Ecological site R078CY114TX
Shallow Red Clay
23-31" PZ

Last updated: 9/15/2023
Accessed: 09/19/2026

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): 078C–Central Rolling Red Plains, Eastern Part

MLRA 78C is characterized by moderately dissected, rolling plains with prominent ridges and valleys and numerous terraces adjacent to dissecting streams. Loamy and clayey soils are generally deep, well drained, and developed in calcareous and gypsiferous sediments of Permian age.

LRU notes

NA

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 shallow and very shallow clay soils. The reference vegetation consist of midgrasses and shortgrasses with scattered forbs and few shrubs. These areas are often intermixed with “badlands” areas where vegetation may be sparse with high amounts of bare ground. While grazing and fire impact these sites, often the vegetation may be more affected by precipitation patterns and slope aspect.

Associated sites

R078CY112TX	**Red Clay (South) 23-30" PZ** Sites are often adjacent, but the shallow site has somewhat deeper soils.

Similar sites

R078CY112TX	**Red Clay (South) 23-30" PZ** Both sites have similar physiographic positions on the landscape but the Shallow site is somewhat less productive.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified

Herbaceous	(1) *Bouteloua curtipendula* (2) *Bouteloua dactyloides*

Physiographic features

This site was formed in residuum over dense non-cemented clay stone red bedrock of Permian age. These soils are on very gently sloping to very steep ridges, side slopes and erosional footslopes on uplands of the Central Rolling Red Plains – Eastern Part (MLRA-78C). Slopes range from less than 1 to 50 percent. Elevation ranges from 900 to 2250 feet.

Table 2. Representative physiographic features

Landforms	(1) Plains > Ridge (2) Plains > Hill
Runoff class	Very high
Flooding frequency	None
Ponding frequency	None
Elevation	270 – 690 m
Slope	0 – 50 %
Water table depth	180 – 200 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA 78C lies within the subtropical sub-humid climate regime, which typically has dry winters with hot and not as humid summers. MLRA 78C extends north and south from Coldwater, Kansas to just northeast of San Angelo, Texas (Ballinger, Texas), and east to west from Weatherford, Oklahoma to west of Shamrock, Texas. This regime is characterized by rapid changes in temperature; marked extremes, both daily and annual; and rather erratic rainfall. The weather is alternately influenced by cold dry air from the Arctic Circle, and warm moist air from the Gulf of Mexico.

Seasonal changes are gradual. Spring is a season of variable weather and relatively high precipitation with prevailing winds from the southwest. Summers are generally hot with low humidity. Fall has long periods of pleasant weather interspersed with moderate to heavy rains. Winter is open and moderate to cold with winds from the north and infrequent snows.

Wind speeds average more than eleven miles an hour with prevailing southern winds. Rather strong winds can occur in all months of the year. While strong gusty winds occur, severe dust storms are rare.

Approximately 75 percent of the rainfall occurs during the warm season, and much of it comes in storms of high intensity and short duration in May and June. These rains can be particularly erosive on sites where vegetation is sparse. Occasional droughts are to be expected. Lack of rainfall and hot, dry winds often curtail forage production during July and August.

Table 3 Representative climatic features

Frost-free period (characteristic range)	170-200 days
Freeze-free period (characteristic range)	190-220 days
Precipitation total (characteristic range)	660-690 mm
Frost-free period (actual range)	170-200 days
Freeze-free period (actual range)	190-230 days
Precipitation total (actual range)	640-740 mm
Frost-free period (average)	190 days
Freeze-free period (average)	210 days
Precipitation total (average)	690 mm

- (1) MEDICINE LODGE [USW00003957], Medicine Lodge, KS
- (2) MUTUAL [USC00346139], Mutual, OK
- (3) CLINTON SHERMAN AP [USW00003932], Dill City, OK
- (4) ALTUS AFB [USW00003981], Frederick, OK
- (5) MUNDAY [USC00416146], Munday, TX
- (6) ABILENE RGNL AP [USW00013962], Abilene, TX

Influencing water features

None.

Wetland description

NA

Soil features

Soils are mapped for each county within the MLRA. Mapunits are representations of the major soil series component(s) and named accordingly. Each Mapunit is spatially represented on a digital soils map as polygons of different shapes and sizes. Within these Mapunits, there are often minor soil series components included. These minor components are soils that occur within a Mapunit polygon but are of small extent (15% or less of the Mapunit area). However, it is difficult to separate these minor soils spatially due to the scale of soil mapping.

Ecological sites are correlated at the component level of the soil survey. Therefore, a single Mapunit may contain multiple Ecological Sites just as it may contain multiple soil components. This is important to understand when investigating soils and Ecological Sites. A soil survey Mapunit may be correlated to a single Ecological Site based on the major component; however, there may be inclusional areas of additional Ecological Sites which are correlated to the minor components of that particular soil Mapunit.

Representative soil components for this site include:
Knoco
The soils are very shallow to shallow, well drained, and permeability is impermeable to very slow. Runoff is high on 0 to 1 percent slopes,

and very high on slopes greater than 1 percent.

Table 4. Representative soil features

Parent material	(1) Residuum – claystone
Surface texture	(1) Clay (2) Silty clay
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Very slow to slow
Depth to restrictive layer	10 – 50 cm
Soil depth	10 – 50 cm
Surface fragment cover <=3"	0 – 20 %
Surface fragment cover >3"	0 – 10 %
Available water capacity (0-101.6cm)	1.27 – 9.14 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 20 %
Electrical conductivity (0-101.6cm)	0 – 10 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0 – 10
Soil reaction (1:1 water) (0-101.6cm)	7.4 – 8.4

Subsurface fragment volume <=3" (Depth not specified)	0 – 10 %
Subsurface fragment volume >3" (Depth not specified)	0 – 10 %

Ecological dynamics

The information contained in the State and Transition Diagram (STD) and the Ecological Site Description was developed using archeological and historical data, professional experience, and scientific studies. The information presented is representative of a very complex set of plant communities. Not all scenarios or plants are included. Key indicator plants, animals and ecological processes are described to inform land management decisions.

The Shallow Red Clay Ecological Site is found on uplands. The soils vary from very shallow clays to silty clays of varying thickness. Slopes vary from gently sloping to very steep ridges and side slopes. Badlands are generally mixed in this site and can occupy as much as 15 to 20 percent of the area. Plant rooting depth is restricted and moisture holding capacity is low and often limiting productivity. Productivity of the site varies with these fluctuations. It is also influenced by aspect. North and east facing slopes will generally have higher production and diversity than south and west facing slopes. This site is characterized by low production as compared to surrounding sites and considerable bare ground which crusts easily.

The reference plant communty is assumed to have been an open Mixed-grass Prairie Community (1.1) with few forbs and only scattered shrubs. Pre-settlement influences included grazing or browsing by endemic pronghorn antelope, deer and migratory bison, severe droughts and infrequent fires. Fires, set by lightening or by Native American Indians, undoubtedly had some impact on the community structure. Studies show that fires, often severe, occurred at 7 to 12 year intervals in this region (Frost 1998). The fires would favor grass vegetation and keep woody plants and forbs in check. The sparse fuel on the site may have reduced the frequency and intensity compared to adjacent sites, however, and fire may not have been the dominant disturbance.

The herbaceous vegetation included a mix of mid and shortgrasses along with limited forbs. The dominant grass species at the time of European settlement was sideoats grama , but little bluestem was often dominant, or co-dominant on north-facing slopes. Characteristic shortgrasses included buffalograss and blue grama. Curlymesquite was also characteristic in the southern portions of the MLRA. Alkali sacaton and silver bluestem were common throughout. The site produced a limited amount and diversity of forbs. Shrubs occupied deeper soil pockets on areas protected from wildfires, contributing three percent, or less, of the annual production. Characteristic shrubs were lotebush, pricklypear and four-winged saltbush. See the Species Composition List below for composition and production estimates of the species believed to have been present when European settlers first arrived.

The Mixed-grass Prairie Community (1.1) was relatively stable and resilient within the climate, soil and fire regime. Nutrient cycling, energy flow and water cycling were in harmony with the climate, grazing and fire regime of the time. With the arrival of European settlers in the mid 1800’s and the invention of wire fencing and windmills in the 1870’s overstocking of the area became widespread. The settlers had little understanding of rangeland productivity and generally overstocked all ranges with livestock. As continuous overgrazing occurred, there was a reduction of the less grazing resistant midgrasses, a decline in mulch and organic matter, and a reduction in intensity and frequency of fires. This shift in plant community composition changed the Mixed-grass Prairie Community into a Shortgrass/Midgrass Community (1.2). Sideoats grama and little bluestem, although persistent under moderate grazing, decrease under continuous overgrazing. In the Shortgrass/Midgrass Community they are being replaced by buffalograss or curlymesquite, alkali sacaton, silver bluestem, dropseeds, hairy grama, other short grasses along with annuals and woody shrubs. Nutrient cycling, watershed protection and energy flow have been somewhat reduced. The shift in plant cover and decline in soil properties favor woody plant encroachment. The woody and herbaceous invaders are generally endemic species releases from competition or fire suppression. Woody plant production will range from 3 to 15 percent. Mesquite and/or juniper are common invaders. Careful grazing management, chemical and/or mechanical brush control of invading woody/cacti competition can restore the Shortgrass/Midgrass Community (1.2) to near reference conditions. If, however, heavy grazing continues without control of shrub invasion the plant community transitions into a Shortgrass/Mixed-brush Community (2.1). The transition from Grassland (1) to Shrubland (2) is complete when shrub canopies (production) exceed 15 percent and the shrub cover becomes resistant to control with prescribed burning. Naturally low biomass production will reduce the effectiveness of prescribed burning on this site.

In the Shortgrass/Mixed-brush Community (2.1), shortgrasses dominate forage production. Increasing amounts of bare ground will be found throughout the site and erosion can occur on steeper slopes. The bare spaces are often occupied by annuals. Grass production will still dominate the site, but encroaching woody species have begun to compete for nutrients and water. This type is still somewhat productive for livestock, but the browse and cover provided by the woody species favor deer and other wildlife. Nutrient cycling, energy flow and watershed protection is reduced as shrubs displace grasses, grazing reduces plant production and ground cover and more soil surface is exposed. The plant community is so degraded that it cannot reverse retrogression without considerable energy and

management inputs. Restoration of the Shortgrass/Mixed-brush Community (2.1) will require prescribed grazing with rest periods during the growing season for several years. Brush control and re-seeding bare areas with adapted native species will be necessary although soil limitations may make reseeding impractical.

Heavy livestock grazing over a long period of time, combined with periodic droughts and no burning will cause the Shortgrass/Mixed-brush Community (2.1) to transition into a Mixed-brush/Shortgrass/Annuals Community (2.2). Woody plants, especially mesquite and/or juniper, will continue to increase in size and density until they dominate the community. This generally occurs when the woody plant cover exceeds 15 percent and shrubs dominate the ecological processes. Annuals will occupy many of the bare areas throughout the site during wet seasons, while only low vigor shortgrasses will persist in shrub interspaces. As grass cover declines, litter, mulch and soil organic matter decline and bare ground, erosion and other desertification processes increase in the spaces between shrubs. The site is so degraded at this stage that little forage of value is produced. The Mixed-brush/Shortgrass/Annuals community is of little forage value for livestock and rather poor habitat for deer and browsing animals. Desirable forage production is low and variable.

Restoration of the Mixed-brush/Shortgrass/Annuals community to grassland is possible, but expensive. The dense brush cover and very limited seed source will require both brush control and re-seeding to restore a grassland state. The shallow fine textured soils and steep slopes limit the use of mechanical treatments and care must be taken in restoration efforts. Following brush management, re-seeding the site to adapted native mixture will be arduous, but necessary. Several years of limited grazing will be necessary. Severe erosion and fertility losses during retrogression may prohibit the site to returning to reference conditions.

State and Transition Diagram:
A State and Transition Diagram for the Shallow Red Clay (R078CY114TX) site is depicted below. Thorough descriptions of each state, transition, and pathway follow the model. Experts base this model on available experimental research, field observations, professional consensus, and interpretations. It is likely to change as knowledge increases.
Plant communities will differ across the MLRA because of the natural variability in weather, soils, and aspect. The Reference Plant Community is not necessarily the management goal; other vegetative states may be desired plant communities as long as the Range Health assessments are in the moderate and above category.

The biological processes on this site are complex. Therefore, representative values are presented in a land management context. The species lists are representative and are not botanical descriptions of all species occurring, or potentially occurring, on this site. They are not intended to cover every situation or the full range of conditions, species, and responses for the site.

Composition by dry weight and percent canopy cover are provided to describing the functional groups. Most observers find it easier to visualize or estimate percent canopy for woody species (trees and shrubs).

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.

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					
0	**Midgrasses**			179-583	
1	**Midgrasses**			90-359	
	tobosagrass	PLMU3	*Pleuraphis mutica*	0-247	–
	alkali sacaton	SPAI	*Sporobolus airoides*	45-90	–
	silver beardgrass	BOLAT	*Bothriochloa laguroides ssp. torreyana*	45-90	–
2	**Shortgrasses**			135-404	
	buffalograss	BODA2	*Bouteloua dactyloides*	90-135	–
	curly-mesquite	HIBE	*Hilaria belangeri*	0-67	–
	blue grama	BOGR2	*Bouteloua gracilis*	22-45	–
	hairy grama	BOHIH	*Bouteloua hirsuta var. hirsuta*	22-45	–
3	**Shortgrasses/Midgrasses**			9-27	
	tumblegrass	SCPA	*Schedonnardus paniculatus*	2-6	–
	Drummond's dropseed	SPCOD3	*Sporobolus compositus var. drummondii*	2-6	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	2-6	–

	slim tridens	TRMU	*Tridens muticus*	2-6	–
	slim tridens	TRMUE	*Tridens muticus var. elongatus*	2-6	–
4	**Shortgrasses**			0-1	
	purple threeawn	ARPU9	*Aristida purpurea*	0-1	–
	Wright's threeawn	ARPUW	*Aristida purpurea var. wrightii*	0-1	–
Forb					
5	**Forbs**			22-67	
	Cuman ragweed	AMPS	*Ambrosia psilostachya*	3-10	–
	prairie clover	DALEA	*Dalea*	3-10	–
	Indian rushpea	HOGL2	*Hoffmannseggia glauca*	3-10	–
	trailing krameria	KRLA	*Krameria lanceolata*	3-10	–
	dotted blazing star	LIPU	*Liatris punctata*	3-10	–
	plains blackfoot	MELE2	*Melampodium leucanthum*	3-10	–
	Nuttall's sensitive-briar	MINU6	*Mimosa nuttallii*	3-10	–
Shrub/Vine					
6	**Shrubs/Vines**			13-40	
	fourwing saltbush	ATCA2	*Atriplex canescens*	1-7	–
	Christmas cactus	CYLE8	*Cylindropuntia leptocaulis*	1-7	–
	featherplume	DAFO	*Dalea formosa*	1-7	–
	black prairie clover	DAFR2	*Dalea frutescens*	1-7	–
	prairie clover	DALEA	*Dalea*	1-7	–
	clapweed	EPAN	*Ephedra antisyphilitica*	1-7	–
	algerita	MATR3	*Mahonia trifoliolata*	1-7	–
	pricklypear	OPUNT	*Opuntia*	1-7	–
	yucca	YUCCA	*Yucca*	1-7	–
	lotebush	ZIOB	*Ziziphus obtusifolia*	1-7	–

Table 6. Community 1.2 plant community composition

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

Table 7. Community 2.1 plant community composition

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

Table 8. Community 2.2 plant community composition

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

Animal community

The Shallow Red Clay Ecological Site wis used by a diversity of wildlife that preferred grassland habitat. Grassland insects, reptiles, birds and mammals frequented the site, either as their base habitat or in conjunction with the adjacent sites. The large grazing and browsing animals included bison, elk, pronghorn, white-tailed and mule deer. Small mammals include many kinds of rodents, jackrabbit, cottontail rabbit, raccoon, skunk, opossum and armadillo. Predators include coyote, fox, bobcat and occasionally mountain lion. Game birds, songbirds, and birds of prey were indigenous or frequent users. Most are still plentiful. Bison and pronghorn antelope, however, are no longer present. White-tailed and Mule deer utilize the site in its various states. Deer, turkey and quail particularly favor the habitat provided by the Shortgrass/Midgrass Prairie (1.2) and Shortgrass/Mixed-brush (2.1) communities. Deer, turkey, quail and dove hunting is an important sport, or commercial enterprise, providing considerable income to land owners. The site is suitable for production of livestock, primarily cattle. In reference conditions it was very suited to primary grass eaters such as cattle. As retrogression occurs and woody plants invade it becomes better habitat for goats, deer and other wildlife because of the browse. Sheep and goats were also once common in the southern portion of the site but are seldom pastured now because of predation and economics. Any livestock should be stocked in proportion to the available grass, forb and browse forage, keeping deer competition for forbs and browse in mind. If the animal numbers are not kept in balance with herbage and browse production through grazing management and good wildlife population

management, the late Mixed-brush/Shortgrass/Annuals phase will have little to offer as habitat except cover. The naturally low and variable production of the site should be kept in mind when calculating stocking rates.

Hydrological functions

The Shallow Red Clay Ecological Site is a well-drained, very shallow upland with slow permeability and poor plant-soil-moisture relationships. Runoff is fast and the site is erosion prone if vegetative cover is sparse and slopes are steep. Exposed surface soils crust readily. Some runoff and erosion probably existed under reference condition, but the Mixed-grass Prairie Community (1.1) vegetation intercepted and utilized much of the incoming rainfall in the soil profile. Only during extended rains or heavy thunderstorms was runoff excessive. Litter and soil movement occurred on steeper slopes but otherwise was slight. Standing plant cover, duff and organic matter decrease and surface runoff increases as the Mixed-grass Prairie Community (1.1) transitions to the Shortgrass/Midgrass Prairie Community (1.2). These processes continue in the interstitial spaces in the Shortgrass/Mixed-brush Community (2.1) phase. Evaporation and interception losses are higher, resulting in less moisture reaching the soil. If overgrazing continues, the plant community deteriorates further and desertification processes continue. Biomass production is reduced relative to the reference community and production has shifted from primarily grasses to primarily woody plants. 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 shrubs. Once the woody canopy surpasses 15 percent, the hydrological and ecological processes, nutrient cycling and energy flow stabilize within the woody plant canopy and the community functions as a shrubland community.

Recreational uses

The Shallow Red Clay Site is moderately suited for outdoor recreational uses including hunting, hiking, camping, equestrian use and bird watching in conjunction with adjacent sites. Deer, turkey, quail and dove hunting is an important sport, or commercial enterprise, providing considerable income to land owners. This site along with adjacent sites provides diverse scenic beauty.

Wood products

None.

Other products

None.

Other information

None.

Inventory data references

Information presented here has been derived from the Very Shallow Clay Range Site 33-44 dated 3/25/1985, literature, limited NRCS clipping data (417s), field observations and personal contacts with range-trained personnel. Photos by J.L. Schuster. Special thanks to the following NRCS personnel for assistance and guidance with development of this ESD: Reggie Quiett and Cody Bauman NRCS Vernon, TX, Mark Moseley, NRCS San Antonio, TX, Justin Clary NRCS Temple, Texas.

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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.

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.

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Date	01/28/2008
Approved by	
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 common and follow old stream meanders. Deposition or erosion is uncommon for normal rainfall.

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):** Expect no more than 20% bare ground randomly distributed throughout.

5. **Number of gullies and erosion associated with gullies:** Some gullies may be present on side drains into perennial and intermittent streams. Gullies should be vegetated and stable.

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

7. **Amount of litter movement (describe size and distance expected to travel):** Under normal rainfall, little litter movement should be expected; however, litter of all sizes may move long distances depending on obstructions under intense storm events.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil surface is resistant to erosion. Stability class range is expected to be 5-6.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** 0-5" red clay, light gray spots in places, weak, medium blocky structure, very hard, very firm, very sticky, very plastic, few roots, calcareous, moderately alkaline; clear smooth boundary.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The prairie of grasses and forbs along with adequate litter and little bare ground provides for maximum infiltration and little runoff under normal rainfall events.

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 midgrasses >>

Sub-dominant: Warm-season shortgrasses >

Other: Forbs > Shrubs/Vines

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** **Slight mortality and decadence is expected for this site.**

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

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** **400 to 1200 pounds 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:** **Honey mesquite, pricklypear, lotebush, yucca, japanese bromegrass, annual broomweed, broom snakeweed.**

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17. **Perennial plant reproductive capability:** **All plants are capable of reproducing except during periods of prolonged drought conditions, heavy natural herbivory, and natural wildfires.**
