

FOREST HEALTH MANAGEMENT PLAN

The Nature Conservancy

JANUARY 26th, 2022

MAP #: 98 PARCEL #: 098 010.00

THE NATURE CONSERVANCY
4245 NORTH FAIRFAX DRIVE SUITE 100
ARLINGTON, VA 22203



Plan Preparer

I have, to the best of my knowledge, and as a qualified resource professional, prepared this plan in accordance with state and national standards and consistent with the landowner's primary forest resource management objectives.

Plan Prepared by:

Britt Townsend

Conservation Forester

The Nature Conservancy

Tennessee Chapter

2 Maryland Farms, Suite 150

Brentwood, TN 37027

b.m.townsend@tnc.org

Britt Townsend

Britt Townsend

January 26, 2022

Plan Preparer Signature

Date

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1 Introduction

1.1 Purpose and Objectives

This Forest Health Management Plan (FHMP) has been developed to guide the natural resource and forest management activities of property in Hardin County, Tennessee (as more particularly described herein, the “Property”). This plan has been written to guide activities on the Property for at least the next five years and will be reviewed, revised, and amended as necessary.

This plan is designed to address ecological, environmental, social, and economic considerations of forest management on the Property. In addition to conforming with the guidance of this forest management plan, all operations on the Property will be conducted in compliance with applicable laws and rights, including both local and national laws. Should any violations or complaints arise, each will be documented, and efforts taken to resolve any issues.

The long-term management goals for the Property have been identified as:

- Maintaining healthy and vigorous forest stands through active management.
- Marketing of commercial timber resources for income.
- Conservation and protection of soil and water.
- Protection of rare, unique natural areas and species.
- Maintaining and improving habitat for wildlife (e.g., deer, bear, turkey, and rare, threatened, and endangered species).
- Providing opportunities for outdoor recreation activities, including wildlife for hunting.

These goals and objectives will be accomplished through a variety of methods, including active forest management, wildlife management, and resource protection. This FHMP assesses current conditions and describes management operations designed to ensure that the landowner’s goals and objectives are achieved.

An important component of achieving these goals with respect to the Property requires adhering to the following set of management principles when conducting any management activities thereon. The principles are grouped into various categories, which are set forth immediately below. Specific objectives will be presented in greater detail later in this FHMP.

Legal Requirements

- Ensure that activities meet or exceed applicable legal and regulatory requirements.

Protect Soil & Water Resources

- Ensure that all management and related activities meet or exceed state and regional Best Management Practices (BMPs).
- Assess potential impacts of management activities on soil and water resources prior to conducting activities.

- Ensure that roads and other activities do not degrade water quality of karst features, wetlands, or streams, or modify sheet flows of water.
- Minimize surface disturbance, including the use of existing road networks rather than constructing new roads and closing and/or improving roads that are found to have negative impacts on water resources.
- Minimize new and improve existing stream and water feature crossings to meet or exceed BMPs.

Forest Characteristics

- Promote both standing and down coarse woody debris.
- Promote structural diversity across the forested landscape to provide a suitable environment for a variety of tree and plant species.
- Manage for late-successional/old growth forest stand characteristics to maintain biological diversity and ecological function.
- Promote species composition and diversity of forests that are best suited for specific site characteristics.
- Silviculture should mimic natural disturbance patterns found in nature (such as windthrow, disease, fire, etc.).

Protection of Wildlife and Natural Communities

- Identify and protect rare and/or unique species and communities.
- Assess proposed harvest sites for rare species and other wildlife considerations (*e.g.*, vernal pools, bear dens, raptor nests, etc.) prior to conducting harvests.
- Minimize negative impacts of harvests on wildlife and habitats.

Property Management

- Identify property boundaries before commencing management activities and notify adjacent landowners of same.
- Document and track all management activities on the property.
- Be a responsible landowner in the community by developing good working relationships with adjacent landowners, community organizations, and other stakeholders.

2 Property Description, Location, and Other Characteristics

2.1 Description

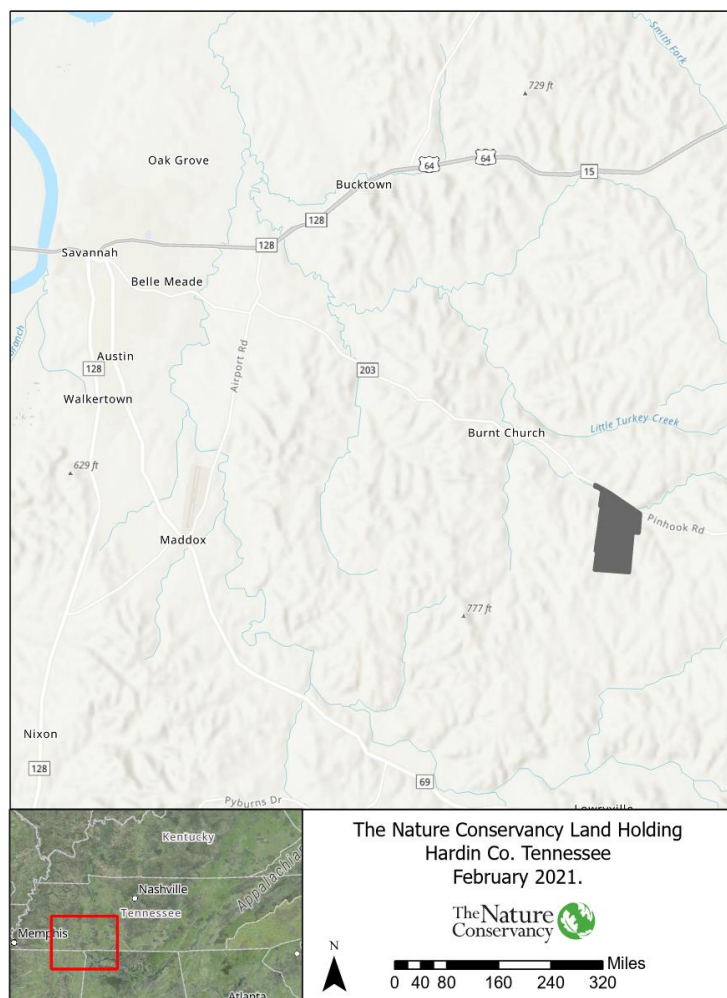
The Property is comprised of 417.4 contiguous acres in Hardin County, Tennessee. Approximately 365.5 acres of the Property is currently forested, with the remaining non-forested lands consisting of agricultural fields. The Property is considerably variable in topography and is home to a variety of different forest types and unique, interesting water features. It is quite unusual for a property of this relatively small size to harbor bottomland hardwood forests, northern mesic coves, and dry upland oaks, hickories, and shortleaf pine. While much of the property has been managed through timber harvesting and agricultural use, pockets of late successional forests displaying old growth characteristics exist on site. Forest stands containing high quality white oak and shortleaf pine can be found on upland slopes and an abundance of natural springs, vernal pools, and small waterfalls dot the landscape. River floodplain forests and wetlands

along Turkey Creek round out an extremely diversified property. It is not one species or habitat that makes this property exceptional but the combination of diversified landscapes that add ecological value, promote biodiversity, and create resilient forests that are better adapted to climate change. The Property is divided into seven separate management units: East Gulf Coastal Plain Northern Dry Upland Hardwood/Pine Forest, consisting of approximately 254.3 acres; East Gulf Coastal Plain Small Stream and River Floodplain Forest, consisting of approximately 35.6 acres; East Gulf Coastal Plain Northern Mesic Hardwood Slope Forest, consisting of approximately 32.6 acres; Planted Loblolly Pine, consisting of approximately 31.1 acres; Old Field/ Early Successional, consisting of approximately 16.9 acres; Pasture, consisting of approximately 44.3 acres; and River, consisting of 2.6 acres.

2.2 Location

The Property is located off Highway 203, approximately 10 miles south east of Savannah, in Hardin County, Tennessee. Savannah, Tennessee, is located approximately two hours east of Memphis and two hours south of Nashville (Figure 1).

FIGURE 1. Property location in Hardin County, Tennessee



2.3 Ownership

The Property is currently owned in fee simple by The Nature Conservancy, and is legally described in Deed Book 221, at Page 253, in the Office of the Register of Deeds for Hardin County, Tennessee. The Property bears Tax Map Number 098 and Parcel ID Number 010.00.

In Tennessee, few local or state regulations exist with respect to the practice of silviculture on private lands. Tennessee recommends and promotes the use of water quality BMPs in the state's Guide to Forestry Best Management Practices in Tennessee, published in 2003 by the Tennessee Department of Agriculture, Division of Forestry (TDF). TDF monitors silviculture and forestry operations in Tennessee in order to protect water quality and to ensure compliance with the Tennessee Water Quality Control Act and the Federal Water Pollution Control Act (commonly referred to as the Clean Water Act or CWA). By employing and enforcing state BMPs in connection with all forestry and silvicultural operations conducted on the Property, all applicable regulations will be satisfied or exceeded.

2.4 Landscape Context & Connectivity

The Property is located within the Highland Rim region, the largest physiographic region in Tennessee. This region extends from the Tennessee River in the west to the Cumberland Plateau in the east. This region is diverse in topography, with rolling hills and wide valleys, heavily dissected by streams. Most of the region is forested with native hardwoods, but due to a long growing season and relatively mild climate, agriculture also has a significant footprint in the area. Approximately 66 percent of the land area in the region surrounding the Property is forestland, with timber and forest products comprising critical industries in the region.

Many of the natural resources on the Property were or are influenced by factors and inputs emanating beyond the boundaries of the Property. It is important to consider the role of the Property in a larger landscape context, as well as to consider the larger landscape's effect on the Property. Management of decisions made with respect to the Property may play a role on a landscape scale by creating various habitats and structures for wildlife, as well as by protecting key natural resources, such as water. Management decisions should consider the larger landscape, including, among other things, consideration of adjacent land uses, in order to create a mosaic of successional stages and habitat types on a broad scale.

2.5 Topography, Geology, & Soils

The Highland Rim province is recognized by its own unique arrangement of natural features that were driven by geologic processes over time. These processes and patterns influence the development of soils, shape the local climate, and are responsible for the distribution of flora and fauna across the landscape. The Property's topography is broad and gently rolling, with elevations ranging from 500 to 650 feet. The soils of the Property are comprised primarily of the Bodine and Ennis soil series. The Bodine series consists of very deep, moderately well drained soils that formed from weathered cherty limestone. Tree species commonly found on Bodine soils include chestnut oak (*Quercus montana*), post oak (*Quercus stellata*), white oak (*Quercus alba*), hickories (*Carya* spp.), maple (*Acer* spp.), American beech (*Fagus grandifolia*), and eastern red cedar (*Juniperus virginiana*). The Ennis soils are found on flood plains and along drainageways. This series is also characterized by very deep and well drained soils that were formed from a combination of limestone, shale, and sandstone. Bottomland hardwood forests, consisting primarily of oak (*Quercus* spp.), hickory (*Carya* spp.), maple (*Acer* spp.), American sycamore (*Platanus occidentalis*), and yellow poplar (*Liriodendron tulipifera*) are found growing in this soil type.

The US Department of Agriculture's Natural Resources Conservation Service's (NRCS) surveys were consulted to determine the Property's mapped soil classifications (see Table 1 below).

TABLE 1. Soils

MAP UNIT	ACRES
Bodine gravelly silt loam	83.1
Ennis silt loam	51.4
Shubuta fine sandy loam	28.4
Smithdale fine sandy loam	25.2
Pickwick silt loam	23.4
Pickwick silty clay loam	19.9
Shubuta fine sandy loam	19.7
Landisburg cherty silty clay	14.8
Humphreys silt loam	13.8
Captina silt loam	13.2
Waynesboro fine sandy loam	9.8
Landisburg cherty silt loam	7.9
Ennis cherty silt loam	7.4
Ennis fine sandy loam	7.4
Gullied land, sandy materials	5.8
Pickwick silt loam	5.4
Ennis cherty silt loam	5.1
Gullied land, loamy materials	4.5
Lobelville silt loam	3.9
Bodine cherty silt loam	3.8
Pickwick silt loam	3.7
Pickwick silty clay loam	3.4
Pickwick-Gullied land complex	3.0
Waynesboro fine sandy loam	2.8
Mountview silt loam	2.7
Humphreys cherty silt loam	2.0
Ennis silt loam	1.9
Shubuta fine sandy loam	1.8
Paden silt loam	1.4
Waynesboro clay loam	1.3

Soil resources should be protected in connection with any operations that take place on the Property. This includes proper construction and mitigation of road features, proper reclamation of disturbed areas, and additional efforts where necessary. All state BMPs for road construction and mitigation of risks should be followed, including proper use of erosion control measures and seeding of disturbed areas. Additional

mitigation efforts, such as temporary water bars or other measures may be required depending on specific site conditions.

At such times when forest treatments take place on the Property, all unmerchantable treetops and slash should be left onsite or otherwise redistributed throughout the harvest area. This residual onsite material provides multiple soil and other ecological benefits, including:

- Diffusion of water during significant rain/storm events;
- Provision of decomposing organic material essential in restoring soils;
- Provision of wildlife habitat for many species, including small mammals, birds, amphibians, insects, and others; and
- Creation of micro-sites enhancing overall forest regeneration conditions.

3 Forest Resource Conditions

3.1 Current & Desired Future Conditions

Most of the forests located on the Property are typical of the region with respect to both their species composition and structure. Forest stands found on the Property are generally mid to late-successional with average volumes and species composition trending more toward shade tolerant species. Pockets of late-successional forest stands that display old growth characteristics do exist on the property. These forest stands are uncommonly found in this region due to extensive timber resource extraction and past land use history. Old growth characteristics include the presence of older trees with minimal disturbance, pit-and-mound topography, and large down woody debris. These areas are considered to have high biological diversity and are critical for maintaining ecosystem services, such as carbon storage and clean water, and are a special feature of this property. By contrast, there are relatively few early successional habitat types found on the Property. Early successional forest stands are dominated by grass and herbaceous vegetation and are primarily made up of young trees and shrubs. These areas are important for providing food and cover for a variety of wildlife, including white-tailed deer, bobwhite quail, and turkey. Natural regeneration of hardwoods has been the primary method of regeneration after timber harvests and natural disturbances, with the exception of approximately 31 acres that was planted in loblolly pine (*pinus taeda*).

To achieve desired forest management goals and objectives together with future forest composition, an integrative and adaptive forest management strategy will be employed. This will include formal forest planning and active management through commercial timber harvests, timber stand improvement (TSI), Integrated Pest Management (IPM), protection of aquatic resources, and targeted wildlife management through habitat improvement and restoration.

It is the intent that the management of the Property will produce healthy, productive, and resilient forests, allowing the Property to function at its full ecological potential. It is believed that productive, vigorous forests with diverse species compositions and age classes will be best suited for future conditions, including the influences of climate change.

3.2 Forest Types & Vegetative Resource Descriptions

The majority of the Property is typical of what is generally found within the region and primarily comprised of dry upland and mixed mesophytic forest types. Dry upland hardwood/pine forests are dominated by a combination of upland oaks, hickories, and pine and are found on well-drained sites. Much of the upland

hardwoods and pine on this property are second growth and are influenced by soil type and past disturbance, however, stands of older, high-quality white oak (*Quercus alba*) and shortleaf pine (*Pinus echinata*) do exist on site. Forest stands of this age and quality are exceedingly uncommon in this region and are a result of minimal natural and human disturbance. Stands of high-quality shortleaf pine (*Pinus echinata*) on the Property are likely a result of historical fire regimes either manmade or natural. Shortleaf pine (*Pinus echinata*) has declined in this region considerably due to fire suppression and conversion to loblolly pine (*Pinus taeda*). Mixed-species forests such as upland hardwoods and shortleaf pine are more versatile habitats, biologically diverse, and are better adapted to changing climates.

The mixed mesophytic forest type varies based on moisture availability and is known for species richness and productivity. These forest types often contain over 75 species of trees, together with numerous under- and mid-story species, and are frequently classified into forest types based on site characteristics and soils. Many of these forests are dominated by various oak species, including chestnut oak (*Quercus montana*), white oak (*Quercus alba*), black oak (*Quercus velutina*), scarlet oak (*Quercus coccinea*), yellow poplar (*Liriodendron tulipifera*), maple (*Acer rubrum* and *A. saccharum*), and hickory (*Carya* spp.). Other tree species that are abundant on the Property include black gum (*Nyssa sylvatica*), American sweetgum (*Liquidambar styraciflua*), shortleaf pine (*Pinus echinata*), and planted loblolly pine (*Pinus taeda*).

Under- and mid-story species typically found include spicebush (*Lindera benzoin*), eastern redbud (*Cercis Canadensis*), flowering dogwood (*Cornus florida*), sassafras (*Sassafras albidum*), sourwood (*Oxydendrum arboreum*), flame azalea (*Rhododendron calendulaceum*), rhododendron (*Rhododendron* spp.), and mountain laurel (*Kalmia latifolia*). A rich and diverse herbaceous layer usually includes grapevine (*Vitis* spp.), greenbrier (*Smilax* spp.), poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), mayapple (*Podophyllum peltatum*), trillium (*Trillium* spp.), cohosh (*Cimicifuga racemosa* and *Caulophyllum thalictroides*), American ginseng (*Panax quinquefolius*), violets (*Viola* spp.), wild geranium (*Geranium maculatum*), and numerous other species.

In formulating forest management planning, it is necessary to define and describe regional and existing vegetative forest types. Under this FHMP these are described as “representative forest types” and are derived from Tennessee’s 2019 State Wildlife Action Plan (SWAP) and onsite assessments. Forest management activities and prescriptions will vary among forest types, as each often possesses varying or unique requirements and/or necessitates differing management actions. Management prescriptions for the Property will also be distributed across the various forest types to ensure that no single type is overly impacted. Additionally, as part of long-term monitoring, changes in status and/or condition of individual forest types will be tracked to note any significant conversions resulting from management or natural processes.

The representative forest types and descriptions listed below are based on a combination of NatureServe (2011) descriptions and onsite assessments gathered at the Property. A forest stand map for the Property illustrates the representative forest types, see Figure 2. Total acreages comprised by each forest type are listed in Table 2.

FIGURE 2. A forest stand map of representative forest types found on the Property

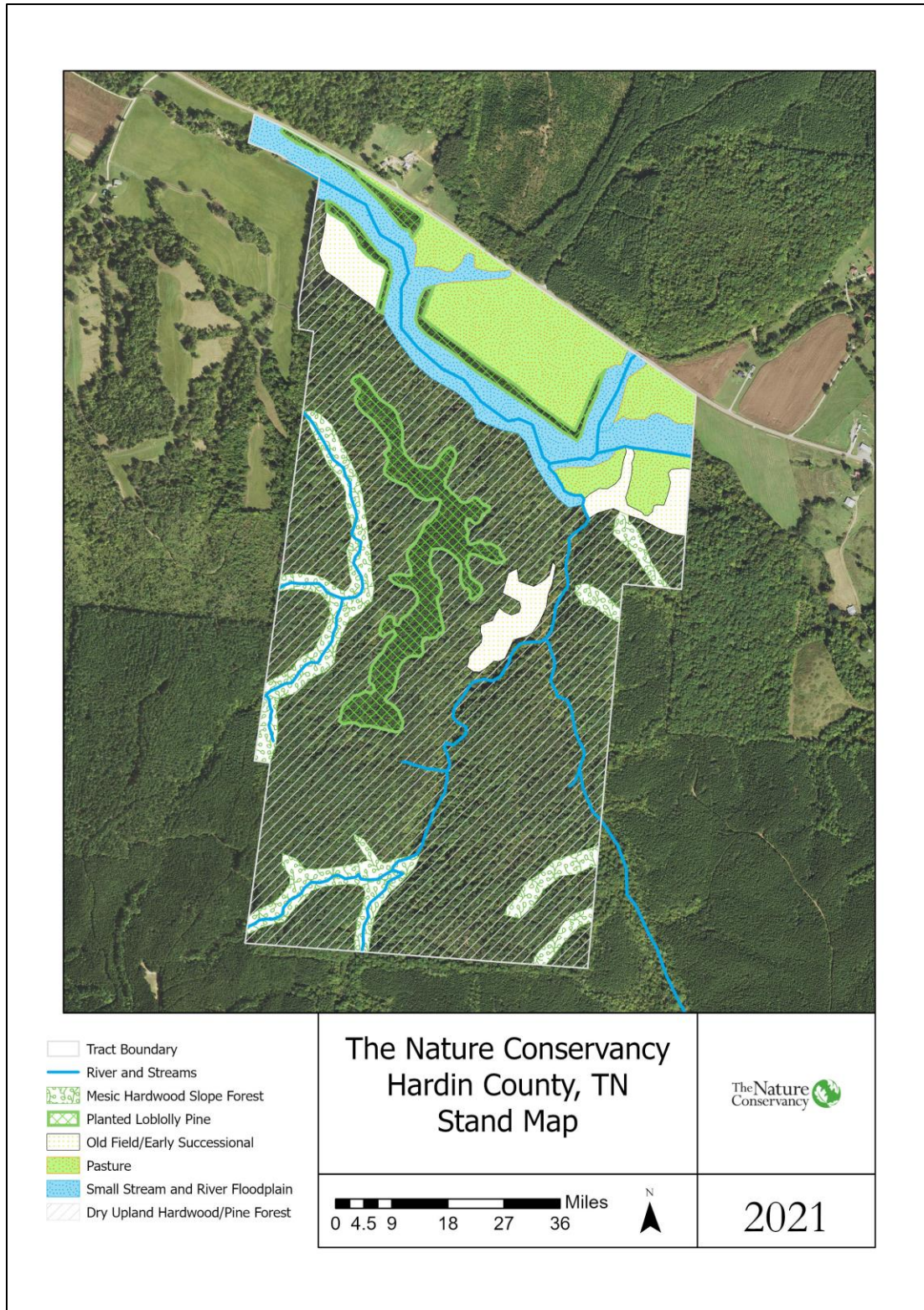


TABLE 2. Representative forest types and acres

HABITAT/FOREST TYPE	ACRES	PERCENT
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East Gulf Coastal Plain Northern Dry Upland Hardwood/Pine Forest	254.3	61
Pasture	44.3	11
East Gulf Coastal Plain Small Stream and River Floodplain Forest	35.6	8
East Gulf Coastal Plain Northern Mesic Hardwood Slope Forest	32.6	8
Planted Loblolly Pine	31.1	7
Old Field/ Early Successional	16.9	4
River	2.6	< 1

East Gulf Coastal Plain Northern Dry Upland Hardwood/Pine Forest

This forest type represents dry, upland, predominantly hardwood forests of the Coastal Plain of western Kentucky and Tennessee, northern Mississippi, and Alabama. White Oak (*Quercus alba*) dominates these upland forests as well hickory species (*Carya* spp.), sweetgum (*Liquidambar styraciflua*), yellow poplar (*Liriodendron tulipifera*), black oak (*Quercus velutina*), and, on occasion, shortleaf pine (*Pinus echinata*). These forests are found predominately on ridgetops and slopes and can occupy sites with varying aspects, soil types, and moisture availability. Submesic to dry-mesic systems tend to be found on mid-slopes with northerly to easterly aspects, and drier forests found on southerly to westerly aspects. Soils are very shallow, well- to excessively well-drained on drier sites and moderately well-drained in submesic systems. In drier sites, Chestnut Oak (*Quercus montana*) is more commonly found, while White Oak (*Quercus alba*) and Black Oak (*Quercus velutina*) are less dominant. Understory vegetation consists mainly of shrubs and small trees such as flowering dogwood (*Cornus florida*), eastern redbud (*Cercis canadensis*), and Blue Ridge blueberry (*Vaccinium pallidum*).

Pasture

This semi-natural habitat occurs in flat to gently sloping floodplains that may have formerly been pure or partly forested canebrakes which are now drained and relatively dry, though subject to seasonal flooding, and dominated primarily by introduced and exotic-invasive grasses. The pastures located on the Property use to be actively grazed by livestock and mowed, and while not particularly conducive to rare plant species, are preferred by some wildlife species, particularly birds, as well as generalist wildlife for easy and consistent grazing and forage. Dominant species include full-sun native and introduced species like Japanese stiltgrass (*Microstegium vimineum*), found mostly around forest edges and roadside disturbances.

East Gulf Coastal Plain Northern Mesic Hardwood Forest

This forest system includes mesic deciduous hardwood forests of the East Gulf Coastal Plain, including Alabama, Mississippi, western Kentucky, and western Tennessee. This forest type occurs on slopes and ravines between dry uplands and stream bottoms. The most characteristic feature of the vegetation in this forest type is American beech (*Fagus grandifolia*), but a variety of other hardwood species may also be found in the overstory. Other mesic hardwoods, including white oak (*Quercus alba*), yellow poplar

(*Liriodendron tulipifera*), sweet gum (*Liquidambar styraciflua*), red maple (*Acer rubrum*), black gum (*Nyssa sylvatica*), and white ash (*Fraxinus americana*) are common tree species found in the overstory.

This diverse, predominately deciduous forest type occurs on deep and enriched soils, often due to or enhanced by the presence of limestone or related base-rich geology. This forest type frequently occurs in protected landscape positions, such as coves or lower slopes. Trees may grow very large in undisturbed areas. The herbaceous layer is very rich, often with abundant spring ephemerals.

Planted Loblolly Pine

Even-aged, regularly spaced forest stands have been established by planting and/or seeding in the process of afforestation or reforestation, where individual trees are generally more than five meters in height. Specifically, this forest type refers to plantations dominated by loblolly pine (*Pinus taeda*).

East Gulf Coastal Plain Small Stream and River Floodplain Forest

This forest type is found along streams throughout the East Gulf Coastal Plain and is associated with brownwater rivers and creek, confined to floodplains. Flooding and scouring both influence this system, resulting in a variety of habitats and hydrological spatial patterns. This system may contain cobble bars with adjacent wooded vegetation and harbor marsh development, except as the result of occasional beaver impoundments. The vegetation is a mosaic of forests, woodlands, shrublands, and herbaceous communities. Canopy cover can vary within examples of this system, but typical tree species may include Sycamore (*Platanus occidentalis*), red maple (*Acer rubrum*), Black birch (*Betula nigra*), sweetgum (*Liquidambar styraciflua*), and oak species (*Quercus* spp.). Shrubs and herbaceous layers often vary in richness and cover. Small seeps dominated by sedges, ferns, and other herbaceous species can often be found within this forest type, especially at the headwaters and terraces of streams.

Old Field / Early Successional

Post-agricultural and post-timbering early and young successional habitats are not specifically defined for Tennessee. While not representative as a true forest type, this system is dominated by regenerating trees, shrub, and herb species having high rates of seed productivity such as red maple (*Acer rubrum*), sourwood (*Oxydendrum arboreum*), yellow poplar (*Liriodendron tulipifera*), black cherry (*Prunus serotina*), eastern red cedar (*Juniperus virginiana*), and a wide and various mixture of native, introduced, and exotic-invasive herbs and grasses. Portions of the Property are composed of this forest type.

River

The Turkey Creek flows southeast through the northern boundary of the Property.

3.3 Species Composition & Stand Characteristics

Species composition on the Property is generally dependent upon environmental conditions present at each individual site and is also influenced by past and current management. There are over 15 significant species present on the Property based on a tract level inventory, with the most represented species being white oak (*Quercus alba*) (25%), hickory (*Carya* spp.) (23%), and yellow poplar (*Liriodendron tulipifera*) (14%) (Figure 3). It is estimated that the total trees per acre (TPA) for the Property is 177, for trees over 5" DBH (Table 3).

FIGURE 3. Species composition (TPA)

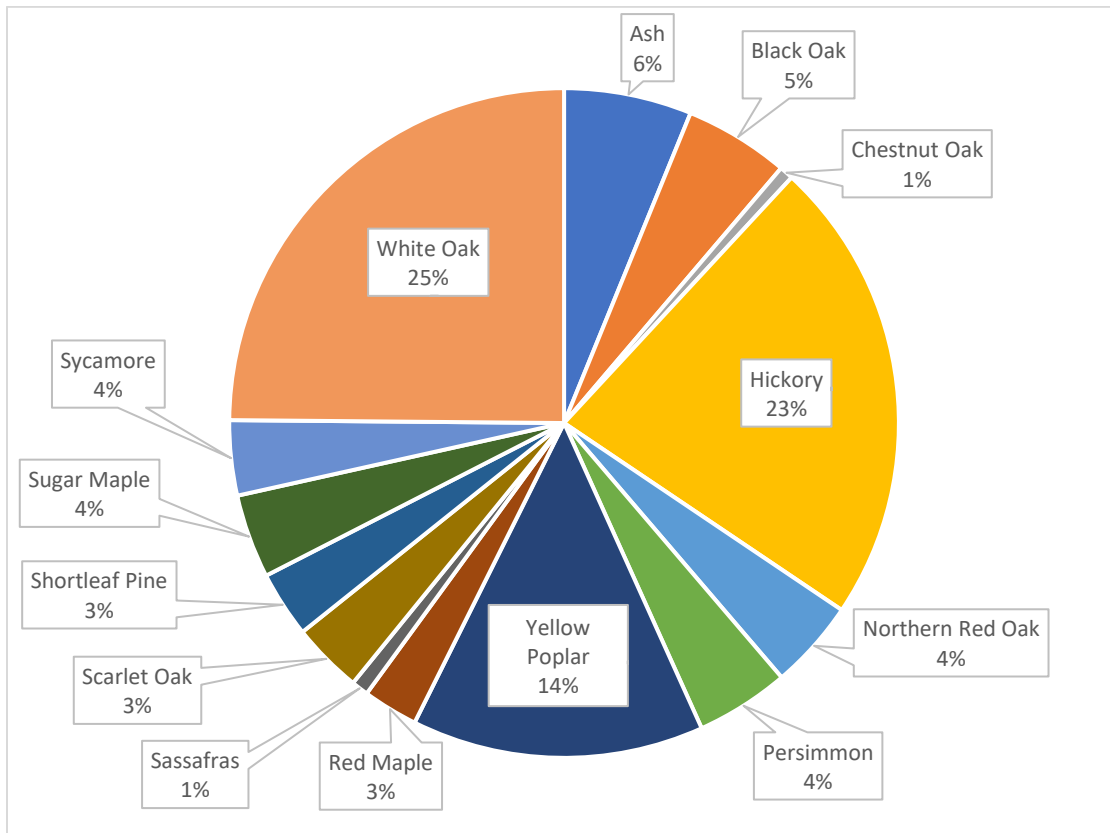


TABLE 3. TPA by species

SPECIES	TPA	TPA %
White Oak	42.7	25
Hickory	38.7	23
Yellow Poplar	24.2	14
Ash	10.6	6
Black Oak	8.7	5
Persimmon	7.8	4
Northern Red Oak	7.4	4
Sugar Maple	7.0	4

Sycamore	6.2	4
Scarlet Oak	5.9	3
Shortleaf Pine	5.5	3
Red Maple	4.6	3
Sassafras	1.4	1
Chestnut Oak	1.1	1

3.4 Forest Stocking

Stocking is a quantitative measure of the area occupied by trees, usually measured in terms of well-spaced trees or basal area per acre. The basal area (BA) for the Property is estimated to be 128.3 ft² per acre (see Table 4.). Basal area is defined as the, “cross-sectional area of a single tree stem, including bark, measured at breast height, or the sum of the cross-sectional areas of all stems in a stand measured at breast height and expressed per unit of land area.” Basal area is a metric designed to indicate the total amount of tree biomass onsite, as it is dependent upon both the number and size of trees present. A basal area of 128.3 ft² per acre and 177 trees per acre is considered fully stocked for forest types that are typical in the region.

TABLE 7. Basal Area

SPECIES	BASAL AREA PER ACRE	BASAL AREA PER ACRE %
White Oak	61.6	48.0
Black Oak	18.2	14.2
Hickory	12.9	10.0
Northern Red Oak	9.1	7.1
Yellow Poplar	8.7	6.8
Sycamore	7.1	5.5
Scarlet Oak	4.8	3.8
Shortleaf Pine	1.9	1.5
Sugar Maple	1.3	1.0
Ash	1.2	0.9
Chestnut Oak	0.5	0.4
Sassafras	0.4	0.3
Persimmon	0.3	0.3
Red Maple	0.1	0.1

3.5 Forest Size and Age Class Distribution

Age classes across the Property are typical for the region and are mostly mid to late-successional and approximately 40-70+ years old. Some stands, particularly in areas of the dry upland hardwood/pine and mesic forest types, are between 70-100 years old. Most stands are comprised of multiple age cohorts, including under- and mid-story regeneration more than 20 years old, a co-dominant over story of 20 to

80 years in age, and a minor component of trees older than 80 years. The planted loblolly pine stand is approximately 20-25 years old.

3.6 Water Resources & Management

The Property also supports forested wetland ecosystems, including isolated wetlands and seasonal vernal pools. Furthermore, wetland sites are likely to be found around natural springs, streams, and ephemeral drains. In association with wetlands, buffers will be established along the periphery total of 100 feet, per guidelines set forth in the [Guide to Forestry Best Management Practices in Tennessee](#).

Protecting water resources and their associated habitats is critical with forest management. In order to achieve this, forested buffers should be maintained around areas with surface waters and any entry points to groundwater. At a minimum, state recommended best management practices (BMPs) for this region shall be followed. Stream management zones (SMZ) will be established for all intermittent, perennial, and other waters on the Property. SMZ buffers also incorporate landforms, erodibility of soil, stability of slope, and stability of stream channel, among other factors, each as necessary to protect water quality and repair habitats.

Additionally, other sensitive or perennial wet areas should be buffered and receive minimal disturbance. State BMPs should be followed, at a minimum, with any operations occurring in or near SMZs and with any negative impacts to the SMZ mitigated. An exception to permit operations within the forested buffers would be for the treatment or removal of invasive and/or non-native species.

3.7 Wildlife Habitat

Wildlife resources are abundant on the Property and regionally within the Western Highland Rim. Recreational hunting and fishing is extremely popular in areas surrounding the Property and, as a result, thriving populations of game species exist. These include white-tailed deer, turkey, black bear, squirrel, dove, among others. Popular game fish include large and small-mouth bass, crappie, and catfish. Non-game species are also critical to the local ecosystems. Small mammals such as rats, mice, and bats, plus others, including neo-tropical migratory birds, amphibians, and insects all contribute to a healthy and stable environment.

In order to maintain healthy and thriving communities of fish and wildlife species, including both game and non-game species, it is important to have rich and diverse habitats. This includes not only healthy aquatic ecosystems to serve those species but also diverse terrestrial and forest landscapes. Diverse forest landscapes include not only older, late successional habitats but also young, immature forests. These different habitats should be distributed across the landscape, including refugia and other features, providing options to host a variety of species. Diverse habitats, including both early and late-successional stands, provide many critical features necessary to support high species richness, including, among others:

- thermal and visual cover, including protection from predators;
- nesting/brooding sites;
- soft mast;
- increases in grasses, herbs, and forbs populations and richness;
- increases in insect and small mammal populations and richness; wildlife travel corridors;
- den, nesting, and roosting sites; and
- maintenance of genetic diversity.

Additional information is available from the Tennessee Wildlife Resources Agency.

4 Forest Management

4.1 Forest Management Goals & Objectives

The long-term management of the Property will be conducted in a manner to promote and advance the following primary goals and objectives:

- Maintain healthy, vigorous, and resilient forests;
- Promote a diversity of forest age classes and structure;
- Market commercial timber resources;
- Conserve and protect soil and water;
- Protect rare and unique areas and species;
- Maintain and improve wildlife habitat;

These primary goals and objectives will be accomplished through a variety of methods, including active forest management, wildlife management, and resource protection. Through application of appropriate silvicultural and management prescriptions, the overall forest condition will be improved over the long term. The treatments that will be applied on the Property have been designed to promote healthy, resilient forests across the landscape, while simultaneously protecting natural resources and improving ecosystem services, such as providing for clean water, clean air, and carbon sequestration. Research that supports ecologically-based forest management and promotes forest conditions that are more resilient to disturbance and climate change, will continue to drive management decisions on the Property within the future.

What follow are general guidelines that should be adhered to in determining harvest activities that will take place at the Property. The recommendations described below assume stand conditions to be healthy and vigorous, with species and age classes permitting. Exceptions may be made in the event of expected losses or mortality from natural disturbances or threats from invasive species. The overall intent of the regime is to diversify age classes, while perpetuating existing forest cover types and increasing acceptable growing stocks, each through appropriate cutting practices and natural regeneration.

East Gulf Coastal Plain Northern Dry Upland Hardwood Forest:

Mid Slopes

The management objectives for this type are: (1) increasing the emphasis on the release of advanced oak regeneration; (2) establishment of oak regeneration through overstory manipulation; and (3) maintenance of canopy levels conducive to adequate regeneration of desirable major species.

The management limitations are: (1) the advanced age and decline of much of the timber; (2) the large stem size which, when coupled with steep slope, creates difficulty in single stem cutting without resulting in excessive felling damage to the residual stand; (3) inadequate and infrequent roads; and (4) increased incidence of fire damage.

Acceptable growing stock: scarlet oak (*Quercus coccinea*), chestnut oak (*Quercus montana*), black oak (*Quercus velutina*), white oak (*Quercus alba*), red oak (*Quercus rubra*), yellow poplar (*Liriodendron*

tulipifera), hickory (*Carya* spp.), white ash (*Fraxinus americana*), sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), and shortleaf pine (*Pinus echinata*).

Mature areas in this type are those where 30 percent of the basal area of merchantable stems of both acceptable and unacceptable growing stock has attained a DBH of at least 16 inches and where at least 75 percent of the merchantable basal area is contained in sawtimber sized stems. Well-stocked areas contain at least 75 BA, with such areas being candidates for a regeneration cut. The regenerated stands should not exceed 10 acres unless sufficient residual basal area can be retained in either a scattered or clumped arrangement and a minimum of 300 stems per acre of acceptable advanced regeneration are in place.

Upper Slopes and Sheltered Ridges

The management objectives for this type are: (1) increasing the emphasis on the release of advanced oak regeneration; (2) establishment of oak regeneration through understory manipulation; and (3) improving both grade and growth rate where possible through improvement cuts and/or thinning.

The management limitations are: (1) availability of mature and/or well stocked stands; (2) steep slopes, (3) low stocking, and (4) slow growth rates.

Acceptable growing stock: scarlet oak (*Quercus coccinea*), chestnut oak (*Quercus montana*), black oak (*Quercus velutina*), white oak (*Quercus alba*), hickory (*Carya* spp.), red maple (*Acer rubrum*), and shortleaf pine (*Pinus echinata*).

Mature areas in this type are those where 30 percent of the basal area of merchantable stems of both acceptable and unacceptable growing stock has attained a DBH of at least 16 inches and where at least 75 percent of the merchantable basal area is contained in sawtimber-sized stems. Well-stocked areas contain at least 75 BA, with such areas being candidates for a regeneration cut. These cuts will be made as small patch clear cuts. The size of these cuts will be determined by the slope and visual objectives but should not exceed 10 acres unless sufficient residual basal area can be retained in either a scattered or a clumped arrangement and a minimum of 300 stems per acre of acceptable advanced regeneration are in place.

Late successional forest stands displaying old growth characteristics should be carefully managed. Land managers should designate and retain patch reserves and dispersed legacy trees (25"+ DBH upland hardwood, 20"+ for shortleaf pine) in these areas. When marking legacy trees, priority should be given to long-lived species such as white oak, sugar maple, and shortleaf pine. In addition, mast producing species and trees with nesting cavities and dens should also be prioritized. Implement uneven aged management strategies to mimic natural disturbance patterns by creating small gaps between ¼ and 1/3 acre in size and retain at least 25% of the main canopy (dominant and co-dominant trees). To increase the number of large trees and accelerate the development of late successional upland hardwood/pine forests, girdle or mechanically fell low quality and competing trees adjacent to the largest, most vigorous trees.

East Gulf Coastal Plain Small Stream and River Floodplain Forest:

Riverine

The management objectives for this type are: (1) maintaining the existing species mix, when possible; (2) correcting for overstocked conditions by thinning and TSI cuts; (3) harvesting financially mature stems in the dominant and co-dominant crown classes; (4) selectively thinning and/or performing improvement cuts in old field poplar stands to promote higher growth rates on the residual stems; and (5) maintaining scenic values and protecting water quality along streams and rivers.

The management limitations for this type are: (1) SMZ constraints, particularly with respect to use of conventional equipment; (2) hydric soils and/or jurisdictional wetland constraints; (3) strong competition from non-native invasive species (NNIS); (4) present locations of the main road system adjacent to streams creates high risk of management-related sediment entering the watershed; and (5) potential for flash flooding.

Acceptable growing stock: yellow poplar (*Liriodendron tulipifera*), ash (*Fraxinus* spp.), American sycamore (*Platanus occidentalis*), black walnut (*Juglans nigra*), red oak (*Quercus rubra*), sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), and red maple (*Acer rubrum*).

East Gulf Coastal Plain Northern Mesic Hardwood Forest:

Riverine

The management objectives for this type are: (1) maintaining the existing species mix, when possible; (2) correcting for overstocked conditions by thinning and TSI cuts; (3) harvesting financially mature stems in the dominant and co-dominant crown classes; (4) selectively thinning and/or performing improvement cuts in old field poplar stands to promote higher growth rates on the residual stems; and (5) maintaining scenic values and protecting water quality along streams and rivers.

The management limitations for this type are: (1) SMZ constraints, particularly with respect to use of conventional equipment; (2) hydric soils and/or jurisdictional wetland constraints; (3) strong competition from non-native invasive species (NNIS); (4) present locations of the main road system adjacent to streams creates high risk of management-related sediment entering the watershed; and (5) potential for flash flooding.

Acceptable growing stock: yellow poplar (*Liriodendron tulipifera*), ash (*Fraxinus* spp.), American sycamore (*Platanus occidentalis*), black walnut (*Juglans nigra*), red oak (*Quercus rubra*), sugar maple (*Acer saccharum*), yellow buckeye (*Aesculus flava*), white ash (*Fraxinus americana*), cucumber tree (*Magnolia acuminata*), and red maple (*Acer rubrum*).

A large portion of this type is contained in streamside management zones, as such FSC streamside management guidelines and Tennessee Best Management Practices (BMPs) will be followed. Within these constraints, the usual practice will be the selection of the occasional mature stem within the buffer zone. Outside the buffer, a crown touching crop tree release prescription should be performed when the stand is immature and single aged.

Broad Cove

The management objectives for this type are: (1) perpetuation of this mesic forest type; (2) cutting to reduce low-quality stems and to correct for overstocking in younger stands; (3) development of areas with acceptable regeneration for rotations of approximately 70 years; and (4) maintenance of acceptable wildlife habitat corridors.

The management limitations for this type are: (1) the scarcity of mid-range age classes; (2) present road locations relative to perennial streams; (3) strong competition from undesirable species; (4) possible equipment limitations; and (5) elevated risk of erosion.

Acceptable growing stock: yellow poplar (*Liriodendron tulipifera*), red oak (*Quercus rubra*), white oak (*Quercus alba*), black oak (*Quercus velutina*), sugar maple (*Acer saccharum*), red maple (*Acer rubrum*), white ash (*Fraxinus americana*), and white pine (*Pinus strobus*).

Within this type, maturity is defined as at least 50 percent of the merchantable growing stock basal area (both acceptable and unacceptable) having reached the target DBH of 24 or more inches. When stocking is between 60 and 85 percent, a stand will be a candidate for a regeneration cut. When a mature stand has a stocking of greater than 85 percent (more than 120 BA), it is a candidate for a partial cut designed to open the stand and encourage the development of regeneration.

Lower Slope

The management objectives for this type are: (1) increasing the emphasis on the release of advanced oak regeneration; (2) the establishment of oak regeneration through understory manipulation; and (3) maintenance of canopy levels conducive to adequate regeneration of major species.

The management limitations are similar to those of the broad cove type, but also include: (1) increasing number of stream courses, both perennial and intermittent; (2) areas of steep slopes; (3) a few areas of heavy rhododendron; and (4) a much higher likelihood of encountering erosion hazards.

Acceptable growing stock: yellow poplar (*Liriodendron tulipifera*), white oak (*Quercus alba*), red oak (*Quercus rubra*), black oak (*Quercus velutina*), scarlet oak (*Quercus coccinea*), chestnut oak (*Quercus montana*), black walnut (*Juglans nigra*), black cherry (*Prunus serotina*), white ash (*Fraxinus americana*), white pine (*Pinus strobus*), shagbark hickory (*Carya ovata*), red maple (*Acer rubrum*), and sugar maple (*Acer saccharum*).

Within this type, maturity is defined as at least 50 percent of the merchantable growing stock basal area (both acceptable and unacceptable) having reached the target DBH of 22 or more inches. When a mature stand has a stocking of between 60 and 85 percent (65 to 100 BA), it is a candidate for a regeneration cut. The regenerated stand should not exceed 10 acres unless sufficient residual basal area can be retained in either a scattered or clumped arrangement and a minimum of 300 stems per acre of acceptable, well distributed, advanced regeneration are in place. When a mature stand has a stocking of greater than 85 percent, it is a candidate for a partial cut.

4.2 Silvicultural Systems

To effectively fulfill the management goals and objectives set forth herein, forest management through applied silviculture will be employed. Recommendations are based on objective, scientifically sound methods and practices. Many of the proposed forest management options fulfill the goals and objectives

of this FHMP through a variety of interconnected processes. It is believed that if properly performed and monitored, the Property's ecosystems, including associated valuable ecosystem services, will benefit from the management recommendations set forth herein.

Silviculture is generally defined as "the art of producing and tending a forest through the application of silvics, and methods are referred to as silvicultural systems." Elements of a silvicultural system include:

- Harmony with goals and characteristics of ownership;
- Provision for regeneration;
- Efficient use of growing space and site productivity;
- Control of damaging agencies;
- Protection of soil and water resources;
- Provisions for sustained yield;
- Optimum use of capital and growing stock;
- Concentration and efficient arrangement of operations;
- Maintenance of desired plant and animal populations;
- Execution of policies relating to landscapes, scenery, and aesthetic considerations.

All silvicultural systems suggested in this FHMP strive to achieve the elements listed above. Systems such as pre-commercial thinning and commercial timber harvesting may be implemented in a manner so as to include shelterwood, group selection, and regeneration harvests where appropriate. Each of these and other methods, described below, will be prescribed to best achieve the stated goals and objectives of this FHMP. Additionally, it is important to note that silvicultural systems have been recommended with a priority placed on transitioning current stand conditions to desired stand conditions, therefore regeneration of the treated stand is often the primary focus of the timber management prescription.

Silviculture methods that may be employed on the Property are as follows:

- Shelterwood – Removal of an existing stand through a series of cuttings, which extend over a relatively short portion of the rotation (from 10 to 15 years). The method encourages the establishment of a new cohort of advanced regeneration under the partial shelter of the residual stand. Once desired species are established by natural regeneration, the overstory stems can be harvested (usually in two successive harvests) to a basal area appropriate for desired goals. For quality timber production, basal area should remain above 60 square feet to reduce the risk of epicormic branching in younger stems. For understory development ideal for wildlife habitat and low browse, target basal area should be between 20 and 30 square feet. Trees that are to be removed should be across all diameters and product classes. Residual trees should be of desirable species and exhibit good geno- and phenotypes. Leaving these trees will mitigate visual impacts of the harvest, provide seed and genetic material, and optimize site conditions for future stands. Advantages of the shelterwood method include control over regeneration composition, generating favorable soil conditions and site protection, and the effective distribution of heavy seed species, such as oak (*Quercus* spp.) and hickory (*Carya* spp.).
- Seed Tree – Removal of the existing stand in one cutting, except for a small number of seed trees left alone or in small groups to provide for the establishment of advanced regeneration. This method is like the shelterwood except that it is designed to be carried out over only two entries

and the initial harvest leaves less in the overstory. Removed trees should be from all diameters and product classes. Residual trees should be of desirable species and exhibit good geno- and phenotypes. Remaining species must also be windfirm enough to withstand the elements, as they will stand exposed. Trees left as seed trees must have seed bearing capacity or must be developed as seed bearers prior to timber harvest.

- Regeneration – Removal of the entire stand in one cutting. This method of harvesting is most economically advantageous and is often a logical practice for stands that are degraded and contain a large percentage of unacceptable growing stock and less valuable species. This is the most effective means of rehabilitating an unhealthy stand to a productive and healthy forest. No regeneration harvest should exceed 10 acres in an individual unit without retention. Furthermore, retention can be accomplished by applying the concept of Variable Retention Forestry (VRF), often with a target of approximately 20 square feet basal area retained across all cut units. VRF is a method of leaving uncut groups of trees or individual trees throughout harvest units. This can be accomplished in the form of groups or linear strips and has been shown to maintain many of the positive benefits of other ecosystem services while still permitting ecological forestry and commercial timber harvests. Extra care should be taken to minimize any visual impacts. Advanced regeneration of desirable species should be present (approximately 300 TPA) prior to any regeneration harvests. Advanced regeneration is the existing growth of young, desirable tree species under the forest canopy. These saplings are generally high in the understory and approaching the mid-story, which frequently allows them to take advantage of openings in the canopy, growing in as the new forest stand. Where advanced regeneration is present, this harvest method may be considered a “one-cut” shelterwood method. Harvest boundaries should have irregular shape designed to mitigate visual impacts and maximize edges for wildlife benefits.
- Group Selection – Removal of small groups or clusters of trees. Group selection harvest involves creating patch-cuts with canopy openings of ½ to 2½ acres in size, resulting in a more diverse and uneven-aged forest structure overall. Under this system, canopy openings should not exceed 2½ acres. Although more difficult to market and manage, the vertical structure maintained by this method presents notable ecological benefits, as it results in less habitat disturbance, soil compaction, and erosion. Additionally, this style mimics conditions frequently observed in natural regeneration dynamics of Appalachian forests. Group selection cuts provide ideal openings and pockets of young vegetation in hardwood forests for wildlife such as grouse, woodcock, wild turkey, deer, and songbirds.
- Individual Tree Selection – Removal of individual trees. This method creates and requires continual creation and maintenance of uneven or multi-cohort stands by means of occasional replacement of single trees with regeneration from any source. Timber can be harvested at periodic intervals of 10 to 25 years. Caution should be applied using this method because, without care, resultant conditions could be similar to those found in high-graded forests. These conditions often lead to less production and less healthy forests over the long-term and the promulgation of multiple cohorts. Additionally, this method does not open large canopy gaps for regeneration of non-shade tolerant species, so further management of the stand is necessary to prevent shade-

tolerant species such as American beech (*Fagus grandifolia*) or sugar maple (*Acer saccharum*) from taking over harvest areas.

Prior to any silvicultural operation, a stand inventory should be conducted, and a precise silvicultural prescription generated by the forest manager. The prescription should include all relevant details of current and future stand conditions and should be designed to meet the specific treatment's, as well as the overall Property's goals and objectives. All treatment systems described above may be applied to any forest type or types, considering existing and future site conditions. More xeric sites with oak/hickory/pine forest types are more likely to benefit from treatments that foster more suitable conditions, such as patch regeneration cuts. Other forest types, such as mesic cove and northern hardwood forest types, are likely to better respond to treatments maintaining more shade and, as a result, moisture on the forest floor.

Management recommendations are included to benefit these forests by removing poor or low-quality trees, encouraging hard mast species and habitat diversity for wildlife, diversifying timber forest products, restoring native forest conditions, and increasing overall vigor and vitality. All tops and debris should be left on site in the forest, providing a micro-site for regeneration, maintaining soil moisture and stability, and providing habitat for wildlife species.

5 Other Management Considerations

5.1 Forest Pests & Pathogens

As is the case in most areas throughout the region, the Property is at risk of the impacts of various forest pests, pathogens, and non-native/invasive species (NNIS). Once these species become established, significant damage to native ecosystems and species is often the result. In addition, the more established a pest, pathogen, or NNIS becomes, the more expensive and challenging it generally becomes to eliminate the incursion. Current forest pest and pathogen threats affecting the Property include, but are not limited to, the hemlock woolly adelgid, emerald ash borer, thousand cankers disease, and gypsy moth, southern pine beetle, among others.

Options to control these pests include containment, mechanical and/or manual treatment, herbicide treatment, and biological controls. Some treatment options, such as chemical and/or biological controls, while available, are frequently prohibitively expensive and often yield only marginal success rates. For many of these pests and pathogens, in order to prevent their spread and minimize the occurrence of additional infestations, best practices such as not moving infected or infested wood to and from the Property, inspecting and washing equipment, and otherwise maintaining healthy and vigorous forest stands is generally a suitable course of action and will serve to greatly limit the spread of these afflictions; however, even so, it is acknowledged that the pervasiveness of some pests and pathogens within the greater ecosystem may eventually result in inevitable damage to forests located on the Property, as well as throughout the greater region, despite adherence to best practices.

For more information, see the USDA National Invasive Species Information Center for Tennessee.

5.2 Non-Native & Invasive Plants and Animals

In addition to forest pests and pathogens, non-native and invasive plant species pose significant risks to the Property. These NNIS frequently disrupt and can cause significant damage to native ecosystems. Current NNIS challenges affecting the Property include instances of multi-flora rose (*Rosa multiflora*),

garlic mustard (*Alliaria petiolate*), ailanthus (*Ailanthus altissima*), Chinese privet (*Ligustrum sinense*), kudzu (*Pueraria lobata*), Japanese stiltgrass (*Microstegium vimineum*), autumn olive (*Elaeagnus umbellata*), and Paulownia (*Paulownia tomentosa*), among others. Eradication methods should be planned at the stand level in conjunction with other activities, considering long-term goals for the Property.

Considering the aggressiveness of many of these NNIS and the historical impacts of the southern pine beetle (*Dendroctonus frontalis*), it is recommended that steps be taken to limit their spread and work be conducted to eliminate these non-native and invasive species where at all possible. In most cases, treatment may be feasible as a suitable first step. Herbicide treatment may be required and should be applied directly to the targeted species. All treatment options should be considered as an ongoing process of proper land management and through implementation of Integrated Pest Management (IPM).

With some pests, such as the emerald ash borer (*Agrilus planipennis*) (EAB), it is critical that mitigation measures be promptly undertaken, which may include treatment and/or salvage operations, to the extent necessary. The Property is located in or is adjacent to counties that are within the federal EAB quarantine and therefore must be monitored closely. No firewood should be moved in or out of a county to a non-quarantine county or counties in order to slow potential spreading. Additionally, given the marginal success of EAB treatments, salvage operations for ash species are, and may continue, to be employed as warranted.

For more information on the EAB, see the USDA's Emerald Ash Borer website.

Also, of serious concern is the hemlock woolly adelgid (*Adelges tsugae*) (HWA). Fortunately, a preventative treatment has been found generally effective in protecting hemlocks (*Tsuga* spp.). Treatments, including pesticide, are available for the treatment of HWA through the Tennessee Division of Forestry. Given the regional scale and impacts of HWA, the pest is likely to find only localized success on the Property.

For more information on the Hemlock woolly adelgid, see USDA's Hemlock woolly adelgid website and the TN Hemlock Conservation Partnership.

The Property should be closely monitored for occurrences of non-native and invasive species. Should any forest pest be observed, the appropriate county forester should be promptly notified and consulted with appropriate mitigation measures taken, including the application of Integrated Pest Management (IPM) as necessary. IPM is a method, or process, designed to control pests while minimizing risks to humans and the environment. IPM is generally considered to have five major components that include:

- Methods for preventing pest problems;
- Pest identification;
- Monitoring and assessing pest numbers and damages;
- Establishing thresholds or guidelines for when management is needed; and
- Using a combination of management when necessary or most appropriate for the treatment of pests.

For more information, see the American Tree Farm System's Integrated Pest Management website.

Several invasive plants threaten the health and productivity of the Property. Some of those include:

- Ailanthus (*Ailanthus altissima*): Shade-intolerant, drought-tolerant, allelopathic species typically found in disturbed areas and along roadsides. Ailanthus (*Ailanthus altissima*) spreads aggressively by seeds and root sprouts; however, it is not currently a serious threat to silvicultural success on the Property.
- Autumn Olive (*Elaeagnus umbellata*): Spreads by animal-dispersed seeds. This plant forms dense stands in forest openings and along forest edges. Autumn Olive (*Elaeagnus umbellata*) is shade tolerant and can become established under forest canopies. Heavy, repeated herbicide treatment will be required in order to control this plant. Currently, autumn olive (*Elaeagnus umbellata*) populations are being monitored at the Property.
- Japanese Honeysuckle (*Lonicera japonica*): Shade tolerant, this common invasive plant overwhelms and replaces native vegetation in all forest types and sites and can form dense tangled masses. Serious infestations may require herbicide treatments. To date, this has not been pursued at the Property.
- Japanese Knotweed (*Fallopia japonica*): Spreads along streams by stem and rhizome fragments, seeds, and mowing. Japanese knotweed (*Fallopia japonica*) is considered a serious threat to native riparian habitats and similar sites. Control of this plant has not been pursued at the Property due to the proximity of most infestations to running surface water.
- Japanese Stilt Grass (*Microstegium vimineum*): Very shade tolerant, spreads by prolific seeding and mechanical and aquatic transport. Can develop dense infestations that exclude native vegetation. Extreme cases will require herbicide treatments.
- Kudzu (*Pueraria lobata*): Spreads by stolons (runners) and rhizomes. Kudzu (*Pueraria lobata*) can also spread by seeds, but this is less common. Kudzu (*Pueraria lobata*) thrives in open or recently disturbed areas and along roadsides. Where management activities are proximate to this plant, the forest over-story should not be disturbed to reduce the likelihood of sunlight encouraging Kudzu (*Pueraria lobata*) growth.
- Multi-flora Rose (*Rosa multiflora*): Spreads by prolific sprouting and seed transport via birds. Can invade young forests and forest edges, with the ability to climb into tree canopies. Shade is used to discourage growth.

5.3 Use of Chemicals & Biological Control Agents

It is acknowledged that in treating NNIS, chemical use, including the use of herbicides and pesticides, may be necessary in order to properly and effectively treat and control some organisms. Chemical use will be minimized in the management of the Property and, in cases where it is the only option or last resort, best practices will always be employed. Additional care is always to be taken when using chemicals on the Property. Ultimately, it is unlikely that chemical controls will be employed on the Property except as part of an IPM strategy or during limited forest restoration activities.

While the use of chemicals will generally be minimized, it is generally accepted as a management practice, and in some cases, chemical use may be the best or only option to effectively control a certain invasive pest or plant. Accordingly, the Society of American Foresters has released an official position on the use of herbicides, especially in connection with the control of NNIS, which is as follows: “The Society of American Foresters (SAF) supports the availability and judicious use of herbicides as an effective and vital tool for controlling undesired vegetation on forest lands. SAF believes that the use of herbicides, when properly applied according to federal and state regulations, is a safe and effective approach for managing undesired vegetation. In addition to helping improve reforestation and forest productivity, herbicide use

is now a particularly important management option for addressing the serious and growing problem of native and non-native invasive species on forest lands” (Society of American Foresters 2008).

5.4 Wildfire & Prescribed Burning

Fire has a long history and has played a significant role in ecosystems throughout the region but has only relatively recently begun to return to common use in forestry practice as a management tool. It is likely that fire was employed by Native Americans, and to a lesser extent by early settlers, as a management tool within the subject landscape; however, in recent history, the lack of prescribed fire and other means of controlling regenerative species composition in a midstory position has led to the emergence of a red maple (*Acer rubrum*)-dominated midstory that will, absent intervention, ultimately replace many of the oaks and hickories currently found in the canopy. To this end, prescribed burning is a cost-effective and wildlife-beneficial tool for stand manipulation and habitat enhancement. Presently, prescribed burning has not been applied to the Property, but dry upland forest types can greatly benefit from prescribed fire.

Common prescribed fire plans for the ecosystems and management on the Property could include:

- Dormant and growing season burns, used in tandem to achieve desired management objectives;
- Burns on frequent (*i.e.*, 3 to 4-year) cycles;
- Less frequent burns on longer cycles (*i.e.*, 50+ years); and
- Targeted site prep burns for research and/or artificial reforestation seedling establishment.

These burn regimes should be applied across the Property at appropriate sites and designed to diversity both forest condition and structure.

Firebreaks and burn plans should be established by the forest manager in consultation with relevant management agencies in Tennessee, and a certified burn manager should be present at all time during a prescribed fire. All prescribed fires should be carried out by professionals, under a specific burn plan, and with strict supervision. Pre- and post-treatment monitoring should be performed to ensure that desired results are achieved and to quantify and track levels of tree mortality. For more information, see the USFS’ Introduction to prescribed fire in Southern ecosystems.

6 Timber Harvest Operations

6.1 General Timber Harvesting Guidelines

Harvest operations on the Property are intended to be limited in occurrence and scope with minimal impacts resulting to other areas. Harvest units are generally designed to consider biological and environmental conditions onsite, as well as aesthetics, wildlife, and future uses and conditions. Silvicultural prescriptions are created to set the trajectory of the stand toward future desired conditions as a resilient forest.

6.2 Harvest Administration

Harvest administration procedures should be employed on the Property in order to achieve the desired management goals and objectives, while also protecting environmental and social considerations. This includes marketing sales to achieve the highest and best uses of products, while choosing contractors that can safely and effectively fulfill contract obligations. Any operations conducted with respect to the Property will be evidenced by a contract outlining all relevant terms and conditions of the engagement,

including, but not limited to, safety, worker rights, environmental safeguards, and landowner expectations.

All harvesting activities that take place on the Property should be conducted by trained and competent contractors or individuals. This includes those that support workers' rights, fair wages, and the safety of their employees, agents, and third parties. All workers should be skilled and trained through proper logging practices, such as those promulgated by the Tennessee Master Logger program. Forest management on the property will be conducted in a safe manner and shall meet or exceed all applicable health and safety laws and regulations. All forest workers should be well qualified to the extent necessary in order to safely and effectively implement the management plan included in their respective operational contracts.

As it relates to contractors performing work on the Property, opportunity should be given to local or regional parties when possible and feasible, providing for positive economic and social impacts in the area, if such parties are suitable and available for the task at hand. Further, as forest products generally serve local markets, this tends to compound the benefits to a locale. The forest industry is a significant contributor to the economy of Tennessee and surrounding states and provides stable, well-paying jobs for area livelihoods. Should any negative impacts be realized or noted, measures should be taken to avoid or mitigate such losses, damages, or issues.

Harvest documents, including treatment maps, silvicultural prescriptions, contract requirements, and any special or unique situations should be clearly discussed with and understood by contractors prior to any commencement of activities at the Property. Additionally, operations should be regularly monitored to ensure adherence to the relevant contract(s) and compliance with all applicable rules, guidelines, regulations, and requirements. Any areas or issues that need improvement should be reported to the contractor so that efforts may be promptly undertaken to resolve the matter.

6.3 Harvest Operations

Forest operations on the Property generate multiple benefits with wide-ranging uses for the region and local economy. Timber products include grade saw-timber, low-grade saw-timber, peelers, and pulpwood. Given sufficient market conditions, all products should be sold at their highest and best use. Waste of forest products can be minimized through effective utilization during harvest operations. For example, all stumps should be cut low and all merchantable products should be removed from the forest. Unmerchantable tops and limbs are to left onsite or scattered across the site if pulled to the landing. Additionally, harvest practices on the Property should protect residual trees and other resources, including soil health, vegetation, and water to ensure the long-term health and viability of the affected ecosystems.

Harvesting methods should be appropriate for particular site conditions, limitations, and stand characteristics. Selected methods should minimize negative impacts on the Property and represent the best system to meet operational goals and objectives. Most harvesting on the Property will be conducted conventionally with small to medium sized logging crews hand felling trees and skidding with either cable or grapple skidders. In areas with particularity high values and prohibitive terrain or other limitations to conventional logging, helicopter, and cable systems may be employed. For areas where equipment operations would have significant negative impacts on site qualities or other characteristics, animal driven systems, such as horse logging, may offer less impactful options.

The following describes a number of harvest systems likely to be employed on the Property:

- Conventional – Trees are hand felled using chainsaws or felled using a rubber-tired cutter. Transportation includes the use of cable and/or grapple skidders to move trees to log landings.
- Cable (High-Lead) – Used in very steep areas, such as gulf sites. Operations involve cutting with a chainsaw and skidding with a high-lead cable system, which is operationally difficult in areas with several rises and depressions.
- Helicopter – This method has extremely high overhead and is reserved for areas of timber with over 10,000 board feet per acre of high-value species. This system is only economically feasible for low acreage, high value, high volume areas.

The transportation infrastructure of the Property should generally suffice for management operations to be conducted thereon. Rubber-tired trucks, including those with both straight and tandem trailers, will conduct most log hauling. Hauling logs on county and state roads is common and accepted in the region, however care should be taken so as to not result in negative impacts to surrounding areas, including the depositing excess mud on the roads and/or damaging surface or shoulders.

Other transportation infrastructure located on the Property includes extensive trails and existing harvest roads. When appropriate, these existing roads and trails should be utilized and improved with modern construction built to BMP standards, except when doing so would ultimately result in greater environmental impacts than building a new road. This includes reducing the use of high-impact features, like low-water crossings, and the upsizing culverts as necessary to accommodate the larger precipitation events that are predicted in future climate scenarios. Any new improved roads will be laid out and assessed for need and environmental impacts. All negative effects of new roads will be mitigated through the application of BMPs and best construction practices. Roads that are no longer in use should be reclaimed and monitored for long-term rehabilitation.

7 Consultation and Coordination

The following parties contributed to the authoring and/or review of this document:

Name	Affiliation	Preferred Contact
Britt Townsend	TNC – Tennessee	b.m.townsend@tnc.org
Gabby Lynch	TNC -- Tennessee	glynch@tnc.org
Corey Giles	TNC – Tennessee	Corey_Giles@tnc.org
Terry Cook	TNC - Tennessee	Terry.Cook@tnc.org

8 Additional Resources

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