Ecological site F134XY210AL
Western Dry Loess Summit - PROVISIONAL

Accessed: 05/03/2024

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): 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. Underlying the loess are Tertiary deposits of unconsolidated sand, silt, clay, gravel, and lignite. 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, mostly Entisols and Inceptisols, are predominantly silty where loess thickness of the uplands are deepest but grade to loamy textures in watersheds covered by thin loess. 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-NRCS, 2006).

This site is restricted to the dry ridgetops of Crowley's Ridge from about Harrisburg in Poinsett County, Arkansas northward through portions of Stoddard County, Missouri.

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: Bluff Hills, 74a (Griffith et al., 1998; Woods et al., 2002; Chapman et al., 2002; Chapman et al., 2004; Woods et al., 2004; Daigle et al., 2006)
-231H - Coastal Plains-Loess section of the USDA Forest Service Ecological Subregion (McNab et al., 2005)
-LANDFIRE Biophysical Setting 4515100 and NatureServe Ecological System CES203.072 Northern Crowley's Ridge Sand Forest and Crowley's Ridge Sand Forest, respectively (LANDFIRE, 2008; NatureServe, 2011)
-Dry Sand Woodland; Dry-Mesic Sand Woodland (Nelson, 2005)
-Western Mesophytic Forest Region - Mississippi Embayment Section - Loess Hills (Braun, 1950)

Ecological site concept

The Western Dry Loess Summit is restricted to the narrow to moderately broad ridgetops of the northern section of Crowley's Ridge. Slopes generally range from 0 to 12 percent but may extend to 15 percent, locally. Soils of this site are largely loess and loess over fluviomarine deposits (sand and gravel), although the latter can be the dominant surface materials in some locations, particularly on eroded sites. Unusual for this site is the droughty nature of the deeper loess deposits, which is reflected in the plant community. Broadly classed, this site supports a dry woodland association that includes areas of oak – hickory and oak – hickory – shortleaf pine. Local exposures of gravel and sand foster subxeric to xeric conditions, and these areas are often comprised of shortleaf pine as the dominant canopy component with associates of blackjack oak, post oak, and black hickory.

Associated sites

F134XY208AL	**Western Dry Loess Backslope - PROVISIONAL** This site adjoins the Western Dry Loess Summit at the shoulder slope position (~12 to 15 percent slopes).

Similar sites

F134XY003AL	**Northern Loess Interfluve - PROVISIONAL** This site is the eastern counterpart (somewhat) to the Western Dry Loess Summit.
F134XY106MS	**Southern Rolling Plains Thin Loess Upland - PROVISIONAL** This site supports similar concepts as the Western Dry Loess Summit ecological site and is considered a southeastern counterpart to the latter.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

The Western Dry Loess Summit ecological site occurs entirely within a distinct physiographic subsection of the Southern Mississippi Valley Loess (MLRA 134): Crowley's Ridge. This prominent physiographic feature is a western counterpart to the Loess Hills east of the Mississippi River (Braun, 1950). Crowley's Ridge is a narrow belt of low, dissected hills that extends roughly 200 miles north to south from southeastern Missouri into eastern Arkansas. Shared characteristics with the bluffs to the east include a loess-cap (but with varying depths) that is underlain by Tertiary deposits of silt, sand, clay, and gravel. One notable distinction of its geographic location is that the entire length of Crowley's Ridge is surrounded by the Southern Mississippi River Alluvium (i.e., MLRA 131A; USDA, 2006) and is separated from the Loess Hills to the east by 23 to 50 miles of the vast Mississippi River delta region. Elevation crests over 500 feet above sea level with local topographic relief rising as much as 200 feet above the adjoining alluvial plain (Clark et al., 1974). EPA combines Crowley's Ridge and the bluffs to the east within a single Level IV Ecoregion: the Bluff Hills, 74a (Woods et al., 2004).

Although similarities exist between Crowley's Ridge and the Loess Hills to the east (see Braun, 1950), there are some profound differences with respect to loess thickness. Proceeding northward, loess depths thin markedly and the material is even absent in some locations. Many areas in the northern portion of the Ridge consist of an intricate complex of deep loess, thin loess, and exposed fluviomarine deposits. Such widely varying physical differences exert strong influences on the associated plant communities.

This site is restricted to the droughty summits and ridgetops of Crowley's Ridge. All aspects are well represented.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Interfluve (3) Ridge
Flooding frequency	None
Ponding frequency	None
Elevation	122–177 m
Slope	1–15%
Ponding depth	0 cm
Water table depth	152 cm

Aspect	Aspect is not a significant factor

Climatic features

This site falls under the Humid Subtropical Climate Classification (Koppen System). The mean annual precipitation for this site from 1980 through 2010 was approximately 49 inches with a range from 36 to roughly 65 inches. Maximum precipitation occurs in spring (April and May) and late fall (November and December) and typically decreases throughout the summer. Rainfall often occurs as high-intensity, convective thunderstorms during warmer periods but moderate-intensity frontal systems can produce large amounts of rainfall during winter. Snowfall generally occurs in most years, and the average annual snowfall in the northern portions of this site in Stoddard County, Missouri is 11 inches (USDA-NRCS, 2006). The average annual maximum and minimum air temperature is 69 and 48 degrees F, respectively. The average frost-free and freeze-free periods are 196 to 225 days, respectively.

Table 3. Representative climatic features

Frost-free period (average)	196 days
Freeze-free period (average)	225 days
Precipitation total (average)	1,245 mm

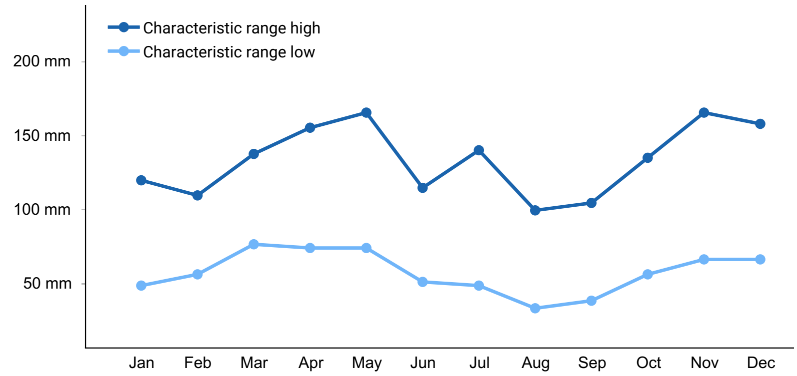

Figure 1. Monthly precipitation range

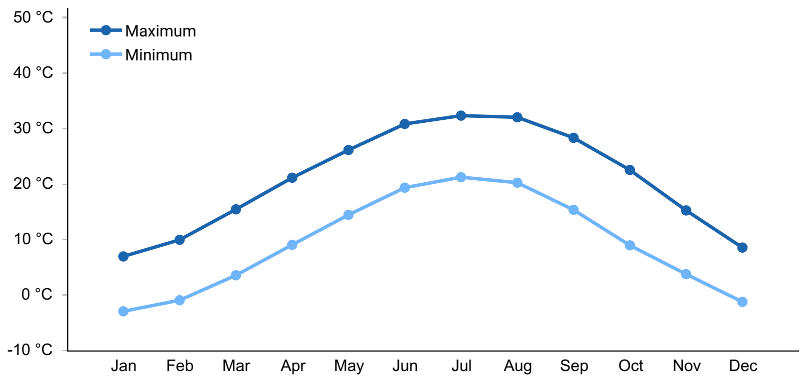

Figure 2. Monthly average minimum and maximum temperature

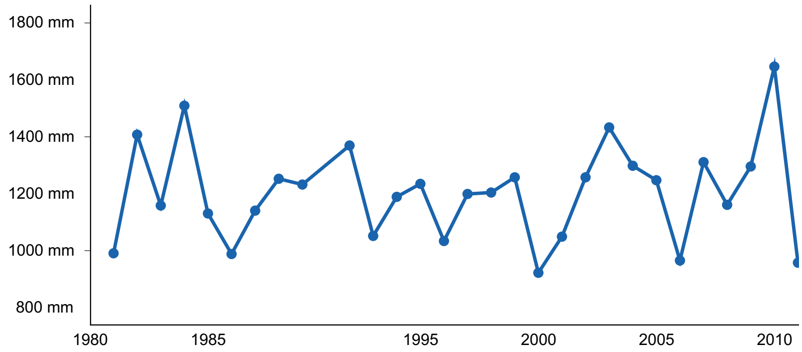

Figure 3. Annual precipitation pattern

Climate stations used

- (1) MALDEN MUNI AP [USC00235207], Malden, MO
- (2) WYNNE [USC00038052], Wynne, AR
- (3) JONESBORO 2 NE [USC00033734], Jonesboro, AR
- (4) PARAGOULD 1S [USC00035563], Paragould, AR
- (5) ADVANCE 1 S [USW00093825], Advance, MO

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 soils of this site are well drained and consist of a complex mixture of deep loess, thin loess, and exposed fluviomarine deposits (gravel and sand). A commonality among these soils is the dry association of plants that is supported; the exposed gravelly/sandy soils produce the driest and least productive plant community.

The deep loess soil (> 4 feet) associated with this site is the Memphis series (Fine-silty, mixed, active, thermic Typic Hapludalfs). Interestingly, the dry plant association occurring on this site is unlike that observed on Memphis soils elsewhere in the MLRA. Base saturations (a measure of a soil's natural fertility) for the Memphis series, a taxonomic criterion, should exceed 60 percent. It is unknown if the Memphis soils of this site meet that criterion. The dry plant communities of this site suggest that either loess depth may be too shallow or base saturations too low to classify as Memphis. Soil series that may be present on this site, other than Memphis, are the Lexington and Feliciana series. Lexington (Fine-silty, mixed, active, thermic Ultic Hapludalfs) soils formed in a loess mantle approximately 2 to 3 feet thick, and the loess cap overlies loamy or sandy marine sediments. Feliciana (Fine-silty, mixed, active, thermic Ultic Hapludalfs) soils are classified as deep loess and has a base saturation percentage less than 60 but higher than 35 percent. Both Lexington and Feliciana have been observed to support a drier oak - hickory association east of the Mississippi River.

Occurring within close distance to many of the Memphis soil map units are Brandon soils and a Brandon – Saffell soil complex. Brandon soils (Fine-silty, mixed, semiactive, thermic Typic Hapludults) consist of a thin loess mantle that is 20 to 40 inches thick over very gravelly or gravelly marine and riverine deposited materials. Solum thickness ranges from 20 to more than 48 inches. Rock fragments range from 0 to 5 percent in the solum and from 30 to 80 percent in the 2 Bt and 2C horizons. Reaction ranges from strongly to very strongly acid.

Saffell soils (Loamy-skeletal, siliceous, semiactive, thermic Typic Hapludults) formed in loamy and gravelly marine sediments of Tertiary Age. Soil reactions range from strongly acid to very strongly acid (USDA-NRCS, 2016).

The properties among the three soils that are associated with this site differ markedly. Their inclusion in this provisional site should be viewed as temporary (one of convenience) until future, more rigorous soil – site investigations better describe their differences (and/or similarities) with respect to plant community response and management. Final analysis may suggest that each soil component warrants its own separate and distinct ecological site.

Table 4. Representative soil features

Surface texture	(1) Gravelly silt loam (2) Very gravelly fine sandy loam (3) Loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate to rapid
Soil depth	203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	8.38–21.59 cm
Electrical conductivity (0-101.6cm)	0–1 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5–5.7
Subsurface fragment volume <=3" (Depth not specified)	0–37%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

This ecological site occurs exclusively on narrow ridgetops to moderately broad divides in the northern section of Crowley's Ridge. Unlike the prevailing soil type to the south, which is predominantly thick loess soils, this site is comprised of an intricate complex of deep loess (> 4 feet thick), thin loess (< 4 feet), and loamy-skeletal material, mainly surface sand and gravel. This complexity of the physical environment is clearly expressed in the plant communities.

Based on recent observations, areas supporting a thick loess cap (as determined by mapped Memphis soils) appear to support a dry, mixed oak – hickory association. Canopy components of this association may vary by stand but in general, characteristic species include southern red oak, black oak, and post oak with white oak and northern red oak occurring on more moist sites. Representative hickories include shagbark, mockernut, pignut, and black, the latter occurring on the driest sites.

Where loess deposits thin, the community shifts to a drier association with a greater concentration of post oak, black hickory, and an entrance or increased presence of shortleaf pine and blackjack oak. The relative abundance or dominance of community components may vary by stand with some sites dominated by oaks and yet others by shortleaf pine. Land use history of some sites may have an important influence on stand composition.

A subxeric to xeric community occurs on ridgetops where loess is completely absent. Here, surface material is entirely gravel and sand and the community shifts to predominately a shortleaf pine woodland with associates of blackjack oak, post oak, and black hickory.

The pre-settlement vegetation of Crowley's Ridge was projected by Clark et al. (1974), which was drawn from the journals of early naturalists and published state geologic reports (e.g., Call, 1891). For the portion of the Ridge associated with this site, Clark et al. classed much of the area as an Oak – Hickory – Pine forest with potential overlap with a predominantly Mixed Oak – Hickory type. Today, vestiges of these vegetation types occur in scattered locations. One likely difference between the pre-settlement communities and current conditions is reflected in structural characteristics. The pre-settlement plant communities on the dry ridgetops were very likely open woodlands where fire was a critical and recurring disturbance factor. Many of the fires may have originated on the Western Lowlands ecoregion, which occurs to the west of Crowley's Ridge. Those fires may have carried into and through the dry communities of this site (NatureServe, 2011; Tom Foti, personal communication).

Once settlement commenced, land uses and habitat alteration were extensive. Any location that could grow crops was farmed. Much of the area was either converted to pastureland or remained in timber and consistently logged. Today, major land uses continue to be pastureland and forest production.

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

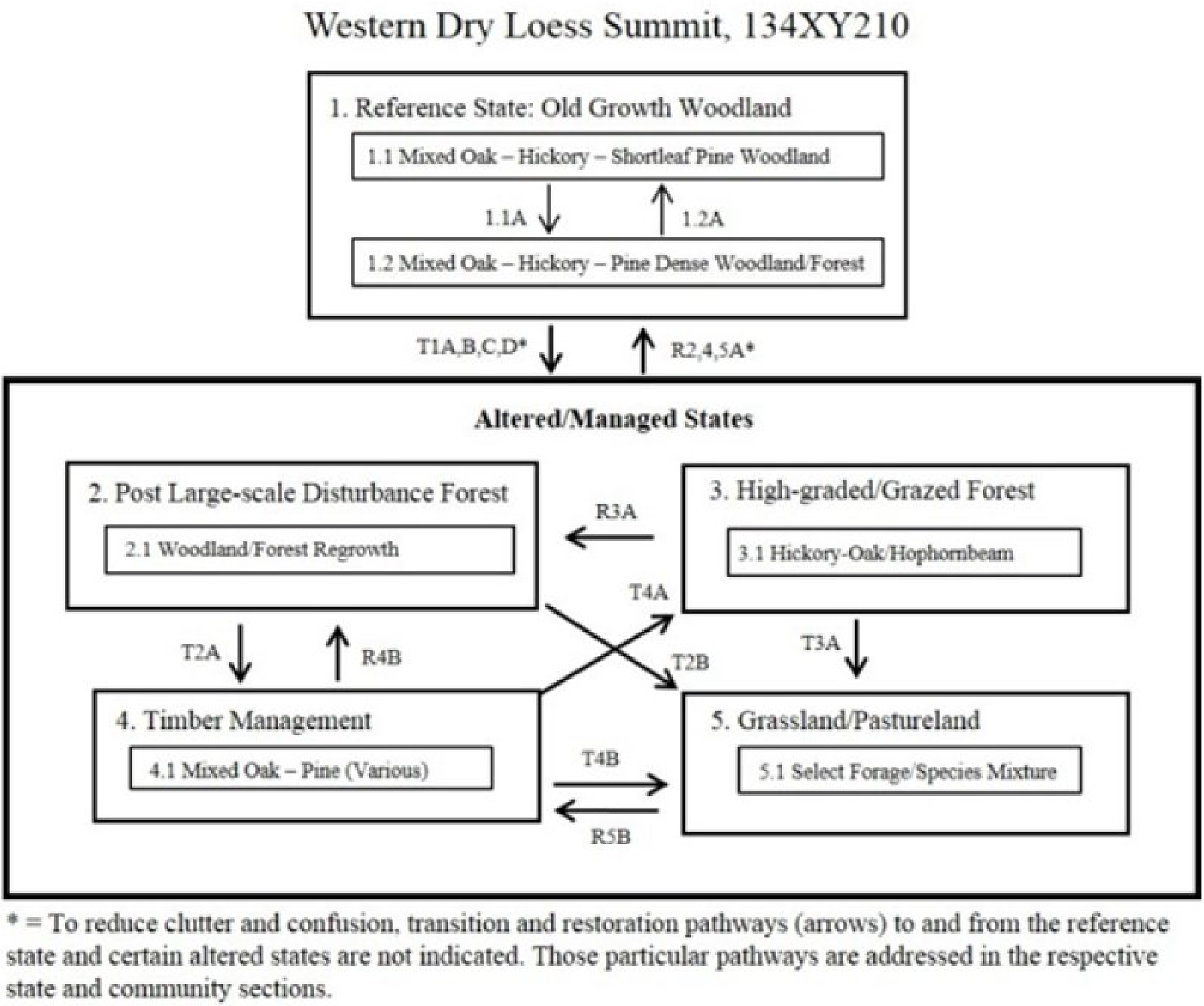

Figure 5. STM - Western Dry Loess Summit

Pathway	Practice
1.1A	natural succession over time; disturbance minimal, gap-scale
1.2A	Return of fire; large gap- to incomplete stand-scale disturbance (wind, ice, mixed-severity fire)
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 6. Legend - Western Dry Loess Summit

State 1
Old Growth Woodland

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 remaining. However, based on landscape position, soils, and existing community components, strong inferences over the structure and dynamics of that system are drawn. Many species associated with this site respond well to fire, and the system, as a whole, is “fire-adapted” (NatureServe, 2011). Structurally, the community is characterized as woodland, and fire on a frequent return interval is projected to maintain a late development, open canopy woodland (based on LANDFIRE models; see LANDFIRE, 2008). Two community phases are recognized for the reference state and they are distinguished from one another mainly by succession and disturbance type, size, and frequency.

Community 1.1
Mixed Oak – Hickory – Shortleaf Pine Woodland

This community phase represents the successional stage, compositional, and structural complexity of stands supporting perceived reference conditions. The community name, however, is somewhat deceiving as there is great variation in the dominance of individual species from stand to stand. Dominance and overall composition are highly dependent upon soil type. For instance, local sites having thicker loess tend to support a greater concentration and diversity of oaks and other hardwoods. Canopy components often dominating sites with a deeper loess cap include post oak, southern red oak, black oak, white oak, northern red oak, in addition to various hickories, winged elm, ash, black gum and less frequently, shortleaf pine. There is a shift among some components where the loess cap thins. Locations with thin loess support greater concentrations of shortleaf pine in addition to the continued presence of post oak, southern red oak, black oak, and black hickory. White oak and northern red oak numbers begin to decrease under these conditions. Where fluviomarine deposits are the principal surface material, shortleaf pine is the dominant species with associates of blackjack oak, post oak, and black hickory with an understory dominated by farkleberry and aromatic sumac. A central structural characteristic of the reference community phase is an open woodland profile. All major height classes are relatively open with the exception of the ground cover, which supports a moderate to high cover of herbaceous vegetation.

Community 1.2
Mixed Oak – Hickory – Shortleaf Pine Dense Woodland/Forest

Many of the same canopy components of Phase 1 occurs in this phase with the possible exception of an increased presence of shade tolerant species entering the community. A major distinction among the two types is increased crowding and encroachment of an expanding understory, which extends into higher strata of the woodland community. Overall, this phase supports a greater density or cover of woody vegetation at most all height strata or classes. The herbaceous ground component is generally the most impacted level of the community due to higher shade and loss of growing space.

Pathway 1.1A
Community 1.1 to 1.2

This pathway represents a decrease in disturbance frequency leading to a more closed, late development system. Overall, disturbance is light, infrequent, and localized – the result of single tree senescence or small group windthrow and a suppressed fire return interval.

Pathway 1.2A
Community 1.2 to 1.1

This pathway involves an increase in disturbance. Mixed severity fire is anticipated to thin this community back to Phase 1.1. Additional disturbances include larger gap- to incomplete stand-scale openings due to wind, ice, and forest management (e.g., group selection, basal area reductions).

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, wildfire, 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 forbs and graminoids. Overstory species anticipated to occur during the stand-initiation stage include post oak, southern red oak, black oak, shortleaf pine, and various hickories (black hickory particularly on the driest 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 large, healthy 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. This approach 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

High-graded stands generally consist of a paucity of oaks. Species typically left or avoided during harvests often include hickory and practically the entire understory. This often results in canopies largely comprised of the preceding species along with a dense understory of hophornbeam and “scrub oak” or undesirable species such as post oak and blackjack oak. Noticeable characteristics of this condition are a conspicuous reduction of more merchantable oaks and other valuable hardwoods. The most palatable forage of a forest stand is typically the herbaceous understory, which is 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 activities on this site. Various management or silvicultural methods can lead to very different structural and compositional results. The range of methods are diverse and include even-aged (e.g., clearcut and shelterwood) and uneven-aged (single tree, diameter-limit, basal area, group selection, etc.) approaches. Included within these methods 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 methods and management strategies 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 and shortleaf pine. 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 shortleaf pine may only require timber stand improvement methods where pine is currently dominant, or artificial regeneration may be called for where other hardwoods predominate. The droughty nature of this site responds well to fire, and low intensity ground fires on a frequent return interval can be an effective tool for reducing competition and potentially enhancing production of individual trees. The complex distribution of soils on this site may affect the response of a given stand. For this very reason, consideration of site factors and conditions should be applied into the decision-making process well before management begins. 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 forage.

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, suitable 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:**