USDA Natural Resources
Conservation Service

Ecological site F121XY023KY
Well Drained & Moderately Well Drained Fragipan Upland

Last updated: 10/01/2024
Accessed: 05/20/2025

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): 121X–Kentucky Bluegrass

General: MLRA 121 is in Kentucky (83 percent), southern Ohio (11 percent), and southern Indiana (6 percent). It makes up about 10,680 square miles (27,670 square kilometers). The cities of Cincinnati, Ohio, and Louisville, Frankfort, and Lexington, Kentucky, are in this area.

Physiography: This area is primarily in the Lexington Plain Section of the Interior Low Plateaus Province of the Interior Plains.

Soils: The dominant soil orders in MLRA 121 are Alfisols, Inceptisols, and Mollisols. The soils in the area dominantly have a mesic soil temperature regime, an udic soil moisture regime, and mixed mineralogy. They are shallow to very deep, generally well-drained, and loamy or clayey. Hapludalfs formed in residuum on hills and ridges (Beasley, Cynthiana, Eden, Faywood, Lowell, and McAfee series) and in loess over residuum on hills and ridges (Carmel and Shelbyville series). Paleudalfs (Crider and Maury series) formed in loess or other silty sediments over residuum on hills and ridges. Fragiudalfs (Nicholson series) formed in loess over residuum on ridges. Hapludolls formed in residuum on hills and ridges (Fairmount series) and in alluvium on floodplains (Huntington series). Eutrudepts (Nolin series) formed in alluvium on flood plains.

Geology: Most of this area has an Ordovician-age limestone that has been brought to the surface in the Jessamine Dome, a high part of a much larger structure called the Cincinnati Arch. The strata of limestone have a propensity to form caves and karst topography. Younger units of thin-bedded shale, siltstone, and limestone occur at the eastern and western edges of the area.

The area has no coal-bearing units. Pleistocene-age loess deposits cover most of the bedrock units in this MLRA, and some glacial lake sediments are at the surface in the northwest corner of the area. Unconsolidated alluvium is deposited in the river valleys.

Classification relationships

Southern Interior Low Plateau Dry-Mesic Oak Forest, Unique Identifier: CES202.898 (NatureServe, 2015)

Ecological site concept

The Well Drained & Moderately Well Drained Fragipan Upland ecological site is characterized by deep to moderately deep soils that have a fragipan layer usually between 20-40". Representative soils include: Nicholson, Tilsit.

The majority of these sites within MLRA 121 are now utilized as pasture or cropland, so high quality forested reference communities are extremely rare. Oak and hickory trees would be the historical dominant forest type; however, due to the cessation of a natural fire regime and decades of disturbances, phase 1.2 is now common.

State 1, Phase 1.1: Plant species dominants:
Quercus alba-Quercus velutina/Lindera benzoin/Polygonum virginianum-Dentaria heterophylla (white oak – black oak / spicebush / Virginia knotweed – slender toothwort)

State 1, Phase 1.2: Plant species dominants: Acer saccharum-Liriodendron tulipifera/Lindera benzoin/Polygonum virginianum-Dentaria heterophylla
Dominant phase 1.1 trees may include Quercus alba (white oak), Quercus muehlenbergii (chinkapin oak), Quercus rubra (red oak), Quercus shumardii (Shumard oak), Carya ovata (shagbark hickory), Carya tomentosa (mockernut hickory), Ulmus rubra (slippery elm), Acer saccharum (sugar maple), Fraxinus quadrangulata (blue ash), Cercis canadensis (redbud), Cornus florida (dogwood), Oxydendrum arboreum (sourwood), Ulmus americana (American elm), and Juniperus virginiana (eastern red cedar).

Phase 1.2 is typified by dominant trees that are more mesic, quick-growing, and shade tolerant than oaks or hickories. This community has increased due to the cessation of fire in the early 1900’s. Sugar maple, tulip tree, and sweet gum are the most commonly found species on these sites according to NASIS field data. Other quick growing species present may include hackberry, boxelder, and white ash. The increase in forest floor shade reduces oak-hickory regeneration while providing an advantageous environment for the continuation of shade-tolerant tree species to be dominant.

Forest stand management inputs including maple-ash removal, prescribed fire, non-native species control and other timber stand improvement activities are often warranted on these sites to develop a quality reference community.

State: 2. Pasture
State 2, Phase 2.1: Managed Pasture. Plant species dominants: Schedonorus arundinaceus (tall fescue)

State 2, Phase 2.2: Minimally Managed Pasture. Plant species dominants: Rosa multiflora- Rubus spp. /Schedonorus arundinaceus

State 2, Phase 2.3: Warm season pasture. This sites are very suitable for the development of warm season pastures for forage production or wildlife habitat. Species composition is dependent upon seeding and management.

State: 3. Transitional (Abandoned) Field

State 3, Phase 31: Plant species dominants: eastern red cedar (Juniperus virginiana)/ tall fescue (Schedonorus arundinaceus)-giant ironweed (Vernonia gigantean).

State: 4. Honeysuckle Invaded Woodland
State 4, Phase 4.1: Plant species dominants: Acer saccharum- Celtis occidentalis/ Lonicera maackii.

This state is characterized by a dense understory of Lonicera spp. (usually L. maackii in MLRA 121) which fundamentally alters the native plant communities due to shade and competition. Long-term, multi-year control efforts are required to control this aggressive non-native plant and restore native woodlands.

State: 5. Cropland
State 5, Phase 5.1: Plant species dominants: dependent upon seeding and management. Most common crops are corn and soybeans.

Associated sites

F121XY022KY	**Somewhat Poorly Drained Fragipan Upland** Somewhat Poorly Drained Fragipan Uplands

Table 1. Dominant plant species

Tree	(1) *Quercus alba* (2) *Quercus velutina*
Shrub	(1) *Lindera benzoin*
Herbaceous	(1) *Polygonum virginianum* (2) *Dentaria heterophylla*

Physiographic features

The Well Drained & Moderately Well Drained Fragipan Upland ecological site is characterized by deep to moderately deep soils that have a fragipan layer usually between 20-40".

It is anticipated that multiple ESDs may come from this group once field work commences. Grouping will likely be influenced by flooding/ponding duration.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Flat
Runoff class	Low to very high
Elevation	430–1,000 ft
Slope	0–12%
Ponding depth	0–30 in
Water table depth	17–72 in
Aspect	Aspect is not a significant factor

Climatic features

These ecological sites are located in MLRA 121 and are at the northern periphery of the humid subtropical climate zone. Generally characterized by hot, humid summers and cold winter, the area has four distinct seasons. The expected annual precipitation for sites included in this ecological site description is generally in the range of 40 to 50 inches. The majority of precipitations falls during the freeze-free months, and thunderstorms with heavy rainfall are common during the spring and summer months. The freeze-free period varies somewhat based on localized topography and longitude.

MLRA climate summary: The average annual precipitation in most of this area is 41 to 45 inches. It is 45 to 52 inches along the southern edge of the area. About one-half of the precipitation falls during the growing season. Most of the rainfall occurs as high-intensity, convective thunderstorms. The annual snowfall averages about 14 inches (370 millimeters). The average annual temperature is 51 to 57 degrees F (10 to 14 degrees C). From: Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin (U.S. Department of Agriculture Handbook 296, 2006)

Table 3. Representative climatic features

Frost-free period (characteristic range)	160-178 days
Freeze-free period (characteristic range)	186-199 days
Precipitation total (characteristic range)	43-45 in
Frost-free period (actual range)	155-183 days

Freeze-free period (actual range)	186-205 days
Precipitation total (actual range)	43-45 in
Frost-free period (average)	169 days
Freeze-free period (average)	193 days
Precipitation total (average)	44 in

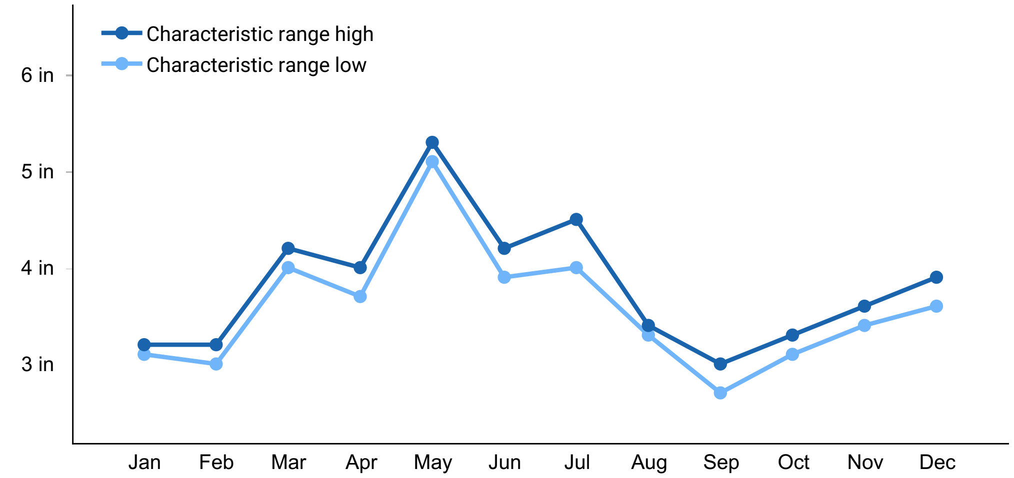

Figure 1. Monthly precipitation range

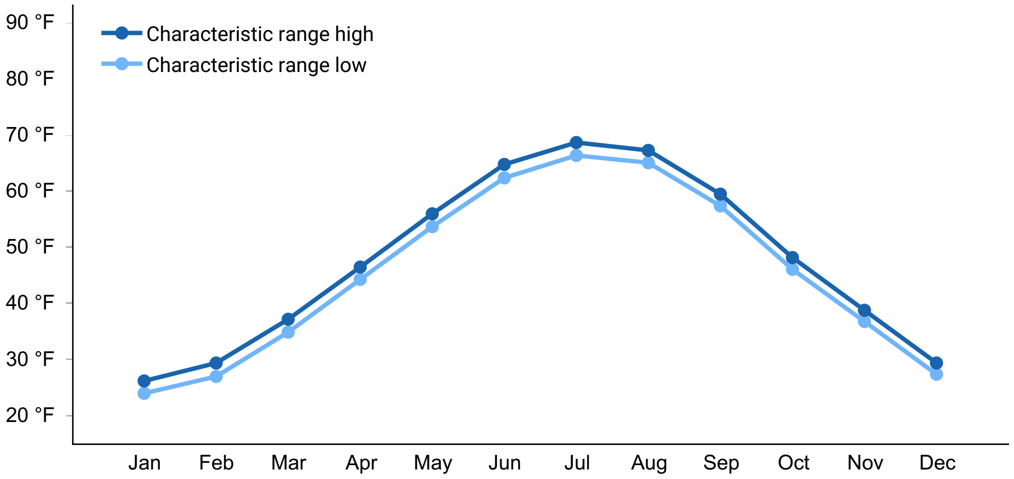

Figure 2. Monthly minimum temperature range

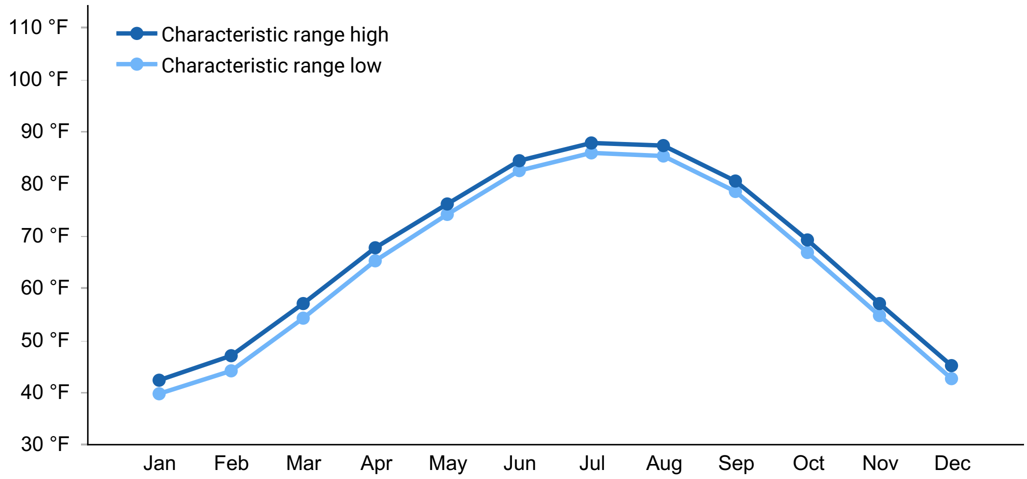

Figure 3. Monthly maximum temperature range

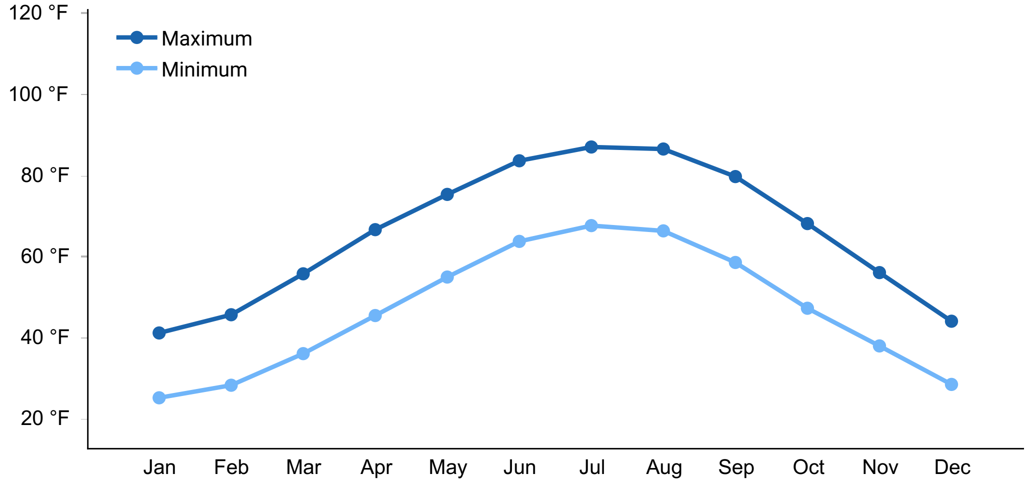

Figure 4. Monthly average minimum and maximum temperature

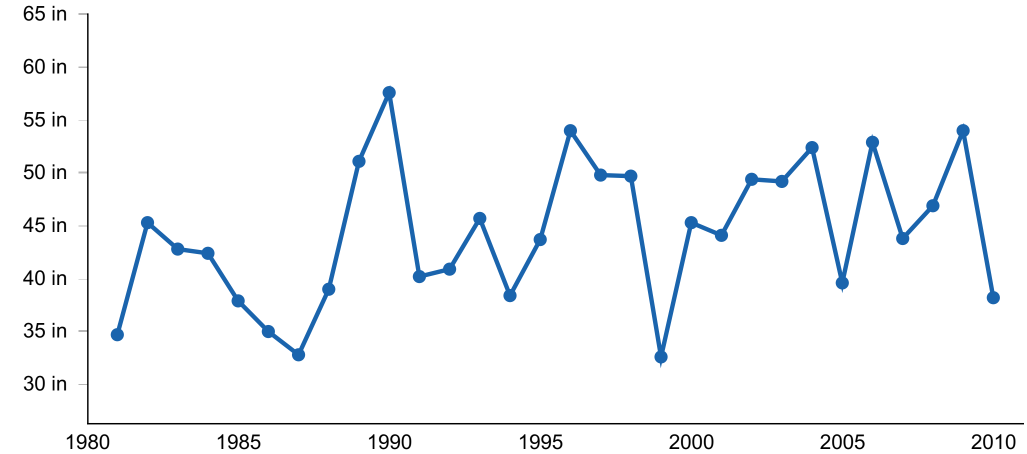

Figure 5. Annual precipitation pattern

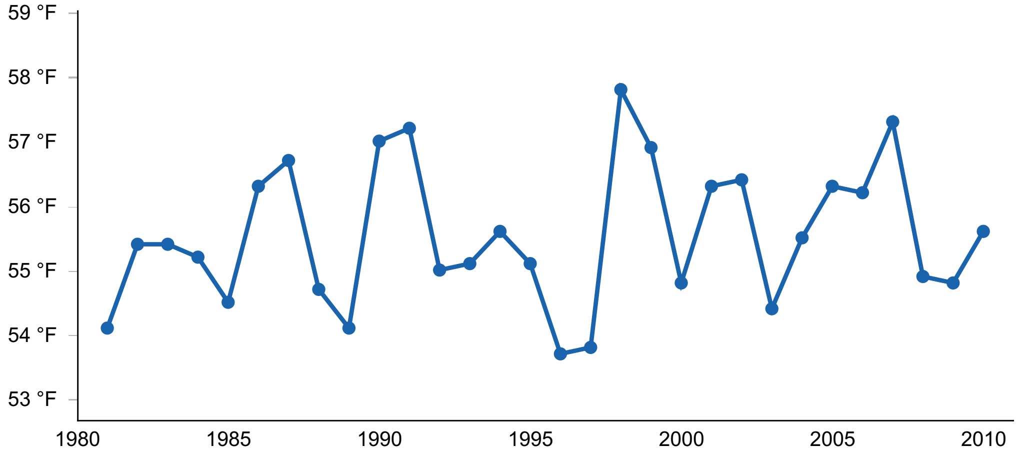

Figure 6. Annual average temperature pattern

Climate stations used

- (1) LEXINGTON BLUEGRASS AP [USW00093820], Lexington, KY
- (2) CINCINNATI NORTHERN KY AP [USW00093814], Burlington, KY
- (3) LOUISVILLE INTL AP [USW00093821], Louisville, KY

Influencing water features

There are no influencing water features.

Soil features

Group includes WD & MWD Fragipan Upland soils. Representative soils include: Nicholson, Tilsit.

Table 4. Representative soil features

Parent material	(1) Residuum–shale and siltstone (2) Loess
Surface texture	(1) Silt loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained
Permeability class	Very slow
Soil depth	72 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	4 in

Soil reaction (1:1 water) (0-40in)	3.5–7.8
Subsurface fragment volume <=3" (Depth not specified)	0–18%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

State and transition model

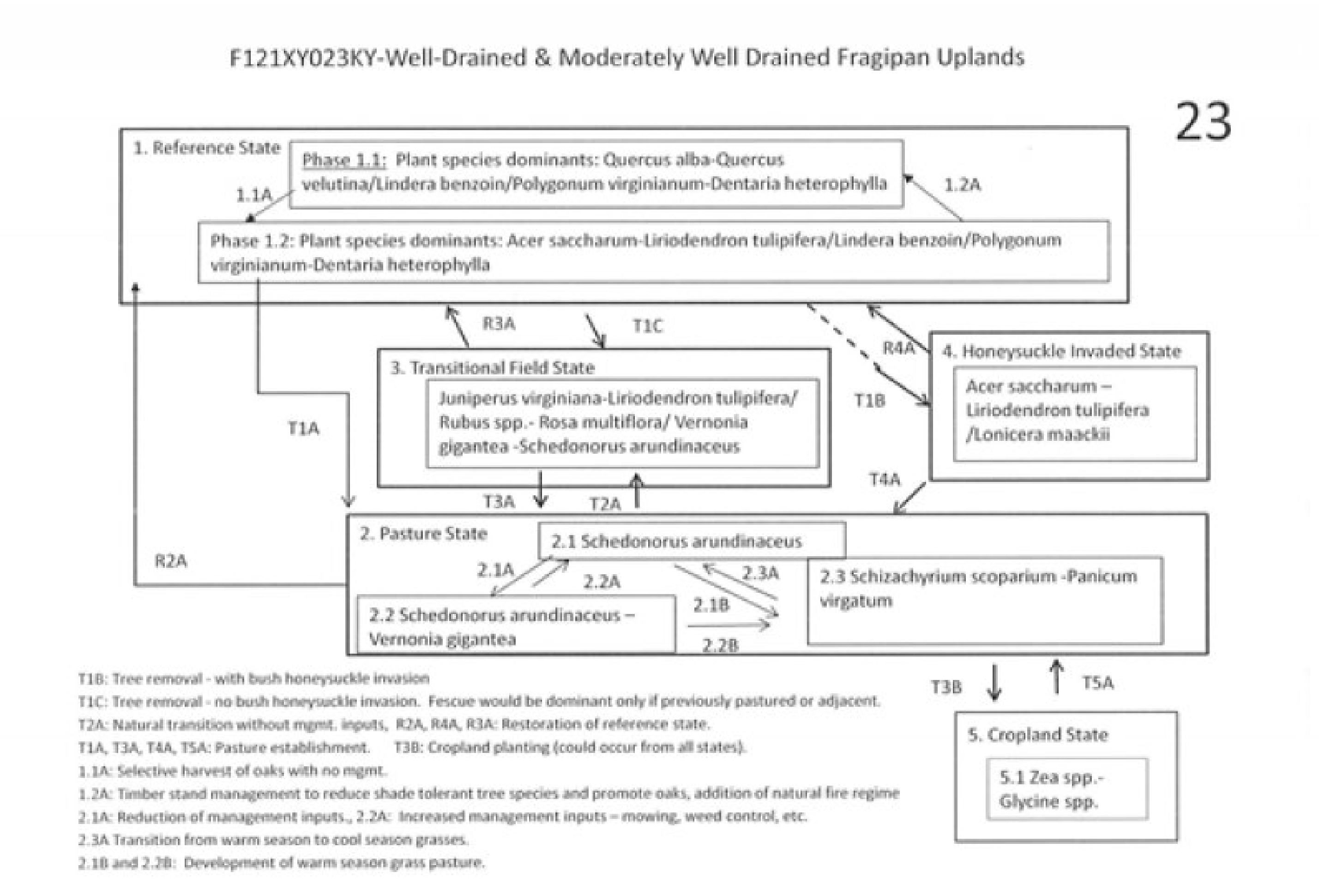

Figure 7. MLRA 121, Group 23

Inventory data references

Site Development and Testing Plan
Future work is needed, as described in a future project plan, to validate the information presented in this provisional ecological site description. Future work includes field sampling, data collection and analysis by qualified vegetation ecologists and soil scientists. As warranted, annual reviews of the project plan can be conducted by the Ecological Site

Technical Team. A final field review, peer review, quality control, and quality assurance reviews of the ESD are necessary to approve a final document.

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Contributors

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Approval

Greg Schmidt, 10/01/2024

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	05/20/2025
Approved by	Greg Schmidt
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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

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

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

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

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

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

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

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

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

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

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):**

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

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

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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:**

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17. **Perennial plant reproductive capability:**
