

## Ecological site R082BY004OK Boulder Ridge Savannah

Last updated: 9/19/2023  
Accessed: 05/10/2025

### 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.

### MLRA notes

Major Land Resource Area (MLRA): 082B–Wichita Mountains

This area is entirely in southwestern Oklahoma. It makes up about 1,060 square miles. The towns of Granite, Snyder, Medicine Park, and Meers are in this MLRA. U.S. Highways 62 and 183 intersect in the area, and Interstate 44 crosses the far eastern end. Quartz Mountain State Park, the Wichita Mountains Wildlife Refuge, and the Fort Sill Military Reservation are also in this area.

The surface geology of this MLRA is dominated by intrusive igneous rocks (primarily granite) of Precambrian age with associated limestone, sandstone, dolomite, chert, and shale of Cambrian age. This area is underlain by both igneous and sedimentary rocks in a structurally complex setting. Igneous rocks primarily include granite, rhyolite, gabbro, and anorthosite of Precambrian age. Sedimentary rocks include limestone, sandstone, dolomite, and chert. A large outcrop known as the "Limestone Hills" is part of this unit. The Meers Fault is a prominent geologic feature in this area.

### 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.

This area is included in EPA Level IV Ecoregion 27k "Wichita Mountains".

### Ecological site concept

The Boulder Ridge Savannah ecological site occurs on ridges of cobbly granitic colluvium. Soils are loamy over clay with cobbles. These sites are predominately grassland with woody species interspersed along fault lines.

### Associated sites

R082BY036OK	<b>Granite Hills PE 38-48</b> Granite Hills are typically upslope from Boulder Ridge on shallower soils and have more stones than cobbles.
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Table 1. Dominant plant species

Tree	(1) <i>Quercus stellata</i>
Shrub	Not specified
Herbaceous	(1) <i>Andropogon gerardii</i>

### Physiographic features

The Boulder Ridge Savannah ecological site occurs on mountain slopes of the Wichita Mountains. Slopes range from 3 to 20 percent with a majority occurring in the 10 to 20 percent range.

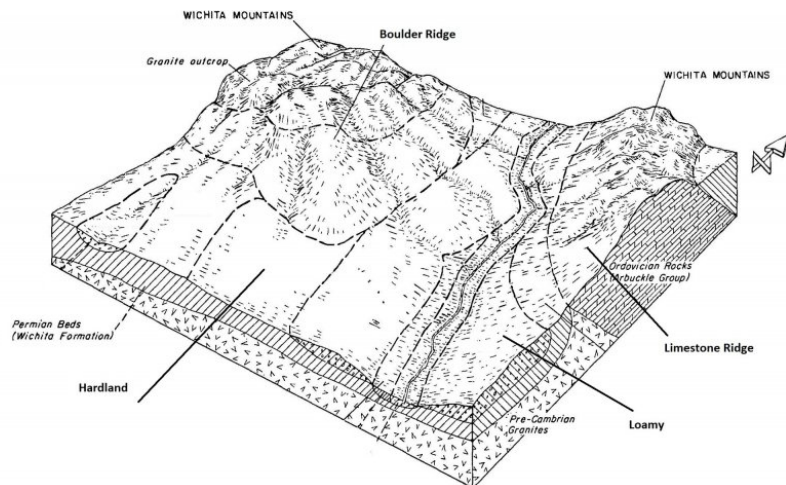


Figure 1.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope
Runoff class	High to very high
Elevation	1,000–2,500 ft
Slope	3–20%
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

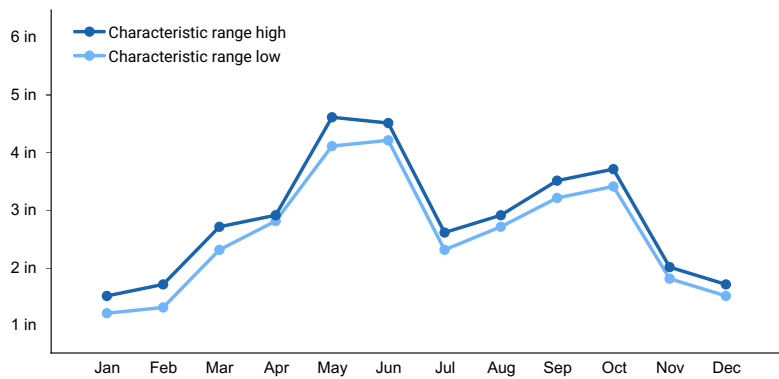
Runoff class	Not specified
Elevation	Not specified
Slope	3–30%

## Climatic features

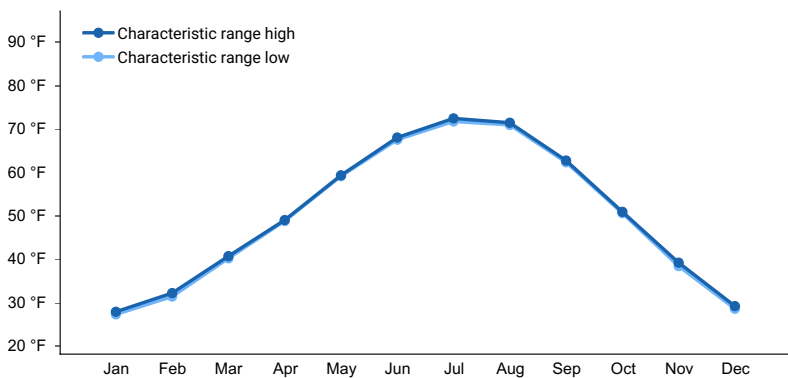
The climate is characterized by hot, often dry summers; mild autumns; mild to cold winters; and moist cool springs. There can be a wide fluctuation in annual and seasonal rainfall. Extremes in precipitation can range from as low as 10 inches to as high as 45 inches annually. Drought cycles occur at unpredictable intervals, range in duration from 3 to 5 years and occasionally last longer than 5 years. Approximately 75 percent of the total annual rainfall occurs during April to September.

Table 4. Representative climatic features

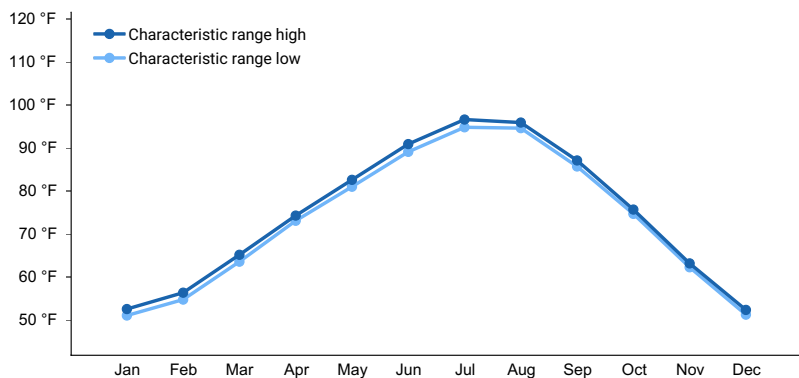
Frost-free period (characteristic range)	167-186 days
Freeze-free period (characteristic range)	190-211 days
Precipitation total (characteristic range)	31-34 in
Frost-free period (actual range)	158-189 days
Freeze-free period (actual range)	180-219 days
Precipitation total (actual range)	30-35 in
Frost-free period (average)	176 days
Freeze-free period (average)	200 days
Precipitation total (average)	33 in



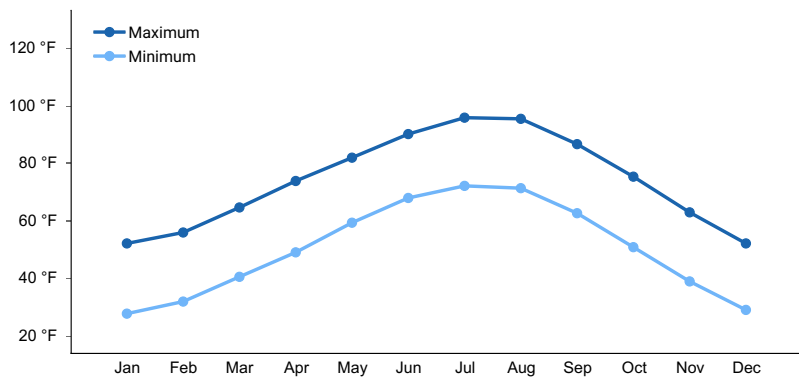
**Figure 2. Monthly precipitation range**



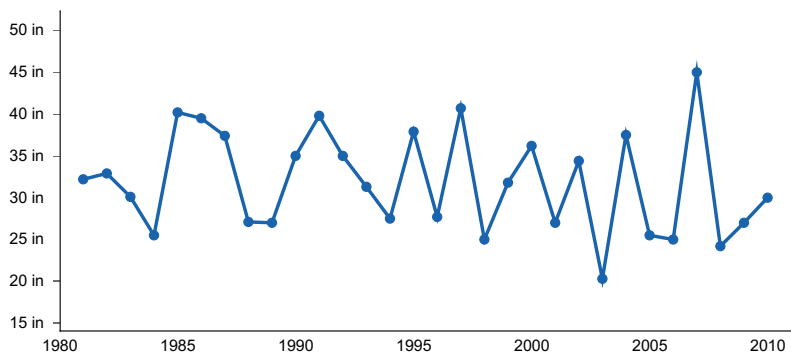
**Figure 3. Monthly minimum temperature range**



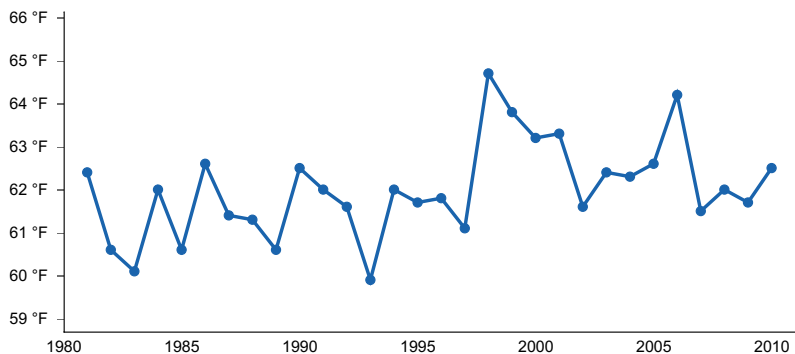
**Figure 4. Monthly maximum temperature range**



**Figure 5. Monthly average minimum and maximum temperature**



**Figure 6. Annual precipitation pattern**



**Figure 7. Annual average temperature pattern**

## Climate stations used

- (1) LAWTON MUNI AP [USW00003950], Lawton, OK
- (2) LAWTON [USC00345063], Lawton, OK
- (3) WICHITA MTN WR [USC00349629], N Central Comanche Cnty, OK
- (4) ALTUS DAM [USC00340184], Lone Wolf, OK

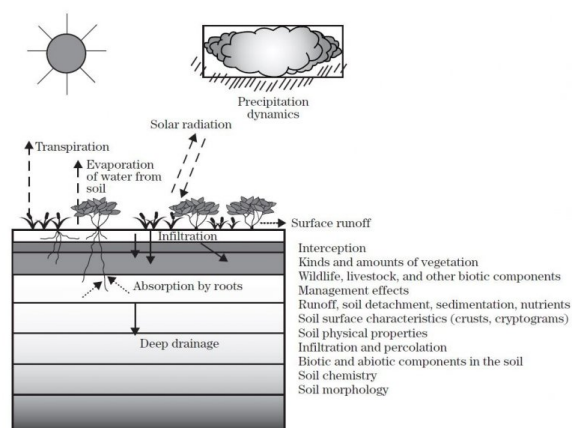
## Influencing water features

The Boulder Ridge Savannah ecological site is on uplands, and not influenced by wetlands or riparian systems.

## Wetland description

NA

**Figure 7-1** The hydrologic cycle with factors that affect hydrologic processes



**Figure 8.**

Soil features

Representative soils: Brico soil series

The Brico soil series consists of very deep, well drained, soils that formed in colluvial material weathered from dominantly granitic rock of Cambrian age. The dominant textures are loams at the surface and clays in the subsoil.

TAXONOMIC CLASS: Clayey-skeletal, mixed, active, thermic Typic Argiustolls

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 percent 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.

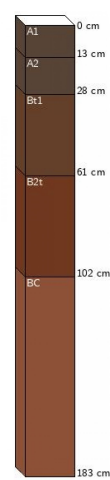


Figure 9.

Table 5. Representative soil features

Parent material	(1) Colluvium–granite
Surface texture	(1) Cobbly clay loam (2) Very cobbly clay (3) Extremely cobbly
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Moderately slow
Soil depth	62–80 in
Surface fragment cover <=3"	15–42%
Surface fragment cover >3"	6–40%
Available water capacity (0-40in)	2.2–5.7 in
Electrical conductivity (0-40in)	0–1 mmhos/cm

Sodium adsorption ratio (0-40in)	0–4
Soil reaction (1:1 water) (0-4in)	6.1–7.3
Subsurface fragment volume <=3" (Depth not specified)	10–45%
Subsurface fragment volume >3" (Depth not specified)	10–50%

## Ecological dynamics

The Boulder Ridge Savannah ecological site consists of dynamic plant communities resulting from the complex interaction of many ecological factors and processes. The vegetation evolved on deep soils with heavy-textured subsurface layers under a diverse, fluctuating climate. Plants were historically grazed by herds of large herbivores and periodically subjected to intense wildfires.

Vegetation varies from tallgrasses, midgrasses, trees, and brush in occasional deep soil areas and crevices to shortgrasses and annuals in shallower soils. A high percent of the site is exposed rock with mosses and lichens.

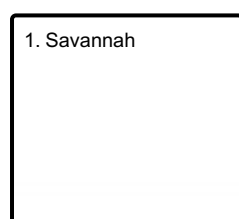
Time since fire is an important predictor of woody species abundance. While many of the woody species are capable of surviving and re-sprouting post-fire, periodic burning keeps them as a minor component of the community. Historic estimates place the fire return interval from 2 to 5 years in this region. These particular sites have an abundance of large rock outcrops that protect vegetation from fires. Increases in woody species have been noted in areas that have not been subjected to fire for many years.

While the plants on the Boulder Ridge Savannah ecological site are adapted to periodic grazing, prolonged abusive grazing practices can lead to a shift in species composition. Palatable species are grazed heavier and non-palatable species are able to out-compete them for resources. If shortgrasses and/or bare ground increase, there may be an increased risk of precipitation runoff and decreased infiltration.

Drought can also have an impact on species composition, productivity, and vigor. Long-term drought, when coupled with abusive grazing, can exacerbate the decline of range health on the site.

## State and transition model

### Ecosystem states



### State 1 Savannah

The Savannah State represents the range in variability under natural disturbances such as periodic grazing, fire, and drought. The dominant plant species are warm-season grasses with some forbs and few woody species.

**Characteristics and indicators.** While many woody species may occupy the site, herbaceous vegetation has driven the ecological function. Granite cobbles and rock outcrops range from 25 to 70 percent cover. Woody canopy may be highly variable, but is generally less than 30 percent coverage. Herbaceous species include little bluestem, big bluestem, Indiangrass, switchgrass, and wildrye as well as native lespedezas, sunflowers, and other asters. Woody species include oak species, sumac, and hackberry. Estimated annual production is 1,000 to 3,500 pounds per acre.

**Resilience management.** While some areas may be suitable for bison or cattle grazing, many areas are restricted

to grazing by smaller browsers. Therefore, grazing is not as important in driving the dynamics as on other sites. Fire return and intensity has a greater impact on regulating woody species on the site. However, some areas are protected from most fires due to surface rock and fuel continuity.

## Animal community

The Boulder Ridge Savannah ecological site supports a vast array of animals and birds. Many species are protected in their native habitat by the Wichita Mountains National Wildlife Refuge operated by the U.S. Fish and Wildlife Service. Over 50 mammal, 240 bird, 64 reptile and amphibian, 36 fish, and 806 plant species are protected within the park's borders, making it one of the most diverse wildlife refuges in the country. Herds of bison, deer, and elk roam through the park. Prairie-dog towns are also present. Thirteen separate lakes are managed by the Refuge, including Lakes Elmer Thomas, French, Jed Johnson, Lawtonka, Quahnah Parker, Rush, and more. Fish include large and smallmouth bass, sunfish, crappie, and channel catfish.

## Hydrological functions

Due to the abundance of surface rock, substantial runoff can be expected. However, adequate cover of perennial plants should decrease the risk of water erosion.

## Recreational uses

Rock climbing, picnicking, hiking, backpacking, geology viewing, mountain biking, and camping are just a few of the many recreational activities offered in this site.

## Wood products

Although timber is available, very few, if any, wood products are derived from this site other than fence posts and firewood.

## Other products

NA

## Other information

NA

## Inventory data references

Draft ESDs, Oklahoma NRCS.

Historic Range Site Descriptions, Oklahoma NRCS.

Inventory Project, dated 1988, Oklahoma NRCS.

Soil Survey Manuscripts, Comanche and Kiowa Counties, Oklahoma.

Yields are estimates based on very limited clipping data.

## Type locality

Location 1: Kiowa County, OK	
Township/Range/Section	T3N R16W S11
Latitude	34° 45' 10"
Longitude	98° 51' 39"
General legal description	Kiowa County, Oklahoma; about 4 miles north and 5 miles east of Mountain Park, OK; about 600 feet south and 50 feet east of the northwest corner of section. 11, T. 3 N., R. 16 W. U.S.G.S. Quadrangle: Cooperton, OK; Latitude: 34 degrees, 45 minutes, 10 s

## Other references

Buck, Paul. 1964. Relationships of the woody vegetation of the Wichita Mountains Wildlife Refuge to geological formations and soil types. Ecology 45: 336-344.

Crockett, Jerry J. 1964. Influence of soils and parent materials on grasslands of the Wichita Mountains Wildlife Refuge, Oklahoma. Ecology 45: 326-335.

## Contributors

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## Approval

Bryan Christensen, 9/19/2023

## 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, along with 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.

This site description, along with others in the MLRA 82B, is the product of the Provisional Ecological Site Description initiative from 2015 to 2020. The sites were described with limited field work and rely heavily on historical reports and documentation due to the scope of the initiative, time constraints, and staffing shortages. The Boulder Ridge Savannah ecological site will be further researched, sampled, and documented throughout the course of a Digital Soil Mapping (DSM) update project commencing by the Altus Soil Survey Office staff.

## 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)	Harry Fritzler, Steve Glasgow, Jack Eckroat, Mark Moseley
Contact for lead author	Suite 206 100 USDA Stillwater, Oklahoma 74074
Date	07/01/2005
Approved by	Bryan Christensen
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

1. **Number and extent of rills:** There are few, if any, rills and there is no active headcutting and sides are covered with



vegetation.

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2. **Presence of water flow patterns:** There is little, if any, evidence of soil deposition or erosion (some possibly apparent around rocks and grass roots after significant rain events).
3. **Number and height of erosional pedestals or terracettes:** Pedestaled plants or rocks are rare, usually not more than ½ inch deep. Terracettes uncommon, but may be found on the steeper portion of the site, but usually do not exceed 12 inches apart.
4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Variable, but should average ~15% bare ground on this site. Bare areas are small and not connected.
5. **Number of gullies and erosion associated with gullies:** None due to shallow soils, drainages are represented as natural stable channels; vegetation is common with no signs of erosion.
6. **Extent of wind scoured, blowouts and/or depositional areas:** None.
7. **Amount of litter movement (describe size and distance expected to travel):** Uniform distribution of litter. Litter rarely moves >12 inches on flatter slopes and may be as much as doubled on steeper slopes, then only during high intensity storms.
8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Surface soil is stabilized (Stability Score 5-6). Stability scores based on a minimum of 6 samples tested.
9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface intact A horizon: 0 to 11 inches, brown cobbly loam, fine granular structure B horizon: 11 to 40 inches, reddish brown very cobbly clay to red extremely cobbly clay loam. Soil structure is medium blocky to sub angular blocky.
10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Infiltration and runoff are affected more by the slope and the amount of rocks on the surface (15-40%) than any changes in plant community composition and distribution. (Tallgrass/Midgrass dominated). Any changes in infiltration and runoff can be attributed to other factors (e.g. compaction).
11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** There is usually no compaction layer.
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: Tallgrasses, Midgrasses

Sub-dominant: Shortgrasses, Forbs

Other: Shrubs, Annuals, Trees

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** There is some plant mortality and decadence on the perennial grasses, especially in the absence of fire and herbivory or following severe drought, but usually <5%.
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14. **Average percent litter cover (%) and depth ( in):** Litter should cover >80% of the area between plants with accumulations of ~1/2 inch deep.
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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Normal production is 500 – 2000 pounds 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:** No invasive species. Invasives might include: mesquite, prickly pear, eastern redcedar, annuals and non-natives.
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17. **Perennial plant reproductive capability:** All plants capable of reproducing at least every 2 years. Seed stalks, stalk length, and seedheads are numerous and what would be expected. Overall health of plants is what would be expected.
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