USDA Natural Resources Conservation Service

Ecological site F123XY001TN
Limestone Uplands

Last updated: 9/06/2018
Accessed: 05/11/2025

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): 123X–Nashville Basin

123—Nashville Basin
This area is entirely in Tennessee (fig. 123-1). It makes up about 5,625 square miles (14,580 square kilometers). The cities of Nashville, Franklin, Hendersonville, Columbia, Murfreesboro, and Shelbyville are in this area.
Physiography
Most of this area is in the Nashville Basin Section of the Interior Low Plateaus Province of the Interior Plains. A small part of the northeast corner and the western and southern fourth of the area are in the Highland Rim Section of the same province and division. Most of the outer part of the Nashville Basin is deeply dissected and consists of steep slopes between narrow, rolling ridgetops and narrow valleys. The inner part of the basin is dominantly undulating and rolling. In many areas the land surface is deeply pitted by limestone sinks, and outcrops of limestone are almost everywhere. Elevation generally is about 650 feet (200 meters), but it is 1,000 to 1,325 feet (305 to 405 meters) on isolated hills and is as low as 450 feet (135 meters) in some of the more deeply cut stream channels.

Geology
The bedrock geology in this area consists of Ordovician limestone exposed by geologic erosion of the top of the Nashville Dome (a high part of the Cincinnati Arch) throughout this area. Sinkholes are common in the limestone and are either open to the subsurface or are covered by soils and colluvium that have collected in the depressions formed on the land surface above the sinkhole. Younger rocks occur as a rim just outside this area. Surficial deposits include loess on the less eroded landforms and alluvium along the rivers and streams.

Source: United States Department of Agriculture, Natural Resources Conservation Service. 2006. 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.

LRU notes

N/A

Classification relationships

Scientific Name: Southern Interior Low Plateau Dry-Mesic Oak Forest
Unique Identifier: CES202.898

Ecological site concept

This mixed oak and oak-hickory forest concepts are derived from available NRCS data. Field verification is needed prior to utilizing this information for conservation planning.

NatureServe Ecological Associations found on these soils may include:
Common Name: Interior Southern Red Oak - White Oak Forest, CEGL007244
Common Name: White Oak - Mixed Oak Dry Mesic Alkaline Forest, CEGL002070
Common Name: Shumard Oak - Chinkapin Oak Mesic Limestone Forest

Table 1. Dominant plant species

Tree	(1) *Quercus falcata* (2) *Quercus alba*
Shrub	(1) *Cornus florida* (2) *Cercis canadensis*
Herbaceous	(1) *Sanicula canadensis* (2) *Desmodium*

Physiographic features

This ecosite is found on hills, plateaus, and basins in MLRA 123. NASIS list the unique landforms as escarpment, flat, hillside, hillslope, and ridge.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Flat (3) Escarpment
Flooding frequency	None
Ponding frequency	None
Elevation	360–1,400 ft
Slope	2–40%
Water table depth	13–51 in
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation in this area is 48 to 57
inches (1,220 to 1,450 millimeters). The maximum
precipitation occurs in midwinter and early in spring, and the minimum occurs in autumn. Rainfall primarily occurs during high-intensity, convective thunderstorms. Some snow occurs in winter, but it does not remain on the ground for long periods.
The average annual temperature is 56 to 60 degrees F (14 to 16 degrees C). The freeze-free period averages 210 days and ranges from 195 to 230 days. The longer freeze-free periods occur in the southern part of the area.

Source: United States Department of Agriculture, Natural Resources Conservation Service. 2006. 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.

Table 3. Representative climatic features

Frost-free period (average)	170 days
Freeze-free period (average)	194 days
Precipitation total (average)	55 in

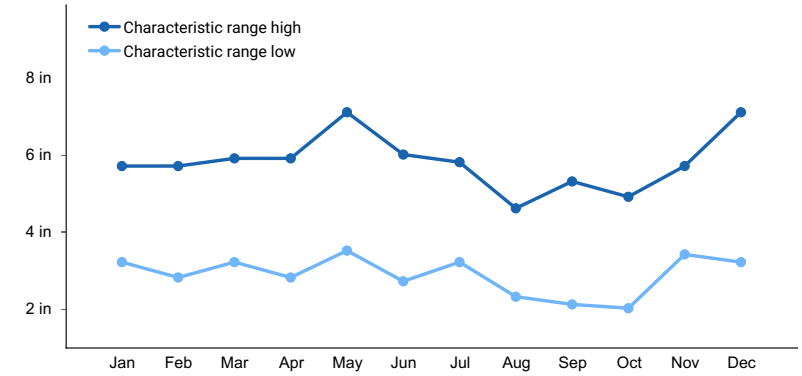


Figure 1. Monthly precipitation range

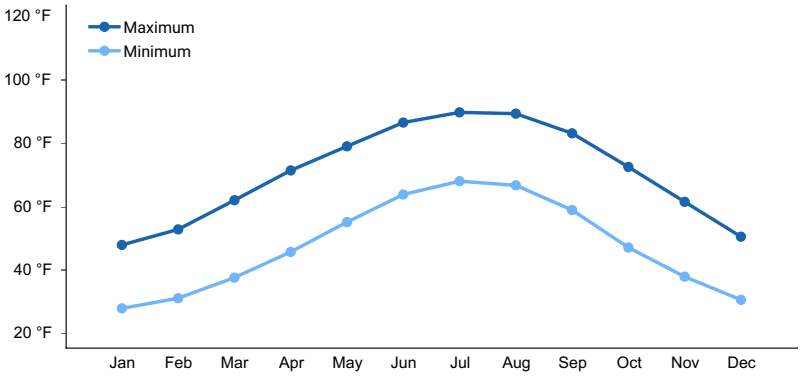


Figure 2. Monthly average minimum and maximum temperature

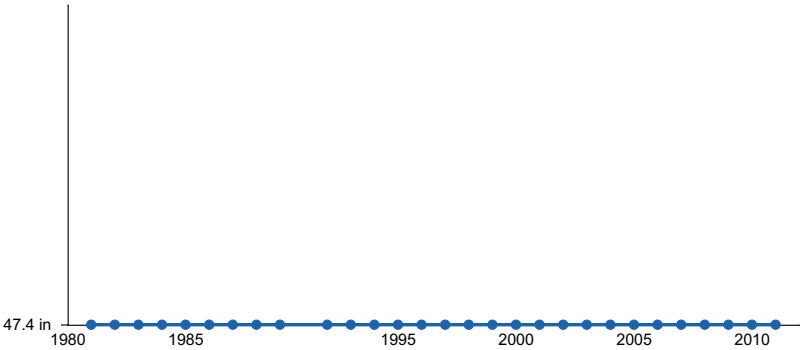


Figure 3. Annual precipitation pattern

Climate stations used

- (1) COLUMBIA 3 WNW [USC00401957], Columbia, TN
- (2) NASHVILLE INTL AP [USW00013897], Nashville, TN
- (3) GAINESBORO [USC00403370], Gainesboro, TN
- (4) FAYETTEVILLE WTP [USC00403074], Fayetteville, TN

Influencing water features

These sites have no influencing water features.

Soil features

Multiple soil series are included in this PES group including Talbott, Stiversville, Sandhill, Mimosa, Maury, Inman, Hampshire, Donerail, Colbert, Braxton, Bradyville, and Ashwood. Included soils vary in depth and multiple ESDs may be developed in the future from this grouping.

Table 4. Representative soil features

Parent material	(1) Residuum–limestone (2) Loess–limestone and shale (3) Alluvium–limestone and sandstone
Surface texture	(1) Channery loam (2) Very gravelly silty clay loam (3) Flaggy clay loam
Family particle size	(1) Loamy
Drainage class	Moderately well drained to well drained
Permeability class	Slow to moderately rapid
Soil depth	16–59 in
Surface fragment cover <=3"	0–8%
Surface fragment cover >3"	0–8%
Available water capacity (0-40in)	2–7 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	5.3–6.5
Subsurface fragment volume <=3" (Depth not specified)	0–20%
Subsurface fragment volume >3" (Depth not specified)	0–30%

Ecological dynamics

Provisional Ecological Site (PES): F123XY001TN - Limestone Uplands
Major Land Resource Area (MLRA) 123

This PES describes ecological communities likely to be found on soil in the PES soil grouping. Future field work is required to develop detailed and accurate ecological site descriptions (ESDs) that can be used by conservation planners for restoration and planning activities. This PES describes hypotheses based on available data from many different sources and scales and has not been developed using site specific ecological field monitoring. Future ESD development will result in this initial PES group being split into more refined ecological communities.

Soil series currently included in this project are Ashwood, Barfield, Bradyville, Braxton, Colbert, Donerail, Gladdice, Hampshire, Inman, Maury, Mimosa, Noah, Sandhill, Stiversville, and Talbott.
Forest Vegetation as listed in Official Series Descriptions (OSDs):
Ashwood: The native vegetation is forests of hickory, hackberry, elm, black walnut, redbud, black locust, ash, and red cedar.
Barfield: original hardwood trees consisting chiefly of oak, hickory, red cedar, elm, maple, and redbud.
Bradyville: About 5 percent is in woodland consisting chiefly of oaks, hickory, elm, hackberry, and red cedar.
Braxton: The native vegetation was mixed hardwood forest.
Colbert: Forest are mixed hardwoods and pine.
Donerail: Native vegetation was principally hardwood forests of white and red oak, elm, ash, hackberry, black walnut and black locust, with glades of grasses, sedges, and canes.
Gladdice: The native vegetation is forests of hickory, hackberry, elm, black walnut, redbud, black locust, ash, and red cedar.
Hampshire: The native vegetation is forests of oaks, walnut, locust, ash, hickory, beech, elm, and maple.

Inman: The native vegetation is forest of oaks, walnut, locust, ash, hickory, beech, elm, maple, and cedar.
Maury: Native vegetation was dominated by oaks, elm, ash, black walnut, black and honey locust, hackberry, black cherry, and Kentucky coffee tree. Glades of native grasses and canes were reported by early settlers.
Mimosa: Wooded areas are in oak, hickory, black walnut, elm, maple, hackberry, black and honey locust, and redcedar.
Noah: Native vegetation is mixed hardwoods of oak, hickory, elm, yellow-poplar, locust and dogwood.
Sandhill: Most areas are used for growing pasture and hay or are in hardwood forest.
Stiversville: The native vegetation was oak, hickory, elm, hackberry, maple, beech, black walnut, ash, locust, and yellow poplar.
Talbott: Originally hardwoods, chiefly oak, hickory, elm, maple, and redcedar.
Trees listed for PES map units in the USDA-NRCS Tennessee County Soil Surveys include southern red oak, white oak, eastern red cedar, tulip poplar, northern red oak, loblolly pine, shortleaf pine, Virginia pine, black walnut, black cherry, common hackberry, and black locust. Most commonly listed species for these soils were southern red oak, white oak, eastern red cedar and pines.

Only two tree species can be selected for entry into the ESIS database as dominants: however, multiple tree species can be dominant on these sites and it will vary by aspect, soil depth, seed sources, management, disturbance history, fire regime, micro-topography and available water. Trees found on these sites include southern red oak, white oak, black oak, Shumard oak, northern red oak, chinkapin oak, pignut hickory, shagbark hickory, black oak, black cherry, white ash, hophornbeam, American hophornbeam, common serviceberry, blue ash, sugar maple, flowering dogwood, eastern redbuds, tulip poplar, and blackgum.

Ecological Dynamics
This PES describes an oak-hickory forest community on predominately limestone soils in the Nashville Basin area of Tennessee. There will be variations in plant composition on these sites due to soil depth, available water, and aspect. Actual field work is required to develop a full ecological site description (ESD), a field-based state and transition model, and accurate plant community phases to support future conservation planning.

State 1. (Reference)
State 1, Phase 1.1: Plant species dominants: southern red oak (*Quercus falcata*) – white oak (*Quercus alba*) / eastern dogwood (*Cornus florida*) – eastern redbud (*Cercis canadensis*) /
Canadian blacksnakeroot (*Sanicula canadensis*) - ticktrefoil (Desmodium spp.)

Most mapunits in this initial PES grouping range from moderately deep to very deep; however, a few mapunits of shallow Barfield soils have been included too. Future ESD develop will result in field monitoring that will provide the needed documentation to split this initial PES group into multiple ESDs.

Protected sites will have a robust and diverse herbaceous layer including many native spring wildflowers such as dwarf larkspur, spring beauty, bloodroot, hepatica, false rue anemone, twinleaf, early rue anemone, violets, and trillium. Common summer understory species may include agrimony, black snakeroot, white snakeroot, Virginia creeper, poison ivy, bedstraw, and avens. Shrubs may include coralberry, blueberries, and in more sheltered areas, northern spicebush.

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

Plant species within pasture phases depend on seeding, management, and concurrent land uses. As with all sites, soil characteristics and management inputs will influence production levels.

Many species of warm-season or cool-season grasses are feasible for these sites. Common forage species include tall fescue, orchard grass, Johnson grass, and timothy.

Management of pasture sites should follow conservation planning standards and protocols which will benefit water quality, forage production, and soil health.

Transitioning this state to a reference condition would likely require extensive and long-term timber stand improvement practices including control of non-native vegetation and management for desired native tree, shrub

and understory species.

State 3. Transitional Field
State 3, Phase 3.1: Plant species dominants: Eastern red cedar (*Juniperus virginiana*) / tall ironweed (*Vernonia gigantea*n)- tall fescue (*Schedonorus arundinaceus*)

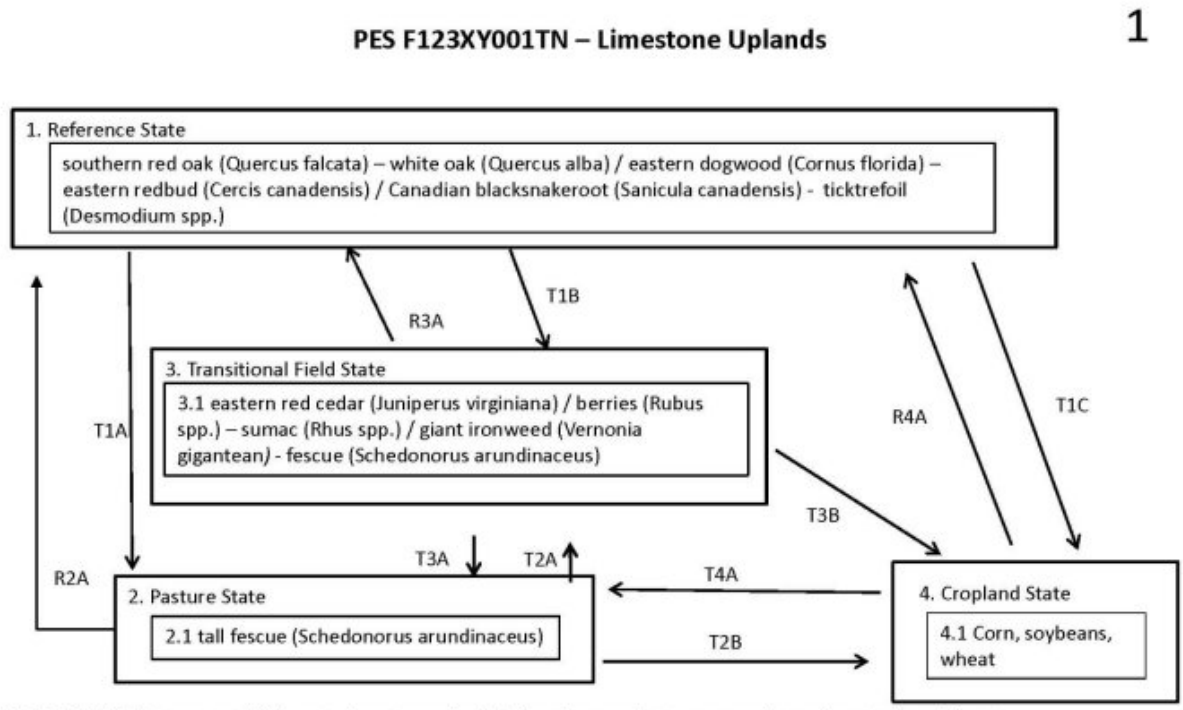
Tree species would be dependent upon several factors including severity and duration of disturbance, adjacent plant communities, available seed sources, post-disturbance management (control of invasive plants, grazing, etc.). A wide range of hardwoods is possible and may include tulip poplar, maples, ashes, locust, black cherry, eastern red cedar, pines, and if seed sources are nearby, oaks and hickories. Common shrubs would be berries, roses, and sumac.

Transitioning this state to a reference condition will require timber stand improvement practices to control non-native vegetation and manage for higher quality oak or hickory species.

State 4. Croplands
Dependent upon seeding and management. Corn and soybeans are common.

Abandonment of cropland would result in weed species taking over the site. Dozens of species are possible depending on the seed sources. Initially annual weeds would predominate followed annual and perennial grasses, shrubs, and finally, pioneer tree species such as pines, eastern red cedar, locusts, maples, ashes, and tulip poplar. Restoration would be required to return this State to a reference community, including oak and hickory regeneration, control of non-native vegetation, and planting of native understory species. Protection from disturbance (grazing) would also be required.

State and transition model



State 1
Forestland (Reference)

This State is a oak-hickory or mixed oak hardwood forest. The Hierarchical Classification Relationship to reference this community is: Scientific Name: Southern Interior Low Plateau Dry-Mesic Oak Forest Unique Identifier: CES202.898

Community 1.1
Oak Hickory Forest

Forest overstory. These sites and mixed oak or oak-hickory forests. NRCS data currently available lists southern red oak (Quercus falcata) and white oak (Quercus alba) as the most prevalent overstory species. Besides oaks and hickories, other hardwoods found on these sites may include ashes, maples, elms, black walnut, black cherry, blackgum, dogwoods, redbuds, and hophornbeams.

Future ESD development will result in this initial PES forest group being split into more defined groups.

Forest understory. eastern dogwood (Cornus florida) – eastern redbud (Cercis canadensis) / Canadian blacksnakeroot (Sanicula canadensis) - ticktrefoil (Desmodium spp.)

State 2
Pastureland (managed)

This state will consist of whatever grass and/or forbs have been seeded and managed for. Most common is fescue or fescue - orchard grass -clover mix. Native or non-native grasses could be grown on these sites.

Community 2.1
Managed Pasture

Reoccurring management inputs including mowing, brush control, weed control and seeding may be occurring. Species managed for may including native and non-native grasses depending on management objectives.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	–	–	–
Total	**–**	**–**	**–**

State 3
Transitional

This state is a successional vegetation state which without interference will move naturally from a managed pasture scenario to an unmanaged pasture to a shrubland to a mixed woodland. Each of these phases would exhibit differing dominant species - grasses to shrubs to trees. However, timber stand improvement would be needed to achieve a quality oak or oak-hickory reference state community.

Community 3.1
Transitional

Transitional field state is a successional stage. One possible scenario is that a major disturbance (logging, massive storm damage, fire)has occurred to a forestland and moved to this phase. Another alternative is that a managed pasture is no longer being maintained and brush/trees are encroaching on the site. Many of these sites have high wildlife values.

Forest overstory. This successional site will include various trees depending on seed sources. Eastern red cedar will be common on limestone sites along with various hardwoods such as maples, ashes, and oaks.

Forest understory. Grass and forbs will be a mix of many native and introduced species. Common grasses will include tall fescue, orchard grass, Johnson grass, foxtails, bromes, and timothy. Common herbs include both native and weedy species such as tall ironweed, goldenrods, thistles, pigweed, ragweed (common and giant), sour dock, chicory, Queen Anne's lace, etc.

State 4
Cropland

The dominant species in this state will depend upon what is planted and what the landowner management goals are. Corn, soybean, wheat, and tobacco are just some of the crops found on these soils. USDA-NRCS county soil surveys are available to landowner and provide production data for croplands based on soil series.

Community 4.1
Cropland

Species and management will depend on objectives. Commonly grown crops include corn, soybeans, and in some areas, tobacco.

Transition T1A
State 1 to 2

Forest to pastureland

Transition T1B

State 1 to 3

This is a transitional (successional) state. This state could occur due to disturbances which remove the overstory canopy. This state would also occur moving from a managed to unmanaged pasture. Tree species would encroach. Forest state management would be required to achieve a quality mixed oak or oak hickory forest.

Transition T1C
State 1 to 4

Forestland to Cropland

Restoration pathway R2A
State 2 to 1

Restoration of an oak-hickory or mixed-oak forest from a pasture state. Multiple forest conservation practices would be required to successfully restore this reference community. Forest management planning, weed control, plantings, brush management, and even fire management may be warranted.

Conservation practices

Brush Management
Tree/Shrub Site Preparation
Tree/Shrub Establishment
Upland Wildlife Habitat Management
Invasive Plant Species Control
Forest Management Plan - Written
Forest Management Plan - Applied

Transition T2A
State 2 to 3

Managed pasture to abandoned pasture. natural successional changes will occur including brush and trees encroaching on the site. Often these sites have high wildlife values.

Transition T2B
State 2 to 4

Pastureland to croplands. Crops seeded will depend on management goals.

Restoration pathway R3A
State 3 to 1

Restoration of a oak-hickory or mixed-oak forest would require multiple conservation practices and long-term management inputs. Practices may include brush and non-native species control and desired tree species plantings. the development of a comprehensive forest management plan would be the initial step toward a successful forestland restoration goal.

Conservation practices

Brush Management
Tree/Shrub Site Preparation
Tree/Shrub Establishment
Forest Stand Improvement
Forest Management Plan - Written

Forest Management Plan - Applied

Transition T3A
State 3 to 2

Transitional site to managed pasture. Management activities may include brush removal, weed control, seeding, fertilizer, etc.

Transition T3B
State 3 to 4

Management transition from pasture to cropland. Seeded species will depend upon management objectives.

Restoration pathway R4A
State 4 to 1

Restoration of cropland to a oak-hickory or mixed oak forest would require multiple forest stand improvement activities. A comprehensive forest management plan would be the first step in restoring this high quality environment.

Conservation practices

Brush Management
Tree/Shrub Establishment
Forest Stand Improvement
Native Plant Community Restoration and Management
Forest Management Plan - Written
Forest Management Plan - Applied

Transition T4A
State 4 to 2

Cropland can be transitioned to any of the States on this STM model, but the most common is transitioning to a managed pasture state.

Additional community tables

Table 6. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
white ash	FRAM2	*Fraxinus americana*	Native	–	–	–	–
blue ash	FRQU	*Fraxinus quadrangulata*	Native	–	–	–	–
shagbark hickory	CAOV2	*Carya ovata*	Native	–	–	–	–
pignut hickory	CAGL8	*Carya glabra*	Native	–	–	–	–
white oak	QUAL	*Quercus alba*	Native	–	–	–	–
southern red oak	QUFA	*Quercus falcata*	Native	–	–	–	–
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	–	–	–	–
Shumard's oak	QUSH	*Quercus shumardii*	Native	–	–	–	–
black oak	QUVE	*Quercus velutina*	Native	–	–	–	–
northern red oak	QURU	*Quercus rubra*	Native	–	–	–	–

Table 7. Community 3.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
honeylocust	GLTR	*Gleditsia triacanthos*	Native	–	–	–	–
eastern redcedar	JUVI	*Juniperus virginiana*	Native	–	–	–	–
tuliptree	LITU	*Liriodendron tulipifera*	Native	–	–	–	–
maple	ACER	*Acer*	Native	–	–	–	–
oak	QUERC	*Quercus*	Native	–	–	–	–

Table 8. Community 3.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
tall fescue	SCAR7	*Schedonorus arundinaceus*	Introduced	–	–
Forb/Herb					
giant ironweed	VEGI	*Vernonia gigantea*	Native	–	–
goldenrod	SOLID	*Solidago*	Native	–	–
Queen Anne's lace	DACA6	*Daucus carota*	Native	–	–
Shrub/Subshrub					
blackberry	RUBUS	*Rubus*	Native	–	–
sumac	RHUS	*Rhus*	Native	–	–
rose	ROSA5	*Rosa*	Native	–	–
Amur honeysuckle	LOMA6	*Lonicera maackii*	Introduced	–	–

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Approval

Nels Barrett, 9/06/2018

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	
Approved by	
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):

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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:**
