

Ecological site R042AC255TX **Sandstone Hill and Mountain, Desert Grassland**

Last updated: 8/10/2020
 Accessed: 05/13/2025

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.

Associated sites

R042AC244TX	Gravelly, Desert Grassland Can be adjacent to and in a lower position.
R042AB586TX	Sandstone Hill and Mountain, Hot Desert Shrub Located on south facing slopes along the transition between Desert Grassland and Hot Desert Shrub vegetative zones. An indicator of the Hot Desert Shrub site is the presence of chino grama as the dominant grass.

Similar sites

R042AC249TX	Limestone Hill and Mountain, Desert Grassland Species composition and production will vary but physiographic features are similar.
-------------	--

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

The site occurs on gently sloping to steep sandstone hills, mountains, and ridges. Slopes range from 3 to about 60 percent. Runoff is low on 3 to 5 percent slopes, medium on slopes of 5 to 20 percent, and high to very high on slopes greater than 20 percent. Aspect influences plant composition and production.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Mountain (3) Ridge
Flooding duration	Very brief (4 to 48 hours)
Flooding frequency	Rare to occasional
Ponding frequency	None
Elevation	1,067–1,524 m

Slope	3–60%
Aspect	N, S

Climatic features

The average annual precipitation ranges from 12 to 14 inches and highly variable from 3 to 32 inches. Approximately 75 percent of the precipitation occurs as widely scattered thunderstorms of high intensity and short duration during the summer. Occasional precipitation occurs as light rainfall during the cool season. Negligible amounts of precipitation falls in the form of sleet or snow.

The optimum growing season ranges from July 1 through September, but is governed by time and amount of rainfall. Although frost-free days begin in April, sufficient moisture for growing plants to reach maturity is usually not available until late summer or early fall. Mean annual air temperature is 64° F. Daytime temperatures near 100° F are common from May through August. The prevailing wind is from the southwest. Average wind speed is highest, around 11 miles per hour, in March and April.

The combination of low rainfall and relative humidity, warm temperatures, and high solar radiation creates a significant moisture deficit. The annual Class-A pan evaporation is approximately 85 inches.

Table 3. Representative climatic features

Frost-free period (average)	232 days
Freeze-free period (average)	255 days
Precipitation total (average)	356 mm

Influencing water features

None.

Soil features

The site consists of very shallow to shallow, well drained, gravelly and loamy soils that formed in both residuum and colluvium weathered from sandstone bedrock. In addition to sandstone, the Buckear series will also have soils weathered from shale. Outcrops of tilted, strongly cemented sandstone and large sandstone boulders are common. Depth to root restricting layer ranges from 8 to 20 inches. The soils are well drained and have a low water holding capacity.

The site consists of very shallow to shallow, well drained, gravelly and loamy soils that formed in both residuum and colluvium weathered from sandstone bedrock. In addition to sandstone, the Buckear series will also have soils weathered from shale. Outcrops of tilted, strongly cemented sandstone and large sandstone boulders are common. Depth to root restricting layer ranges from 8 to 20 inches. The soils are well drained and have a low water holding capacity.

Associated soil series for the Sandstone Hill & Mountain ecological site include: Allamore, Beach, Buckear, and Coyanosa.

Table 4. Representative soil features

Parent material	(1) Residuum–sandstone
Surface texture	(1) Very gravelly loam (2) Very cobbly loam (3) Very gravelly fine sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained

Permeability class	Very slow to slow
Soil depth	10–51 cm
Surface fragment cover ≤3"	25–60%
Surface fragment cover >3"	10–25%
Available water capacity (0–101.6cm)	2.54 cm
Calcium carbonate equivalent (0–101.6cm)	0–30%
Electrical conductivity (0–101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0–101.6cm)	0
Soil reaction (1:1 water) (0–101.6cm)	6.6–8.4
Subsurface fragment volume ≤3" (Depth not specified)	30–55%
Subsurface fragment volume >3" (Depth not specified)	5–15%

Ecological dynamics

The reference plant community for the Sandstone Hill & Mountain (Desert Grassland) ecological site is characterized by bunch and stoloniferous mid and shortgrasses associated with a diverse variety of woody shrubs and forbs. Species composition and production varies with the interaction of yearly weather conditions, aspect, elevation, geologic attributes, and the natural variability of the soils.

Probably the factor that most influenced the historic vegetative composition of the site was extended dry weather. High rainfall events did occur but were sporadic. The perennial grasses dominating the site could survive the periodic droughts as long as the density of woody plants did not become excessive, and top-removal of the grass plants did not occur too frequently. Overgrazing amplifies the effects of drought. Insects, rodents, infrequent fire, and herbivores such as mule deer and desert bighorn sheep were also present. Bison were not documented in the historical record as being present in any significant amount. A lack of sufficient water and rough terrain were probably contributing factors.

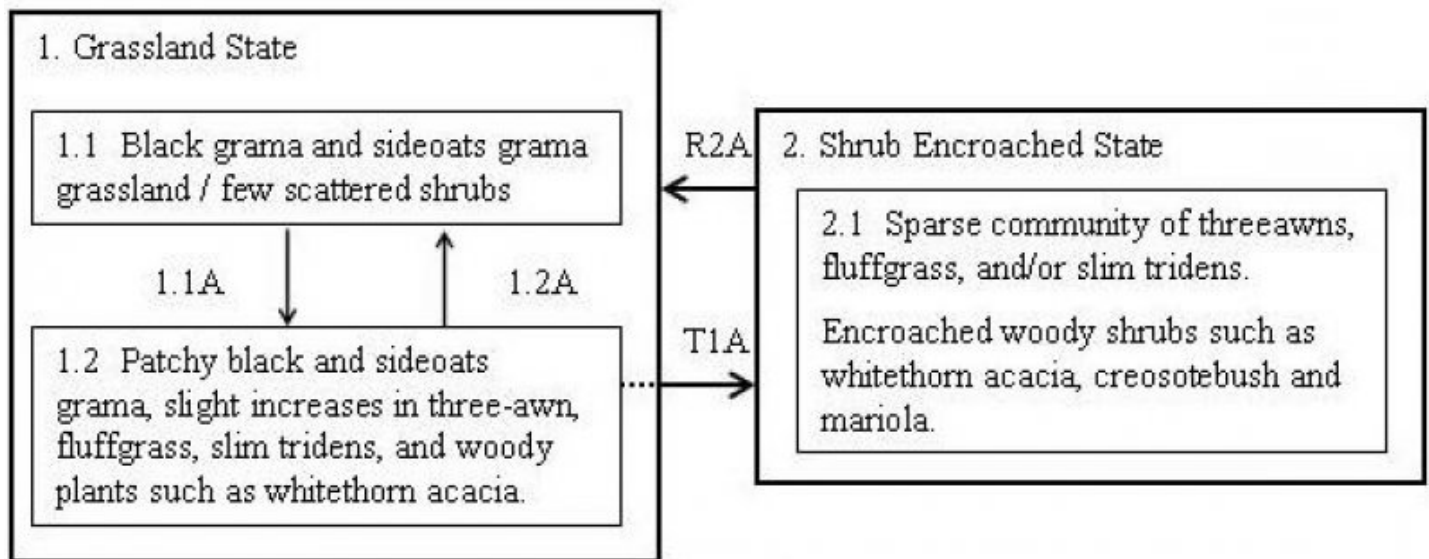
Extensive ranching activity by settlers began in the Trans-Pecos region in the late 1800s. The majority of the domestic livestock grazing during that time were cattle, sheep, and goats. Some historical accounts document ranches with stocking rates as high as one animal unit per four acres; this was far from sustainable in this environment. High stocking rates combined with multiyear droughts deteriorated the condition of rangelands in many parts of the Trans-Pecos region.

Within the Sandstone Hill & Mountain ecological site, improper grazing management will lead to transitions in grass species composition and an increase in shrubs. Ecological processes such as water and nutrient cycles may also be affected by improper grazing management.

The following diagram suggests general pathways that the vegetation on this site might follow. There are other plant communities and states not shown on 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

Sandstone Hill & Mountain (Desert Grassland)
R042XC255TX



Legend

1.1A Improper grazing (exacerbated by drought)

1.2A Prescribed grazing and favorable rainfall

T1A Continued improper grazing (exacerbated by drought)

R2A Brush management treatments, prescribed grazing, and favorable rainfall

Figure 4. Sandstone Hill & Mtn (Desert Grassland) - STM Diag

State 1

Grassland State

Community 1.1

Black grama/Sideoats grama Grassland Community



Figure 5. 1.1 Black grama/Sideoats grama Grassland Community

The black grama-sideoats grama grassland is the reference plant community for the site. Grasses account for approximately 80 percent of plant community by air dry weight, while shrubs and forbs account for 15 and 5 percent, respectively. The site is characterized by high perennial grass cover, minimal soil movement, and small, unconnected bare patches. Black grama and sideoats are the dominant grasses while other grasses such as Arizona cottontop, plains bristlegrass, sand dropseed, cane bluestem, and Hall’s panicum occur in association. Common shrubs include sotol, yucca, range ratany, feather dalea, skeletonleaf goldeneye, and pricklypear. Species composition and production will vary with aspect, elevation, slope gradient, and the natural range of soil characteristics. Under continuous heavy grazing by domestic livestock, palatable grasses such as black grama, plains bristlegrass, Arizona cottontop decrease in composition, while less palatable grasses such as fluffgrass, threeawns, and slim tridens begin to increase. Conservation practices such as prescribed grazing can help arrest and restore the trend back towards the reference plant community.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	448	673	897
Shrub/Vine	84	123	168
Forb	28	45	56
Tree	–	–	–
Total	560	841	1121

Figure 7. Plant community growth curve (percent production by month). TX0026, Grama Dominated Grassland with scattered shrubs. Black and sideoats grama dominates the community along with few shrubs scattered across landscape..

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

Community 1.2

Patchy Black grama and Sideoats grama Community



Figure 8. 1.2 Patchy Black Grama and Sideoats Grama Communit

The patchy black grama-sideoats grama plant community is a response to improper grazing management. Drought will only exacerbate the situation. Perennial grass cover is lower and patchy. Grasses such as threeawns, fluffgrass, slim tridens, and annual grasses have increased. Either separately or in combination, shrubs such as whitethorn acacia, lechuguilla, mariola, and creosotebush have also increased. Both annual and perennial forbs will also increase in relative composition. Continued intense grazing within this plant community and soil erosion can trigger the site to transition to the Shrub Encroached State 2. A combination of favorable rainfall and conservation practices such as prescribed grazing can help facilitate the recovery of grasses more palatable to livestock. A combination of community phases 1.1 and 1.2 occurring within a given area can provide the necessary habitat heterogeneity for both livestock and wildlife.

Pathway 1.1A

Community 1.1 to 1.2



Black grama/Sideoats grama
Grassland Community



Patchy Black grama and
Sideoats grama Community

With improper grazing exacerbated by drought, the Black grama and Sideoats Grama Grassland Community converts to Patchy Black grama and Sideoats Grama Grassland Community.

Pathway 1.2A

Community 1.2 to 1.1



Patchy Black grama and
Sideoats grama Community



Black grama/Sideoats grama
Grassland Community

With Prescribed Grazing and favorable rainfall, the Patchy Black grama and Sideoats grama Grassland Community converts to Black grama and Sideoats grama Grassland Community.

Conservation practices

Prescribed Grazing

State 2
Encroached Shrub State

Community 2.1
Shrub Encroached Community



Figure 9. 2.1 Shrub Encroached Community



Figure 10. 2.1 Shrub Encroached Community (2)

This plant community 2.1 is the result of prolonged and extensive overutilization of plant resources by livestock. The plant community is mostly devoid of any grasses and is characterized “increaser” shrubs such as whitethorn acacia, lechuguilla, and/or creosotebush. A combination of prescribed grazing, brush management and favorable rainfall over several years can potentially facilitate grass recolonization. The rate of recovery will depend on the extent to which soil properties were altered during retrogression (Heitschmidt and Stuth 1991).

Transition T1A
State 1 to 2

With continued improper grazing exacerbated by drought, the Grassland State converts to Shrub Encroached State.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	Midgrasses			140–280	
	black grama	BOGR4	Bouteloua eriopoda	112–224	

	black grama	BOLE4	<i>Bouteloua eriopoda</i>	112–224	–
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	84–168	–
2	Midgrasses			196–392	
	Arizona cottontop	DICA8	<i>Digitaria californica</i>	67–112	–
	green sprangletop	LEDU	<i>Leptochloa dubia</i>	67–112	–
	spike dropseed	SPCO4	<i>Sporobolus contractus</i>	67–112	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	67–112	–
	cane bluestem	BOBA3	<i>Bothriochloa barbinodis</i>	50–84	–
3	Mid/Shortgrasses			84–168	
	plains lovegrass	ERIN	<i>Eragrostis intermedia</i>	28–56	–
	cliff muhly	MUPO	<i>Muhlenbergia polycaulis</i>	28–56	–
	Hall's panicgrass	PAHA	<i>Panicum hallii</i>	28–56	–
	streambed bristlegrass	SELE6	<i>Setaria leucopila</i>	28–56	–
	mesa dropseed	SPFL2	<i>Sporobolus flexuosus</i>	28–56	–
4	Shortgrasses			28–56	
	threeawn	ARIST	<i>Aristida</i>	11–28	–
	low woollygrass	DAPU7	<i>Dasyochloa pulchella</i>	11–28	–
	fall witchgrass	DICO6	<i>Digitaria cognata</i>	11–28	–
	nineawn pappusgrass	ENDE	<i>Enneapogon desvauxii</i>	11–28	–
	slim tridens	TRMU	<i>Tridens muticus</i>	11–28	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0–17	–
Shrub/Vine					
5	Tall shrubs			39–78	
	whitethorn acacia	ACCO2	<i>Acacia constricta</i>	11–28	–
	catclaw acacia	ACGR	<i>Acacia greggii</i>	11–28	–
	jointfir	EPHED	<i>Ephedra</i>	11–28	–
	ocotillo	FOSP2	<i>Fouquieria splendens</i>	11–28	–
	creosote bush	LATR2	<i>Larrea tridentata</i>	11–28	–
	algerita	MATR3	<i>Mahonia trifoliolata</i>	11–28	–
	western honey mesquite	PRGLT	<i>Prosopis glandulosa</i> var. <i>torreyana</i>	11–28	–
	littleleaf sumac	RHMI3	<i>Rhus microphylla</i>	11–28	–
	resinbush	VIST	<i>Viguiera stenoloba</i>	11–28	–
	lotebush	ZIOB	<i>Ziziphus obtusifolia</i>	11–28	–
6	Shrubs			22–45	
	featherplume	DAFO	<i>Dalea formosa</i>	6–17	–
	littleleaf ratany	KRER	<i>Krameria erecta</i>	6–17	–
	mariola	PAIN2	<i>Parthenium incanum</i>	6–17	–
	woody crinklemat	TICAC	<i>Tiquilia canescens</i> var. <i>canescens</i>	6–17	–
7	Shrubs			22–45	
	lechuguilla	AGLE	<i>Agave lechuguilla</i>	6–17	–
	tree cholla	CYIMI	<i>Cylindropuntia imbricata</i> var. <i>imbricata</i>	6–17	–
	green sotol	DALE2	<i>Dasylirion leiophyllum</i>	6–17	–
	Texas sacahuista	NOTE	<i>Nolina texana</i>	6–17	–

	pricklypear	OPUNT	<i>Opuntia</i>	6–17	–
	yucca	YUCCA	<i>Yucca</i>	6–17	–
Forb					
8	Forbs			28–56	
	Forb, annual	2FA	<i>Forb, annual</i>	0–6	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	1–6	–
	angel's trumpets	ACLO2	<i>Acleisanthes longiflora</i>	1–6	–
	croton	CROTO	<i>Croton</i>	1–6	–
	bladderpod	LESQU	<i>Lesquerella</i>	1–6	–
	arrowleaf mallow	MASA3	<i>Malvella sagittifolia</i>	1–6	–
	plains blackfoot	MELE2	<i>Melampodium leucanthum</i>	1–6	–
	menodora	MENOD	<i>Menodora</i>	1–6	–
	polygala	POLYG	<i>Polygala</i>	1–6	–
	globemallow	SPHAE	<i>Sphaeralcea</i>	1–6	–
	pricklyleaf dogweed	THAC	<i>Thymophylla acerosa</i>	1–6	–
	Rocky Mountain zinnia	ZIGR	<i>Zinnia grandiflora</i>	1–6	–

Animal community

The reference plant community is suited for conservative livestock grazing by cattle, horses, burros, and sheep and goats. However cattle may find limited accessibility on slopes greater than 15 percent. Livestock should be stocked in proportion to the grazeable grass, forbs, and browse. Improper grazing management, especially during droughts, causes a gradual decline in range health, reducing livestock nutrition and habitat quality for some wildlife. The flower buds, blooms, and fruit of sacahuista can be toxic livestock, especially sheep and goats. A minimum toxic dose for sheep is about 1 percent of the animal's weight in buds or blooms (Hart et al. 2003).

Wildlife that use this site for at least a portion of their overall habitat needs include mule deer, javelinas, bobcats, coyotes, black-tailed jackrabbits, cottontails, raccoons, ringtails, gray foxes, mice, and ground squirrels. Birds that use this site as for at least a portion of their habitat needs include scaled quail, dove, raptors, and numerous song birds. Insects and reptiles such as rattlesnakes and lizards also frequent the area.

Plant Preference by Animal Kind:

These preferences are somewhat general in nature as the preferences for plants is dependent upon grazing experience, time of year, availability of choices, and total forage supply.

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. 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 site is located in both a surface water run-in and runoff position. Surface rock fragments and a high grass cover help reduce runoff potential especially on steep slopes. The reference plant community 1.1 provides the optimum hydrologic function for the site. A reduction in grass and ground cover, as in plant communities 1.2 and 2.1, will impair the hydrologic function of the site by increasing surface runoff and decreasing water infiltration.

Recreational uses

The site can be used for hiking and hunting.

Wood products

N/A

Other products

N/A

Other information

N/A

Inventory data references

Information presented here has been developed from NRCS clipping, composition, plant cover, soils data and ecological interpretations gained by field observation.

Other references

Hart, C.R., T. Garland, A.C. Barr, B.B. Carpenter, and J.C. Reagor. 2003. Toxic plants of Texas. Texas Cooperative Extension publication, Texas A&M Press, College Station.

Heitschmidt, R.K. and J.W. Stuth, eds. 1991. Grazing management: an ecological perspective. Portland, OR: Timberline Press.

USDA, National Water and Climate Center, "Climate Reports," <http://www.wcc.nrcs.usda.gov/climate/> (accessed January 2007).

USDA, Natural Resources Conservation Service, "Plants Database," <http://plants.usda.gov/> (accessed August 2009)

Reviewers:

Lynn Loomis, SS, NRCS, Marfa, TX

David Trujillo, RMS, NRCS, Las Cruces, NM

Mark Moseley, RMS, NRCS, Boerne, TX

Contributors

Michael Margo, RMS, NRCS, Marfa, Texas

Unknown

Approval

Scott Woodall, 8/10/2020

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)	Michael Margo, RMS, NRCS, Marfa, Texas
Contact for lead author	Zone RMS, San Angelo, Texas, 325-944-0147
Date	02/02/2010
Approved by	Scott Woodall
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

2. **Presence of water flow patterns:** None, except following high intensity storms, when short (less than 1 m) and discontinuous flow patterns may appear. Flow patterns in drainages are linear and continuous.

3. **Number and height of erosional pedestals or terracettes:** None.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 1-3% bare ground.

5. **Number of gullies and erosion associated with gullies:** None.

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

7. **Amount of litter movement (describe size and distance expected to travel):** In drainages, there can be significant amounts of litter moved long distances. On most of the site, minimal and short distance (<5ft) of litter movement associated with high intense rainfall.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Stability class anticipated to be 1-3 at the surface.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** 1-4 inches thick, reddish or yellowish brown surface horizon with a weak granular or subangular structure.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** A high canopy cover of midgrass bunch and stoloniferous grasses will help minimize runoff and maximize infiltration. Grasses should comprise approximately 80% of total plant composition by weight. Shrubs will comprise about 15% by weight.

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

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 stoloniferous grasses >

Sub-dominant: Warm-season perennial bunchgrasses > Warm-season narrowleaf bunchgrasses > Shrubs >

Other: Subshrubs > Fibrous and Succulent leaves > Perennial forbs > Annual forbs > Annual grasses > Warm-season narrowleaf shortgrasses

Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** All grasses will show some mortality and decadence in addition to annual forbs. Mid/tall perennial shrubs will show some mortality or decadence only after prolonged and severe droughts. Subshrubs will be less resistant to severe droughts than mid/tall perennial shrubs.
-

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

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 500 to 1000 pounds per acre.
-

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:** Lehmann"s lovegrass is one potential invasive species that may occur on this site.
-

17. **Perennial plant reproductive capability:** All species should be capable of reproduction except during periods of prolonged drought conditions, heavy natural herbivory, or intense wildfires.
-