USDA Natural Resources
Conservation Service

Ecological site F134XY006AL
Northern Loess Sideslope - PROVISIONAL

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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.

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 134X–Southern Mississippi Valley Loess

The Southern Mississippi Valley Loess (MLRA 134) extends some 500 miles from the southern tip of Illinois to southern Louisiana. This MLRA occurs in Mississippi (39 percent), Tennessee (23 percent), Louisiana (15 percent), Arkansas (11 percent), Kentucky (9 percent), Missouri (2 percent), and Illinois (1 percent). It makes up about 26,520 square miles. Landscapes consist of highly dissected uplands, level to undulating plains, and broad terraces that are covered with a mantle of loess. The soils, mainly Alfisols, formed in the loess mantle. Stream systems of the MLRA typically originate as low-gradient drainageways in the upper reaches that broaden rapidly downstream to wide, level floodplains with highly meandering channels. Alluvial soils are predominantly silty where loess thickness of the uplands are deepest but grade to loamy textures in watersheds covered by thin loess. Underlying the loess mantle are Tertiary deposits of unconsolidated sand, silt, clay, gravel, and lignite. Crowley's Ridge, Macon Ridge, and Lafayette Loess Plains are discontinuous, erosional remnants that run north to south in southeastern Missouri - eastern Arkansas, northeastern Louisiana, and south-central Louisiana, respectively. Elevations range from around 100 feet on terraces in southern Louisiana to over 600 feet on uplands in western Kentucky. The steep, dissected uplands are mainly in hardwood forests while less sloping areas are used for crop, pasture, and forage production (USDA, 2006).

This site occurs throughout the Loess Plains (EPA Level IV Ecoregion: 74b) from western Kentucky south to the Southern Rolling Plains (EPA Level IV Ecoregion: 74c) in southwestern Mississippi. The accompanying map illustrates the distribution of this site as occurring throughout the Loess Hills (Ecoregion: 74a), which is an artifact of soil mapping. This site is associated with loess-capped sideslopes east of the Loess Hills.

Classification relationships

All or portions of the geographic range of this site falls within a number of ecological/land classifications including:
-NRCS Major Land Resource Area (MLRA) 134 – Southern Mississippi Valley Loess
-Environmental Protection Agency's Level IV Ecoregion: Loess Plains, 74b (Griffith et al., 1998; Woods et al., 2002; Chapman et al., 2004)
-231H - Coastal Plains-Loess section of the USDA Forest Service Ecological Subregion (McNab et al., 2005)
-LANDFIRE Biophysical Setting 4714270 and NatureServe Ecological System CES203.353 East Gulf Coastal Plain Jackson Plain Prairie and Barrens (LANDFIRE, 2009; NatureServe, 2009)
-LANDFIRE Biophysical Setting 4713060 and NatureServe Ecological System CES203.482 East Gulf Coastal Plain Northern Loess Plain Oak-Hickory Upland, (LANDFIRE, 2009; NatureServe, 2009)
-LANDFIRE Biophysical Setting 4713070 and NatureServe Ecological System CES203.483 East Gulf Coastal Plain Northern Dry Upland Hardwood Forest (LANDFIRE, 2009; NatureServe, 2009)
-LANDFIRE Biophysical Setting 4713250 and NatureServe Ecological System CES203.477 East Gulf Coastal Plain Northern Mesic Hardwood Forest (LANDFIRE, 2009; NatureServe, 2009)
-Western Mesophytic Forest Region - Mississippi Embayment Section (Braun, 1950)

Ecological site concept

The Northern Loess Sideslope is characterized by deep, well drained soils that formed in a mantle of loess greater than two feet thick. The site principally occurs on sideslopes of the Loess Plains and secondarily along the western edge of the Southeastern Plains. Slopes of this site are greater than 12 percent and are frequently within the range of 12 to 35 percent. Natural vegetation prior to settlement likely consisted of an open, oak – hickory woodland association in the north with an increase in shortleaf pine farther south. In areas where fire occurred more frequently, a mosaic of conditions ranging from oak – pine savannas to prairie may have occurred. Under a frequent fire regime, upper slopes likely remained open with an increase in woody vegetation density downslope toward the adjoining drainageways and floodplains. Differences in vegetation also occurred along a moisture gradient. Drought-tolerant species typically occupied mid- to upper slope positions and on exposed (southeast to west-facing) sideslopes. Conversely, species requiring greater moisture were often restricted to footslopes and protected (northwest to east-facing) sideslopes.

Associated sites

F134XY003AL	**Northern Loess Interfluve - PROVISIONAL**

Similar sites

F134XY208AL	**Western Dry Loess Backslope - PROVISIONAL**

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

The Northern Loess Sideslope is broadly distributed across the largest physiographic subsection or ecoregion of the MLRA, the Loess Plains. West to east, this ecological site extends from the border of the Loess Hills (EPA Level IV Ecoregion: 74a), across the Loess Plains, and into portions of the Southeastern Plains (EPA Level III Ecoregion: 65) where loess continues to cap the interfluves and adjoining sideslopes. North to south, the site extends from the plains in western Kentucky to the border of the Southern Rolling Plains in southwestern Mississippi. The latter forms the southern-most boundary of the site due to warmer average annual air temperatures, greater annual rainfall, and a transition to slightly warmer soils (Chapman et al., 2004).

Characteristics of this region generally include undulating uplands, gently rolling hills, and irregular plains. Topographic relief of the Loess Plains is generally low, averaging about 30 to 70 feet. Upland slopes typically range from 0 to 20 percent with 1 to 8 percent being dominant. Elevations in the range of 300 to 400 feet are commonplace to the south but increase to nearly 600 feet in the north. In portions of western Kentucky and Tennessee, the undulating pattern of the plains is interrupted by dissected landscapes. Such areas tend to be hillier with steeper slopes and greater relief and appear to be concentrated along the borders of broader valleys and floodplains. As the plains continue eastward, starkness of the terrain becomes even more pronounced, which signals the transition of the Loess Plains to the thin loess-capped ridges, hills, and plateaus along the western edge of the Southeastern Plains. To the south, through much of Mississippi, the Loess Plains consists of a very thin east – west belt, compressed between the dissected Loess Hills and Mississippi Alluvial Plain to the west and the Coastal Plain to the east. The convergence of such contrasting ecoregions contribute to a very complex pattern of soils, landforms, and vegetation communities.

This particular site occurs on sideslopes of the Loess Plains and locally along the western border of the Southeastern Plains where a loess cap of at least two feet remain. Slopes of this site are greater than 12 percent with dominant slopes ranging from 12 to 35 percent. Aspect has tremendous influences on vegetation communities of this site with protected slopes (northwest to east-facing) supporting a greater number of species, higher site productivity, and a community consisting of species associated with more moist conditions (i.e., mesophytes). Exposed slopes (southeast to west-facing) are drier and support a much drier association of plants.

Table 2. Representative physiographic features

Landforms	(1) Hill
Flooding frequency	None
Ponding frequency	None
Elevation	150–650 ft
Slope	12–40%
Water table depth	60 in
Aspect	N, S, W

Climatic features

This site falls under the Humid Subtropical Climate Classification (Koppen System). The average annual precipitation for this site from 1980 through 2010 is 56 and ranges from 53 in the north to 58 inches in the south. Maximum precipitation occurs in winter and spring and precipitation decreases gradually throughout the summer, except for a moderate increase in midsummer. Rainfall often occurs as high-intensity, convective thunderstorms during warmer periods but moderate-intensity frontal systems can produce large amounts of rainfall during winter, especially in the southern part of the area. Snowfall generally occurs in the north during most years. However, accumulations are generally less than 12 inches and typically melt within 3 to 5 days. South of Memphis, winter precipitation sometimes occurs as freezing rain and sleet. The average annual temperature is 60 degrees F and ranges from 58 in the north to 64 degrees F in the south. The freeze-free period averages 222 days and ranges from 206 days in the north to 252 days in the south. The frost free period averages 197 days and ranges from 191 in the north to 224 days in the southern extent.

The broad geographic distribution of this site north to south naturally includes much climatic variability with areas farther south having a longer growing season and increased precipitation. These climatic factors likely lead to important differences in overall plant productivity and key vegetation components between the southern and northern portions of this site. As future work proceeds, the current distribution of the Northern Loess Interfluve will likely be revised with a “central” site interjected between the northern and southern extremes of this MLRA.

Table 3. Representative climatic features

Frost-free period (average)	197 days
Freeze-free period (average)	222 days
Precipitation total (average)	56 in

Climate stations used

- (1) GILBERTSVILLE KY DAM [USC00153223], Gilbertsville, KY
- (2) BATESVILLE 2 SW [USC00220488], Batesville, MS
- (3) GRENADA [USC00223645], Grenada, MS
- (4) HOLLY SPRINGS 4 N [USC00224173], Holly Springs, MS
- (5) LEXINGTON [USC00225062], Lexington, MS
- (6) VICKSBURG MILITARY PK [USC00229216], Vicksburg, MS
- (7) YAZOO CITY 5 NNE [USC00229860], Yazoo City, MS
- (8) MILAN EXP STN [USC00406012], Milan, TN
- (9) PADUCAH [USW00003816], West Paducah, KY
- (10) JACKSON INTL AP [USW00003940], Pearl, MS
- (11) SENATOBIA [USC00227921], Coldwater, MS
- (12) COLLIERVILLE [USC00401950], Collierville, TN
- (13) NEWBERN [USC00406471], Newbern, TN
- (14) UNION CITY [USC00409219], Union City, TN
- (15) BROOKPORT DAM 52 [USC00110993], Paducah, IL
- (16) COVINGTON 3 SW [USC00402108], Covington, TN
- (17) BARDWELL 2 E [USC00150402], Bardwell, KY
- (18) LOVELACEVILLE [USC00154967], Paducah, KY
- (19) MURRAY [USC00155694], Murray, KY
- (20) CANTON 4N [USC00221389], Canton, MS
- (21) OAKLEY EXP STN [USC00226476], Raymond, MS
- (22) BOLIVAR WTR WKS [USC00400876], Bolivar, TN
- (23) DRESDEN [USC00402600], Dresden, TN

Influencing water features

This site is not influence by a hydrologic regime.

Soil features

Please note that the soils listed in this section of the description may not be all inclusive. There may be additional soils that fit the site’s concepts. Additionally, the soils that provisionally form the concepts of this site may occur elsewhere, either within or outside of the MLRA and may or “may not” have the same geomorphic characteristics or support similar vegetation. Some soil map units and soil series included in this “provisional” ecological site were used as a “best fit” for a particular soil – landform catena during a specific era of soil mapping, regardless of the origin of parent material or the location of MLRA boundaries. Therefore, the listed soils may not be typical for MLRA 134 or a specific location, and the associated soil map units may warrant further investigation in a joint ecological site inventory – soil survey project. When utilizing this provisional description, the user is encouraged to verify that the area of interest meets the appropriate ecological site concepts by reviewing the soils, landform, vegetation, and physical location. If the site concepts do not match the attributes of the area of interest, please review the Similar or Associated Sites listed in the Supporting Information section of this description to determine if another site may be a better fit for your area of interest.

The parent material of this site is a mantle of highly-erodible loess. Loess thickness of the site ranges from 2 to 40 feet with an average depth of 10 to 20 feet over the central portion of the plains. The greatest depths occur along the border of the Loess Plains and the Loess Hills where about 30 to 40 feet of loess blanket the uplands. Loess depths progressively thin eastward to about 2 feet thick in portions of the Southeastern Plains.

The soils of this site are well drained, have moderate permeability in the upper part, and consist of silt loam surface horizons with subsoils that include silt loam, silty clay loam, loam, to gravelly sandy loam. These soils are not affected by seasonal wetness. The principal soils of this ecological site are the Memphis (Fine-silty, mixed, active, thermic Typic Hapludalfs), and Feliciana (Fine-silty, mixed, active, thermic Ultic Hapludalfs), with secondary soils of Lexington (Fine-silty, mixed, active, thermic Ultic Hapludalfs) and Brandon (Fine-silty, mixed, semiactive, thermic Typic Hapludults) series. Base saturations (a measure of a soil’s natural fertility) vary widely among these soils.

Memphis soils have base saturations that generally exceed 60 percent, a taxonomic criteria for the series. Feliciana soils are similar to Memphis soils but have a base saturation of less than 60 percent but are generally higher than 40 percent. Base saturations for Lexington soils range from 36 to 59 percent but are commonly less than 40 percent. Brandon soils have base saturations less than 35 percent. Given the soils' inherent low fertility and dense, gravelly subsoils, Brandon soils are "provisionally" included in this site until a thorough inventory has been conducted and results analyzed. It is highly likely that Brandon soils support and produce a much drier and less productive plant community than either Memphis, Feliciana, and/or Lexington soils (USDA-NRCS, 2016).

Table 4. Representative soil features

Surface texture	(1) Silt loam (2) Silty clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate to rapid
Soil depth	80 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	5.7–8.7 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)	5–6.2
Subsurface fragment volume <=3" (Depth not specified)	0–50%
Subsurface fragment volume >3" (Depth not specified)	1–5%

Ecological dynamics

This provisional ecological site is broadly distributed across MLRA 134. Where this site occurs along the transition of the Loess Hills to the Loess Plains, loess thickness can be very deep, often greater than 20 feet, locally (D. Thomas, personal communication). Proceeding eastward, loess depths progressively thin with some areas along the eastern boundary of the MLRA having less than 24 inches of the mantle remaining. This gradient in loess depth can exert strong influences on vegetation, and accordingly, species composition may vary locally across this gradient (Bryant et al., 1993). Areas supporting very deep loess soils have been observed to produce exceptional growth by a wide range of hardwoods and competition among species can become intense (Johnson, 1958; Hodges, 1995; Goelz and Meadows, 1995). Conversely, soils that have a thin loess cap (especially less than 3 feet thick) tend produce a drier association and diversity appears to decrease overall.

There is also a soil moisture gradient associated with this site that is generally attributable to aspect and slope position. In general, exposed southeast to west-facing slopes and upper slope positions are much drier and those areas are often occupied by a drier plant association (i.e., species more tolerant of droughty conditions). Conversely, footslope positions and protected northwest to east-facing slopes are moister and support a greater number of species requiring or preferring moderately levels of moisture (i.e., mesophytes). The contrasting plant communities occurring across this pronounced dry – moist gradient are referred to as dry – mesic forests (the usage of "mesic" in this case refers to moderate moisture and not soil temperature regime).

An additional characteristic of this site is its close association with the adjoining Northern Loess Interfluve site, which encompasses the upland interfluves and divides. Historically, the latter supported a mosaic of biological communities that ranged from prairie to woodland. Fire was an important recurring disturbance that maintained open conditions, and where fires occurred, at a minimum the upper to mid-slope positions would have burned. This site likely consisted of a range of physiognomic characteristics (structural profile) that included savanna to open woodland conditions (especially upper slopes) to closed, robust forests. Forest conditions most likely occurred on protected slopes and especially in narrow ravines of highly dissected landscapes. The latter would have served as natural fire breaks (Estes et al., 2016).

The extensive north – south distribution of this site interjects additional considerations. Shortleaf and loblolly pine, along with other species having more southerly distributions, increased in importance and abundance farther south, although pine occurrence on deeper loess was probably more infrequent.

Given this broad range of environmental characteristics, a simple two-species classification of this site is an impossibility. Several local plant associations or natural communities would've been supported (and are supported today) across these diverse conditions. Broadly characterized, this site probably favored a mixed oak – hickory association that varied from dry to mesic depending on local site factors. And, both woodland and forest conditions occurred, which varied by slope position, landscape dissection, and the occurrence and frequency of fire.

Today, this system borders intensive land uses that consists mainly of agriculture production. A very minor and limited presence of agriculture may continue to occur on this site where slopes are less precipitous (e.g., 12 to 15 percent). However, lessons from long ago warn of cropland establishment on steep, loess-capped slopes. Loessal soils are highly erodible and unwise agricultural pursuits a century ago turned some areas into "waste land". Due to the impacts that production can exert on the steep slopes of this site, that land use is not considered as an altered state or management action. Land uses of this site today include pasturage and timber management.

Of particular note and concern, the broad range of soils "provisionally" associated with this site vary in a number of critical soil properties including loess thickness, natural fertility (or base saturation percentages), and subsoil texture, to name a few. Further confounding these influences, climate differences also occur north to south. The breadth of environmental variability of this site, as it is currently mapped, necessitates future investigations to ascertain the collective influences of both climate and soils on local vegetation communities. Future work may culminate in the determination of a latitudinal division or break of this site (if it is justified) and a much more accurate and defensible soil – vegetation community correlation. Succinctly put, one or more ecological sites are likely to be defined based on soil differences and climatic influences. This provisional site is essentially a foundation from which to begin future soil – site surveys and ecological site inventories.

Following this narrative, a "provisional" state and transition model is provided that includes the "perceived" reference state and several alternative (or altered) vegetation states that have been observed and/or projected for this ecological site. This model is based on limited inventories, literature, expert knowledge, and interpretations. Plant communities will differ across MLRA 134 due to natural variability in climate, soils, and physiography. Depending on objectives, the reference plant community may not necessarily be the management goal.

The environmental and biological characteristics of this site are complex and dynamic. As such, the following diagram suggests pathways that the vegetation on this site might take, given that the modal concepts of climate and soils are met within an area of interest. Specific locations with unique soils and disturbance histories may have alternate pathways that are not represented in the model. This information is intended to show the possibilities within a given set of circumstances and represents the initial steps toward developing a defensible description and model. The model and associated information are subject to change as knowledge increases and new information is garnered. This is an iterative process. Most importantly, local and/or state professional guidance should always be sought before pursuing a treatment scenario.

State and transition model

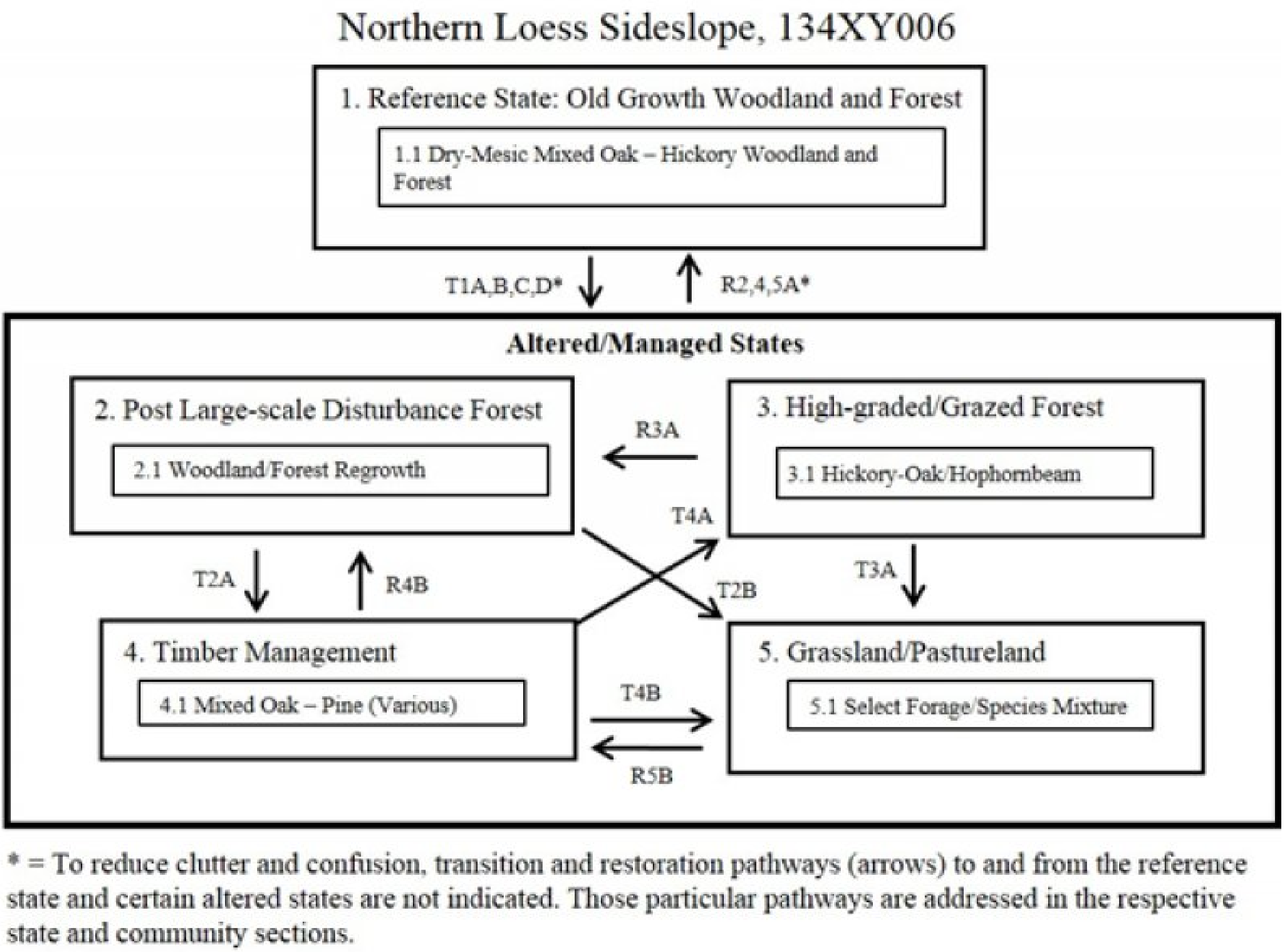

Figure 6. STM - Northern Loess Sideslope

Pathway	Practice
T1A, R3A, R4B	large-scale stand initiating disturbance (wind, ice, replacement fire, clearcut; State 2)
T1B, T4A	repeated select harvest (high-grading) and/or livestock grazing - uncontrolled access (State 3)
T1C	beginning point uneven-aged stand; goal of mixed oak or pine management; timber stand improvements; group selection; single tree harvest (State 4)
T1D, T2B, T3A, T4B	mechanical removal of vegetation; herbicide application; seedbed preparation; planting desired species at appropriate rate (State 5)
T2A, R5B	beginning point even-aged stand; potential planting; competitor control – herbicide/mechanical; TSI (State 4)
R2A, R4A, R5A	natural succession over time; may require exotic plant control and reestablishment of missing species (State 1)

Figure 7. Legend - Northern Loess Sideslope

State 1
Old Growth Woodland and Forest

The pre-settlement plant community of this ecological site was largely removed more than 150 years ago, and there are no extant examples of that community. However, based on landscape position, soils, and existing community components, inferences over the structure and dynamics of that system are drawn. This site is distributed across a highly dissected terrain and accordingly, encompasses many complexities including varying loess depths; exposed vs. protected aspects; large north – south distribution; and a pronounced moisture gradient from upper slopes to footslope positions. Reference conditions for this site vary naturally with respect to those physical differences and includes several distinct natural communities or associations. A single community phase is recognized for the reference state due to a paucity of current information on this system. Future inventories and collaborations with others may help to determine a more definitive and accurate representation of reference conditions for this provisional site.

Community 1.1
Dry-Mesic Mixed Oak – Hickory – Woodland and Forest

The dominant species that occur over the distribution of this site are highly varied and directly influenced by soil type, aspect, and landscape position. Historically, a large proportion of the site, particularly upper slopes and possibly some exposed slopes, may have been influenced by periodic fire. However, certain positions and locations such as moist footslopes and north-facing slopes may have developed full, overlapping canopies and functioned as natural fire breaks. This community phase is so named to include the broad compositional and structural variation over the distribution of this site. Mid- to upper slope positions on exposed aspects likely supported woodland characteristics. Periodic fires helped to maintain an open to moderately open canopy and understory. Species characteristic of the drier, upper slopes of this site likely included southern red oak, post oak, blackjack oak, and occasional white oak. Associates included pignut hickory, mockernut hickory, black gum, and an understory of hophornbeam, farkleberry, bigleaf snowbell, among others. On the driest sites, shortleaf pine and sand hickory may have occurred, the former increasing in abundance farther south. Mid- to upper slopes on protected aspects likely supported an oak – hickory association that consisted of white oak, southern red oak, northern red oak, black oak, cherrybark oak, various hickories, black gum, and hophornbeam and dogwood as mid-story components. The lower slopes likely supported the largest trees and highest canopy coverage. This protected environment fostered greater diversity of canopy components including American beech, tuliptree, sweetgum, maple, walnut, white oak, northern red oak, cherrybark oak, hickory, and a fairly dense understory that consisted of American hornbeam, pawpaw, spicebush, and occasionally, red buckeye. In the southern portions of this site, northern red oak would have been absent with Shumard's oak increasing in abundance. Additionally, loblolly pine may have entered the community along the lower to mid-slope positions (NatureServe, 2009).

State 2
Post Large-scale Disturbance Forest

This state is characterized by the regeneration or regrowth of a pre-existing forest stand following a major, stand-replacing disturbance. Scale of the disturbance is at the stand level and is greater than one acre in size (Johnson et al., 2009). Potential types of disturbances include catastrophic windstorms, severe fire, insect outbreaks, silvicultural clearcuts, and particularly destructive ice storms. The resulting, even-aged stand (or single-cohort) is set on a new course of development, which is highly dependent upon several critical factors including: the composition and structure of the stand prior to the disturbance; the degree or intensity of the disturbance; size and configuration of the disturbed area; and distance to seed sources. Composition and condition of the stand prior to a major disturbance may dictate, in large part, future composition of the regenerating stand. Although colonization by new species is expected soon after the disturbance, many of the pre-existing overstory components are anticipated to occupy position in the new, developing stand – their presence arising mainly from stump or root sprouts, advance regeneration, and germination from the seed bank (Oliver and Larson, 1990). If the intensity of the disturbance only removed the overstory and damage to the understory strata was light, then understory components of advance regeneration may proliferate in the new opening. This may be a desired condition if managing for an oak shelterwood harvest and subsequent oak recruitment. However, this scenario is particularly problematic in high-graded stands.

Community 2.1
Woodland/Forest Regrowth

Soon after overstory removal, numerous species may colonize large openings and influence the dynamics of the site. Initial colonizers are often forbs, graminoids, and vines that may have existed in the seed bank, were forest floor components prior to disturbance, or transported into the site via wind and/or animals. Early successional or pioneer species may include winged elm, sumac, greenbrier, grapevine, blackberry, and various graminoids. Overstory species anticipated to occur during the stand-initiation stage may be dictated by aspect, slope position, dissection of the landscape, and loess depth. Species expected to return following stand replacement include post oak, southern red oak, black oak, blackjack oak, and various hickories on the driest sites and white oak, northern red oak, hickory, beech, maple on moist, protected sites. Composition of the young stand will vary dramatically if the disturbance is a well-designed and implemented shelterwood harvest that favors the advancement of an established oak understory. For stands that were highly altered prior to the disturbance (e.g., high-graded), intensive management may be necessary in order to establish a desired composition. Management actions may include controlling undesirable species mechanically and chemically and planting the desired components.

State 3
High-graded/Grazed Forest

Forests in this state have undergone repeated select harvests over time. Actions leading to this condition consist of removing the largest and healthiest trees of the most desirable species and leaving low-quality trees (damaged and deformed) and undesirable species. This action, conducted repeatedly, can cause tremendous shifts in species composition and can decrease the vigor and health of the residual stand. Without implementing carefully prescribed management actions, species composition of extreme high-graded stands may remain in a highly altered condition for many decades, even after large, stand-replacing disturbances resets “successional opportunity.” Today, this vegetation state probably represents the conditions of many forest stands throughout the distribution of this site. Local stands in which desirable species such as oaks and shortleaf pine were repeatedly targeted often results in sites with proportionally more hickory. Because “overgrazed woods” often consists of components very similar to high-graded stands, uncontrolled livestock access to forests is also included in this state. It does not take into account carefully prescribed and/or managed forms of forest grazing (e.g., agroforestry or silvopasture), which generally has a mutual goal of providing quality forage and productive forest management. The conditions considered and represented here are the extreme cases of long-term forest grazing; this form of uncontrolled access has been referred to as “turning livestock into the woods” (Brantly, 2014). A single community phase is selected to represent the breadth of conditions that may be anticipated in stands having been high-graded and uncontrolled access by livestock.

Community 3.1
Hickory-Oak/Hophornbeam

The vegetation assemblage of a high-graded stand generally consists of a paucity of oaks left in the overstory. However, some oaks that have very little commercial value are retained, such as blackjack oak and post oak. A similar effect may be seen in some grazed sites where grazing preference targets more palatable species. Therefore, oak is retained in the community phase name of this ecological site due to grazing effects and harvest practices that leave undesirable species in the stand. Under high-grading practices, species typically left or avoided during harvests often include hickory and practically the entire understory. This has resulted in canopies largely comprised of the preceding species along with a dense understory of hophornbeam and other shade tolerant species. Noticeable characteristics of this condition are a conspicuous reduction of oaks and other valuable hardwoods. The most palatable forage within forest stands are often the herbaceous understory, and those are typically targeted first. The combined effects of trampling, browsing woody plants, and foraging on the herbaceous layer often results in a high percentage of bare soil, exposed roots, and an open understory. Furthermore, overstory trees occurring in stands with high livestock traffic grow more slowly over time (Johnson, 1952).

State 4
Timber Management

This state represents a broad range of management objectives, options, and stand conditions including woodlots allowed to grow or revert naturally; repeated single-tree harvests (often high-graded); carefully prescribed treatments; and conversion to a monoculture or single-species stand. Various management or silvicultural methods can lead to very different structural and compositional results. For prescribed management options, methods are diverse, which include even-aged (e.g., clearcut and shelterwood) and uneven-aged (single tree, diameter-limit, basal area, group selection, etc.) approaches. Included within these approaches is an option to use disturbance mechanisms (e.g., fire, TSI, etc.) to reduce competition and achieve maximum growth potential of the desired species. Inherently, these various approaches result in different community or “management phases” and possibly alternate states. The decision to represent these varying approaches and management results into a single state and phase at this time hinges on the need for additional information in order to formulate definitive pathways, management actions, and community responses. Forthcoming inventories of this site will provide more detail on this state and associated management phases.

Community 4.1
Mixed Oak – Pine (Various)

Some of the most desirable timber on this site consists of oak. Depending on the desired end product, management activities will differ. Management for oak dominant stands may be achieved by shelterwood and/or seed tree approaches. Managing for other hardwoods, and pine to the south, may only require timber stand improvement methods or artificial regeneration may be called for where other hardwoods predominate. Although the loessal soils of this site generally favor hardwood production, pine monocultures have been established in some locations, particularly to the south. Of note, competition intensifies from various hardwoods on more moist sites and managing for oak and/or pine can be problematic (see Johnson et al., 2009). Fire as a management tool on this site is limited given its location on steeper slopes. Finding the appropriate approach for a given stand and environment necessitates close consultation with trained, experienced, and knowledgeable forestry professionals. It is strongly urged and advised that professional guidance be secured and a well-designed silvicultural plan developed in advance of any work conducted.

State 5
Grassland/Pastureland

This state is representative of sites that have been converted to and maintained in pasture and forage cropland, typically a grass – legume mixture. For pastureland, planning or prescribing the intensity, frequency, timing, and duration of grazing can help maintain desirable forage mixtures at sufficient density and vigor (USDA-NRCS, 2010; Green et al., 2006). Overgrazed pastures can lead to soil compaction and numerous bare spots, which may then become focal points of accelerated erosion and colonization sites of undesirable plants or weeds. Establishing an effective pasture management program can help minimize the rate of weed establishment and assist in maintaining vigorous growth of desired forage. An effective pasture management program includes: selecting well-adapted grass and/or legume species that will grow and establish rapidly; maintaining proper soil pH and fertility levels; using controlled grazing practices; mowing at proper timing and stage of maturity; allowing new seedings to become well established before use; and renovating pastures when needed (Rhodes et al., 2005; Green et al., 2006). It is strongly advised that consultation with State Grazing Land Specialists and District Conservationists at local NRCS Service Centers be sought when assistance is needed in developing management recommendations or prescribed grazing practices.

Community 5.1
Select Forage/Species Mixture

This community phase represents commonly planted forage species on pasturelands, haylands, and open grasslands. The suite of plants established on any given site may vary considerably depending upon purpose, management goals, usage, and soils. Most systems include a mixture of grasses and legumes that provide forage throughout the growing season. Cool season forage may include tall fescue (*Schedonorus arundinaceus*), orchardgrass (*Dactylis glomerata*), white clover (*Trifolium repens*), and red clover (*T. pratense*), and warm season forage often consists of bermudagrass (*Cynodon dactylon*), bahiagrass (*Paspalum notatum*), and annual lespedeza (Kummerowia spp.). Several additional plants and/or species combinations may be desired depending on the objectives and management approaches and especially, local soils. Should active management (and grazing) of the pastureland be halted, this phase will transition to “old field” conditions, which is the transitional period between a predominantly open, herbaceous field and the brushy stage of a newly initiated stand of trees.

Transition T1A
State 1 to 2

This pathway represents a large-scale, stand replacing disturbance, which may be caused by a catastrophic windstorm (e.g., straight-line winds, tornado), ice storm, severe fire, or a silvicultural clearcut. For this stressor to occur, most or all of the overstory must be removed or destroyed. A few residual trees may persist, but overall, the disturbance must be intensive enough, at least one acre or larger (Johnson et al., 2009), that a new, even-aged stand is created.

Transition T1B
State 1 to 3

Repeated selective harvesting or high-grading of stands over time can cause shifts in species composition, structure, and overall health of affected stands. High-grading occurs when the most desirable trees of select species are repeatedly removed leaving behind inferior, low quality stems and undesirable species. This transition also includes uncontrolled access by livestock and impacts from sustained, selective grazing and browsing.

Transition T1C
State 1 to 4

This pathway consists of prescribed silvicultural activities specifically designed to meet stand compositional and production objectives.

Transition T1D
State 1 to 5

Actions required to convert forests to pasture or forage production include forest clearing, stump removal, herbicide application, seedbed preparation, and the establishment of desired plants.

Restoration pathway R2A
State 2 to 1

This pathway represents a return to reference conditions through natural succession, if the disturbance occurred within a reference community.

Transition T2A
State 2 to 4

This pathway represents the development of an even-aged stand that is prescribed to meet compositional and production objectives.

Transition T2B
State 2 to 5

Pathway represents a conversion of the emerging stand to pastureland or hayland. Actions required include forest clearing, stump removal, herbicide application, seedbed preparation, and the establishment of desired plants.

Restoration pathway R3A
State 3 to 2

This pathway represents a large-scale, stand replacing disturbance, which may be caused by a catastrophic windstorm (e.g., straight-line winds, tornado), ice storm, severe fire, landslide, or a silvicultural clearcut.

Transition T3A
State 3 to 5

Actions include forest clearing, stump removal, herbicide application, seedbed preparation, and the establishment of desired plants.

Restoration pathway R4A
State 4 to 1

Natural succession over a period of time coupled with disturbance such as low intensity (and possibly mixed severity fire) may transition a former timber-managed stand to one supporting reference conditions. Some question remains whether a return to reference conditions will occur in every situation, especially since some components may have been selectively culled from the stand. Management activities to aide recovery may include exotic species control and silvicultural treatment.

Restoration pathway R4B
State 4 to 2

This pathway represents a large-scale, stand-initiating disturbance, which effectively removes most or all of the pre-existing overstory. Disturbances may include a catastrophic windstorm, severe wildfire, and silvicultural management (even-aged).

Transition T4A
State 4 to 3

Repeated selective harvesting or high-grading of stands over time can cause shifts in species composition, structure, and overall health of affected stands. This transition also includes uncontrolled access by livestock and impacts from sustained, selective grazing and browsing. Impacts from continual grazing and uncontrolled access can result in the removal of palatable understory components, alteration of species composition in current and future stands, conditions for exotic plant invasions, and soil compaction and erosion.

Transition T4B
State 4 to 5

Actions include forest clearing, stump removal, herbicide application, seedbed preparation, and the establishment of desired plants.

Restoration pathway R5A
State 5 to 1

This pathway represents natural succession back to perceived reference conditions. The period required for this transition to take place likely varies by location and is dependent upon local site conditions. LANDFIRE models (2008) suggest that over 60 years is required for a return to a late development community and this pathway is highly dependent upon species present in the developing stand in addition to the appropriate level and type of disturbance (e.g., fire return interval). Significant efforts may be required before a return to reference conditions is achieved (e.g., exotic species control, appropriate intensity and return interval of fire, potential artificial regeneration of community components, etc.).

Restoration pathway R5B
State 5 to 4

This pathway represents prescribed management strategies for transitioning abandoned pastureland to managed woodland. Activities may include artificial regeneration of desired species; exotic species control; appropriate intensity and return interval of fire.

Additional community tables

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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:

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

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

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

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

17. **Perennial plant reproductive capability:**