USDA Natural Resources Conservation Service

Ecological site F114XA404IN
Outwash Upland Forest

Last updated: 9/26/2024
Accessed: 05/13/2025

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): 114X–Southern Illinois and Indiana Thin Loess and Till Plain

MLRA 114 makes up about 4,550 square miles (11,795 square kilometers. The three parts of this MRLA are mostly in the Till Plains Section of the Central Lowland Province of the Interior Plains. The western third of the western part is in the Highland Rim Section of the Interior Low Plateaus Province of the Interior Plains. The eastern half of the eastern part is in the Kanawha Section of the Appalachian Plateaus Province of the Appalachian Highlands. Both large and small tributaries of the Ohio River dissect the nearly level to very steep glaciated uplands in this area. The major streams and rivers have well defined valleys with broad flood plains and numerous stream terraces. The flood plains along the smaller streams are narrow. Broad summits are nearly level to gently sloping. Elevation ranges from 320 feet (100 meters) on the southernmost flood plain along the Ohio River to 1,250 feet (380 meters) on the highest ridges. Local relief is mainly 10 to 50 feet (3 to 15 meters), but it can be 50 to 100 feet (15 to 30 meters) along drainageways and streams. Also, the Ohio River bluffs are as much as 300 feet (90 meters) above the river valley floor.

Classification relationships

USFS: 222 Eastern Broadleaf Forest (Continental) Province

Homoya's Natural Regions of Indiana: Bluegrass Region

The following NatureServe Explorer Ecological System has a high level of probability to match the ecological site found on these soils. Field verification is needed prior to using this information for conservation planning and/or restoration initiatives:

Ecological site concept

The Outwash Upland Forest site is that of a dry oak-hickory forest. The forest canopy is dominated by black oak, white oak and shagbark hickory. Associate canopy species include included black cherry, sassafras, and pignut hickory. Fire played an important role in maintaining an open understory, so brambles and native roses were common in the understory. A frequent fire regime allowed prairie species such as Pennsylvania sedge and big bluestem to exist on sites. Low severity surface fires maintained the dominance of oak and hickory trees. An increase in the fire return interval will move this state to more fire sensitive, shade tolerant species such as sugar maple and American beech. Currently, the majority of the site is in agricultural production, with the majority being used for growing corn and soybeans.

Associated sites

F114XA502IN	**Till Uplands** Till Upland sites may be associated with Outwash Upland Forest sites.

Similar sites

F114XA103IN	**Sloping Lacustrine Forest** Similar tree species (oak, hickory, maple.) may be found on Sloping Lacustrine Forest sites.

Table 1. Dominant plant species

Tree	(1) *Quercus* (2) *Carya ovata*
Shrub	(1) *Rubus* (2) *Rosa*
Herbaceous	(1) *Schizachyrium*

Physiographic features

These soils are on backslopes, shoulders, and summits. Landforms include outwash plains and outwash terraces.

Table 2. Representative physiographic features

Landforms	(1) Outwash plain > Hill (2) Outwash plain > Terrace--outwash or marine
Runoff class	Negligible to high
Flooding frequency	None
Ponding frequency	None
Elevation	107–305 m
Slope	0–35%
Water table depth	64–89 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

About 60 percent of the precipitation falls during the freeze-free period. Most of the rainfall occurs as high-intensity, convective thunderstorms during summer. Snowfall is common in winter. . The freeze-free period averages about 180 days.

Table 3. Representative climatic features

Frost-free period (characteristic range)	154-160 days
Freeze-free period (characteristic range)	179-185 days
Precipitation total (characteristic range)	1,118-1,194 mm
Frost-free period (actual range)	153-160 days
Freeze-free period (actual range)	177-190 days
Precipitation total (actual range)	1,092-1,194 mm
Frost-free period (average)	157 days
Freeze-free period (average)	183 days
Precipitation total (average)	1,168 mm

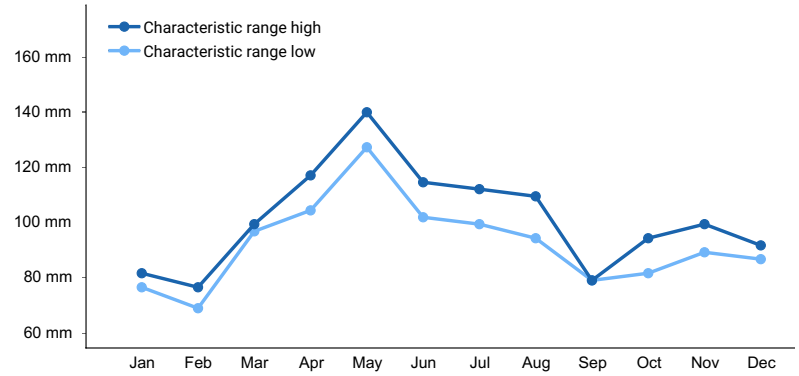


Figure 1. Monthly precipitation range

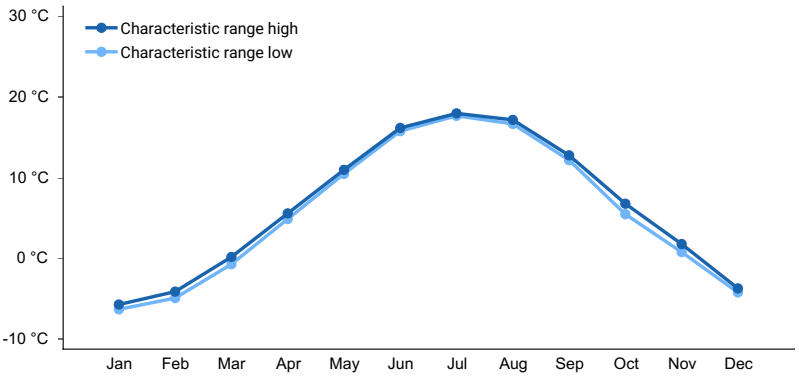


Figure 2. Monthly minimum temperature range

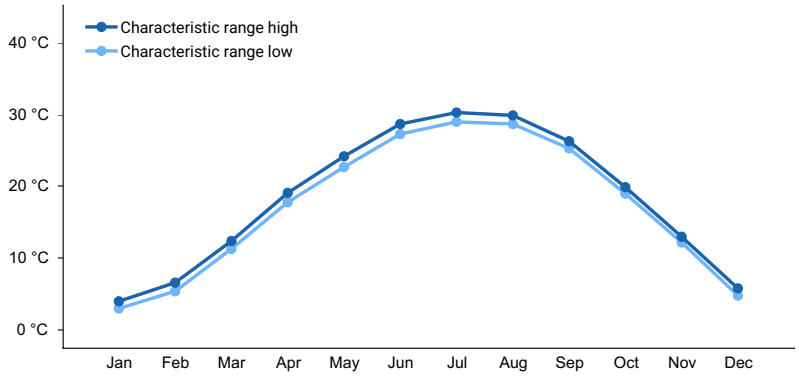


Figure 3. Monthly maximum temperature range

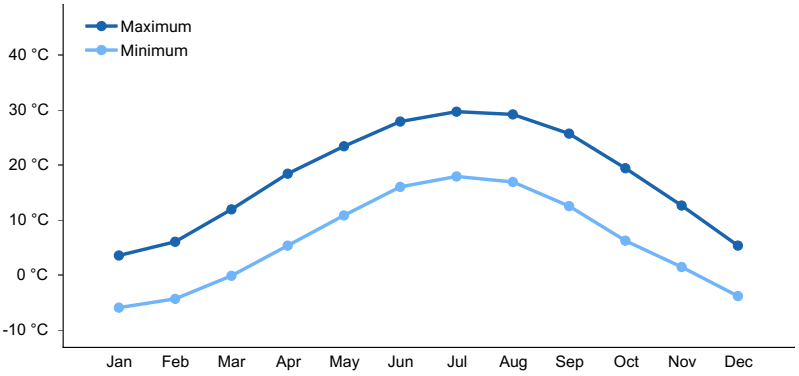


Figure 4. Monthly average minimum and maximum temperature

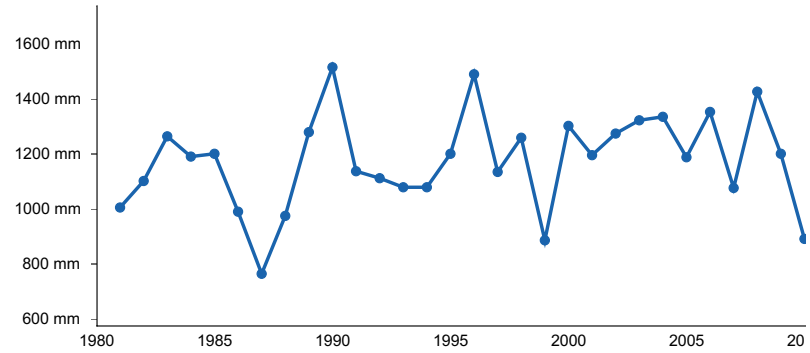


Figure 5. Annual precipitation pattern

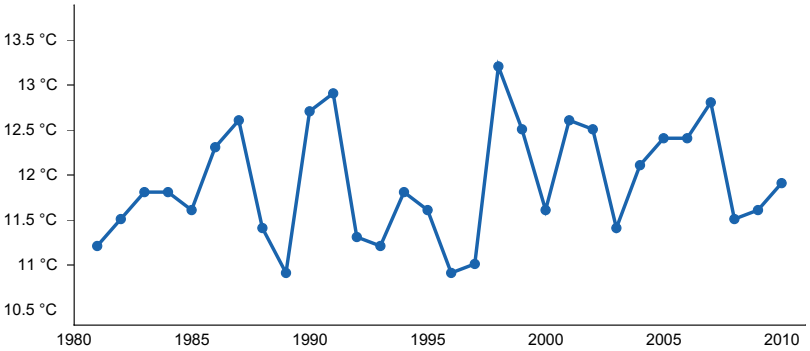


Figure 6. Annual average temperature pattern

Climate stations used

- (1) NORTH VERNON 2 ESE [USC00126435], North Vernon, IN
- (2) HILLSBORO [USC00333758], Hillsboro, OH
- (3) MILFORD [USC00335268], Milford, OH
- (4) SEYMOUR 2 N [USC00127935], Seymour, IN

Influencing water features

These sites are no influenced by wetland or riparian water features.

Soil features

Soils are very deep, moderately well drained to well drained, and on outwash plains and terraces. Series currently in this group include Alford, Chetwynd, Chili, Libre, Medona, Negley, Ninevah, Parke, Pike, Rainsboro, Sardinia, Vallonia, Williamsburg.

Table 4. Representative soil features

Parent material	(1) Outwash (2) Loess
Surface texture	(1) Loam (2) Silt loam (3) Clay loam (4) Sandy clay loam
Drainage class	Moderately well drained to well drained
Permeability class	Moderately slow to moderately rapid
Depth to restrictive layer	51–89 cm
Soil depth	152–203 cm
Surface fragment cover <=3"	0–5%

Surface fragment cover >3"	0–5%
Available water capacity (Depth not specified)	12.7–17.78 cm
Soil reaction (1:1 water) (Depth not specified)	4.9–6.2
Subsurface fragment volume <=3" (Depth not specified)	0–15%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Table 5. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	Not specified
Soil depth	Not specified
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (Depth not specified)	10.16–20.83 cm
Soil reaction (1:1 water) (Depth not specified)	Not specified
Subsurface fragment volume <=3" (Depth not specified)	Not specified
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

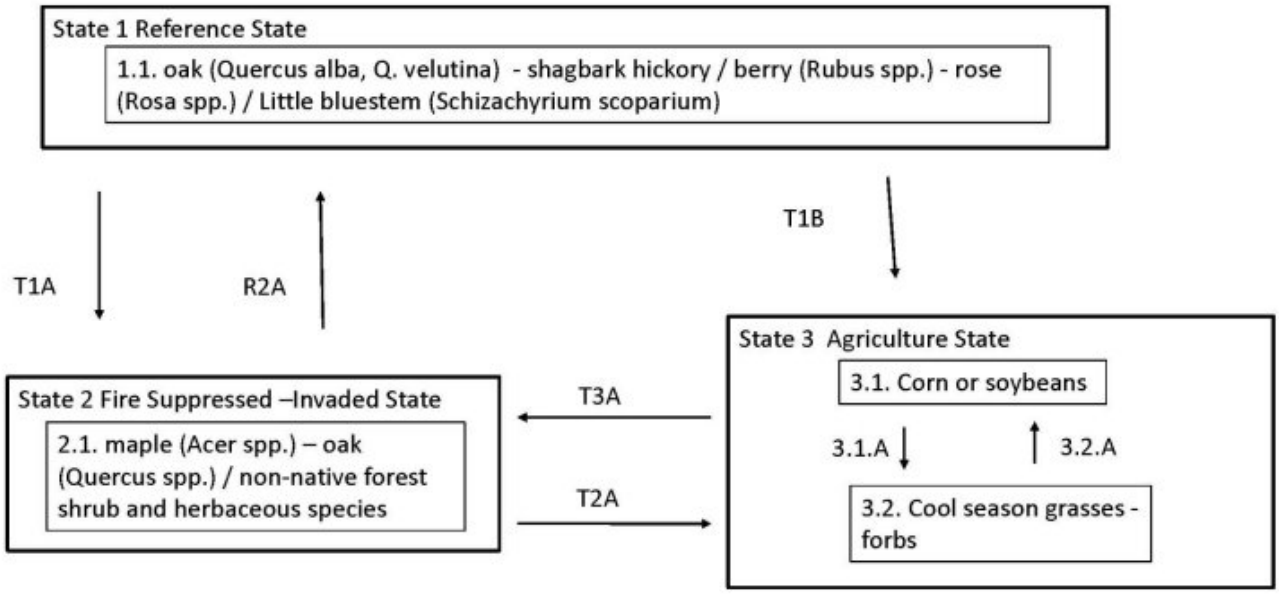
In reference conditions, this forested site was dominated by black oak, shagbark hickory, pignut hickory, and white oak. Frequent fires maintained an open canopy and allowed the presence of grasses and shrubs. Brambles and native roses are common in the understory. Many species of native forbs, herbs, and vines were present. Vines included poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), and grapes (Vitis spp.).

Lack of fire will result in an increase in tree density , shade, and forest species. Herbs found on densely forested sites (lack of regular fires) will include multiple species of ticktrefoil (Desmodium spp.), bedstraws (Galium spp.), mayflower (Maianthemum spp.), and agrimony (Agrimonia spp.) Other species may include Clayton’s Sweetroot (*Osmorhiza claytonii*), American hogpeanut (*Amphicarpaea bracteata*), rattlesnake fern (*Botrychium virginianum*), and woodoats (*Danthonia spicata*).

An absence of the normal fire return interval, large scale canopy removal, or prolonged disturbances will promote shade tolerant species, specifically sugar maple, tulip poplar, and beech to become more dominant. Most of the current sites have had historic disturbances, including selective harvesting, and have lost much of the oak component.

The majority of these sites have been converted to agriculture or developed.

State and transition model



State 1
Reference State

The historic reference state is an open oak -hickory forest. Dominants include white oak, black oak, shagbark hickory, and pignut hickory. Tree density and understory composition was dependent upon fire return intervals and other natural disturbances. Frequent fires would push the understory community toward a more open structure with prairie species present. Lack of fire would allow more shade tolerant forest plants to increase.

Dominant plant species

- black oak (*Quercus velutina*), tree
- white oak (*Quercus alba*), tree
- shagbark hickory (*Carya ovata*), tree
- pignut hickory (*Carya glabra*), tree
- sumac (*Rhus*), shrub
- greenbrier (*Smilax*), shrub
- rose (*Rosa*), shrub
- little bluestem (*Schizachyrium scoparium*), grass
- sedge (*Carex*), grass

Community 1.1
Reference Community

This community is characterized by an oak-hickory forest with the dominant species being white oak and shagbark hickory. The competitive advantage of these species is maintained by a natural fire regime with a return interval

approximately 30-45 years. (LandFire, 2010) Principal canopy components are black oak (*Quercus velutina*), shagbark hickory (*Carya ovata*), white oak (*Q. alba*), and pignut hickory (Carya alba). Other species on site include sugar maple (*Acer saccharum*), black cherry (*Prunus serotina*), elms (Ulmus spp.), sassafras (*Sassafras albidum*), and white ash (*Fraxinus americana*). Historically, shellbark hickory (*Carya laciniosa*) was likely present. An absence of a natural fire regime, large-scale canopy disturbance, or selective harvest without timber stand management will result in these sites transitioning to a dry- mesic hardwood forest dominated by sugar maple, tulip poplar, white ash, and/or American beech. Today, most sites are utilized for agricultural production.

Dominant plant species

- white oak (*Quercus alba*), tree
- black oak (*Quercus velutina*), tree
- pignut hickory (*Carya glabra*), tree
- shagbark hickory (*Carya ovata*), tree
- sumac (*Rhus*), shrub
- rose (*Rosa*), shrub
- greenbrier (*Smilax*), shrub
- eastern poison ivy (*Toxicodendron radicans*), other herbaceous
- sedge (*Carex*), other herbaceous

State 2
Fire Suppressed- Invaded State

This state is characterized by fire suppression which transitions the community from an open oak reference community to a denser forested site. Lack of burning will allow more fire intolerant trees, shrubs and sub-canopy species to develop. Understory species composition and density will be altered by an increase in shading. Most remaining wooded sites have undergone substantial disturbances (clearing, oak removal, grazing, etc.). Disturbances often provide a pathway for the introduction of non-native species. The aggressive nature of these plants results in substantial changes to the native plant community. Trees on these sites will depend on the type of disturbance and the available seed sources.

Dominant plant species

- maple (*Acer*), tree
- oak (*Quercus*), tree
- Amur honeysuckle (*Lonicera maackii*), shrub
- autumn olive (*Elaeagnus umbellata*), shrub
- sassafras (*Sassafras albidum*), shrub
- garlic mustard (*Alliaria petiolata*), other herbaceous
- Japanese honeysuckle (*Lonicera japonica*), other herbaceous
- spindletree (*Euonymus*), other herbaceous

Community 2.1
Fire Suppressed-Invaded Community

Lack of fire transitions the community from an open oak woodland to a denser forested site. Fire suppression allows for a denser growth of trees, shrubs and sub-canopy species. Understory species composition and density will be altered by an increase in shading. Many remaining wooded sites have incurred disturbances such as clearing, oak removal, heavy grazing, etc. Disturbances often provide a pathway for the introduction of non-native species. The aggressive nature of these plants results in substantial changes to the native plant community. Trees on site will depend on the type of disturbance and the available seed sources.

Dominant plant species

- maple (*Acer*), tree
- ash (*Fraxinus*), tree
- cottonwood (*Populus*), tree
- honeysuckle (*Lonicera*), shrub
- autumn olive (*Elaeagnus umbellata*), shrub

- garlic mustard (*Alliaria petiolata*), other herbaceous
- Japanese honeysuckle (*Lonicera japonica*), other herbaceous
- spindletree (*Euonymus*), other herbaceous

State 3
Agricultural State

Agricultural uses vary depending on landowner objectives. Many species of cool season or warm season grasses along with forbs can be planted on these sites. Row crops are also grown in many locations.

Dominant plant species

- tall fescue (*Schedonorus arundinaceus*), grass
- white clover (*Trifolium repens*), grass
- red clover (*Trifolium pratense*), grass
- brome (*Bromus*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- corn (*Zea mays*), other herbaceous
- soybean (*Glycine max*), other herbaceous

Community 3.1
Cropland Community

This plant community is generally in a corn to soybean to corn rotation. Many crops can be grown on these sites. Species selection will depend on management goals.

Community 3.2
Pasture Community

Many species of warm season and cool season grasses can be grown on these sites. Plant selection will depend on landowner goals.

Dominant plant species

- brome (*Bromus*), grass
- tall fescue (*Schedonorus arundinaceus*), grass
- Kentucky bluegrass (*Poa pratensis*), grass
- red clover (*Trifolium pratense*), other herbaceous
- white clover (*Trifolium repens*), other herbaceous

Pathway 3.1A
Community 3.1 to 3.2

Establishment of pasture. Management inputs may include site preparation, seeding, weed control, and brush control.

Pathway 3.2A
Community 3.2 to 3.1

Establishment of cropland. Plants utilized will depend on management objectives. Inputs will likely include site preparation, seeding, fertilizing, and weed control.

Transition T1A
State 1 to 2

Lack of natural fire regimes will result in fire intolerant tree species increasing. Maple, ash, poplar, and beech gain co-dominance on these sites if fire free intervals extend beyond approximately 40 years.

Transition T1B
State 1 to 3

Clearing of site for the purpose of cropland production. Not all mapunits may be appropriate for agricultural conversion due to slope.

Restoration pathway R2A
State 2 to 1

Restoration to the reference site would require long-term management efforts including brush control, weed control, timber stand improvement projects, and prescribed fire.

Transition T2A
State 2 to 3

Transition the Invaded State to an agricultural state would require substantial management inputs including tree/shrub removal, site preparation, brush control, weed control, and planting of desired species. NOTE: many mapunits in this initial PES grouping are not appropriate for crop production due to slope and high risk of soil erosion and water quality impacts.

Transition T3A
State 3 to 2

Abandoning an agricultural site would allow for successional plant communities to take hold and dominate. First, weedy annuals would increase followed by shrubs, perennials and tree seedlings/saplings. Eventually tree species would be dominate, and the species composition would vary greatly depending on available seed sources. Common species on these sites include maple, ash, cottonwood, and numerous non-native species.

Additional community tables

Inventory data references

No field monitoring was conducted as part of this PES development. Future ESD development may result in plant community edits, soil mapunits being added or removed from this grouping, and/or additions or modifications to the narratives, tables, vegetation descriptions and state and transition model.

Other references

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Approval

Greg Schmidt, 9/26/2024

Acknowledgments

PES documents developed for adjacent MLRAs in Indiana and Ohio served as a source of information as these regions often shared similar soil series with MLRA 114A. NRCS county soil surveys where a valuable reference including tree species observed on site by NRCS staff. Soil Survey and NRCS Indiana resource soil scientists contributed field observation, field notes, and extensive soil mapping expertise.

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)	A Arends, ESI Specialist
Contact for lead author	
Date	05/13/2025
Approved by	Greg Schmidt
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

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

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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):**

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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:**
