USDA Natural Resources Conservation Service

Ecological site R112XY123KS
Loamy Terrace

Last updated: 11/05/2024
Accessed: 12/22/2024

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): 112X–Cherokee Prairies

MLRA 112 (Cherokee Prairies) is in Kansas (48 percent), Oklahoma (29 percent), and Missouri (23 percent) makes up about 20,885 square miles (54,092 square kilometers).

This area is in the Osage Plains Section of the Central Lowland Province of the Interior Plains. It is a gently sloping to rolling dissected plains. Elevation ranges from 120 to 1,540 feet (30 to 470 meters). Even though the area is thoroughly dissected, local relief typically is only 3 to 10 feet (1 to 3 meters) and major valleys generally are less than 8 feet (25 meters) below the adjacent uplands.

The extent of the major hydrologic unit area is made up of major rivers such as the Neosho, Verdigris, Osage, and Marais des Cygnes. The Harry Truman reservoir lies in the western part of Lake of the Ozarks in Missouri and is on the Osage and Grand Rivers.

This area is dominantly underlain by Pennsylvanian and in some areas, Permian and Mississippian sandstone, shale, and limestone bedrock. The northern part of the area has a thin mantle of loess. The dominant soils within this region are Mollisols and Entisols. Alfisols occur in the eastern part of the MLRA. There are small areas of Vertisols throughout the MLRA. It also contains small areas of Vertisols. Soils in this region are developed in residuum, loess, colluvium, and alluvium. These soils were developed under big bluestem, little bluestem, Indiangrass, and switchgrass on the western part of this area. The eastern part of the area and the valleys in the western part support hardwoods, mainly northern red oak, white oak, and shagbark hickory with islands of tall prairie grasses being common. Major wildlife species of this area are deer, cottontail rabbit, fox squirrel, and bobwhite quail.

This MLRA is mostly rangeland, hayland, and pasture. More than two-fifths of the area supports pasture grasses and legumes. The western part of this area generally supports tall prairie grasses. Big bluestem, little bluestem, Indiangrass, and switchgrass are the main species. The cropland is used to produce winter wheat, soybeans, corn, grain sorghum, and other feed grains. The forested areas are mainly on steep valley sides and in low-lying areas on flood plains.

Classification relationships

U.S. Department of Agriculture
Major Land Resource Area (MLRA) 112 - Cherokee Prairies

US Forest Service Ecoregions (1994-1995):
Domain name: Humid Temperate Domain
Division name: Prairie Division
Province name: Prairie Parkland (Temperate) Province
Province code: 251

Terrestrial Natural Community Type in Missouri (Nelson, 2010):
The reference state for this ecological site is most similar to a Wet-Mesic Bottomland Prairie.

National Vegetation Classification System Vegetation Association (NatureServe, 2010):
The reference state for this ecological site is most similar to Andropogon gerardii - Panicum virgatum - Helianthus grosseserratus Herbaceous Vegetation (CEGL002024).

Geographic relationship to the Missouri Ecological Classification System (Nigh & Schroeder, 2002): This ecological site occurs throughout the Cherokee Plains and Scarped Osage Plains Subsections.

NatureServe (2018):
Class: Shrub & Herb Vegetation
Subclass: Temperate & Boreal Grassland & Shrubland
Formation: Temperate Grassland & Shrubland
Division: Central North American Grassland & Shrubland
Macrogroup: Central Lowlands Tallgrass Prairie
Group: Central Tallgrass Prairie
Alliance: Central Dry & Dry-Mesic Tallgrass Prairie

Ecological site concept

The Loamy Terrace ecological site is located on stream terrace and floodplain step landforms adjacent to large rivers and stream. These sites are located outside of the floodplain.

Associated sites

R112XY102KS	**Clayey Upland** The Clayey Upland ecological site is above the Loamy Terrace ecological site. This site is made up of poorly to moderately well drained soils with silt loam to silty clay surface layers, and clayey subsoils. It has a parent material of loess over residuum and residuum from limestone and shale. It is generally on a slope range of 1 to 15 percent.
R112XY103KS	**Loamy Upland** This Loamy Upland ecological site is above the Loamy Terrace ecological site. This site is made up of somewhat poorly to well drained soils with a surface layer of silt loam, loam, and silty clay loam and a loamy or clayey subsoil. It has a parent material of loess over residuum and residuum from limestone, sandstone, and shale. It is generally on a slope range of 1 to 15 percent.
R112XY124KS	**Wet Floodplain** The Wet Floodplain ecological site is slightly below the Loamy Terrace ecological site. This site is made up of poorly to somewhat poorly drained soils with silty clay loam or silty clay texture surface horizons, and loamy or clayey subsoils. It has a parent material of clayey and loamy alluvium. It is generally on a slope range of 0 to 3 percent.
R112XY125KS	**Loamy Floodplain** The Loamy Floodplain ecological site is slightly below the Loamy Terrace ecological site. This site is made up of moderately well to well drained soils with silt loam to silty clay loam surface horizons and loamy subsoils. It has a parent material of loamy alluvium. It is generally on a slope range of 0 to 2 percent.

Similar sites

R112XY122OK	**Wet Terrace** The Wet Terrace ecological site is similar in landform position but is made up of wetter soils that have a seasonal or perennial high-water table less than 24 inches from the surface.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Cephalanthus occidentalis* (2) *Amorpha fruticosa*

Herbaceous	(1) *Spartina pectinata* (2) *Calamagrostis canadensis*

Physiographic features

The Loamy Terrace ecological site is located on stream terraces and floodplain steps with slopes of less than 3 percent. The site receives runoff from adjacent upland sites. Most adjacent sites are subject to early-spring flooding, but these flood events do not have a major impact on the ecological processes of the Loamy Terrace site.

The block figure below (adapted from Preston, 1977) shows the typical landscape position of this ecological site, and landscape relationships with other ecological sites. It is within the area labeled “2” on the figure and is typically on higher positions in the floodplain. Wet Floodplain and Loamy Floodplain sites are often adjacent to this site, on lower positions. The dashed lines within the Wet Floodplain area on the diagram indicate the various soils included in the ecological site.

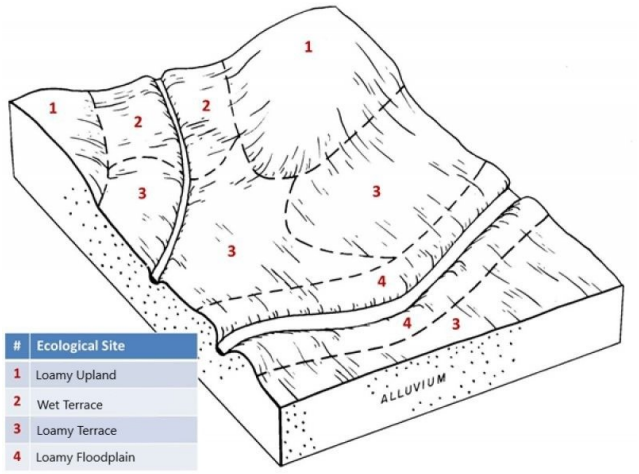


Figure 1. Landform relationships for this ecological site.

Table 2. Representative physiographic features

Landforms	(1) Stream terrace (2) Flood-plain step
Runoff class	Very low to low
Flooding duration	Extremely brief (0.1 to 4 hours) to very brief (4 to 48 hours)
Flooding frequency	None to very rare
Ponding frequency	None
Elevation	145–390 m
Slope	0–3%
Water table depth	61–152 cm
Aspect	Aspect is not a significant factor

Climatic features

MLRA 112 (Cherokee Prairies) has a continental climate marked by strong seasonality. In winter, dry-cold air masses periodically swing south from the northern plains and Canada. If they invade reasonably humid air, snowfall and rainfall result. In summer, moist, warm air masses swing north from the Gulf of Mexico and can produce abundant amounts of rain, either by fronts or by convectional processes. In some summers, high pressure stagnates over the region, creating extended droughty periods. Spring and fall are transitional seasons when abrupt changes in temperature and precipitation may occur due to successive, fast-moving fronts separating contrasting air masses. Seasonality in precipitation is very pronounced due to strong continental influences. June precipitation, for example, averages three to four times greater than January precipitation. During years when precipitation comes in

a fairly normal manner, moisture is stored in the top layers of the soil during the winter and early spring, when evaporation and transpiration are low. During the summer months the loss of water by evaporation and transpiration is high, and if rainfall fails to occur at frequent intervals, drought will result. Drought directly influences ecological communities by limiting water supplies, especially at times of high temperatures and high evaporation rates.

Representative climatic features shown in Table 3 were derived from the climate stations selected for use within the MLRA.

Table 3. Representative climatic features

Frost-free period (characteristic range)	156-196 days
Freeze-free period (characteristic range)	186-221 days
Precipitation total (characteristic range)	1,041-1,118 mm
Frost-free period (actual range)	150-205 days
Freeze-free period (actual range)	177-227 days
Precipitation total (actual range)	1,041-1,168 mm
Frost-free period (average)	178 days
Freeze-free period (average)	203 days
Precipitation total (average)	1,092 mm

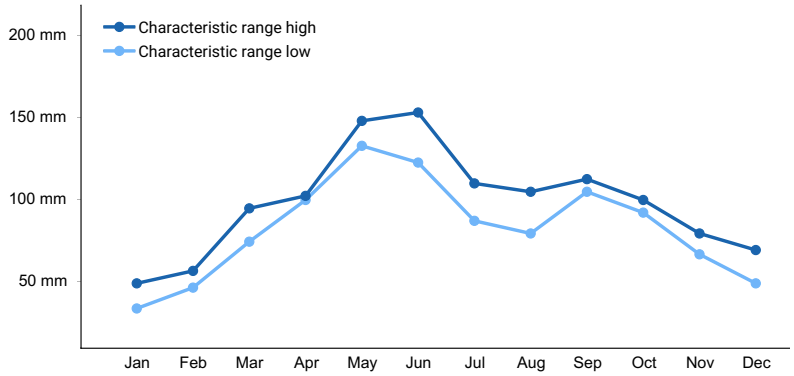


Figure 2. Monthly precipitation range

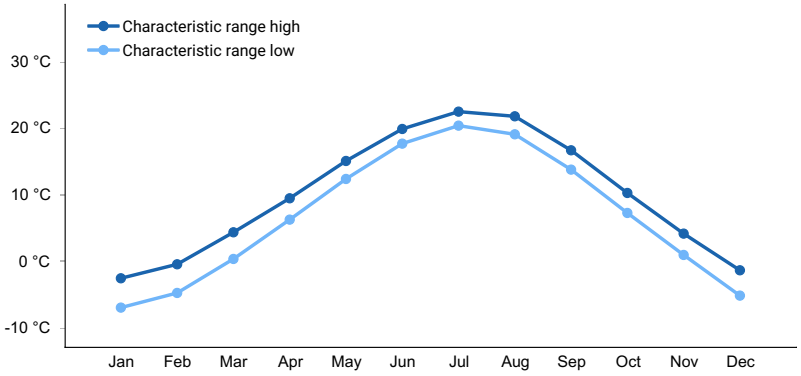


Figure 3. Monthly minimum temperature range

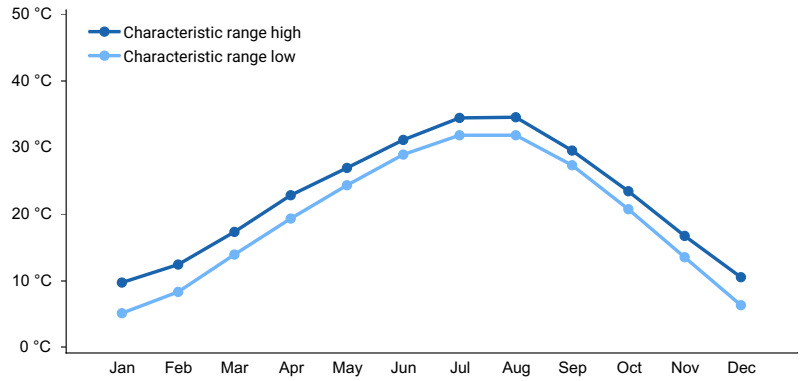


Figure 4. Monthly maximum temperature range

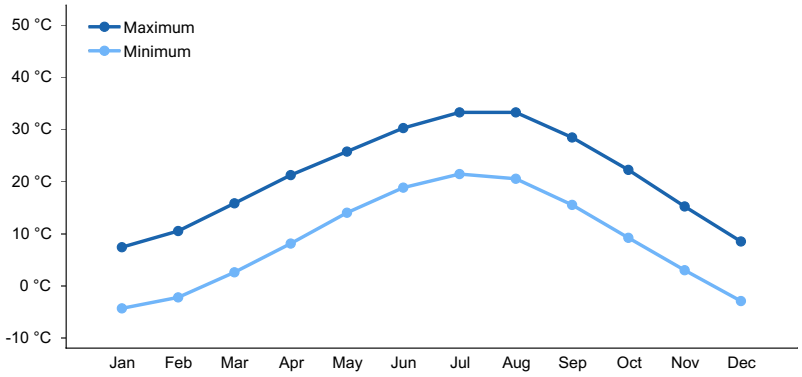


Figure 5. Monthly average minimum and maximum temperature

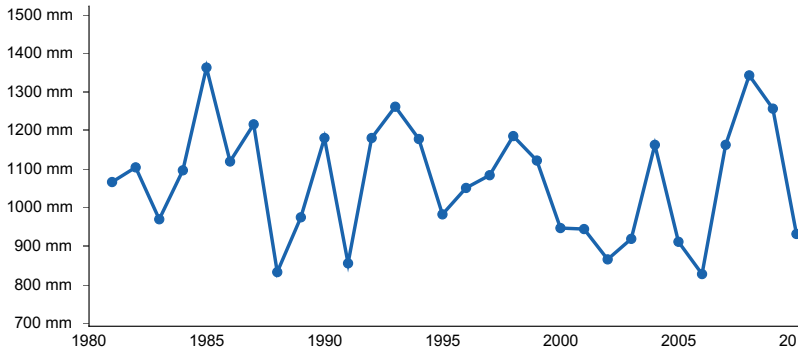


Figure 6. Annual precipitation pattern

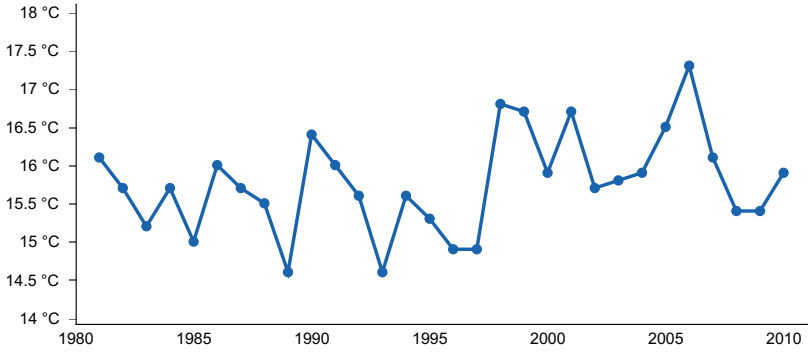


Figure 7. Annual average temperature pattern

Climate stations used

- (1) HUMBOLDT [USC00143867], Humboldt, KS
- (2) PAOLA [USC00146209], Paola, KS
- (3) TULSA INTL AP [USW00013968], Tulsa, OK

- (4) NOWATA [USC00346485], Nowata, OK
- (5) EUFAULA 6 SSW [USC00342993], Canadian, OK
- (6) HOLDENVILLE 2SSE [USC00344235], Holdenville, OK
- (7) GARNETT 1 E [USC00143008], Garnett, KS

Influencing water features

These sites may be influenced by very brief to brief flooding events.

Soil features

Soils that make up the Loamy Terrace ecological site have no rooting restriction. Organic matter content is variable due to flood depositional history. Parent material is alluvium. They have silt loam and loam surface horizons, and loamy subsoils. Soil series associated with this site include Choska, Garton, Mason, Okay, Welda.

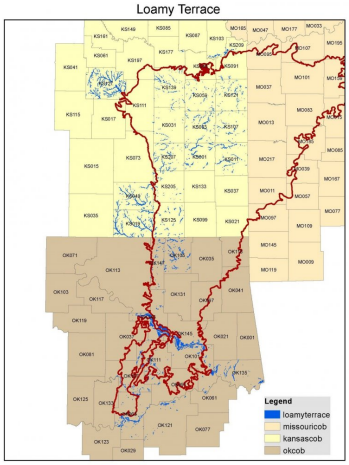


Figure 8. Loamy Terrace mapunits for MLRA 112.

Table 4. Representative soil features

Parent material	(1) Alluvium
Surface texture	(1) Silt loam (2) Loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Slow to moderate
Soil depth	152–203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	15.24–20.32 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	4.5–7.3

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

Ecological dynamics

The reference community is characterized as a tallgrass prairie unit dominated by big and little bluestem, Indiangrass, switchgrass, eastern gamagrass and a wide variety of prairie wildflowers while other species such as Culver's root, Michigan lily, and bunchflower added to the mix of upland drainageway prairie species. Slightly higher areas within or at the edge of the ecological site supported scattered bur oak, pin oak, elm, shellbark hickory, and willow.

This ecological site occurred back from the main river channel and was the highest area in the floodplain. The higher position and loamy soil texture created a better drainage situation. Consequently, the site is less wet than adjacent sites. These areas rarely flooded.

Fire played a key role in maintaining this ecological site, likely occurring at least once every three years. Fire removed dead plant litter and provided room for a lush growth of prairie vegetation. Fire also controlled woody species. During fire free intervals woody species would have increased in abundance and spread out onto the main prairie. Grazing by native large herbivores, such as bison, elk, and deer furthermore impacted these sites. Their activities altered the composition, fuel loads and structure of the vegetation, adding to the diversity of structure and composition.

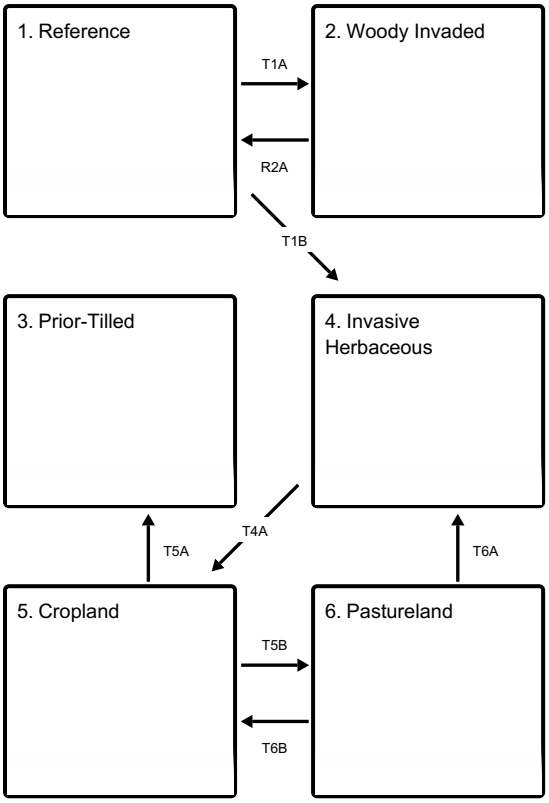
These are productive sites. Today, Loamy Terrace ecological sites are nearly extirpated from the region as the former terrace prairies and savannas have been converted to intensive agriculture. While re-establishing prairie and savanna on converted agriculture sites is beneficial to wildlife, restoration to the reference state from agricultural land is a long term proposition with uncertain outcomes.

The state and transition model is provided to diagram the complex interactions briefly discussed here. The model includes states, plant communities, transitions, and restoration pathways detailing what experts have gathered from available experimental research, field observations, professional consensus, and interpretations. There may be other states or plant communities, with additional transitions and restoration pathways, not shown in the model, as well as noticeable variations within those illustrated.

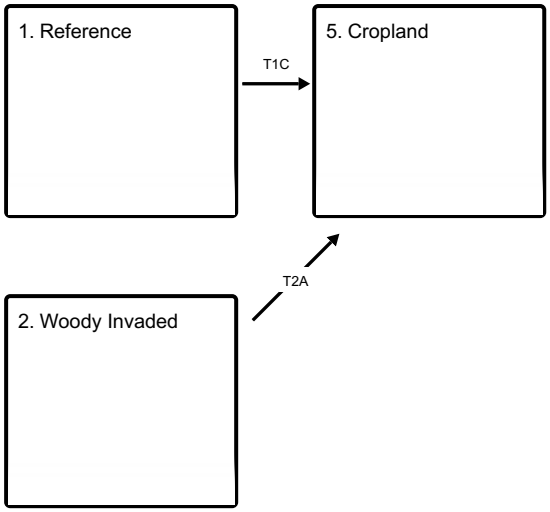
The state and transition model consists of six states and nine community phases. These states and community phases interact based on the timing, intensity, and frequency of prescribe burning and prescribed grazing, introduction of invasive species, and tillage practices. The Reference State (1) is typically burned every 1 to 3 years. Fire removes dead plant litter and provides room for a lush growth of prairie vegetation. Fire also keep woody species from invading the rangeland. The Woody Invaded State (2) is characterized by a fire frequency and return interval greater than 20 years and a canopy cover percent between 40 and 60 percent. The Prior-Tilled State (3) consists of sites that were allowed to regenerate through natural revegetation or artificially reseeded after tillage practices have ceased. The Invasive Herbaceous State (4) is characterized by invasive, non-native grasses and forbs. The Cropland State (5) consists of land converted to agricultural cropland and dominated by row crops. The Pastureland State (6) is characterized by seeded grasses, usually cool season, that receive fertilizer and irrigation inputs to maintain the pasture, often used for grazing.

State and transition model

Ecosystem states



States 1, 5 and 2 (additional transitions)



T1A - Fire suppression greater than 20 years; woody invasion.

T1B - Invaded by non-native grasses and forbs.

T1C - Tillage and seeding of agricultural crops.

R2A - Restoration inputs -thinning and prescribed fire

T2A - Tillage and seeding of agricultural crops.

T4A - Tillage and seeding of agricultural crops.

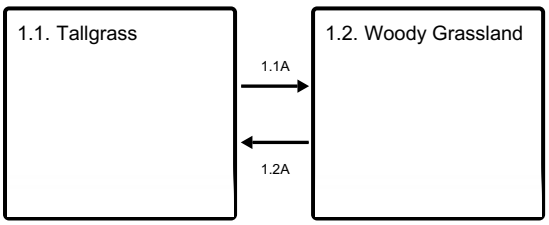
T5A - Natural revegetation or reseeding

T5B - Seeding and establishment of pasture species and proper pasture management.

T6A - Invaded by non-native grasses and forbs.

T6B - Tillage and seeding of agricultural crops

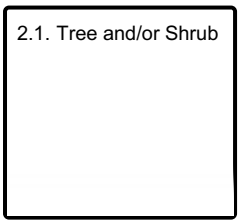
State 1 submodel, plant communities



1.1A - Fire free interval 10 or more years

1.2A - Fire interval 2-3 years

State 2 submodel, plant communities



State 3 submodel, plant communities

3.1. Go-Back

3.2. Reseed

State 4 submodel, plant communities

4.1. Caucasian Bluestem

4.2. Sericea Lespedeza

State 5 submodel, plant communities

5.1. Cropland

State 6 submodel, plant communities

6.1. Fescue, Brome, Bluegrass

State 1
Reference

This State is tall grass prairie dominated by big bluestem, eastern gamagrass and a wide variety of prairie forbs. In some areas, bur oak, pin oak, shellbark hickory, American elm, American hazelnut, prairie willow and wild plum occur as scattered individuals across the landscape. Two plant community phases occurred that will transition back and forth depending on fire return intervals. Longer return fire intervals will allow woody species to increase such as prairie willow, dogwoods and wild plum. When fire return intervals shorten these woody species will decrease or be eliminated. This state is extinct. All former reference states have been converted to cool season grassland and intensive agriculture cropland.

Dominant plant species

- bur oak (*Quercus macrocarpa*), tree
- prairie willow (*Salix humilis*), shrub
- dogwood (*Cornus*), shrub
- American plum (*Prunus americana*), shrub
- big bluestem (*Andropogon gerardii*), grass
- eastern gamagrass (*Tripsacum dactyloides*), grass
- butterfly milkweed (*Asclepias tuberosa*), other herbaceous
- prairie blazing star (*Liatris pycnostachya*), other herbaceous
- white wild indigo (*Baptisia alba*), other herbaceous
- eastern purple coneflower (*Echinacea purpurea*), other herbaceous

Community 1.1

Tallgrass

This community is a native tallgrass prairie with a wide variety of native forbs and scattered shrubs and tree saplings. Species include prairie willow, big bluestem, and eastern gamagrass.

Dominant plant species

- prairie willow (*Salix humilis*), shrub
- big bluestem (*Andropogon gerardii*), grass
- eastern gamagrass (*Tripsacum dactyloides*), grass

Community 1.2
Woody Grassland

This plant community results from continued overgrazing, fire suppression, and reduced flooding. The presence of native tallgrasses, such as big bluestem and eastern gamagrass, has decreased. Numerous sedge and rush species have become established. Longer fire free intervals allowed woody species to increase such as prairie willow, dogwoods, and wild plum. When fire return intervals shorten these woody species will decrease.

Dominant plant species

- American plum (*Prunus americana*), shrub
- prairie willow (*Salix humilis*), shrub
- big bluestem (*Andropogon gerardii*), grass
- eastern gamagrass (*Tripsacum dactyloides*), grass
- sedge (*Carex*), grass
- rush (*Juncus*), grass

Pathway 1.1A
Community 1.1 to 1.2

Fire free interval of 10 plus years.

Pathway 1.2A
Community 1.2 to 1.1

Fire interval of 2-3 years.

State 2
Woody Invaded

The Woody Invaded State is dominated by a shrub and/or tree plant community. The increase and spread of shrubs and trees resulted from fire suppression and flooding reduction for 20 or more years. Woody plants can increase up to 34% from a lack of fire according to a study from 1937 to 1969, in contrast to a 1% increase on burned areas (Bragg and Hulbert, 1976). Periodic burning and significant flooding events will hinder the establishment of most woody species and favor forbs and grasses. However, not all unburned areas have a woody plant invasion. Birds, small mammals, and livestock are instrumental in the distribution and spread of seed for most tree and shrub species common to this site. The speed of encroachment varies considerably.

Characteristics and indicators. Hydrologic function in the Woody Invaded State is affected by the amount of shrub and/or tree cover compared to the Reference State. Canopy interception loss can vary from 25.4% to 36.7% (Thurow and Hester, 1997). A small rainfall event is usually retained in the foliage and does not reach the litter layer at the base of the tree. Only when canopy storage is reached and exceeded does precipitation fall to the soil surface. Interception losses associated with the accumulation of leaves, twigs, and branches at the bases of trees are considerably higher than losses associated with the canopy. The decomposed material retains approximately 40% of the water that is not retained in the canopy (Thurow and Hester, 1997). Soil properties affected include biological activity, infiltration rates, and soil fertility. The Woody Invaded State has not had tillage as a disturbance and could have plants identified in the Invasive Herbaceous State and/or the Pastureland State present on the site.

Resilience management. The Woody Invaded State is characterized as a degraded reference site that has experienced fire suppression for 20 or more years, a lack of significant flooding events, and insufficient woody plant control methods such as mechanical, chemical, biological. The lack of sunlight, due to shading by the shrubs and/or trees, will favor cool-season species that can reduce fire intensity if fire timing is during their active growth period and would help sustain the Woody Invaded State.

Dominant plant species

- bur oak (*Quercus macrocarpa*), tree
- pin oak (*Quercus palustris*), tree
- shellbark hickory (*Carya laciniosa*), tree
- oak (*Quercus*), shrub
- big bluestem (*Andropogon gerardii*), grass
- eastern gamagrass (*Tripsacum dactyloides*), grass
- goldenrod (*Solidago*), other herbaceous

Community 2.1
Tree and/or Shrub

Due to fire suppression, these communities are dominated by wood species - both trees and shrub are prevalent compared to the communities in State 1. Species include bur oak, pin oak, and shellbark hickory.

Dominant plant species

- pin oak (*Quercus palustris*), tree
- bur oak (*Quercus macrocarpa*), tree
- shellbark hickory (*Carya laciniosa*), tree
- oak (*Quercus*), shrub
- big bluestem (*Andropogon gerardii*), grass
- eastern gamagrass (*Tripsacum dactyloides*), grass

State 3
Prior-Tilled

The Prior-Tilled State consists of abandoned cropland where the original plant community was destroyed through inversion by tillage but revegetation has occurred. Two plant communities are identified in the Prior-Tilled State and are identified by revegetation factors. The communities are identified as being naturally revegetated through succession (Go-back) or planted/seeded to species similar in composition to the reference plant community (Reseed). Plant species composition in the Prior-Tilled State is difficult to define due to the variability of plant communities that can exist.

Characteristics and indicators. The Prior-Tilled State is an alternative state since the energy, hydrologic, and nutrient cycles are significantly altered to that of the Reference State in its natural disturbance regime. Repeated tillage and planting of annual crops resulted in major changes in soil conditions. Reductions in organic matter, mineral levels, soil structure, oxygen levels, and water holding capacity, along with increased runoff/erosion and shifts in the populations of soil-dwelling organisms, are common in this state. The extent of these changes are dependent upon duration of cropping, crop types grown, and other management practices. Bulk density, aggregate stability, soil structure, and plant functional and structural groups are not fully restored to that of the Reference State. Mechanical tillage can destroy soil aggregation. Soil aggregates are an example of dynamic soil property change. Aggregate stability is critical for infiltration, root growth, and resistance to water and wind erosion (Brady and Weil, 2008).

Resilience management. The Prior-Tilled State is a result of a land use management decision and is sustained by diminished soil function. Implementation of practices that positively impact plant community diversity, energy flow, and nutrient and water cycle, should benefit rehabilitation. Documentation does not support rehabilitation to a Reference State within known management time frames.

Dominant plant species

- prairie threeawn (*Aristida oligantha*), grass
- prairie cupgrass (*Eriochloa contracta*), grass
- composite dropseed (*Sporobolus compositus*), grass
- big bluestem (*Andropogon gerardii*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- Indiangrass (*Sorghastrum nutans*), grass
- eastern gamagrass (*Tripsacum dactyloides*), grass
- annual ragweed (*Ambrosia artemisiifolia*), other herbaceous
- common sunflower (*Helianthus annuus*), other herbaceous
- Illinois bundleflower (*Desmanthus illinoensis*), other herbaceous
- Maximilian sunflower (*Helianthus maximiliani*), other herbaceous

Community 3.1
Go-Back

This plant community occurs on areas that were formerly farmed. When tillage operations were discontinued, the areas were allowed to revegetate or “go back” naturally in contrast to artificial reseeding with a selected species or group of species. This is a slow, gradual process that entails many years and many successional changes or stages in the plant community. The speed and extent of revegetation depends on the size of the area, level of grazing management and the proximity of the area to existing seed sources. In the initial stages of revegetation the site is usually dominated by annual forbs such as annual ragweed, great ragweed, Canadian horseweed, common sunflower, annual marshelder and golden tickseed. Gradually these are replaced by annual grasses including prairie threeawn, crabgrass, prairie cupgrass, little barley, cheatgrass and bearded sprangletop. Usually plant succession will progress until the plant community is dominated by perennial grasses and grasslike plants including composite dropseed, foxtail barley, marsh bristlegrass, silver beardgrass, buffalograss, Torrey’s rush and sand dropseed. These plants can form a stable community. In time, with prescribed grazing management, other perennial grasses and forbs common in the Reference State return to the site. Adjoining areas with seed sources of big bluestem, Indiangrass and other tallgrasses may enhance recovery when included in a planned grazing system which includes significant growing season rest periods. Some go-back areas are invaded by trees and shrubs. The more common include Siberian elm, common hackberry, eastern redcedar, eastern cottonwood, black willow, roughleaf dogwood and coralberry. Occasional burning effectively controls these woody plants.

Dominant plant species

- prairie threeawn (*Aristida oligantha*), grass

Community 3.2
Reseed

This plant community also occurs on areas that were formerly farmed. When farming operations ended, the area was seeded and established to a mixture of plants, usually native species common in the Reference State. Most seeding mixtures consisted of a blend of grasses that included big bluestem, Indiangrass, switchgrass and little bluestem. In some locations seed of additional plants such as eastern gamagrass, prairie bundleflower and Maximilian sunflower were included in the mixture. Once these areas become established, production is comparable to that of the Reference State. When reseeded areas and areas supporting native rangeland exist in the same pasture, they seldom are utilized at the same intensity because domestic livestock usually prefer plants on the native rangeland areas. When feasible, reseeded plant communities should be managed as separate pastures or units. These areas are also generally productive when managed for hay production. Some seeded areas are invaded by trees and shrubs during the establishment period of the desired plants. These invader species commonly include Siberian elm, common hackberry, eastern redcedar, eastern cottonwood, black willow, and roughleaf dogwood. Occasional burning is effective in controlling the establishment of these woody plants.

Dominant plant species

- big bluestem (*Andropogon gerardii*), grass
- little bluestem (*Schizachyrium scoparium*), grass
- Indiangrass (*Sorghastrum nutans*), grass
- eastern gamagrass (*Tripsacum dactyloides*), grass
- Illinois bundleflower (*Desmanthus illinoensis*), other herbaceous

- Maximilian sunflower (*Helianthus maximiliani*), other herbaceous

State 4
Invasive Herbaceous

The Invasive Herbaceous State is identified by a significant presence of non-native herbaceous plant species and is characterized by the composition of plant species and soil functions that govern the ecological processes.

Characteristics and indicators. Species that define this state include sericea lespedeza and Caucasian bluestem. Sericea lespedeza and Caucasian bluestem community phases are partially defined by the total production exceeding 15% by weight on a per acre basis. Ecological processes within this state that are affected and differ from the Reference State are hydrologic cycle and nutrient cycle. Water content and infiltration rates are also affected by the species in the plant community phase.

Resilience management. The Invasive Herbaceous State is sustained through continued reduction in health and vigor of native plant species and the increase in health and vigor, including seed production, of non-native herbaceous species. Agronomic inputs from direct fertilization or nutrient-rich runoff from adjacent crop fields will provide advantages for non-native cool-season grass species growth. Ensuring a lack of forage quality due to season of grazing, type of grazing animal, or chemical composition of the non-native plants will deter grazing of non-native plant species and increase grazing pressure on native plant species. A general lack of treatment measures for individual species control, maintenance, and/or eradication will also allow persistence of this state.

Dominant plant species

- sericea lespedeza (*Lespedeza cuneata*), shrub
- Caucasian bluestem (*Bothriochloa bladhii*), grass

Community 4.1
Caucasian Bluestem

Caucasian bluestem is present at levels exceeding 15% by weight on a per acre basis and governing the ecological processes and potential uses of this community. Caucasian bluestem might be the most serious threat and most aggressive of the introduced, invasive, and noxious species of this time. Interspatial erosion can be present due to the clumpy growth of the plant which leads to a rough surface to walk or drive on. Caucasian bluestem is allelopathic (producing toxic chemicals that negatively impact the germination and/or growth of other plants) and often exists as a monoculture due to its competitive ability. Having this species present on a site can and will allow further invasion of adjacent sites if proactive prevention and control measures are not implemented. Research and trial studies are continuously being conducted on control measures for Caucasian bluestem. Soil dynamic property changes include infiltration, biological activity, and soil fertility.

Resilience management. Caucasian bluestem is extremely competitive with its allelopathic nature, lower palatability compared to native species, ability to persist with heavy utilization, and tolerance to drought. To prevent further loss of native plant composition, ensure native plant vigor remains high via a forage-animal balance based on forage composition and palatability, and utilize spot application of herbicides to control new and existing Caucasian bluestem plants. Fire can be utilized to remove standing dead growth and increase palatability of Caucasian bluestem in a mixed plant community, especially initial spring growth. Impacts to Caucasian bluestem via alternate timing of fire (late summer) is currently being investigated. There have been cases where the native taller grasses appear to shade and out-compete the Caucasian bluestem, but more commonly, it is crowding out the native grass as it spreads. There are ungrazed places on the Konza Prairie Research and biological station where Caucasian bluestem was introduced from feeding livestock contaminated hay and it is now crowding out the native grass.

Dominant plant species

- Caucasian bluestem (*Bothriochloa bladhii*), grass
- soybean (*Glycine max*), other herbaceous

Community 4.2

Sericea Lespedeza

Sericea lespedeza (*Lespedeza cuneata*) is present at levels exceeding 15% by weight on a per acre basis and governing the ecological processes and potential uses of this community. Sericea lespedeza is invasive and listed as a statewide noxious weed in Kansas. It competes with the native plant community for sunlight, water, and nutrients, and produces allelopathic compounds (toxic chemicals that negatively impact the germination and/or growth of other plants). It also contains tannins, that limit palatability, and produces copious amounts of seed that remain viable in the soil for decades. This species will quickly invade rangelands without proactive control measures.

Resilience management. Sericea lespedeza (*Lespedeza cuneata*) is extremely competitive with its allelopathic nature, lower palatability compared to native species, and good seedling vigor. To prevent further loss of native plant composition, ensure native plant vigor remains high via a forage-animal balance based on forage composition and palatability, utilize spot application of herbicides to control new and existing sericea lespedeza plants, and consider diversifying grazing livestock type. Control measures for sericea lespedeza involve herbicide application following extension recommendations and product label for proper rates and timing. Utilization and control can also be provided through sheep and goat grazing. Conventional management practices such as prescribed grazing with cattle and dormant-season fire have been less than effective in preventing the spread of sericea lespedeza in rangelands. Some suppression of sericea lespedeza has been observed after mowing or summer burning. Late summer fire significantly reduces seed production the year of burn. An integrated approach is needed when treating this species.

Dominant plant species

- sericea lespedeza (*Lespedeza cuneata*), shrub

State 5
Cropland

The Cropland State is dominated by row crops such as corn, wheat, and soybeans. It occurs on areas that have been mechanically tilled and converted to agricultural cropland. After tillage, efforts are then taken to plant various crops through a conservation cropping system.

Dominant plant species

- wheat (*Triticum*), grass
- corn (*Zea mays*), other herbaceous
- soybean (*Glycine max*), other herbaceous

Community 5.1
Cropland

This community occurs on areas where land use has been converted to intensive agriculture cropland through mechanical tillage and a conservation cropping system. Primary crops include corn, soybeans, and wheat.

Dominant plant species

- wheat (*Triticum*), grass
- corn (*Zea mays*), other herbaceous
- soybean (*Glycine max*), other herbaceous

State 6
Pastureland

The Pastureland State is identified by a significant presence of non-native herbaceous plant species and is characterized by the composition of plant species, agronomic inputs from direct fertilization, and soil functions that govern the ecological processes. Sites consisting of introduced species and managed for their continued presence or spread should not be evaluated within this model and instead, consider using a separate land use model such as Pasture.

Characteristics and indicators. Tall fescue, smooth brome, and Kentucky bluegrass are partially defined by the total production exceeding 40% by weight on a per acre basis. Ecological processes within this state that are affected and differ from the Reference State are hydrologic cycle and nutrient cycle. Water content and infiltration rates are also affected by the species in the plant community phase.

Resilience management. Pastureland is sustained through continued reduction in health and vigor of native plant species and the increase in health and vigor, including seed production, of non-native herbaceous species. Agronomic inputs from direct fertilization or nutrient-rich runoff from adjacent crop fields will provide advantages for non-native cool-season grass species growth. Ensuring a lack of forage quality due to season of grazing, type of grazing animal, or chemical composition of the non-native plants will deter grazing of non-native plant species and increase grazing pressure on native plant species. A general lack of treatment measures for individual species control, maintenance, and/or eradication will also allow persistence of this state.

Dominant plant species

- tall fescue (*Schedonorus arundinaceus*), grass
- smooth brome (*Bromus inermis*), grass
- Kentucky bluegrass (*Poa pratensis*), grass

Community 6.1
Fescue, Brome, Bluegrass

Tall fescue, smooth brome, and Kentucky bluegrass (all being cool-season grasses) are present at levels exceeding 40% by weight on a per acre basis and are governing the ecological processes and potential uses of this community. Timing of plant growth has shifted from summer (May through August) and now mostly occurs in spring and fall (March to May and September to November). Fire intensity of late spring burns can be greatly impeded due to the significant quantity of cool-season grass present. Any one or a combination of these species can be considered an invaded community. Soil dynamic property changes include biological activity and soil fertility.

Resilience management. Tall fescue, smooth brome, and Kentucky bluegrass are sustained or increased with nutrient additions and absence of fire. To prevent further loss of native plant composition, avoid nutrient additions, ensure native plant vigor remains high via a forage-animal balance based on forage composition and seasonal availability, utilize herbicides when natives are dormant but cool-seasons are actively growing, and utilize consecutive late spring prescribed burns. Chemical control will involve herbicide application following extension recommendations and product label for proper rates and timing. Intensifying grazing pressure (leaf removal of cool-season grasses) during the spring and fall and removing grazing pressure during the summer will reduce cool-season grass vigor and allow native warm-season plants an opportunity to maximize growth and gain vigor. Prescribed burning will require sufficient standing dead material in order to conduct a burn in late spring as warm-season grasses initiate growth. If the goal is continued presence or spread of tall fescue, smooth brome, or Kentucky bluegrass, consider using a separate land use model such as Pasture.

Dominant plant species

- Kentucky bluegrass (*Poa pratensis*), grass
- tall fescue (*Schedonorus arundinaceus*), grass
- smooth brome (*Bromus inermis*), grass

Transition T1A
State 1 to 2

Fire suppression greater than 20 years; woody invasion.

Transition T1B
State 1 to 4

A transition from Reference to an Invasive Herbaceous State occurs when the site is invaded by either Sericea lespedeza and/or Caucasian bluestem with the total production exceeding 15% by weight on a per acre basis.

Transition T1C
State 1 to 5

Tillage (or no-till if that management style is preferred) and seeding of agricultural crops will transition this site from a Reference State to a Cropland State.

Restoration pathway R2A
State 2 to 1

Woody removal; thinning; prescribed fire 1-3 years.

Transition T2A
State 2 to 5

Tillage (or no-till if that management style is preferred) and seeding of agricultural crops will transition this site from a Woody Invaded State to a Cropland State.

Transition T4A
State 4 to 5

Tillage (or no-till if that management style is preferred) and seeding of agricultural crops will transition this site from an Invasive Herbaceous State to a Cropland State.

Transition T5A
State 5 to 3

Allowing the site to naturally revegetate as it regenerates, or reseeding the site with native grasses and forbs with proper management afterwards will transition this site from a Cropland to a Prior-Tilled State.

Transition T5B
State 5 to 6

Seeding of cool season grasses and forbs and proper pasture management will transition this Cropland to a Pastureland.

Transition T6A
State 6 to 4

A transition from Pastureland to an Invasive Herbaceous State occurs when the site is invaded by either Sericea lespedeza and/or Caucasian bluestem with the total production exceeding 15% by weight on a per acre basis.

Transition T6B
State 6 to 5

Tillage (or no-till if that management style is preferred) and seeding of agricultural crops will transition this site from a Pastureland to a Cropland.

Additional community tables

Animal community

Wildlife*

Game species that utilize this ecological site include:
White-tailed Deer will utilize this ecological site for browse (plant leaves in the growing season, seeds and soft mast in the fall/winter). This site type also can provide escape cover.

Migratory Waterbirds: Sora, Common Snipe and Virginia Rail

Furbearers: Muskrat, Beaver, and Mink.

Bird species associated with this ecological site's reference state condition:
Breeding birds: Sedge Wren, Red-Winged Blackbird, Least Bittern, Marsh Wren, and Common Yellowthroat.
Migratory birds: Sora, Virginia Rail, Sedge Wren, Least Bittern, Yellow Rail and Common Snipe.

Amphibian and reptile species associated with this ecological site's reference state condition: Western Chorus Frog (Pseudacris triseriata triseriata), Plains Leopard Frog (Rana blairi), Graham's Crayfish Snake (Regina grahamii), Midland Brown Snake (Storeria dekayi wrightourm), and prairies with crawfish burrows may have Northern Crawfish Frog (Rana areolata circulosa).

Small mammals associated with this ecological site's reference state condition: Muskrat (Ondatra zibethicus), Southern Bog Lemming (Synaptomys cooperi), and Mink (Mustela vison).

Many native insect species are likely associated with this ecological site, especially native bees, ants, beetles, butterflies and moths, and crickets, grasshoppers and katydids. However information on these groups is often lacking enough resolution to assign them to individual ecological sites.

Insect species known to be associated with this ecological site's reference state condition: Swamp Milkweed Leaf Beetle (Labidomera clivicollis), Cordgrass Planthopper (Prokelisia crocea), Dion Skipper butterfly (Euphyes dion), Duke's Skipper butterfly (Euphyes dukesi), native bees (Lasioglossum hartii, Hesperapis carinata, Svastra atripes and Cemolobus ipomoeae), Bullate Meadow katydid (Orchelimum bullatum) and Sedge Grasshopper (Stethophyma celatum).

Other invertebrates: Grassland Crayfish (Procambarus gracilis)

*This section prepared by Mike Leahy, Natural Areas Coordinator, Missouri Department of Conservation, 2013

Other information

Forestry

Management: This ecological site is not recommended for traditional timber management activity. Historically this site was dominated by a ground cover of native prairie grasses and forbs. Some scattered open grown trees may have also been present. May be suitable for non-traditional forestry uses such as windbreaks, environmental plantings, alley cropping (a method of planting, in which rows of trees or shrubs are interspersed with rows of crops) or woody bio-fuels.

Inventory data references

The STM model is based on available experimental research, field observations, professional consensus, and interpretations. It is likely to change as knowledge increases.

Other references

Fitzgerald, J.A. and D.N. Pashley. 2000a. Partners in Flight bird conservation plan for the Ozark/Ouachitas. American Bird Conservancy. Brentwood, Missouri.

Fitzgerald, J.A. and D.N. Pashley. 2000b. Partners in Flight bird conservation plan for the Dissected Till Plains. American Bird Conservancy. Brentwood, Missouri.

Heitzman, J.R. and J.E. Heitzman. 1996. Butterflies and moths of Missouri. 2nd ed. Missouri Department of Conservation, Jefferson City, Missouri.

Jacobs, B. 2001. Birds in Missouri. Missouri Department of Conservation, Jefferson City, Missouri.

Johnson, T.R. 2000. The amphibians and reptiles of Missouri. 2nd ed. Missouri Department of Conservation, Jefferson City, Missouri.

NatureServe. 2010. Vegetation Associations of Missouri (revised). NatureServe, St. Paul, Minnesota.

Nelson, Paul W. 2010. The Terrestrial Natural Communities of Missouri. Missouri Department of Conservation, Jefferson City, Missouri.

Nigh, Timothy A., & Walter A. Schroeder. 2002. Atlas of Missouri Ecoregions. Missouri Department of Conservation, Jefferson City, Missouri.

Pitts, D.E. and W.D. McGuire. 2000. Wildlife management for Missouri landowners. 3rd ed. Missouri Department of Conservation, Jefferson City, Missouri.

Schwartz, C.W., E.R. Schwartz and J.J. Conley. 2001. The wild mammals of Missouri. University of Missouri Press, Columbia and Missouri Department of Conservation, Jefferson City, Missouri.

U.S. Dept. of Agric. Natural Resources Conservation Service. 2004. Soil Survey of Jasper County, Missouri. Washington D.C.

U.S. Dept. of Agric. Soil Conservation Service. 1977. Soil Survey of Vernon County, Missouri. Washington D.C.

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Approval

Suzanne Mayne-Kinney, 11/05/2024

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)	
Contact for lead author	
Date	12/22/2024
Approved by	Suzanne Mayne-Kinney
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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

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5. **Number of gullies and erosion associated with gullies:**

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

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

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

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

14. **Average percent litter cover (%) and depth (in):**

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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:**

17. **Perennial plant reproductive capability:**