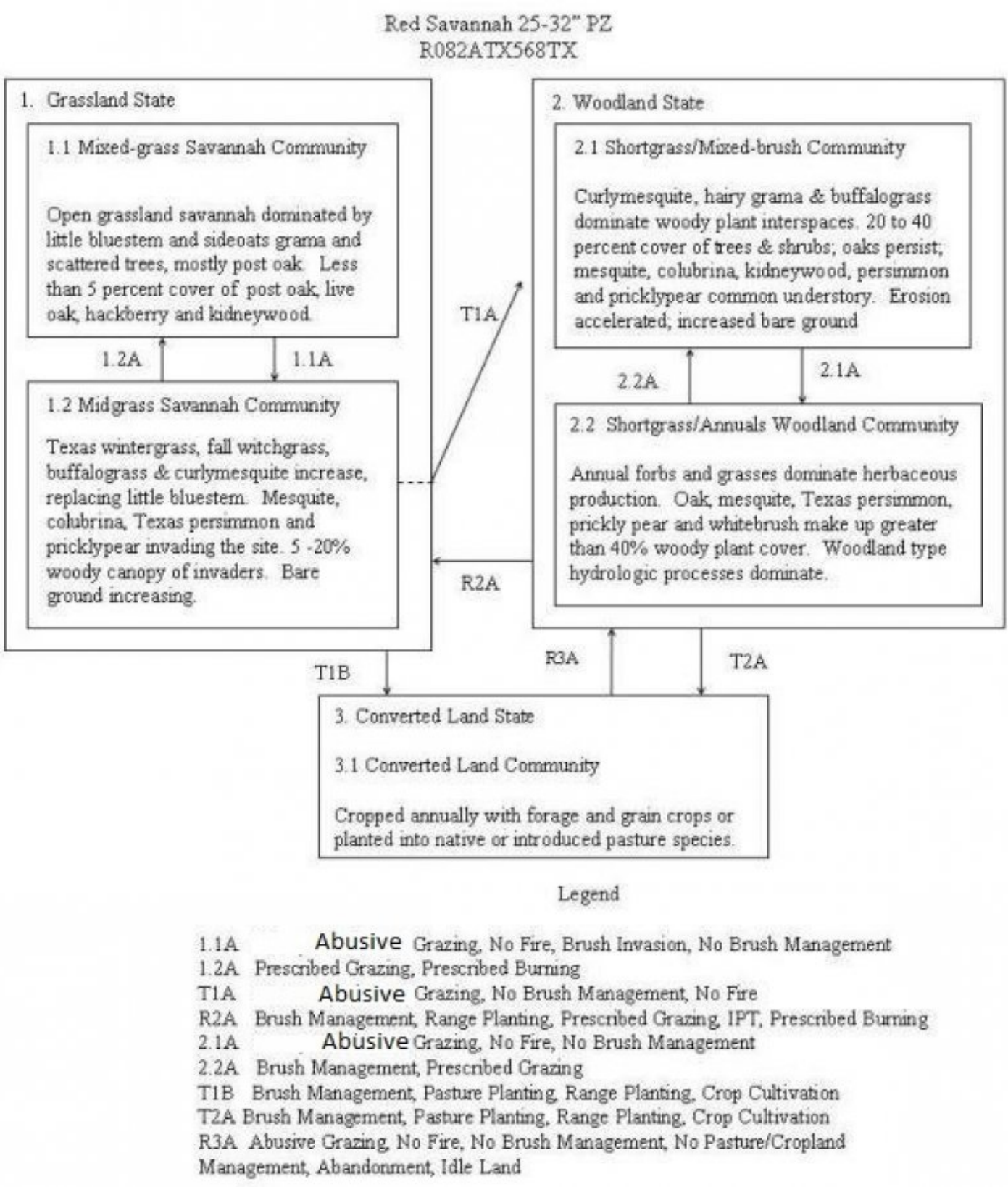
Loss of herbaceous cover and increased bare ground precludes effective burning and allows accelerated erosion. Soil organic matter and soils structure decline as less vegetative matter is added to the soil. Soil and litter movement will occur during flood-producing rains. Water infiltration into the soil decreases. When woody plant canopy reaches 20 to 25 percent and grasses provide less than 50 percent of the herbage production, the transition from the Midgrass Savannah Community (1.2) to a Shortgrass/Mixed-Brush Community (2.1) is complete. At this point, there is generally not enough fine fuel produced by the grassland component to control the woody plants with prescribed burning. Once this threshold is reached in the transition, proper grazing management and prescribed burning alone cannot reverse the transition from the grassland state. Intensive, and usually expensive, brush control practices must be applied to reverse the transition to a dense woodland community.

With time and continued overgrazing by livestock and deer, oaks, mesquite and/or juniper eventually become so dominant in a Woodland/Shortgrass/Annuals Community (2.2) that only remnants of grassland vegetation remain in the interspaces. The understory and interspaces support remnants of reference vegetation, which is generally in low vigor and productivity due to shading and competition for water and nutrients. Desertification including erosion, loss of soil organic matter and more xeric microclimate conditions prevail until the woodland matures. The Woodland/Shortgrass/Annuals (2.2) community cannot be restored to a Grassland State (1.0) without extensive brush management, range planting and prescribed grazing conservation practices.

The following diagram suggests some pathways that the vegetation on this site might take. There may be other states not shown in the diagram. This information is intended to show what might happen in a given set of circumstances; it does not mean that this would happen the same way in every instance. Local professional guidance should always be sought before pursuing a treatment scenario.

State and Transition Model:

State and transition model



State 1
Grassland State

Historically, trees, tallgrasses and shrubs were scattered along draws and deeper soil areas where soil moisture conditions are above average. Midgrasses dominated the plain and hillslope areas. The resulting plant community of the Red Savannah Ecological Site was a Mixed-grass Savannah Community (1.1) with tallgrasses, midgrasses,

shortgrasses, perennial forbs and scattered trees. The Midgrass Savannah Community (1.2) is midgrass dominated savannah being encroached by indigenous or invading woody species that had been held at low densities by repeated fires, browsing by wildlife and competition from a vigorous grass component. Numerous woody species, including bumelia, pricklypear, kidneywood and mesquite, are increasing in density because overgrazing by livestock has reduced grass cover, exposed some soil and reduced fine fuel for fire.

Dominant plant species

- oak (*Quercus*), tree
- little bluestem (*Schizachyrium scoparium*), grass
- sideoats grama (*Bouteloua curtipendula*), grass

Community 1.1
Mixed-grass Savannah Community

Figure 9. 1.1 Mixed-grass Savannah Community

The reference plant community for this site was a grassland savannah composed of mostly midgrasses with tallgrasses and scattered trees and shrubs along draws. The Mixed-grass Savannah Community (1.1) is the interpretive plant community for this site. It evolved under the influence of grazing, periodic fire and a subtropical climate. Wildfires set either by Indians or lightning, occurred at 7 to 12 year intervals (Frost 1998). Woody plants, consisting of scattered trees or shrub mottes, shade less than 5 percent of the site. Post oak, live oak, hackberry and shrubs such as catclaw acacia, kidneywood, pricklyash, Texas persimmon, colubrina, hoptree, algerita, bumelia and pricklypear are likely present but are kept suppressed by periodic fires, droughts and competition from grassland vegetation. Above ground primary plant production ranges from 1000 to 3500 pounds per year. The grassland component accounts for 90 to 95 percent of the sites primary production, with little bluestem and sideoats grama the most abundant and productive species. Indiangrass is confined to draws and wetter areas. Secondary midgrasses are Arizona cottontop, cane bluestem, green sprangletop, plains lovegrass, Canada wildrye and Texas wintergrass. Shortgrasses, like buffalograss, curlymesquite, hairy grama and sand dropseed are present in small amounts. Engelmann’s daisy, catclaw sensitivebriar, bundleflower, western indigo and orange zexmenia are a few of the small but important forb component of the plant community (See Plant Community Composition and Annual Production table below for postulated composition). Runoff and erosion from the site is slight due to abundant grass cover, gentle slopes, litter and good soil structure. The vegetative ground cover helps disperse and slow down runoff, thus holding soil in place and enhancing infiltration. Concentrated water flow patterns are rare in this plant community. The Mixed-grass Savannah Community (1.1) is resilient and stable under pre-settlement conditions, but overgrazing by livestock in the early to mid-1800s started a transition from open savannah grassland toward woody plant dominated vegetation on some sites. Overstocking and reduction of periodic fires can cause the demise of the Mixed-grass Savannah Community. Without proper grazing management that adjusts animal numbers based on annual forage production, and judicious prescribed burning, this plant community transitions into a Midgrass Savannah Community (1.2).

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1009	2724	3531
Forb	56	151	196
Tree	34	91	118
Shrub/Vine	22	61	78
Total	**1121**	**3027**	**3923**

Figure 11. Plant community growth curve (percent production by month). TX4410, Mid/Tallgrass Oak Savannah with <5% Woody Canopy. Mid and tallgrasses with oak savannah having less than 5% woody canopy cover..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2	3	5	13	23	15	4	5	15	7	5	3

Community 1.2
Midgrass Savannah Community

Figure 12. 1.2 Midgrass Savannah Community

The Midgrass Savannah Community (1.2) is midgrass dominated savannah being encroached by indigenous or invading woody species that had been held at low densities by repeated fires, browsing by wildlife and competition from a vigorous grass component. Numerous woody species, including bumelia, pricklypear, kidneywood and mesquite, are increasing in density because overgrazing by livestock has reduced grass cover, exposed some soil and reduced fine fuel for fire. The woody canopy varies between 5 and 20 percent depending on the severity of grazing, time since last burned and availability of invading species. Typically, oaks increase in size and mesquite increases in density. Less preferred brushy species such as Texas persimmon, condalia, pricklypear, colubrina, catclaw acacia and tasajillo also increase or invade. The preferred tallgrasses are being replaced by the more grazing resistant midgrasses. Sideoats grama and little bluestem persist but in lesser amounts. Other characteristic grasses are vine mesquite, Arizona cottontop, plains lovegrass and the feathery bluestems. Most of the perennial forbs found in the reference communtiy remain in this plant community, but less palatable forbs are increasing. In this phase, the increasing woody species are generally less than five feet tall and are subject to control by improved grazing management, prescribed burning or individual plant treatments (IPT). Annual primary production ranges from 800 to 3000 pounds per acre depending on precipitation amounts and the soil series. Forage production is still predominantly by grass species. Heavy continuous grazing has reduced plant cover, litter and mulch and has increased bare ground exposing the soil to water erosion. There could be some mulch and litter movement during rainstorms but due to gentle slopes and grass cover, little soil movement would take place in this vegetation type. The Midgrass Savannah Community (1.2) on this site provides good forage for livestock and habitat for wildlife. Maintaining the site in this vegetation type with managed grazing and periodic prescribed burning is a good option for all types of livestock and wildlife production. If overstocking continues, however, the mid-grasses give way to short-grasses and annuals. The changes in species composition are small initially, but unless proper grazing and prescribed burning are applied; the woody species will continue to increase in size and density. When the canopy of the woody plants becomes dense enough (20 %) and tall enough (>5 feet) to suppress grass growth and resist fire

damage, a threshold in ecological succession is crossed. The Midgrass Savannah Community (1.2) transitions into the Shortgrass/Mixed-brush Community (2.1).

Table 6. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	717	1849	2522
Shrub/Vine	135	370	504
Tree	45	123	168
Forb	45	123	168
Total	**942**	**2465**	**3362**

Figure 14. Plant community growth curve (percent production by month). TX4411, Midgrass Savannah with Woody Encroachment. Midgrass Savannah with Woody Encroachment..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	3	5	13	22	15	5	3	15	7	5	4

Pathway 1.1A
Community 1.1 to 1.2

Mixed-grass Savannah Community

Midgrass Savannah Community

Conversion of Mixed-grass Savannah Community to the Midgrass Savannah Community. Major driver forces include Abusive Grazing, No Fire, Brush Invasion, and No Brush Management.

Pathway 1.2A
Community 1.2 to 1.1

Midgrass Savannah Community

Mixed-grass Savannah Community

Conversion of Midgrass Savannah Community back to the Mixed-grass Savannah Community. Conservation Practices that can help with the plant community transition include Prescribed Grazing and Prescribed Burning. In this phase, the increasing woody species are generally less than five feet tall and are subject to control by improved grazing management, prescribed burning or individual plant treatments (IPT) in order to return to community 1.1.

Conservation practices

Prescribed Burning
Prescribed Grazing
Planned Grazing System

State 2
Woodland State

The Shortgrass/Mixed-brush Community (2.1) is the result of long-term overgrazing by livestock, the reduction or elimination of fire and little, if any, brush management. Oak and/or mesquite dominate this community. Mesquite has generally increased in density and stature. The Shortgrass/Annuals Woodland Community (2.2) is the result of continuous overgrazing and no brush management. It is the mature stage of the Woodland State (2.0). Mesquite generally dominates the vegetation structure because most oaks have been removed and are unable to regenerate under prevailing conditions.

Dominant plant species

- oak (*Quercus*), tree
- mesquite (*Prosopis*), tree
- pricklypear (*Opuntia*), shrub
- threeawn (*Aristida*), grass

Community 2.1
Shortgrass/Mixed-brush Community

Figure 15. 2.1 Shortgrass/Mixed-brush Community

The Shortgrass/Mixed-brush Community (2.1) is the result of long-term overgrazing by livestock, the reduction or elimination of fire and little, if any, brush management. Oak and/or mesquite dominate this community. Mesquite has generally increased in density and stature. Common understory shrubs are mesquite seedlings, pricklypear, algerita, condalia, Texas persimmon, whitebrush, catclaw acacia and pricklyash. Characteristic grasses are Texas wintergrass, curlymesquite, buffalograss and cedar sedge. Characteristic forbs include Texas bluebonnet, yarrow, orange zexmenia, western ragweed, prairie coneflower, silky evolvolus, filaree and coneflower. With continued overgrazing, either by livestock or deer, the brush canopy increases in density and thickens while shortgrasses such as three-awns, red grama, hairy tridens and annuals increase and the midgrasses decrease. Annual primary production varies from 800 to 3000 pounds per acre. Grasses and forbs generally make up less than 60 percent of the annual herbage production. The tree and mixed-brush overstory can reach 20 to 40 percent ground cover and produce 20 to 40 percent of the annual production. This community provides food and cover for wildlife, but preferred forage for livestock is becoming limited. Returning the Shortgrass/Mixed-brush Community (2.1) to a Midgrass Savannah Community (1.2) or maintaining its composition and structure is difficult, but can be done. Proper stocking through control of livestock and deer numbers plus brush management is necessary. Without brush management, this type continues a transition toward a Shortgrass/Annuals Woodland Community (2.2) regardless of livestock grazing management practiced.

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	448	1233	1681
Shrub/Vine	224	616	841
Tree	135	370	504
Forb	90	123	336
Total	**897**	**2342**	**3362**

Figure 17. Plant community growth curve (percent production by month). TX4412, Shortgrass/Mixed-brush Community. Shortgrass dominant with mixed-brush species..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	3	5	13	22	15	5	3	15	7	5	4

Community 2.2
Shortgrass/Annuals Woodland Community

Figure 18. 2.2 Shortgrass/Annuals Woodland Community

The Shortgrass/Annual Woodland Community (2.2) is the result of continuous overgrazing and no brush management. It is the mature stage of the Woodland State (2.0). Mesquite generally dominates the vegetation structure because most oaks have been removed and are unable to regenerate under prevailing conditions. Where oaks have not been removed they are co-dominant with mesquite. Common understory shrubs for this plant community are pricklypear, algerita, condalia, Texas persimmon, colubrina, whitebrush, Hercules‘ club pricklyash, and catclaw acacia. Shortgrasses and low-quality annuals occupy the woody plant interspaces and cool-season grasses are found within the woody canopy. Characteristic grasses are three-awns, hairy grama, red grama, Texas grama, and hairy tridens. Texas wintergrass and cedar sedge may persist in the understory. Common forbs include prairie coneflower, orange zexmenia, slender verbena, silky evolvolus, western ragweed, wild buckwheat, aster and annuals. Annual primary production varies from 1000 to 3000 pounds per acre. Grasses and forbs make up 25 percent or less of the annual herbage production. The tree/mixed-brush overstory can reach 70 to 80 percent ground cover and produce 70 percent or more of the annual production. Although this state provides cover for wildlife, only limited preferred forage or browse is available for livestock or wildlife. The shrub layer is usually made up of low preference browse species. This plant type will continue to thicken until it stabilizes within the present climate regime and soil. Without intensive brush control and management inputs, this plant community cannot be reversed. Returning the Shortgrass/Annuals Woodland Community (2.2) back to a Grassland State (1.0) requires extensive and expensive reclamation practices. Mechanical and/or chemical brush control must be followed by revegetation, prescribed grazing and prescribed burning practices. Land use other than livestock production might dictate alternative reclamation approaches to create the plant community that best fits the landowner’s intended use.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Tree	448	986	1345
Shrub/Vine	336	740	1009
Grass/Grasslike	224	493	673
Forb	112	247	336
Total	**1120**	**2466**	**3363**

Figure 20. Plant community growth curve (percent production by month). TX4413, Shortgrass/Annuals Woodland Community. Woodland community with shortgrasses and annuals..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
3	3	7	13	20	15	7	5	10	7	5	5

Pathway 2.1A
Community 2.1 to 2.2

Shortgrass/Mixed-brush Community

Shortgrass/Annuals Woodland Community

The Shortgrass/Mixed-brush Community (2.1) is the result of long-term overgrazing by livestock, the reduction or elimination of fire and little, if any, brush management. Oak and/or mesquite dominate this community. Without brush management, this type continues a transition toward a Shortgrass/Annuals Woodland Community (2.2) regardless of livestock grazing management practiced.

Pathway 2.2A
Community 2.2 to 2.1

Shortgrass/Annuals Woodland Community

Shortgrass/Mixed-brush Community

The Shortgrass/Annuals Woodland Community (2.2) can transition to the Shortgrass/Mixed-brush Community (2.1) with the implementation of Brush Management and Prescribed Grazing conservation practices.

Conservation practices

Brush Management
Prescribed Grazing
Planned Grazing System

State 3
Converted Land State

The Converted Land State is the composite of two land uses: pastureland and cropland. Pastureland is converted into native and introduced pasture species. Cropland is converted into cool and warm-season forage and small grain crops. This conversion requires intensive management inputs such as brush management, pasture/range

planting, and crop cultivation.

Dominant plant species

- Bermudagrass (*Cynodon dactylon*), grass
- kleingrass (*Panicum coloratum*), grass

Community 3.1
Converted Land Community

The Converted Land community is the composite of two land uses: native and introduced grass species pastureland and cropland. Pastureland is converted into native and introduced pasture species. Cropland is converted into cool and warm-season forage and small grain crops. This conversion requires intensive management inputs such as brush management, pasture/range planting, and crop cultivation. This community can also revert back to the Woodland State by Heavy Continuous Grazing, No Fire, No Brush Management, No Pasture/Cropland Management, Abandonment and Idle Land.

Figure 21. Plant community growth curve (percent production by month). TX4400, Cool-season Small Grain. Community planted into cool-season grasses such as wheat and oats..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5	5	10	10	5	0	0	0	20	25	15	5

Figure 22. Plant community growth curve (percent production by month). TX4401, Warm-Season Cropland. Community planted into warm-season crops such as forage sorghum..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	8	20	25	20	10	10	5	2	0	0

Figure 23. Plant community growth curve (percent production by month). TX4402, Pastureland Community. Warm-season native and introduced grass species such as kleingrass, blue pancium, and weeping lovegrass..

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2	2	18	23	17	6	4	16	6	3	2

Transition T1A
State 1 to 2

The transition between the Grassland State and the Woodland State is dramatic. Heavy Continuous Grazing, No Brush Management, and No Fire are several of the key driving forces in creating the plant functional group shift from Grassland to Shrubland State. The changes in species composition are small initially, but unless proper grazing and prescribed burning are applied; the woody species will continue to increase in size and density. When the canopy of the woody plants becomes dense enough (20 %) and tall enough (>5 feet) to suppress grass growth and resist fire damage, a threshold in ecological succession is crossed.

Transition T1B
State 1 to 3

The transition from the Grassland State (1.0) to the Converted Land State (3.0) requires intensive management inputs such as Brush Management, Pasture Planting, Range Planting, and Crop Cultivation. Land use other than livestock production might dictate alternative reclamation approaches to create the plant community that best fits the landowner’s intended use.

Restoration pathway R2A
State 2 to 1

The transition from the Woodland State (2.0) to the Grassland State (1.0) requires intensive management inputs.

Without intensive brush control and management inputs, this plant community cannot be reversed. Returning from the Woodland State (2.0) back to a Grassland State (1.0) requires extensive and expensive reclamation practices. Mechanical and/or chemical brush control must be followed by revegetation, prescribed grazing and prescribed burning practices.

Conservation practices

Brush Management
Prescribed Burning
Prescribed Grazing
Range Planting
Planned Grazing System

Transition T2A
State 2 to 3

The transition from the Woodland State (2.0) to the Converted Land State (3.0) requires intensive management inputs such as Brush Management, Pasture Planting, Range Planting, and Crop Cultivation. Land use other than livestock production might dictate alternative reclamation approaches to create the plant community that best fits the landowner's intended use.

Transition T3A
State 3 to 2

The transition from the Converted Land State (3.0) to the Woodland State (2.0) is the result of implementing abusive grazing pressure, no fires, no brush management, no pastureland/cropland management, no pest or nutrient management, land abandonment, and idle land. This plant type will continue to thicken until it stabilizes within the present climate regime and soil. Without intensive brush control and management inputs, this plant community cannot be reversed to a grassland or woodland state.

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Tallgrasses**			785–1121	
	little bluestem	SCSC	*Schizachyrium scoparium*	768–1104	–
	Indiangrass	SONU2	*Sorghastrum nutans*	45–67	–
2	**Midgrasses**			538–673	
	sideoats grama	BOCU	*Bouteloua curtipendula*	538–673	–
3	**Midgrasses**			673–841	
	cane bluestem	BOBA3	*Bothriochloa barbinodis*	84–106	–
	Arizona cottontop	DICA8	*Digitaria californica*	84–106	–
	plains lovegrass	ERIN	*Eragrostis intermedia*	84–106	–
	green sprangletop	LEDU	*Leptochloa dubia*	84–106	–
	vine mesquite	PAOB	*Panicum obtusum*	84–106	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	84–106	–
	Texas fluffgrass	TRTE2	*Tridens texanus*	84–106	–
4	**Shortgrasses**			269–336	
	purple threeawn	ARPU9	*Aristida purpurea*	17–22	–

	Wright's threeawn	ARPUW	*Aristida purpurea var. wrightii*	17–22	–
	buffalograss	BODA2	*Bouteloua dactyloides*	17–22	–
	hairy grama	BOHI2	*Bouteloua hirsuta*	17–22	–
	hooded windmill grass	CHCU2	*Chloris cucullata*	17–22	–
	tumble windmill grass	CHVE2	*Chloris verticillata*	17–22	–
	fall witchgrass	DICO6	*Digitaria cognata*	17–22	–
	hairy woollygrass	ERPI5	*Erioneuron pilosum*	17–22	–
	red lovegrass	ERSE	*Eragrostis secundiflora*	17–22	–
	sand lovegrass	ERTR3	*Eragrostis trichodes*	17–22	–
	curly-mesquite	HIBE	*Hilaria belangeri*	17–22	–
	Hall's panicgrass	PAHA	*Panicum hallii*	17–22	–
	large-spike bristlegrass	SEMA5	*Setaria macrostachya*	17–22	–
	lovegrass tridens	TRER	*Tridens eragrostoides*	17–22	–
	slim tridens	TRMU	*Tridens muticus*	17–22	–
5	**Cool-season grasses**			129–157	
	Canada wildrye	ELCA4	*Elymus canadensis*	67–90	–
	Texas wintergrass	NALE3	*Nassella leucotricha*	17–45	–
	Texas bluegrass	POAR	*Poa arachnifera*	6–17	–
	sedge	CAREX	*Carex*	0–6	–
Forb					
6	**Forbs**			129–174	
	Forb, annual	2FA	*Forb, annual*	6–17	–
	Indian mallow	ABUTI	*Abutilon*	6–17	–
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	6–17	–
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	6–17	–
	white sagebrush	ARLUM2	*Artemisia ludoviciana ssp. mexicana*	6–17	–
	aster	ASTER	*Aster*	6–17	–
	bundleflower	DESMA	*Desmanthus*	6–17	–
	buckwheat	ERIOG	*Eriogonum*	6–17	–
	dwarf morning-glory	EVOLV	*Evolvulus*	6–17	–
	blazing star	LIATR	*Liatris*	6–17	–
	Texas lupine	LUTE	*Lupinus texensis*	6–17	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	6–17	–
	groundcherry	PHYSA	*Physalis*	6–17	–
	upright prairie coneflower	RACO3	*Ratibida columnifera*	6–17	–
	globemallow	SPHAE	*Sphaeralcea*	6–17	–
	vervain	VERBE	*Verbena*	6–17	–
Shrub/Vine					
7	**Shrubs/Vines**			54–67	
	catclaw acacia	ACGR	*Acacia greggii*	4–8	–
	nakedwood	COLUB	*Colubrina*	4–8	–
	Texas persimmon	DITE3	*Diospyros texana*	4–8	–

	jointfir	EPHED	*Ephedra*	4–8	–
	stretchberry	FOPU2	*Forestiera pubescens*	4–8	–
	algerita	MATR3	*Mahonia trifoliolata*	4–8	–
	pricklypear	OPUNT	*Opuntia*	4–8	–
	hoptree	PTELE	*Ptelea*	4–8	–
	bully	SIDER2	*Sideroxylon*	4–8	–
	greenbrier	SMILA2	*Smilax*	4–8	–
	Hercules' club	ZACL	*Zanthoxylum clava-herculis*	4–8	–
Tree					
8	**Trees**			78–101	
	hackberry	CELTI	*Celtis*	6–17	–
	walnut	JUGLA	*Juglans*	6–17	–
	honey mesquite	PRGL2	*Prosopis glandulosa*	6–17	–
	blackjack oak	QUMA3	*Quercus marilandica*	6–17	–
	post oak	QUST	*Quercus stellata*	6–17	–
	live oak	QUVI	*Quercus virginiana*	6–17	–
	western soapberry	SASAD	*Sapindus saponaria var. drummondii*	6–17	–
	elm	ULMUS	*Ulmus*	6–17	–

Animal community

Many types of grassland insects, reptiles, birds and mammals frequent the site, either as their base habitat or maneuvering from the adjacent sites. Small mammals include many kinds of rodents, jackrabbit, cottontail rabbit, raccoon, skunk, opossum and armadillo. Predators include coyote, fox, bobcat and occasionally mountain lion. One predator that was eliminated in the 1960s is the screwworm. The screwworm fed on fresh wounds and no doubt had a role in limiting deer numbers and causing a great negative economic impact on livestock operations. Game birds, songbirds, and birds of prey were indigenous or frequent users. Most are still plentiful. Native white-tailed deer and many species of exotic deer now utilize the Red Savannah site in its various states. Various species of exotic wildlife have been introduced in the region. Their numbers must be included along with livestock and native wildlife, primarily white-tailed deer, in any conservation plan. Feral hogs may also be present on the site. They can be damaging to the plant community if their numbers are not managed. Deer, turkey and quail particularly favor the habitat provided by the Midgrass Savannah (1.2) and Shortgrass/Mixed-brush (2.1) communities.

The site is suitable for the production of livestock, including cattle, sheep and goats. In reference condition, the site is very suited to primary grass eaters such as cattle. As retrogression occurs and woody plants invade, the Midgrass savannah (1.2) and Shortgrass/Mixed-brush (2.1) plant communities become good habitat for sheep, goats, deer and other wildlife because of the desirable browse and cool season grasses. Cattle, sheep and goats should be stocked in proportion to the available grass, forb and browse forage, keeping deer competition for forbs and browse in mind. Deer populations must also be kept within limits of the habitat sustainability even if the site is managed exclusively for deer. If the animal numbers are not kept in balance with herbage and browse production through prescribed grazing management and good wildlife population management, the Shortgrass/Annuals Woodland Community (2.2) will have little to offer as habitat except cover.

Plant Preference by Animal Kind:
This rating system provides general guidance as to animal preference for plant species. It also indicates possible competition between kinds of herbivores for various plants. Grazing preference changes from time to time, especially between seasons, and between animal kinds and classes. Grazing preference does not necessarily reflect the ecological status of the plant within the plant community. For wildlife, plant preferences for food, and plant suitability for cover are rated. Refer to habitat guides for a more complete description of a species habitat needs.

Legend: P=Preferred D=Desirable U=Undesirable N=Not Consumed T=Toxic X=Used, but not degree of utilization

unknown
Preferred – Percentage of plant in animal diet is greater than it occurs on the land
Desirable – Percentage of plant in animal diet is similar to the percentage composition on the land
Undesirable – Percentage of plant in animal diet is less than it occurs on the land
Not Consumed – Plant would not be eaten under normal conditions. It is only consumed when other forages not available.
Toxic – Rare occurrence in diet and, if consumed in any tangible amounts results in death or severe illness in animal.

Hydrological functions

The climate affecting the hydrology of the Red Savannah Ecological Site is humid subtropical with approximately two-thirds of annual rainfall occurring during the April to October growing season. Rainfall during this period generally comes as thunderstorms and large amounts of rain may fall in a short time. The site warms up early but is very droughty in the summer months and warm-season grasses grow very little after June even if it rains. Water movement to underground layers is moderately high, contributing to the recharge of aquifers and sustained stream flow. The site is well drained. Runoff is moderate, with good cover, but on steeper slopes erosion could be a hazard with excessive defoliation in the Shortgrass/Mixed-brush (2.1) type.

Under the reference condition, the grassland vegetation intercepted and utilized much of the incoming rainfall in the soil solum. Only during extended rains or heavy thunderstorms was there much runoff. Litter and soil movement was slight. Standing plant cover, duff and organic matter decrease and surface runoff increase as the Mixed-grass Savannah Community (1.1) transitions to the Midgrass Savannah (1.2). These processes continue in the interstitial spaces in the Shortgrass/Mixed-brush Community (2.1). The woody plants compete for moisture with the remaining grasses and forbs further reducing production and ground cover in openings. Decreased litter and more bare ground allow erosion from soils in openings between trees in this phase. Once the Shortgrass/Annuals Woodland Community (2.2) canopy surpasses 50 percent, the hydrology and ecological processes, nutrient cycling and energy flow, stabilize within the woody plant canopy (Thurow 1991).

Recreational uses

The Red Savannah Site is well suited for many outdoor recreational uses including recreational hunting, hiking, camping, equestrian and bird watching. This site along with adjacent Loamy Bottomland site provides diverse scenic beauty and many opportunities for recreation and hunting.

Wood products

Posts and specialty wood products are made from mesquite, oak and many shrubs. Mesquite and oak are used for firewood and charcoal.

Other products

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

Inventory data references

Information presented was derived from the revised Red Savannah Range Site, literature, limited NRCS clipping data (417s), field observations and personal contacts with range-trained personnel. Photos by J.L. Schuster.

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Acknowledgments

Site Development and Testing Plan:

Future work, as described in a Project Plan, to validate the information in this Provisional Ecological Site Description is needed. This will include field activities to collect low, medium and high-intensity sampling, soil correlations, and analysis of that data. Annual field reviews should be done by soil scientists and vegetation specialists. A final field review, peer review, quality control, and quality assurance reviews of the ESD will be needed to produce the final document. Annual reviews of the Project Plan are to be conducted by the Ecological Site Technical Team.

QC/QA completed by:
Bryan Christensen, SRESS, NRCS, Temple, TX
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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)	Mark Moseley, RMS, NRCS, San Antonio, Texas
Contact for lead author	Zone Rangeland Management Specialist, San Angelo, Texas 325-944-0147
Date	12/23/2008
Approved by	Bryan Christensen
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None to Slight.

2. **Presence of water flow patterns:** Water flow patterns are uncommon. Any follow drainages.

3. **Number and height of erosional pedestals or terracettes:** None to slight. Uncommon on this site.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 0-5%.

5. **Number of gullies and erosion associated with gullies:** Few. Should be vegetated.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None.

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

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

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** 0-8 inche thick, loam, brown, weak fine and very fine subangular blocky structure. SOM 0-3%.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Open prairie grassland in HCPC allows moderate infiltration and reduced 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):** None.

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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: Warm-season midgrasses >

    Sub-dominant: Warm-season tallgrasses >

    Other: Cool-season grasses > Forbs > Shrubs/vines > Trees

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Perennial grasses will naturally exhibit a minor amount (less than 5%) of senescence and some mortality every year.

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14. **Average percent litter cover (%) and depth (in):** Litter is primarily herbaceous.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1000 to 3500# per year.

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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:** Mesquite, pricklypear, lotebush and tasajillo.

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17. **Perennial plant reproductive capability:** All perennial species should be capable of reproducing every year unless disrupted by extended drought, overgrazing, wildfire, insect damage, or other events occuring immediately prior to, or during the reproductive phase.
