Ecological site F128XY518WV
Mesic Alfic Limestone Uplands

Accessed: 04/25/2024

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): 128X–Southern Appalachian Ridges and Valleys

MLRA 128, partially shown as the gray shaded area on the accompanying figure, falls into the East and Central Farming and Forest Region. This MLRA is in Tennessee (36 percent), Alabama (27 percent), Virginia (25 percent), and Georgia (12 percent). It makes up about 21,095 square miles (54,660 square kilometers).

Most of this MLRA is in the Tennessee Section of the Valley and Ridge Province of the Appalachian Highlands. The thin stringers in the western part of the area are mostly in the Cumberland Plateau Section of the Appalachian Plateaus Province of the Appalachian Highlands. A separate area of the MLRA in northern Alabama is in the Highland Rim Section of the Interior Low Plateaus Province of the Interior Plains. The western side of the area is dominantly hilly to very steep and is rougher and much steeper than the eastern side, much of which is rolling and hilly. Elevation ranges from 660 feet (200 meters) near the southern end of the area to more than 2,400 feet (730 meters) in the part of the area in the western tip of Virginia. Some isolated linear mountain ridges rise to nearly 4,920 feet (1,500 meters) above sea level.

The MLRA is highly diversified. It has many parallel ridges, narrow intervening valleys, and large areas of low, irregular hills. The bedrock in this area consists of alternating beds of limestone, dolomite, shale, and sandstone of early Paleozoic age. Ridgetops are capped with more resistant carbonate and sandstone layers, and valleys have been eroded into the less resistant shale beds. These folded and faulted layers are at the southernmost extent of the Appalachian Mountains. The narrow river valleys are filled with unconsolidated deposits of clay, silt, sand, and gravel.

Ecological site concept

This PES occurs on residuum and colluvium on uplands underlain by limestone in the mesic temperature regime of the southern ridge and valley, MLRA 128.

This ecological site occurs primarily in the Virginia portion of 6-KNO. The Virginia DCR, in THE NATURAL COMMUNITIES OF VIRGINIA: CLASSIFICATION OF ECOLOGICAL COMMUNITY GROUPS has classified it as Dry-Mesic Calcareous Forest, Montane Dry Calcareous Forest/Woodland, and Limestone/Dolomite Barren from accessible classification plots made available to NRCS. [Reference: Fleming, G.P., K.D. Patterson, K. Taverna, and P.P. Coulling. 2013. The natural communities of Virginia: classification of ecological community groups. Second approximation. Version 2.6. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA.]

Table 1. Dominant plant species

Tree	(1) *Acer saccharum* (2) *Acer nigrum*
Shrub	(1) *Rhamnus caroliniana*

Herbaceous	Not specified

Physiographic features

This PES occurs on residuum and colluvium on uplands underlain by limestone in the mesic temperature regime of the southern ridge and valley, MLRA 128.

Table 2. Representative physiographic features

Landforms	(1) Interfluve (2) Fan (3) Hill
Elevation	400–3,250 ft
Slope	5–90%
Water table depth	60 in
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation in most of this area is 41 to 55 inches (1,040 to 1,395 millimeters). It increases to the south and is as much as 66 inches (1,675 millimeters) at the highest elevations in east Tennessee and the northwest corner of Georgia. The maximum precipitation occurs in midwinter and midsummer, and the minimum occurs in autumn. Most of the rainfall occurs as high-intensity, convective thunderstorms. Snowfall may occur in winter. The average annual temperature is 52 to 63 degrees F (11 to 17 degrees C), increasing to the south. The freeze-free period averages 205 days and ranges from 165 to 245 days. It is longest in the southern part of the area and shortest at high elevations and at the northern end.

Table 3. Representative climatic features

Frost-free period (average)	144 days
Freeze-free period (average)	177 days
Precipitation total (average)	43 in

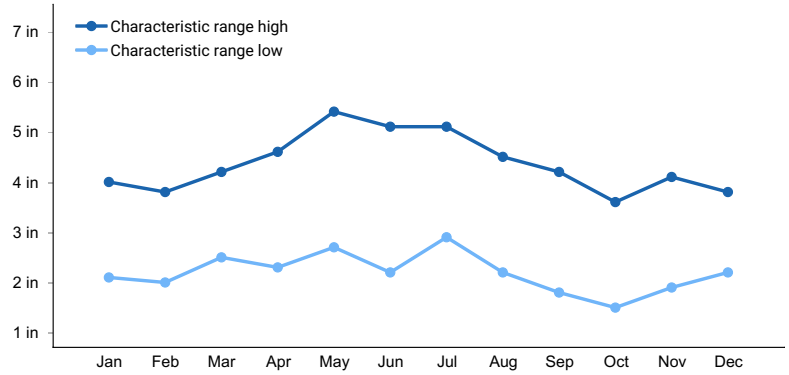

Figure 1. Monthly precipitation range

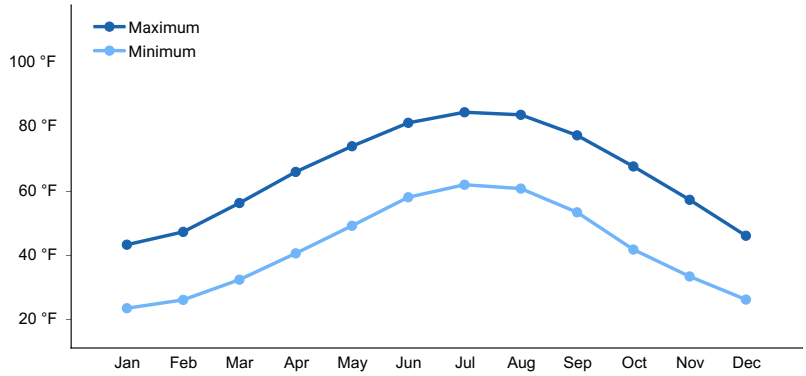

Figure 2. Monthly average minimum and maximum temperature

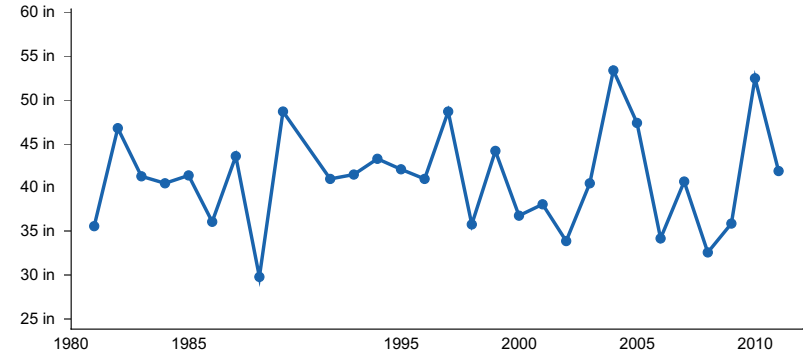

Figure 3. Annual precipitation pattern

Climate stations used

- (1) ABINGDON 3S [USC00440021], Abingdon, VA
- (2) WYTHEVILLE 1 S [USC00449301], Wytheville, VA
- (3) ROANOKE RGNL AP [USW00013741], Roanoke, VA
- (4) STAFFORDSVILLE 3 ENE [USC00448022], Pearisburg, VA

Influencing water features

This ecological site is not influenced by wetland or riparian water features.

Soil features

These soils formed in residuum and colluvium on uplands underlain by limestone. The slopes range from 0 to 100 percent. They are very shallow to very deep (1 to more than 60 inches) to bedrock, and are well to excessively drained. The available water capacity of these soils is very low to moderate. The depth to a seasonal high water table is more than 6 feet. They are not subject to flooding or ponding. The soil reaction ranges from very strongly acid to moderately alkaline (pH from 4.5 to 8.4).

The soil series associated with this site are: Barfield, Carbo, Cynthiana, Gladeville, Opequon, Beech Grove, Benthole

Parent Material Kind: Residuum, Colluvium

Parent Material Origin: limestone and dolomite; limestone and shale; limestone, argillaceous; limestone, unspecified

Table 4. Representative soil features

Parent material	(1) Residuum–limestone and shale (2) Colluvium–limestone

Surface texture	(1) Flaggy clay (2) Gravelly sandy loam (3) Very cobbly silty clay loam
Drainage class	Well drained
Permeability class	Rapid
Soil depth	11–34 in
Surface fragment cover <=3"	0–7%
Surface fragment cover >3"	1–7%
Available water capacity (0-40in)	0.9–4.8 in
Soil reaction (1:1 water) (0-40in)	5.9–7.3
Subsurface fragment volume <=3" (Depth not specified)	0–70%
Subsurface fragment volume >3" (Depth not specified)	0–30%

Ecological dynamics

The Virginia DCR, in THE NATURAL COMMUNITIES OF VIRGINIA: CLASSIFICATION OF ECOLOGICAL COMMUNITY GROUPS has classified it as Dry-Mesic Calcareous Forest, Montane Dry Calcareous Forest/Woodland, and Limestone/Dolomite Barren from accessible classification plots made available to NRCS. [Reference: Fleming, G.P., K.D. Patterson, K. Taverna, and P.P. Coulling. 2013. The natural communities of Virginia: classification of ecological community groups. Second approximation. Version 2.6. Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA.]

For the basis of descriptions below, the Thermic Shallow Alfic Limestone Uplands ESD was used. However, some soils on this PES will be deeper, resulting in a much richer forest type. This is reflected in the VDCR's classification of multiple communities.

State and transition model

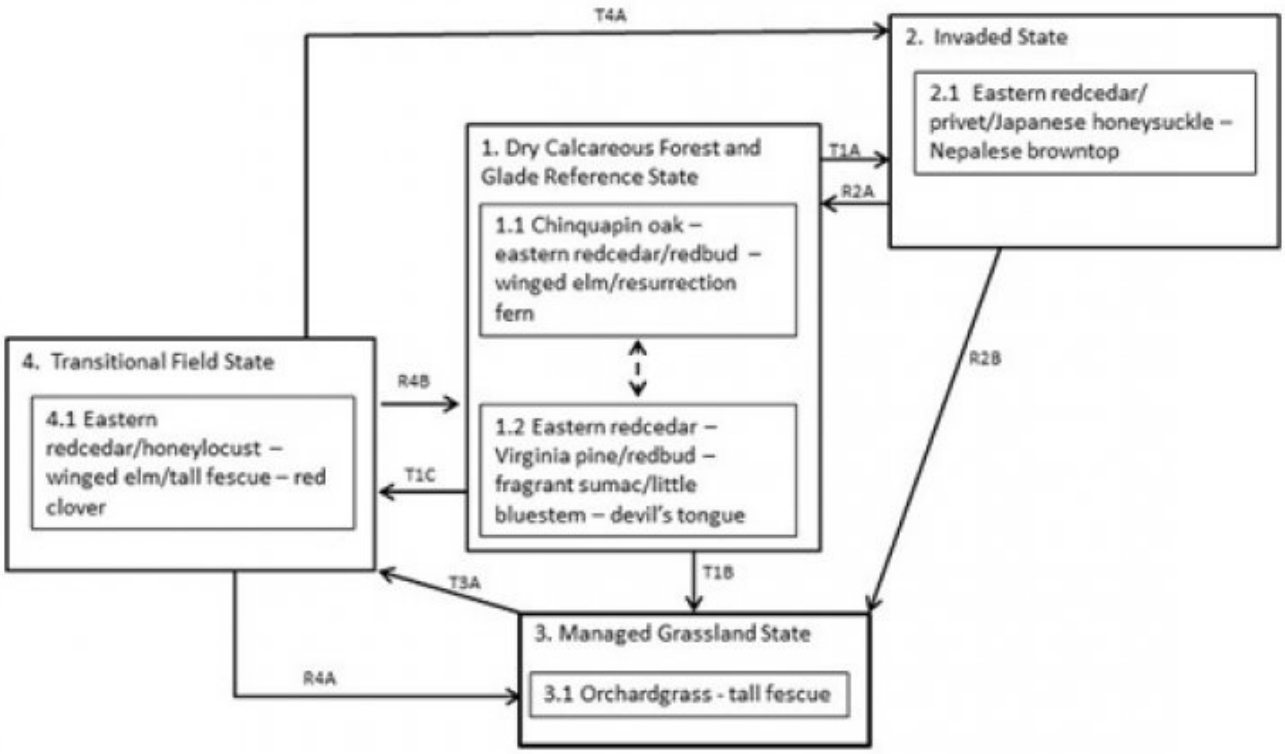

Figure 5. State and Transition Diagram

State 1
Dry Calcareous Forest and Glade Reference State

The reference community for this ecological state occurs as a mosaic of dry forests, woodlands and small glades across the landscape. Past disturbance, both human caused and naturally occurring, can influence the degree of openness and thereby the distribution of species. In addition, the strike of limestone bedrock often determines where true glades versus forests occur. Where strike is sharp, solution pipes form and deeper soils accumulate, favoring tree growth. Where bedrock is more level, with shallow soils forming, glades and woodlands tend to occur. This is highly variable across the Major Land Resource Area and species can shift temporally due to edaphic conditions from year to year. For example, in periods of drought, forest species retreat, which creates the open conditions that favor grasses and herbs.

Community 1.1
Chinquapin oak – eastern redcedar/redbud – winged elm/resurrection fern

This phase of the reference state occurs over soils derived from limestone that typically have a neutral pH and relatively dry conditions. Forests are dominated by calciphiles, including chinquapin oak, Shumard oak, white ash, eastern red cedar, eastern redbud, and many elms and hickories. Shrubs and small trees include fragrant sumac, rusty blackhaw, dwarf hackberry, and Carolina buckthorn. Plant composition will vary according to the pH and level of moisture in the soil as well as soil depth. These forests typically occur as part of a vegetation mosaic with cedar glades on more level limestone. They can also occur on limestone outcrop at the base of other geologic formations, such as the Rome formation. In Georgia, these communities occur on the lower slopes of the eastern side of Lookout Mountain and Pigeon Mountain and on parts of Lavender Mountain at Berry College (Edwards, Ambrose and Kirkman 2013). The neutral pH and resulting pattern of calciphytic plants are the main factors that differentiate this ecological site from others. Without disturbance, such as fire, these forests will succeed from oak dominated canopies to more shade tolerant species such as red maple, sugar maple and American beech (Edwards, Ambrose and Kirkman 2013). The presence of oak and pine possibly reflects past disturbances that opened canopies up enough to facilitate their establishment. Gaps were likely an important component of forest dynamics, especially on steeper bluffs or through openings created by fire (W.L. Lipps 1966; Wharton 1978; Pyne 1982; Schuler and

McClain 2003 in Edwards, Ambrose and Kirkman 2013). The variation in the composition of this plant community complicates fire management. Currently, the Georgia Department of Natural Resources recommends fire-return intervals of five - seven years for some plant communities on this ecological site. However, any fire management plan should be developed with professionals on site, based on local conditions. Fires can foster high herbaceous diversity in these communities but can also damage fire-intolerant trees and shrubs that can be important features of the natural system (Edwards, Ambrose and Kirkman 2013).

Forest overstory. The forests occurring on this phase of the ecological site are closed canopy stands distinguished by calcium-loving species in all strata (Edwards, Ambrose and Kirkman 2013). Important overstory trees include chinquapin oak, Shumard oak, white oak, eastern red cedar and numerous hickory species. The ones most commonly noted were shagbark and mockernut hickory. Ashes, especially white ash, are important on this site, as well as slippery elm, winged elm, and the hawthorns. Vines and ferns can be important in this community phase and a common sight is a chinquapin oak or eastern red cedar covered in resurrection fern (pictured above).

Forest understory. Forest understories in this phase tend to be sparse, due to the closed canopy. However, because it favors calciphiles, species composition can be quite different from other ecological sites in the Ridge and Valley. Resurrection fern and purple cliffbrake are common. Typical herbs include Indian pink, hoary puccoon, smallhead blazing star, wild petunia, and trailing lespedeza. Tree and shrub regeneration is well represented in the understory with white ash and sugar maple predominating. Vines can be important, perhaps reflecting past disturbance. Common vines include crossvine, trumpet creeper, common moonseed, and greenbrier. Mosses and lichens can be important components of this site and commonly grow on bedrock outcrops. Depending on the percent of canopy cover, grasses may occur on this phase. Some of the native panic grasses and purpletop tridens are common and can be prolific in places.

Table 5. Soil surface cover

Tree basal cover	5-8%
Shrub/vine/liana basal cover	1-3%
Grass/grasslike basal cover	1-10%
Forb basal cover	1-5%
Non-vascular plants	0-3%
Biological crusts	0-15%
Litter	30-80%
Surface fragments >0.25" and <=3"	0-7%
Surface fragments >3"	2-10%
Bedrock	15-47%
Water	0%
Bare ground	0-3%

Table 6. Woody ground cover

Downed wood, fine-small (<0.40" diameter; 1-hour fuels)	5-20%
Downed wood, fine-medium (0.40-0.99" diameter; 10-hour fuels)	5-20%
Downed wood, fine-large (1.00-2.99" diameter; 100-hour fuels)	5-10%
Downed wood, coarse-small (3.00-8.99" diameter; 1,000-hour fuels)	5-10%
Downed wood, coarse-large (>9.00" diameter; 10,000-hour fuels)	0-10%
Tree snags** (hard***)	–
Tree snags** (soft***)	–
Tree snag count** (hard***)	
Tree snag count** (hard***)	

*** Decomposition Classes: N - no or little integration with the soil surface; I - partial to nearly full integration with the soil surface.**

**** >10.16cm diameter at 1.3716m above ground and >1.8288m height--if less diameter OR height use applicable down wood type; for pinyon and juniper, use 0.3048m above ground.**

***** Hard - tree is dead with most or all of bark intact; Soft - most of bark has sloughed off.**

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	1-1%	1-2%	0-1%
>0.5 <= 1	–	1-2%	1-2%	1-3%
>1 <= 2	–	1-5%	1-1%	1-1%
>2 <= 4.5	–	1-10%	–	–
>4.5 <= 13	–	2-20%	–	–
>13 <= 40	5-25%	–	–	–
>40 <= 80	25-60%	–	–	–
>80 <= 120	0-5%	–	–	–
>120	–	–	–	–

Community 1.2
Eastern redcedar – Virginia pine/redbud - fragrant sumac/little bluestem – devil's-tongue

The natural forest openings that correspond to glade communities on this ecological site are chiefly scattered in areas underlain by limestone of the Chickamauga group, especially Lenoir limestone (Martin 1989). Stunted cedar and pine and a few shrub species surround an herb-dominated outcrop. Wherever joints in the rock have accumulated soil, woody plants will establish. Climate conditions vary from year to year. Woody plants, especially cedar trees, will do better in years with more precipitation and fall back in hot, dry periods. Vegetation is similar to the cedar glades of middle Tennessee, but pine is a significant component (Martin 1989). This phase may be considered distinct from other prairie-like areas in that it is chiefly edaphic in nature. The bare rock and shallow soils create moisture and temperature extremes that fluctuate from year to year and season to season, restricting these sites to plant species that have adapted to heat and drought (Edwards, Ambrose and Kirkman 2013). Precipitation differences cause these sites to have radically different appearances from year to year. Correspondingly, these sites can change greatly in appearance with the season. In spring, open glades might be carpeted with wildflowers but when the annuals die, xerophytes such as devil's tongue, false aloe and croton become more conspicuous (Edwards, Ambrose and Kirkman 2013). Erosion, drought, fire, grazing, frost-heave and shrink-swell soils can all contribute to keeping these systems open (Edwards, Ambrose and Kirkman 2013). The role of fire is not well understood from a management perspective. However, in Georgia, a fire-return interval of 13 - 25 years has been suggested (Frost 1998; NatureServe Ecology South 2008; in Edwards, Ambrose and Kirkman 2013).

Forest overstory. There are very few forest canopy trees in this phase of the reference state but, when present, common species include Virginia pine and eastern red cedar. Occasionally oak species occur, such as chinquapin oak and shumard oak. Trees in this phase are often shrubby and rarely reach their height potential. Shrub and small tree species include redbud, winged elm, persimmon, fragrant sumac and dogwood.

Forest understory. The Natural Communities of Georgia (2013) divides the vegetation into four categories: gravel glades, grassy glades, shrub thickets and glade woodlands, which are all driven by soil depth at very small scales. Understory composition can vary widely, depending on the location within the site. On gravel glades where there is very little soil, lichens, mosses and least glade cress will dominate. In areas with slightly deeper soils, the gravel glades can support other herbs, typically annuals. Grasses can dominate on sites where there is deeper soil, but not deep enough to support shrubs and small trees. Little bluestem is a typical species noted on these areas.

Some characteristic plants of this phase include hoary puccoon, false aloe, devil's tongue, the ragworts, and the goldenrods.

Table 8. Soil surface cover

Tree basal cover	0-8%

Shrub/vine/liana basal cover	0-4%
Grass/grasslike basal cover	0-15%
Forb basal cover	0-2%
Non-vascular plants	0%
Biological crusts	0-1%
Litter	0-10%
Surface fragments >0.25" and <=3"	0-30%
Surface fragments >3"	0-15%
Bedrock	0-10%
Water	0%
Bare ground	0-5%

Table 9. Woody ground cover

Downed wood, fine-small (<0.40" diameter; 1-hour fuels)	0-2% N*
Downed wood, fine-medium (0.40-0.99" diameter; 10-hour fuels)	0-3%
Downed wood, fine-large (1.00-2.99" diameter; 100-hour fuels)	0-2%
Downed wood, coarse-small (3.00-8.99" diameter; 1,000-hour fuels)	0-1%
Downed wood, coarse-large (>9.00" diameter; 10,000-hour fuels)	0%
Tree snags** (hard***)	–
Tree snags** (soft***)	–
Tree snag count** (hard***)	0 per acre
Tree snag count** (hard***)	

*** Decomposition Classes: N - no or little integration with the soil surface; I - partial to nearly full integration with the soil surface.**

**** >10.16cm diameter at 1.3716m above ground and >1.8288m height--if less diameter OR height use applicable down wood type; for pinyon and juniper, use 0.3048m above ground.**

***** Hard - tree is dead with most or all of bark intact; Soft - most of bark has sloughed off.**

Table 10. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	0-1%	0-1%
>0.5 <= 1	–	–	0-2%	0-1%
>1 <= 2	–	–	–	–
>2 <= 4.5	–	–	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

State 2
Invaded State

Invasive exotic plants are species of plants that have been intentionally or unintentionally introduced into an area outside of their natural range. These plants are rapidly becoming one of the most pressing management issues for land managers. Exotic species can overwhelm native plants by claiming resources such as nutrients, water, light,

and space and can ultimately totally displace native species (Tennessee Exotic Pest Plant Council). By modifying or completely altering the vegetation community, exotic plants can significantly threaten native wildlife communities, including insects that act as pollinators for agriculture crops. The effects are cascading and far reaching and can be extremely detrimental to ecosystem health and stability. Invasion by exotic plants is a significant threat to this ecological site. In the glade phase of the reference state, invasion by the native eastern redcedar due to fire suppression can also be a threat. Prescribed fire and mechanical removal can be useful for creating open conditions conducive to glade plants. For clarification, this state description refers only to invasion by exotic plants. Exotic plant invasion is particularly problematic on this site for a number of reasons. Most of this site (glades and woodlands) has at one time been grazed by domestic livestock, which both introduced exotic plants into the site and created a disturbance that favored their establishment (Baskin and Baskin 1996; Cofer et al. 2008). Not all grazed sites were entirely cleared for pasture. The degree of disturbance as well as the time since abandonment will determine the extent of invasion. Secondly, the lack of natural disturbances, such as fire, have led to the expansion of invasive exotic plants due to the processes of natural succession. One of the most problematic exotic species on this site is Nepalese browntop, which is extremely tolerant of shade. As open conditions become closed forests, it spreads. Likewise, Chinese privet has invaded both glade and forested phases of this site. Both Nepalese browntop and privet inhibit the use of prescribed fire, complicating restoration efforts. Two of the protected areas that fall within this ecological site have management plans that describe their issues with exotic plant encroachment into glade/woodland systems. In one, autumn olive, sericea lespedeza, Chinese privet, Amur honeysuckle, Japanese honeysuckle, multiflora rose, crownvetch, Nepalese browntop, and Johnsongrass are listed as threats to their preserve. In another plan, Chinese privet is listed as a significant threat to the natural integrity of the site. Cofer et al. (2008) found that the exotic species Chinese privet, oxeye daisy, and common dandelion occurred on the majority of the glades in their study of 40 cedar glades in Rutherford County, Tennessee. The occurrence and abundance of exotic plant species on this ecological site will vary based on disturbance history and location. Sites adjacent to roads or disturbed areas are more likely to become invaded. Management plans should be based on local conditions and tailored to the exotic species present. In most cases, if no action is taken to combat invasions, the site will never entirely return to the reference plant community.

Community 2.1
Eastern redcedar/privet/Japanese honeysuckle – Nepalese browntop

Invasion by exotic plant species is a serious problem on this ecological site. Because of the high pH relative to other sites, and the somewhat fragile nature of plant communities, this site may be more susceptible than others in the Ridge and Valley. This site, especially where bedrock is relatively level, would have been heavily grazed in the past, adding to the potential for invasion. This site does not seem to recover as quickly from negative disturbance. Invaded states may never recover their former plant communities if management intervention is not attempted. The species listed in this phase represent a typical assemblage on an invaded state. Species composition will vary according to local conditions and past disturbance history. The species list below is a record of all species noted in the field while investigating this phase of the site. No one plot contained all listed species.

Forest overstory. Forest overstories are not typically different from the reference community, except where eastern redcedar has become dominate on glades. Typical species noted in woodlands and forests include eastern redcedar, chinquapin oak, Shumard oak, and post oak. Other oak species can occur as well as the maples and American beech, although this was not noted frequently. Often, disturbance history can be discerned to some extent by the presence of Virginia pine, which is considered a pioneer species.

Midstory species are also not different from the reference community and include eastern redbud, dwarf hackberry, dogwood, winged elm, and Carolina buckthorn. Notably, mid-story species were less common on highly invaded sites, indicating that their regeneration and establishment potential may be negatively impacted by the presence of invasive exotic plants in the understory. It can be inferred that this also applies to overstory species, given long enough timeframes. Concurrently, grazing animals utilize the mid-story and so would have impacted mid-story species on abandoned sites that were grazed woodlands.

Forest understory. Forest understories are typically highly altered, with invasive exotic species dominating and native species only present in small populations. Species assemblages are altered as well. The presence and abundance of invasive exotic species can be highly variable across the site and is most often an effect of past disturbance history and location.

Table 11. Soil surface cover

Tree basal cover	0-10%
Shrub/vine/liana basal cover	0-10%
Grass/grasslike basal cover	0-1%
Forb basal cover	0-2%
Non-vascular plants	0%
Biological crusts	0-5%
Litter	0-72%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 12. Woody ground cover

Downed wood, fine-small (<0.40" diameter; 1-hour fuels)	–
Downed wood, fine-medium (0.40-0.99" diameter; 10-hour fuels)	–
Downed wood, fine-large (1.00-2.99" diameter; 100-hour fuels)	–
Downed wood, coarse-small (3.00-8.99" diameter; 1,000-hour fuels)	–
Downed wood, coarse-large (>9.00" diameter; 10,000-hour fuels)	–
Tree snags** (hard***)	–
Tree snags** (soft***)	–
Tree snag count** (hard***)	0-5 per acre
Tree snag count** (hard***)	0-2 per acre

*** Decomposition Classes: N - no or little integration with the soil surface; I - partial to nearly full integration with the soil surface.**

**** >10.16cm diameter at 1.3716m above ground and >1.8288m height--if less diameter OR height use applicable down wood type; for pinyon and juniper, use 0.3048m above ground.**

***** Hard - tree is dead with most or all of bark intact; Soft - most of bark has sloughed off.**

Table 13. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	2-60%	0-1%	1-2%
>0.5 <= 1	–	0-5%	0-1%	1-2%
>1 <= 2	–	2-10%	–	–
>2 <= 4.5	–	2-20%	–	–
>4.5 <= 13	–	2-30%	–	–
>13 <= 40	5-20%	–	–	–
>40 <= 80	50-60%	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

State 3
Managed Grassland State

This state represents a once-forested area now cleared for pasture. The Official Soil Series description for Barfield

states that about 50 percent of the original vegetation has been cleared and that most cleared areas are used for pasture. Pasture may be slightly less common on the other mapped soil series included in this site description. Limestone rock outcrop and bare ground related to rock outcrop is common on this site and is often noted in pastures. Most pastures are very old and have been established for a long time. Management practices focus primarily on maintaining healthy pasture conditions rather than new pasture establishment, although that is certainly an option. Balancing stocking rates, grazing rotation, and nutrient inputs are the primary management concerns. In general, pasture management recommendations focus on maximizing desirable forage species to outcompete undesirable or weedy species. Production practices that result in overgrazing and low fertility levels favor emergence, propagation, and growth of weeds (Green et al., 2006). Effective pasture management includes the following practices: - maintaining proper soil pH and fertility levels - using controlled grazing practices - mowing at proper timing and stage of maturity - allowing new seedlings to become well established before use, and - renovating pastures when needed (Green et al. 2006). Tennessee has developed a list of desirable species, intermediate species and undesirable species for use in a Pasture Condition Scoresheet, which can be used to develop management recommendations on a site by site basis. District Conservationists as well as the State Grazing Specialist can be consulted to assist in developing management recommendations. Perilla (*Perilla frutescens*) mint is an exotic, invasive weed that has become a major problem in many pastures. It causes more cattle deaths (in Tennessee) than any other toxic plant (Steckel and Rhodes, 2007). Keeping a ready supply of quality feed available for farm animals in the late summer and early fall will help to minimize the risk to livestock. Cattle will not normally feed on perilla unless there is a shortage of other feed.

Community 3.1
Orchardgrass - tall fescue

The dominance of orchardgrass, red clover and tall fescue in this community phase indicate that nutrient levels are adequate and grazing rotations are long enough to allow pasture plants to recover. Overstocking and infrequent pasture rotation will allow weedier species to invade such as nimblewill and rush. If mowing is infrequent, honey locust and Eastern redcedar will begin to colonize. Patches of bare ground and rock outcrop are common in pastures on this site.

Forest overstory. The overstory in the grassland state is minimal and consists of a few trees growing along the perimeter of pastures and scattered shade trees within pastures.

Forest understory. Ideally, pastures in the grassland state would be primarily composed of tall fescue, red clover and orchardgrass. Numerous other plants could be present in varying numbers depending on the objectives and management approaches of the landowner.

Table 14. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0%
Grass/grasslike foliar cover	0-50%
Forb foliar cover	0-20%
Non-vascular plants	0%
Biological crusts	0%
Litter	0-5%
Surface fragments >0.25" and <=3"	0-3%
Surface fragments >3"	0%
Bedrock	0-2%
Water	0%
Bare ground	0-25%

Table 15. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	0-50%	0-40%
>0.5 <= 1	–	–	0-1%	0-1%
>1 <= 2	–	–	–	–
>2 <= 4.5	–	–	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

State 4
Transitional Field State

This is a transitional state representing an important step in the natural succession of this ecological site. In this state, the plant community is moving from a cleared or managed grassland state to a forested state, whether in reference condition or invaded. Typically, the plant community consists of a high number of grasses, both native and introduced. The types and amounts of grasses are largely related to past land-use. If the site was cleared but never grazed by domestic livestock or managed as a pasture, native warm-season grass species would be more common. Obviously, where land was cleared for pasture, species such as tall fescue would be present, along with a higher number of weedy exotics. This state will also contain a high number of native asters, including the goldenrods and the daisies, which can be important to pollinators and wildlife. One plot was on a wildlife management area, which was focused on dove habitat. Woody species that will begin to encroach include eastern redcedar, honeylocust, winged elm, black walnut (*Juglans nigra*), and boxelder (*Acer negundo*). Periodic mowing can keep this state in an open condition. In some areas, rock outcrop will naturally maintain openness. Mowing becomes almost impossible quickly, as honeylocust especially, begins to encroach. If openness is desired, mowing should be done at least once per year, if not more often. Exotic plant species can become a problem in this state, especially as it transitions over to the invaded state. Because of the openness and relatively short time period since clearance, it is susceptible to a host of non-native plant pests, which can change natural succession pathways and push this state into an invaded state rather than back to the reference community. The type and amount of past disturbance, the degree of interruption of natural disturbance cycles and the surrounding flora will all play a role in which trajectory and to what degree, this state can move. Typical exotic species found in this state include the privets, the exotic lespedezas, Nepalese browntop and the exotic honeysuckles to name a few. In most cases, this state will require some type of exotic plant management if it is to return to the reference plant community.

Community 4.1
Eastern redcedar/honeylocust – winged elm/tall fescue – red clover

This state is succeeding to forest in most cases. It will have varying degrees of openness based on depth to bedrock and, relatedly, soil depth. Naturally shallow areas will largely remain open while areas with deeper soil will host woody plant species. Typical early colonizers include eastern redcedar, honeylocust and winged elm. Succession happens rapidly on this state and so, if openness is desirable, mowing regimes must occur with regularity and relative frequency. In many cases, this site will be susceptible to invasion by exotic invasive plant species. If restoration to the reference plant community is desired, exotic plant management will likely be needed. It should be site based and species specific. The reintroduction of natural disturbances such as fire could be beneficial in some cases. However, it has also been known to spread invasive, exotic plants and so should be used with caution.

Forest overstory. This site has none to very little forest overstory but in some cases an individual tree will occur. In that case, species might include eastern redcedar, boxelder (Acer negundo), honeylocust, and black walnut (Juglans nigra).

Forest understory. Forest understories can be variable, depending on the type and degree of past disturbance and

the plant composition of the surrounding landscape. If invasive exotics occur all around a site in this state, it will be much more likely to be colonized by problematic species. Concurrently, clearings that represent this state within a larger mosaic of forests and woodlands will be colonized by native pioneer woody species more rapidly and to a greater degree. Typical understory species can include native and exotic grasses, numerous genera in the Asteraceae family, lespedezas, and tree and shrub seedlings.

Transition 1A
State 1 to 2

The reference community can become susceptible to invasion by exotic plants if natural disturbance regimes are hampered, if there is a history of human-caused disturbance such as unrestricted grazing, and/or if a site is located close to an invaded area, such as a roadside. In some cases, eastern redcedar, a native species, can become invasive on glades.

Transition 1B
State 1 to 3

The reference community can be and has been in many cases, transitioned into a managed grassland. This requires typical pasture establishment techniques such as clearing trees, establishing pasture grasses and forbs and continuing management such as fertilizing, rotational grazing, etc.

Transition 1C
State 1 to 4

If an area is cleared of trees and abandoned, natural succession will begin and in a short amount of time, woody species such as eastern redcedar, honeylocust (*Gleditsia triacanthos*) and winged elm will dominate the site, making mowing almost impossible. In some places, these areas are intentionally kept open for wildlife. Mowing schedules should consider the rapid colonization of native woody species. In areas where succession starts from an abandoned pasture, species such as tall fescue and red clover may be present. These areas are particularly susceptible to invasion by exotic plant species.

Restoration pathway 2A
State 2 to 1

For glade areas where eastern redcedar has encroached, some mechanical/chemical clearing may be in order before any use of prescribed fire would be effective. In areas where there is a severe exotic plant invasion in addition to cedar encroachment, prescribed fire should be used with extreme caution. Fire is known to favor exotic plants and a misapplication could result in exacerbating the invasion extent. Management of exotic, invasive plants is critical to restore this state to reference conditions. Most invasions require long-term management over years, involving multiple treatments which can vary by species and extent of invasion. Management should be site based and species specific. Technical resources should be consulted to develop site-based management prescriptions.

Conservation practices

Native Plant Community Restoration and Management
Invasive Plant Species Control
Herbaceous Weed Control

Transition 3A
State 3 to 4

The managed grassland state will quickly begin to revert to forest, in most cases, once management and grazing stops. Typically, redcedar and honeylocust will be the first woody invaders and will dominate the site in very little time. Once established, these woody species, especially honeylocust, make it difficult to push this state back to a managed grassland because mowing becomes impossible at a point. Exotic plant species are commonly noted in areas transitioning from a managed grassland state to a different plant community. In some cases, exotic plant

management will be needed, depending on management objectives.

Restoration pathway 4B
State 4 to 1

Depending on the degree of ecological degradation present on a site in this state, it can generally be restored back to a reference plant community through natural succession, exotic plant management and mechanical control of undesirable tree species. Encouraging oak regeneration can also help to push this state back into the reference community. In some cases, prescribed fire might be beneficial but care should be taken as it has been known to spread invasive, exotic plants.

Transition 4A
State 4 to 2

This state is likely to transition to the Invaded State if no management is done to control exotic species. Native trees will naturally seed in over time as well.

Restoration pathway 4A
State 4 to 3

This state can be returned to a managed grassland state with appropriate pasture management such as mowing, seeding and fertilizing.

Additional community tables

Table 16. Community 1.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
eastern redcedar	JUVI	*Juniperus virginiana*	Native	16–43	5–50	4–11	–
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	41–70	5–40	7–12	–
white ash	FRAM2	*Fraxinus americana*	Native	33–48	1–30	5–11	–
Virginia pine	PIVI2	*Pinus virginiana*	Native	21–40	2–15	5–9	–
northern red oak	QURU	*Quercus rubra*	Native	62–72	0–5	9–11	–
winged elm	ULAL	*Ulmus alata*	Native	10–23	1–5	2–5	–
sassafras	SAAL5	*Sassafras albidum*	Native	5–18	0–2	4–5	–
eastern white pine	PIST	*Pinus strobus*	Native	30–50	0–2	0–7	–
flowering dogwood	COFL2	*Cornus florida*	Native	12–15	0–2	3–4	–
common persimmon	DIVI5	*Diospyros virginiana*	Native	25–35	0–2	0–8	–

Table 17. Community 1.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
panicgrass	PANIC	*Panicum*	Native	0–0.5	0–1
purpletop tridens	TRFL2	*Tridens flavus*	Native	0–0.5	0–1
purpletop tridens	TRFL2	*Tridens flavus*	Native	0.5–1	0–1
Forb/Herb					
trailing lespedeza	LEPR	*Lespedeza procumbens*	Native	0–0.5	2–5
aster	ASTER	*Aster*	Native	0.5–1	0–5

wavyleaf aster	SYUN	*Symphyotrichum undulatum*	Native	0.5–1	1–3
agueweed	GEQUQ	*Gentianella quinquefolia ssp. quinquefolia*	Native	0–0.5	2–3
goldenrod	SOLID	*Solidago*	Native	0–0.5	1–2
white crownbeard	VEVI3	*Verbesina virginica*	Native	0.5–1	1–2
trailing lespedeza	LEPR	*Lespedeza procumbens*	Native	0.5–1	1–2
sunflower	HELIA3	*Helianthus*	Native	0–0.5	1–2
sunflower	HELIA3	*Helianthus*	Native	0.5–1	1–2
ticktrefoil	DESMO	*Desmodium*	Native	0–0.5	1–2
purple false foxglove	AGPU5	*Agalinis purpurea*	Native	0–0.5	1–2
bedstraw	GALIU	*Galium*	Native	0–0.5	0–1
sericea lespedeza	LECU	*Lespedeza cuneata*	Introduced	0–0.5	0–1
shaggy blazing star	LIPI7	*Liatris pilosa*	Native	0–0.5	0–1
trailing lespedeza	LEPR	*Lespedeza procumbens*	Native	0–0.5	0–1
white crownbeard	VEVI3	*Verbesina virginica*	Native	0–0.5	0–1
Virginia strawberry	FRVI	*Fragaria virginiana*	Native	0–0.5	0–1
wavyleaf aster	SYUN	*Symphyotrichum undulatum*	Native	0–0.5	0–1
wild petunia	RUELL	*Ruellia*	Native	0–0.5	0–1
smallhead blazing star	LIMI7	*Liatris microcephala*	Native	0–0.5	0–1
Fern/fern ally					
resurrection fern	PLPO2	*Pleopeltis polypodioides*	Native	0–0.5	1–2
resurrection fern	PLPO2	*Pleopeltis polypodioides*	Native	0.5–1	1–2
resurrection fern	PLPO2	*Pleopeltis polypodioides*	Native	1–2	1–2
resurrection fern	PLPO2	*Pleopeltis polypodioides*	Native	2–4.5	1–2
resurrection fern	PLPO2	*Pleopeltis polypodioides*	Native	4.5–13	1–2
purple cliffbrake	PEAT2	*Pellaea atropurpurea*	Native	0–0.5	0–1
Shrub/Subshrub					
rusty blackhaw	VIRU	*Viburnum rufidulum*	Native	2–4.5	2–5
American beautyberry	CAAM2	*Callicarpa americana*	Native	2–4.5	1–4
fragrant sumac	RHAR4	*Rhus aromatica*	Native	1–2	1–3
autumn olive	ELUM	*Elaeagnus umbellata*	Introduced	1–2	1–3
autumn olive	ELUM	*Elaeagnus umbellata*	Introduced	2–4.5	1–3
dwarf hackberry	CETE	*Celtis tenuifolia*	Native	4.5–13	1–3
rusty blackhaw	VIRU	*Viburnum rufidulum*	Native	4.5–13	1–2
common serviceberry	AMAR3	*Amelanchier arborea*	Native	4.5–13	1–2
American bladdernut	STTR	*Staphylea trifolia*	Native	2–4.5	1–2
fragrant sumac	RHAR4	*Rhus aromatica*	Native	0.5–1	1–2
Carolina buckthorn	FRCA13	*Frangula caroliniana*	Native	0.5–2	1–2
Amur honeysuckle	LOMA6	*Lonicera maackii*	Introduced	0–0.5	0–1
fragrant sumac	RHAR4	*Rhus aromatica*	Native	0–0.5	0–1
rusty blackhaw	VIRU	*Viburnum rufidulum*	Native	0–0.5	0–1
autumn olive	ELUM	*Elaeagnus umbellata*	Introduced	0–0.5	0–1
autumn olive	ELUM	*Elaeagnus umbellata*	Introduced	0.5–1	0–1
autumn olive	ELUM	*Elaeagnus umbellata*	Introduced	4.5–13	0–1
rusty blackhaw	VIRU	*Viburnum rufidulum*	Native	0.5–1	0–1

rusty blackhaw	VIRU	*Viburnum rufidulum*	Native	1–2	0–1
dwarf hackberry	CETE	*Celtis tenuifolia*	Native	0–0.5	0–1
dwarf hackberry	CETE	*Celtis tenuifolia*	Native	0.5–1	0–1
dwarf hackberry	CETE	*Celtis tenuifolia*	Native	2–4.5	0–1
dwarf hackberry	CETE	*Celtis tenuifolia*	Native	0–0.5	0–1
dwarf hackberry	CETE	*Celtis tenuifolia*	Native	0.5–1	0–1
dwarf hackberry	CETE	*Celtis tenuifolia*	Native	2–4.5	0–1
dwarf hackberry	CETE	*Celtis tenuifolia*	Native	4.5–13	0–1
striped prince's pine	CHMA3	*Chimaphila maculata*	Native	0–0.5	0–1
Tree					
winged elm	ULAL	*Ulmus alata*	Native	4.5–13	2–8
eastern redcedar	JUVI	*Juniperus virginiana*	Native	4.5–13	2–5
American beech	FAGR	*Fagus grandifolia*	Native	4.5–13	1–4
shagbark hickory	CAOV2	*Carya ovata*	Native	0–0.5	1–4
eastern redcedar	JUVI	*Juniperus virginiana*	Native	2–4.5	1–4
eastern redbud	CECA4	*Cercis canadensis*	Native	4.5–13	1–4
flowering dogwood	COFL2	*Cornus florida*	Native	4.5–13	2–4
eastern redbud	CECA4	*Cercis canadensis*	Native	2–4.5	1–3
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	2–4.5	1–3
American beech	FAGR	*Fagus grandifolia*	Native	2–4.5	1–2
eastern redbud	CECA4	*Cercis canadensis*	Native	0.5–1	1–2
eastern redbud	CECA4	*Cercis canadensis*	Native	1–2	1–2
eastern redbud	CECA4	*Cercis canadensis*	Native	0–0.5	1–2
shagbark hickory	CAOV2	*Carya ovata*	Native	1–2	1–2
shagbark hickory	CAOV2	*Carya ovata*	Native	2–4.5	1–2
shagbark hickory	CAOV2	*Carya ovata*	Native	4.5–13	1–2
winged elm	ULAL	*Ulmus alata*	Native	0.5–1	1–2
winged elm	ULAL	*Ulmus alata*	Native	1–2	1–2
sugar maple	ACSA3	*Acer saccharum*	Native	1–2	1–2
sugar maple	ACSA3	*Acer saccharum*	Native	2–4.5	1–2
sugar maple	ACSA3	*Acer saccharum*	Native	4.5–13	1–2
sugar maple	ACSA3	*Acer saccharum*	Native	0–0.5	1–2
sugar maple	ACSA3	*Acer saccharum*	Native	0.5–1	1–2
Shumard oak	QUSHS2	*Quercus shumardii var. shumardii*	Native	0–0.5	0–1
slippery elm	ULRU	*Ulmus rubra*	Native	4.5–13	0–1
white ash	FRAM2	*Fraxinus americana*	Native	0–0.5	0–1
white ash	FRAM2	*Fraxinus americana*	Native	0.5–1	0–1
winged elm	ULAL	*Ulmus alata*	Native	0–0.5	0–1
dwarf hackberry	CETE	*Celtis tenuifolia*	Native	1–2	0–1
ash	FRAXI	*Fraxinus*	Native	0–0.5	0–1
eastern redcedar	JUVI	*Juniperus virginiana*	Native	0–0.5	0–1
eastern redcedar	JUVI	*Juniperus virginiana*	Native	0.5–1	0–1
eastern redcedar	JUVI	*Juniperus virginiana*	Native	1–2	0–1
black cherry	PRSE2	*Prunus serotina*	Native	0–0.5	0–1

black cherry	PRSE2	*Prunus serotina*	Native	0–0.5	0–1
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	0–0.5	0–1
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	0.5–1	0–1
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	1–2	0–1
post oak	QUST	*Quercus stellata*	Native	0–1	0–1
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	4.5–13	0–1
common persimmon	DIVI5	*Diospyros virginiana*	Native	0–0.5	0–1
flowering dogwood	COFL2	*Cornus florida*	Native	2–4.5	0–1
red maple	ACRU	*Acer rubrum*	Native	0–0.5	0–1
Vine/Liana					
trumpet creeper	CARA2	*Campsis radicans*	Native	0–0.5	1–2
trumpet creeper	CARA2	*Campsis radicans*	Native	0.5–1	1–2
Virginia creeper	PAQU2	*Parthenocissus quinquefolia*	Native	0.5–1	1–2
Virginia creeper	PAQU2	*Parthenocissus quinquefolia*	Native	0–0.5	0–1
Virginia creeper	PAQU2	*Parthenocissus quinquefolia*	Native	1–2	0–1
common moonseed	MECA3	*Menispermum canadense*	Native	0–0.5	0–1
common moonseed	MECA3	*Menispermum canadense*	Native	0.5–1	0–1
common moonseed	MECA3	*Menispermum canadense*	Native	1–2	0–1
crossvine	BICA	*Bignonia capreolata*	Native	0–0.5	0–1
crossvine	BICA	*Bignonia capreolata*	Native	0.5–1	0–1
crossvine	BICA	*Bignonia capreolata*	Native	1–2	0–1
crossvine	BICA	*Bignonia capreolata*	Native	2–4.5	0–1
crossvine	BICA	*Bignonia capreolata*	Native	2–4.5	0–1
devil's darning needles	CLVI5	*Clematis virginiana*	Native	1–2	0–1
common moonseed	MECA3	*Menispermum canadense*	Native	0–0.5	0–1
common moonseed	MECA3	*Menispermum canadense*	Native	0.5–1	0–1
common moonseed	MECA3	*Menispermum canadense*	Native	1–2	0–1
eastern poison ivy	TORA2	*Toxicodendron radicans*	Native	0.5–1	0–1
eastern poison ivy	TORA2	*Toxicodendron radicans*	Native	1–2	0–1
eastern poison ivy	TORA2	*Toxicodendron radicans*	Native	2–4.5	0–1
grape	VITIS	*Vitis*	Native	0–0.5	0–1
grape	VITIS	*Vitis*	Native	0.5–1	0–1
greenbrier	SMILA2	*Smilax*	–	0–0.5	0–1
greenbrier	SMILA2	*Smilax*	Native	2–4.5	0–1
roundleaf greenbrier	SMRO	*Smilax rotundifolia*	Native	0–0.5	0–1
roundleaf greenbrier	SMRO	*Smilax rotundifolia*	Native	0.5–1	0–1
roundleaf greenbrier	SMRO	*Smilax rotundifolia*	Native	1–2	0–1
eastern poison ivy	TORA2	*Toxicodendron radicans*	Native	0–0.5	0–1
crossvine	BICA	*Bignonia capreolata*	Native	4.5–13	0–1

Table 18. Community 1.2 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
eastern redcedar	JUVI	*Juniperus virginiana*	Native	4–20	5–10	2–15	–
winged elm	ULAL	*Ulmus alata*	Native	4–8	0–2	2–5	–
Virginia pine	PIVI2	*Pinus virginiana*	Native	21–40	0–2	7–12	–
eastern redbud	CECA4	*Cercis canadensis*	Native	–	0–1	–	–

Table 19. Community 1.2 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
little bluestem	SCSC	*Schizachyrium scoparium*	Native	0–1	0–5
broomsedge bluestem	ANVI2	*Andropogon virginicus*	Native	–	–
bald brome	BRRA2	*Bromus racemosus*	Introduced	–	–
eastern woodland sedge	CABL	*Carex blanda*	Native	–	–
orchardgrass	DAGL	*Dactylis glomerata*	Introduced	–	–
purpletop tridens	TRFL2	*Tridens flavus*	Native	–	–
composite dropseed	SPCOC2	*Sporobolus compositus var. compositus*	Native	–	–
poverty dropseed	SPVA	*Sporobolus vaginiflorus*	Native	–	–
meadow fescue	SCPR4	*Schedonorus pratensis*	Introduced	–	–
Bosc's panicgrass	DIBO2	*Dichanthelium boscii*	Native	–	–
poverty oatgrass	DASP2	*Danthonia spicata*	Native	–	–
gonolobus	GONOL	*Gonolobus*	Introduced	–	–
wiry panicgrass	PAFL2	*Panicum flexile*	Native	–	–
Forb/Herb					
pinnate prairie coneflower	RAPI	*Ratibida pinnata*	Native	–	0–5
gladecress	LEAVE	*Leavenworthia*	Native	–	–
daisy	CHRYS2	*Chrysanthemum*	Introduced	–	–
Queen Anne's lace	DACA6	*Daucus carota*	Introduced	–	–
hairyfruit chervil	CHTA	*Chaerophyllum tainturieri*	Native	–	–
fivestamen chickweed	CESE4	*Cerastium semidecandrum*	Introduced	–	–
redring milkweed	ASVA	*Asclepias variegata*	Native	–	–
wild bergamot	MOFI	*Monarda fistulosa*	Native	–	–
woodland pinkroot	SPMA3	*Spigelia marilandica*	Native	–	–
diamondflowers	STNIN	*Stenaria nigricans var. nigricans*	Native	–	–
tall thimbleweed	ANVI3	*Anemone virginiana*	Native	–	–
violet	VIOLA	*Viola*	Unknown	–	–
common chickweed	STME2	*Stellaria media*	Introduced	–	–
lyreleaf sage	SALY2	*Salvia lyrata*	Native	–	–
Leonard's skullcap	SCPAM	*Scutellaria parvula var. missouriensis*	Native	–	–
clover	TRIFO	*Trifolium*	Unknown	–	–
goldenrod	SOLID	*Solidago*	Native	–	–
Virginia plantain	PLVI	*Plantago virginica*	Native	–	–
false aloe	MAVI5	*Manfreda virginica*	Native	–	–

false aloe	MAVI3	*Manfreda virginica*	Native	–	–
licorice bedstraw	GACI2	*Galium circaezans*	Native	–	–
hairy sunflower	HEHI2	*Helianthus hirsutus*	Native	–	–
Carolina geranium	GECA5	*Geranium carolinianum*	Native	–	–
flowering spurge	EUCO10	*Euphorbia corollata*	Native	–	–
hoary puccoon	LICA12	*Lithospermum canescens*	Native	–	–
trailing lespedeza	LEPR	*Lespedeza procumbens*	Native	–	–
common yellow oxalis	OXST	*Oxalis stricta*	Native	–	–
foxglove beardtongue	PEDI	*Penstemon digitalis*	Native	–	–
Allegheny-spurge	PAPR7	*Pachysandra procumbens*	Native	–	–
garden vetch	VISAN2	*Vicia sativa ssp. nigra*	Introduced	–	–
violet woodsorrel	OXVI	*Oxalis violacea*	Native	–	–
Fern/fern ally					
purple cliffbrake	PEAT2	*Pellaea atropurpurea*	Native	0–0.5	0–1
glade fern	DIPY	*Diplazium pycnocarpon*	Native	–	–
resurrection fern	PLPOP	*Pleopeltis polypodioides ssp. polypodioides*	Native	–	–
Shrub/Subshrub					
fragrant sumac	RHAR4	*Rhus aromatica*	Native	0–0.5	0–1
fragrant sumac	RHAR4	*Rhus aromatica*	Native	0.5–1	0–1
fragrant sumac	RHAR4	*Rhus aromatica*	Native	1–2	0–1
fragrant sumac	RHAR4	*Rhus aromatica*	Native	2–4.5	0–1
Vine/Liana					
saw greenbrier	SMBO2	*Smilax bona-nox*	Native	0–0.5	0–1
saw greenbrier	SMBO2	*Smilax bona-nox*	Native	0.5–1	0–1
saw greenbrier	SMBO2	*Smilax bona-nox*	Native	1–2	0–1
saw greenbrier	SMBO2	*Smilax bona-nox*	Native	2–4.5	0–1
trumpet honeysuckle	LOSE	*Lonicera sempervirens*	Native	–	0–1

Table 20. Community 2.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
eastern redcedar	JUVI	*Juniperus virginiana*	Native	25–53	0–40	9–12	–
chinquapin oak	QUMU	*Quercus muehlenbergii*	Native	15–60	0–10	4–8	–
post oak	QUST	*Quercus stellata*	Native	45–68	0–10	8–17	–
silktree	ALJU	*Albizia julibrissin*	Introduced	–	–	13	–
elm	ULMUS	*Ulmus*	Native	40–60	–	7–12	–
Shumard oak	QUSHS2	*Quercus shumardii var. shumardii*	Native	45–60	–	9	–
shagbark hickory	CAOV2	*Carya ovata*	Native	–	–	0–20	–
white ash	FRAM2	*Fraxinus americana*	Native	–	–	0–12	–
common persimmon	DIVI5	*Diospyros virginiana*	Native	–	–	0–9	–
mockernut hickory	CATO6	*Carya tomentosa*	Native	–	–	0–12	–
white oak	QUAL	*Quercus alba*	Native	–	–	0–9	–
Virginia pine	PIVI2	*Pinus virginiana*	Native	–	–	0–13	–

Table 21. Community 2.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
Nepalese browntop	MIVI	*Microstegium vimineum*	Introduced	0–0.5	50–75
Forb/Herb					
sericea lespedeza	LECU	*Lespedeza cuneata*	Introduced	–	–
Fern/fern ally					
resurrection fern	PLPO2	*Pleopeltis polypodioides*	Native	0–13	0–2
Shrub/Subshrub					
Amur honeysuckle	LOMA6	*Lonicera maackii*	Introduced	–	5–25
Chinese privet	LISI	*Ligustrum sinense*	Introduced	–	5–25
Dahurian buckthorn	RHDA	*Rhamnus davurica*	Introduced	–	0–5
winter creeper	EUFO5	*Euonymus fortunei*	Introduced	–	–
autumn olive	ELUM	*Elaeagnus umbellata*	Introduced	–	–
burningbush	EUAL13	*Euonymus alatus*	Introduced	–	–
Tree					
American beech	FAGR	*Fagus grandifolia*	Native	–	0–5
eastern redbud	CECA4	*Cercis canadensis*	Native	2–4.5	2–5
paper mulberry	BRPA4	*Broussonetia papyrifera*	Introduced	–	0–2
white ash	FRAM2	*Fraxinus americana*	Native	0.5–2	0–1
eastern redbud	CECA4	*Cercis canadensis*	Native	–	0–1
dwarf hackberry	CETE	*Celtis tenuifolia*	Native	–	0–1
tree of heaven	AIAL	*Ailanthus altissima*	Introduced	–	–
Callery pear	PYCA80	*Pyrus calleryana*	Introduced	–	–
Vine/Liana					
English ivy	HEHE	*Hedera helix*	Introduced	–	5–75
Japanese honeysuckle	LOJA	*Lonicera japonica*	Introduced	–	0–10
trumpet creeper	CARA2	*Campsis radicans*	Native	0–13	0–5
grape	VITIS	*Vitis*	Native	0–40	1–2
eastern poison ivy	TORA2	*Toxicodendron radicans*	Native	–	1–2
crossvine	BICA	*Bignonia capreolata*	Native	0.5–1	0–1
Chinese wisteria	WISI	*Wisteria sinensis*	Introduced	–	–

Table 22. Community 3.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
post oak	QUST	*Quercus stellata*	Native	–	–	–	–
shagbark hickory	CAOV2	*Carya ovata*	Native	–	–	–	–
common persimmon	DIVI5	*Diospyros virginiana*	Native	–	–	–	–
eastern redcedar	JUVI	*Juniperus virginiana*	Native	–	–	–	–

Table 23. Community 3.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
panicgrass	PANIC	*Panicum*	Unknown	–	–
broomsedge bluestem	ANVI2	*Andropogon virginicus*	Native	–	–
field brome	BRAR5	*Bromus arvensis*	Introduced	–	–
purpletop tridens	TRFL2	*Tridens flavus*	Native	–	–
purpletop tridens	TRFL2	*Tridens flavus*	Native	–	–
tall fescue	SCAR7	*Schedonorus arundinaceus*	Introduced	–	–
orchardgrass	DAGL	*Dactylis glomerata*	Introduced	–	–
Kentucky bluegrass	POPR	*Poa pratensis*	Introduced	–	–
Nepalese browntop	MIVI	*Microstegium vimineum*	Introduced	–	–
crabgrass	DIGIT2	*Digitaria*	Unknown	–	–
Forb/Herb					
hogwort	CRCA6	*Croton capitatus*	Native	–	–
red clover	TRPR2	*Trifolium pratense*	Introduced	–	–
Queen Anne's lace	DACA6	*Daucus carota*	Introduced	–	–
Carolina wild petunia	RUCA4	*Ruellia caroliniensis*	Native	–	–
vetch	VICIA	*Vicia*	Unknown	–	–
white clover	TRRE3	*Trifolium repens*	Introduced	–	–
lespedeza	LESPE	*Lespedeza*	Unknown	–	–
narrowleaf plantain	PLLA	*Plantago lanceolata*	Introduced	–	–
fleabane	ERIGE2	*Erigeron*	Unknown	–	–
blessed thistle	CNBE	*Cnicus benedictus*	Introduced	–	–
ragweed	AMBRO	*Ambrosia*	Native	–	–
Vine/Liana					
Carolina coralbead	COCA	*Cocculus carolinus*	Native	–	–

Table 24. Community 4.1 forest overstory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)	Diameter (In)	Basal Area (Square Ft/Acre)
Tree							
boxelder	ACNE2	*Acer negundo*	Native	–	–	–	–
black walnut	JUNI	*Juglans nigra*	Native	–	–	–	–
eastern redcedar	JUVI	*Juniperus virginiana*	Native	–	–	–	–

Table 25. Community 4.1 forest understory composition

Common Name	Symbol	Scientific Name	Nativity	Height (Ft)	Canopy Cover (%)
Grass/grass-like (Graminoids)					
bluegrass	POA	*Poa*	Unknown	–	–
Forb/Herb					
lespedeza	LESPE	*Lespedeza*	Unknown	–	–
Tree					
honeylocust	GLTR	*Gleditsia triacanthos*	Native	–	–
boxelder	ACNE2	*Acer negundo*	Native	–	–
eastern redcedar	JUVI	*Juniperus virginiana*	Native	–	–

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Contributors

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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):**

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:**
