

Ecological site R077CY034TX

Sand Hills

16-21" PZ

Last updated: 9/11/2023
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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 077C–Southern High Plains, Southern Part

MLRA 77C is characterized by nearly level plains with numerous playa depressions, moderately sloping breaks along drainageways, and a steep escarpment along the eastern margin. From southwest to northeast, soils grade from coarse-textured to fine-textured. Soils are generally deep and occur in a thermic soil temperature regime and ustic soil moisture regime bordering on aridic. Current land use is dominantly cropland.

Classification relationships

This ecological site is correlated to soil components at the Major Land Resource Area (MLRA) level which is further described in USDA Ag Handbook 296.

Ecological site concept

This site occurs on windblown, sandy soils on dunes. The reference vegetation consists of deep-rooted tallgrasses with shrubs, midgrasses and forbs. These sites can be very sensitive to long dry periods. If grazed, careful management should be applied to prevent blowouts as the soils are very susceptible to wind erosion.

Associated sites

R077CY052NM	Loamy Sand The Loamy Sand site is on nearly level to gently sloping plains. These sites are on lower landscape positions and adjacent to and intermingled with the Sand Hills site. Midgrasses, tallgrasses, and shrubs dominate these sites.
R077CY035TX	Sandy 16-21" PZ The Sandy site is on plains, dunes, and interdunes. Sandy sites are on lower landscape positions and intermingled with Sand Hills. Midgrasses, tallgrasses, and shrubs dominate these sites.
R077CY036TX	Sandy Loam 16-21" PZ The Sandy Loam site is on plains and playa slopes. These sites are on lower landscape positions and adjacent to and intermingled with the Sand Hills site. Midgrasses and shortgrasses dominate on these sites.

Similar sites

R077DY045TX	Sand Hills 12-17" PZ These sites have very deep sandy soils on windblown sand dunes. Reference vegetation consists of tall and midgrasses, forbs and shrubs. Mean annual precipitation is lower (15 to 17 inches) and this site is less productive than the Sand Hills site in MLRA 77C. In the absence of periodic fire, shrub canopy may increase.
R077AY011TX	Sand Hills 16-22" PZ These sites have very deep sandy soils on windblown sand dunes. Reference vegetation consists of tall and midgrasses, forbs and shrubs. In the absence of periodic fire, shrub canopy may increase.
R077BY020TX	Sand Hills 12-17" PZ These sites have very deep sandy soils on windblown sand dunes. Reference vegetation consists of tall and midgrasses, forbs and shrubs. In the absence of periodic fire, shrub canopy may increase.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Quercus havardii</i> (2) <i>Artemisia filifolia</i>
Herbaceous	(1) <i>Andropogon hallii</i> (2) <i>Calamovilfa gigantea</i>

Physiographic features

This site is an upland with very sandy, undulating to hilly topography and consists of very deep, excessively drained, rapidly permeable eolian deposits. The soils are on duned ridges on convex uplands and sideslopes or plains. Due to the sandy nature of the material, very little runoff is generated and since these soils generally occur on the highest positions on the landscape, no runoff is received from other sites.

Table 2. Representative physiographic features

Landforms	(1) Plateau > Dune (2) Plateau > Hill
Runoff class	Negligible to low
Flooding frequency	None
Ponding frequency	None
Elevation	1,040 – 1,460 m
Slope	0 – 30 %

Ponding depth	0 cm
Water table depth	200 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

Climate is semi-arid dry steppe. Summers are hot with winters being generally mild with numerous cold fronts that drop temperatures into the single digits for 24 to 48 hours. Temperature extremes are the rule rather than the exception. Humidity is generally low and evaporation high. Wind speeds are highest in the spring and are generally southwesterly. Canadian and Pacific cold fronts come through the region in fall, winter and spring with predictability and temperature changes can be rapid. Most of the precipitation comes in the form of rain and during the period from May through October. Snowfall averages around 15 inches but may be as little as 8 inches or as much as 36 inches. Rainfall in the growing season often comes as intense showers of relatively short duration. Long-term droughts occur on the average of once every 20 years and may last as long as five to six years (during these drought years, moisture during the growing season is from 50 to 60 percent of the mean). Based on long-term records, approximately 60 percent of the years are below the mean rainfall and approximately 40 percent are above the mean. May, June and July are the main growth months for perennial warm-season grasses. Forbs make their growth somewhat earlier.

Table 3 Representative climatic features

Frost-free period (characteristic range)	160-190 days
Freeze-free period (characteristic range)	190-210 days
Precipitation total (characteristic range)	460-480 mm
Frost-free period (actual range)	150-200 days
Freeze-free period (actual range)	180-210 days
Precipitation total (actual range)	430-480 mm
Frost-free period (average)	180 days
Freeze-free period (average)	200 days
Precipitation total (average)	460 mm

- (1) BIG SPRING [USW00023041], Big Spring, TX
- (2) DENVER CITY [USC00412408], Denver City, TX
- (3) PORTALES [USC00297008], Portales, NM
- (4) ARCH [USC00290525], Portales, NM
- (5) MULESHOE 19 S [USW00003054], Muleshoe, TX
- (6) PLAINS [USC00417074], Plains, TX

- (7) LITTLEFIELD [USC00415265], Littlefield, TX
- (8) LAMESA 1 SSE [USC00415013], Lamesa, TX

Influencing water features

Water features are not an influencing factor in this site.

Wetland description

N/A

Soil features

The soils for the Sand Hills ecological site have undulating to rolling, deep fine sands with high water infiltration rates and low water storage capacity. The soils have no structure and no well defined horizons; however, some soils may contain lamellae of generally finer textured material which may affect infiltration. Fertility is very low but plant available water is high. Surface temperatures on bare sand are very high and plant establishment is difficult. Wind erosion is an ever present problem unless cover is adequate to stabilize the fragile sands.

Major Soil Taxonomic Units correlated to this site include: Milsand fine sand and loamy fine sand, and Nutivoli fine sand.

Table 4. Representative soil features

Parent material	(1) Eolian deposits – metamorphic and sedimentary rock
Surface texture	(1) Loamy fine sand (2) Fine sand
Family particle size	(1) Sandy
Drainage class	Excessively drained
Permeability class	Rapid
Soil depth	200 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	6.1 – 6.35 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 10 %

Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	6.6 – 8.8
Subsurface fragment volume <=3" (0-101.6cm)	Not specified
Subsurface fragment volume >3" (0-101.6cm)	Not specified

Ecological dynamics

The Sand Hills ecological site is unique in many respects. The site developed in wind-worked alluvial or eolian deposits. The lack of soil development and recent climatic conditions played a major role in plant community development. Typically, these are developmentally very young soils. Areas of the Sand Hills site now supporting a plant community were bare dunes as recently as 50 to 60 years ago. Other sites appear to be more mature and support a more diverse and seemingly stable plant community. Different stages of plant community development can be observed over the range of the site. The reference plant community for this site is difficult to describe because of the different ages of sediments, and the stage of development of the plant community. The age of soil deposition and stability appear to be major factors in this process.

The Tallgrass/Shrubs Community (1.1) is a mixture of tallgrasses (50-60 percent), shrubs (35-45 percent) and perennial forbs (10-15 percent). The amount of annual forbs found is dependent on the moisture situation in a given year. The dominant tallgrasses are sand bluestem (*Andropogon hallii*), giant sandreed (*Calamovilfa gigantea*), little bluestem (*Schizachrium scoparium*) and the taller dropseed species (*Sporobolus* spp). Lesser amounts of switchgrass (*Panicum virgatum*) and Indiangrass (*Sorghastrum nutans*) are found under more favorable moisture conditions. Usually Indiangrass occurs where finer textures occur in the subsoil. A good variety of forbs exist but the amount varied greatly from year to year. The more commonly found forb species are queen's delight (*Stillingia sylvatica*), gaura (*Gaura* spp.), and annual wild buckwheat (*Eriogonum annuum*). The major shrubs are sand shinoak (*Quercus harvardii*), sand sagebrush (*Artemisia filifolia*), and skunkbush sumac (*Rhus aromatica*). Lesser amounts of sand plum (*Prunus angustifolia*), and southwestern rabbit brush (*Chrysothamnus pulchellus*) are usually present in the Texas portion of the MLRA. The woody shrubs are more stable from year to year and can better withstand the climatic extremes; therefore it is probable that shrubs were a major component of the historic plant community. In dryer years the grasses and forbs decline somewhat and in wet years forb growth can be profuse. With abundant early spring moisture, annual wild buckwheat can be the dominant herbaceous plant present. With good summer moisture, the taller grasses become more visible and produce a larger portion of total biomass. The environment in the Sand Hills is harsh and those species that are deep rooted, soil stabilizing and drought tolerant have the advantage. The shrubs and the taller grasses, along with certain tap-rooted forbs best fit that description.

The plant community on this site is influenced by moisture and aspect. North and east aspects will support a slightly different plant community than the south and west aspects. Production levels can be slightly higher on the north and east aspects.

Fire no doubt plays a part in the sites' ecology, as is true of nearly all plains sites. Since cover is sparser than adjacent sites and bare areas exist throughout the site, fuel continuity may not have always been sufficient for a complete burn. There are historical accounts of fires having burned up to the Sand Hills and dying out. There were undoubtedly times when the site did burn and present day observations bear this out. These results are varied. If the soil is bare in early spring and moisture is deficient then some post-burn erosion is likely. The resulting blowing sand can cut off plant bases and seedlings. However, if post-burn rainfall is adequate, erosion can be minimal, and recovery can take place. Frequently, the site requires three or four growing seasons to reach equilibrium. Biomass production is reduced for at least three years. A moderate shift toward grass vegetation with shrub suppression lasting several years will usually result.

Abusive grazing with domestic livestock for prolonged periods will usually see the most palatable plants pressured severely. As retrogression proceeds, this site will move towards the Shrub/Midgrass Community (2.1). Tallgrasses decline and midgrass species increase. The shrub component increases dramatically to >60 percent. Heavy disturbance by hoof action to the soil surface can cause an increase in annual species. There will be a marked increase in western ragweed, dropseed species, perennial three-awns (*Aristida* spp.), and a wide variety of lower successional species. Sand shinoak, sand sagebrush and skunkbush sumac will increase dramatically. Some sites may have an increase in yucca (*Yucca glauca*) plants. Bare areas may become more numerous and wind erosion will increase.

Shrubs are only slightly utilized during the grazing/browsing process, and little pressure is placed upon them. The balance between grass, forbs, and shrubs is rather delicate; and over utilization of the more palatable species favors shrubs. Diversity will be less than under reference conditions. In this phase, ecological processes have changed somewhat, but the pathway back toward the reference community can be initiated through prescribed grazing and selective brush management. Prescribed burns require the utmost caution. Generally there is not enough fine fuel to carry an effective fire. Other tools can be used with less risk. In appropriate conditions careful use of herbicides can suppress shrub growth without destabilizing the site. Care should be taken to avoid treating the tops of dunes and areas of poor cover.

If abusive grazing continues, along with periodic droughts, retrogression will move towards a Shrub Dominant Community (3.1). In extreme cases, shrubs will dominate with mainly annual forbs and grasses being present. Sand shinoak, sand sagebrush, and skunkbush sumac increase. Some sand hills sites may see a major increase in yucca plants. Numerous bare areas will be scattered throughout the site. The rolling mini-dune areas may begin to show signs of wind erosion from the lack of deep-rooted grass cover. The plant community can become so degraded that it cannot recover without extensive energy and management inputs. At this point, a major threshold has been crossed. Restoration of the Shrub Dominant Community (3.1) requires re-seeding, prescribed grazing (3 - 5 consecutive years deferment during the growing season), and extensive brush and pest management.

The shrub dominant community is generally stable. However, plant diversity is important to ecological processes, and in the management of the site for wildlife. The state of the plant community certainly influences the quality of habitat for quail, pronghorn and mule deer frequenting the site. All of these species prefer a mixture of grass, forbs and shrubs. A variety of shrubs, tallgrasses, and forbs will be more beneficial for wildlife habitat and livestock grazing, and will aid in the function of the ecological processes such as nutrient cycling and the hydrological cycle.

NOTE: Rangeland Health Reference Worksheets have been posted for this site on the Texas NRCS website (www.tx.nrcs.usda.gov) in Section II of the eFOTG under (F) Ecological Site Descriptions.

STATE AND TRANSITIONAL PATHWAYS : (DIAGRAM)

Narrative:
The following diagram suggests some pathways that the vegetation on this site might take. There may be other 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.

Changes in the structure and composition of the plant community may be due to management and/or natural occurrences. At some point thresholds are crossed as indicated by the lined box on the State and Transition Diagram. This suggests that once changes have progressed to a certain point, the plant community has been altered to the extent that a return to the former state is not possible unless some form of energy is applied. These changes take place on all ecological sites. Some sites support communities that are more resistant to change than others. Also, some sites are more resilient and can heal or restore themselves more easily. Usually, changes in management practices alone, such as grazing techniques, will not be sufficient to restore former plant communities. An example of energy input might be the implementation of chemical brush management to decrease the amount of woody/cacti shrubs and increase the amount of grasses and forbs. This shift in community balance could not be brought about with grazing alone. The amount of energy required to bring about a change in plant community balance may vary a great deal depending on the present state and the desired result.

The plant community balance of this site is more fragile than some of the short grass sites. This balance is necessary for the community to function properly. Tall grasses are not as resistant to grazing as short and mid grass species. The soil is more fragile since it is sandy and can result in plant and soil disturbance from hoof action. If cover is very poor, wind erosion will occur.

STATE AND TRANSITIONAL PATHWAYS: (DIAGRAM)

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	Tallgrasses			628-897	

	sand bluestem	ANHA	<i>Andropogon hallii</i>	392-560	–
	little bluestem	SCSC	<i>Schizachyrium scoparium</i>	157-224	–
	giant sandreed	CAGI3	<i>Calamovilfa gigantea</i>	78-112	–
2	Midgrasses			123-179	
	sideoats grama	BOCU	<i>Bouteloua curtipendula</i>	56-168	–
	sand lovegrass	ERTR3	<i>Eragrostis trichodes</i>	56-168	–
	thin paspalum	PASE5	<i>Paspalum setaceum</i>	28-84	–
3	Shortgrasses			157-224	
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	22-112	–
	fringed signalgrass	URCI	<i>Urochloa ciliatissima</i>	22-56	–
	Wright's threeawn	ARPUW	<i>Aristida purpurea</i> var. <i>wrightii</i>	22-56	–
	hairy grama	BOHI2	<i>Bouteloua hirsuta</i>	22-56	–
	coastal sandbur	CESP4	<i>Cenchrus spinifex</i>	0-56	–
	fall witchgrass	DICO6	<i>Digitaria cognata</i>	22-56	–
	gummy lovegrass	ERCU	<i>Eragrostis curtipedicellata</i>	22-56	–
	red lovegrass	ERSE	<i>Eragrostis secundiflora</i>	22-56	–
4	Cool-season grasses			34-45	
	Canada wildrye	ELCA4	<i>Elymus canadensis</i>	22-45	–
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	22-45	–
5	Tallgrasses			34-45	
	switchgrass	PAVI2	<i>Panicum virgatum</i>	22-45	–
	Indiangrass	SONU2	<i>Sorghastrum nutans</i>	22-45	–
6	Midgrasses			45-67	
	spike dropseed	SPCO4	<i>Sporobolus contractus</i>	22-67	–
	giant dropseed	SPGI	<i>Sporobolus giganteus</i>	22-67	–
Forb					
7	Forbs			157-224	
	Cuman ragweed	AMPS	<i>Ambrosia psilostachya</i>	28-56	–
	golden prairie clover	DAAU	<i>Dalea aurea</i>	28-56	–
	purple prairie clover	DAPU5	<i>Dalea purpurea</i>	28-56	–
	beeblossom	GAURA	<i>Gaura</i>	28-56	–
	bluebowls	GIRI3	<i>Giliastrum rigidulum</i>	28-56	–
	camphorweed	HESU3	<i>Heterotheca subaxillaris</i>	28-56	–
	dotted blazing star	LIPU	<i>Liatris punctata</i>	28-56	–
	grassland blazingstar	MEST3	<i>Mentzelia strictissima</i>	28-56	–
	littleleaf sensitive-briar	MIMI22	<i>Mimosa microphylla</i>	28-56	–
	evening primrose	OENOT	<i>Oenothera</i>	28-56	–
	gilia beardtongue	PEAM	<i>Penstemon ambiguus</i>	28-56	–
	queen's-delight	STSY	<i>Stillingia sylvatica</i>	28-56	–
	annual buckwheat	ERAN4	<i>Eriogonum annuum</i>	0-34	–
	Forb, annual	2FA	<i>Forb, annual</i>	0-34	–
Shrub/Vine					
8	Shrubs			359-516	
	sand sagebrush	ARFI2	<i>Artemisia filifolia</i>	224-516	–
	Havard oak	QUHA3	<i>Quercus havardii</i>	224-516	–
	fragrant sumac	RHAR4	<i>Rhus aromatica</i>	224-516	–

9	Shrubs			34-45	
	southwestern rabbitbrush	CHPU4	<i>Chrysothamnus pulchellus</i>	34-45	–
	Oklahoma plum	PRGR	<i>Prunus gracilis</i>	34-45	–

Table 6. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Table 7. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
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Animal community

The animal species that utilize this site as habitat are mainly small mammals, song birds, and traditional game species like bobwhite and scaled quail, mule deer, pronghorn antelope and lesser prairie chicken. The combination of grasses, forbs, and woody shrubs that occur provide suitable habitat for all the above species. Water in the form of surface ponds, springs, or flowing streams is not usually present. Species that require daily watering may move in and out of the site. Predators such as coyotes and bobcats may utilize the site for hunting prey and to hide during the day. If the site is a shrub dominant community, then diversity is decreased and the wildlife habitat will usually be less desirable.

Hydrological functions

Almost no water moves off site. Precipitation infiltrates very rapidly. Water in excess of plant needs percolates into shallow aquifers and may manifest itself as spring flow further down in the geologic formation. Recharge may be the greatest contribution the site makes in the water cycle.

Recreational uses

Hunting, Camping, Hiking, Bird watching, Photography, Horseback Riding

Wood products

None.

Other products

None.

Other information

None.

Inventory data references

NRCS FOTG – Section II of the FOTG Range Site Descriptions and numerous historical accounts of vegetative conditions at the time of early settlement in the area were used in the development of this site description. Vegetative inventories were made at several site locations for support documentation. Inventory Data References (documents): NRCS FOTG – Section II - Range Site Descriptions NRCS Clipping Data summaries over a 20 year period

Other references

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- Gould F. 1978. Common Texas Grasses: an illustrated guide. College Station, TX: Texas A & M Press.
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- North Rolling Plains RC&D, NRCS, and GLCI. 2006 edition. Common Rangeland Plants of the Texas Panhandle.
- Scifres CJ, Hamilton WT. 1993. Prescribed burning for brushland management: the South Texas example. College Station, TX: Texas A & M Press.

7. Natural Resources Conservation Service - Range Site Descriptions
8. USDA-Natural Resources Conservation Service - Soil Surveys & Website soil database

The following individuals assisted with the development of this site description:

Clint Rollins –Rangeland Management Specialist- NRCS; Amarillo, Texas

Justin Clary – Rangeland Management Specialist – NRCS; Temple, Texas

Contributors

Duckworth-Cole, Inc.

T. Craig Byrd

Approval

Bryan Christensen, 9/11/2023

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.

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)	Stan Bradbury, Zone RMS, NRCS, Lubbock, Texas
Contact for lead author	806-791-0581
Date	09/04/2007
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. Number and extent of rills: None to slight.
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2. Presence of water flow patterns: None to slight.

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

4. Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):
35-40%

5. Number of gullies and erosion associated with gullies: None to slight.

6. Extent of wind scoured, blowouts and/or depositional areas: Moderate.

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

8. Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values): Not
resistant to surface erosion.

9. Soil surface structure and SOM content (include type of structure and A-horizon color and thickness): Fine sand single
grained surface and very low SOM.

10. Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on
infiltration and runoff: Basal cover and density with moderate interspaces should make rainfall impact minimal. This site has rapid
permeability, runoff is slow and available water holding capacity is low.

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 tallgrasses >

Sub-dominant: Warm season midgrasses >

Other: shrubs >

Additional: forbs > cool-season grasses

13. Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):
Growth due to their growth habit will exhibit some mortality and decadence though minimal.
-

14. Average percent litter cover (%) and depth (in): Litter is dominantly herbaceous.
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15. Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):
1,300 - 1,800 lbs per acre.
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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: Sand sagebrush and sand shinoak can become invasive.
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17. Perennial plant reproductive capability: All plant species should be capable of reproduction except during periods of prolonged drought conditions, heavy natural herbivory or intense wildfires.
-