Indiana Department of Natural Resources
Division of Forestry

Indiana Department of Natural Resources

Resource Management Guides
Ferdinand-Pike State Forest
30-day Public Comment Period: April 27, 2020 – May 26, 2020

The Indiana State Forest system consists of approximately 158,000 acres of primarily forested land. These lands are managed under the principle of multiple use-multiple benefit to provide forest conservation, goods and services for current and future generations. The management is guided by scientific principles, guiding legislation and comprehensive forest certification standards which are independently audited to help insure long term forest health, resiliency and sustainability.

For management and planning purposes each State Forest is divided into a system of compartments and tracts. In general terms compartments are 300-1,000 acres in size and their subunits (tracts) are 10 - 300 acres in size. Resource Management Guides (RMGs) are then developed for each tract to guide their management through a 15-25 year management period. There are approximately 1,600 tracts in the State Forest system. During annual planning efforts 50-100 tracts are reviewed and RMGs developed based on current conditions, inventories and assessments.

The RMGs listed below and contained in this document are part of the properties annually scheduled forest inventories under review for Ferdinand-Pike State Forest.

Compartment 5 Tract 1 (Ferdinand)
Compartment 7 Tract 2 (Ferdinand)
Compartment 10 Tract 4 (Pike)
Compartment 11 Tract 1 (Pike)

To submit a comment on this document, go to:
www.in.gov/dnr/forestry/8122.htm

You must indicate the State Forest Name, Compartment number and Tract number in the "subject or file reference" line to ensure that your comment receives appropriate consideration. Comments received within 30 days of posting will be considered and review posted at http://www.in.gov/dnr/forestry/3634.htm.

Ferdinand State Forest Compartment: **05** Tract: **01**
Tract Acreage: **119** Commercial Forest Acreage: **119**
Forester: **Evan McDivitt** Date: **7/22/2019**
Management Cycle End Year: 2039 Management Cycle Length: 20 Years

Location
Compartment 5 Tract 1 (C5T1), also identified as 6310501, is located in Dubois County, Sections 9, 10, & 16, T3S, R3W, Jefferson Township.

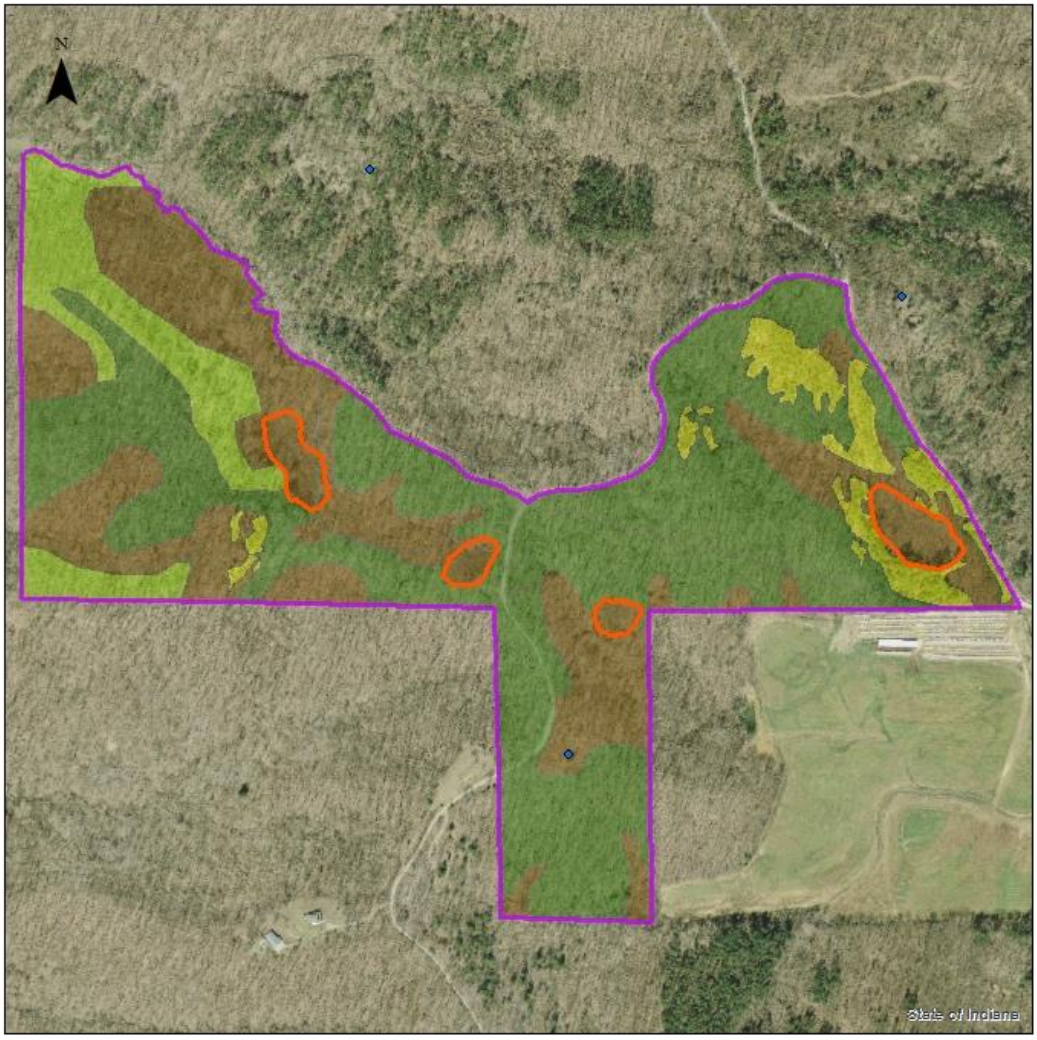
General Description
C5T1 contains 119 forested acres. Most of the tract is composed of a combination of mixed hardwoods and oak-hickory. There are a few pine patches throughout the tract as well.

Oak-Hickory (87 estimated acres): This type is found primarily on summits and south-facing slopes. Possibly some areas where oak-hickory is found in this tract may have a fire history as well. Primary species that dominate the overstory are chestnut, white, and black oak with some northern red oak, and pignut hickory. In these areas, most of the understory consists of beech-maple or has an abundance of greenbrier and R*ubus*. Some areas have decent chestnut oak advance regeneration.

Mixed Hardwoods (17 estimated acres)*:* Mixed hardwoods are found throughout the tract on various sites, typically on north-facing slopes and along ephemeral drainages. They consist primarily of yellow-poplar. Some of the mixed hardwoods are intermingled with white pine in portions close to, and often inside, old pine plantations. Overstory consists of yellow poplar, sugar maple, blackgum, American beech, and some oaks. Species in the understory include blackgum, red maple, paw-paw, white ash, sweetgum, dogwood, sugar maple, American beech, and some scattered oaks. The 1988 and 2003 group openings contain young closed canopy mixed hardwoods.

Pine (15 estimated acres): There are some stagnant and declining pine plantations in this tract. These plantations contain an overstory of pine (eastern white, shortleaf, and Virginia pine) with an understory of beech, maple, and other mixed hardwoods.

Ferdinand-Pike State Forest
Compartment 5 Tract 1
Cover Types Map



History

This tract was purchased from three separate purchases. The first was from Melinda M. Taylor and John Henry Taylor et al of Dubois County consisting of 40 acres in March 1941 (Book 5, Page 217, deed # 19-30-0030). The second and largest acquisition of 160 acres came from Samuel C. and Mary S. Newton in May 1941 (Book 5, Page 231, deed # 19-30-0031). The remaining acres were purchased from Herman Knies, Egid M. Striegel and Fred Humber of Dubois County in July 1945 (Book 5, Page 460, deed # 19-30-0040). Land from these three purchases was combined into C5T1 as well as other tracts on Ferdinand State Forest.

Resource Management History

Notes from the tract file document this area contained numerous old fields upon state acquisition. There is documentation of elderly residents who grew up around this tract recounting crop farming and livestock production possibly within this tract prior to state acquisition. Evidence of coal and oil production was found along the southern portion of the western boundary line.

A wildlife pond was built in this tract in 1965.

This tract was inventoried in 1974 by forester Bill Hahn who found 4,551 bd.ft. per acre total volume and 2,880 bd.ft. per acre in harvest volume on approximately 76 acres. He noted evidence of previous timber harvesting.

There were two timber sales in this tract in 1974. The first covered the northeast corner and encompassed 47 acres with a total of 91,740 bd.ft. Doyle sold for $8,215.29 to Indiana Hardwoods of Chandler. The second was in the southeast corner and lower 20 acres covering 55 acres totaling 62,090 bd.ft. Doyle sold for $5,865.00 to Dolly Madison Industries of Ferdinand. A pine sale consisting of 32,371 bd.ft. Doyle (some of this volume coming from a different tract) in the east half of the tract was sold in 1988 for $1,951.26 to Kenneth Jackson of Birdseye in an attempt to salvage wind thrown trees from an April 1988 windstorm. Later in 1988, a quarter bushel of scarlet oak acorns was planted in the wind thrown opening by hand as a property experiment in oak regeneration in group openings. Branchville Labor Line completed vine and cut-stump TSI in 1988 and 1991.

In 1991, forester Janet Eger inventoried this tract estimating 5,448.67 bd.ft. per acre total volume and 1,249.20 bd.ft. per acre harvest volume across 108 acres.

In 2000, the tract was inventoried by forester Gretchen Herbaugh who estimated 7,196.70 bd.ft. per acre total volume and 2,387.80 bd.ft. per acre harvest stock across 108 acres.

In 2003, a timber harvest was conducted on 61 acres totaling 140,300 bd.ft. Doyle and sold for $48,098.50 to Rasche Brothers Logging of Ferdinand. BMP monitoring was conducted following the harvest in November 2003 documenting effective implementation of BMPs for water quality. Timber stand improvement (TSI) was conducted in 2004 to complete openings.

An inventory conducted by forester Evan McDivitt in 2019 estimated 7,852 bd.ft. per acre total volume across 119 acres. Group openings from the 1988 and 2003 harvest were revisited during

this inventory. Follow-up on the scarlet oak acorn planting in the 1988 wind thrown opening found few 3-inch dbh scarlet oak saplings highly suppressed under 16-inch dbh yellow poplars.

Landscape Context

This tract lies within the Crawford Upland Section of the Shawnee Hills Natural Region. The entire tract lies within the Southern Hills and Lowlands physiographic province. Additionally, the entire tract lies within the Crawford-Mammoth Cave Uplands part of the Interior Plateau ecoregion. Pre-settlement land cover for this tract has been classified as *Quercus-carya* vegetation type. Water from this tract drains into the Lower Ohio-Little Pigeon watershed. There is a wildlife pond in the southern portion of the tract. Hardwoods dominate the tract with clusters of pine canopy cover noted in a few locations. Areas within a one mile radius of this tract contain additional portions of Ferdinand State Forest as well as areas with deciduous forest, cultivated crops, developed open space, herbaceous vegetation, and hay/pasture.

Topography, Geology, and Hydrology

Topography in this tract consists of steep hills and a winding, narrow ridgetop that extends along the northern tract boundary and then further extends northwest through the central portion of the tract. Numerous ridge fingers protrude from this ridge. This topographic position has created numerous aspects with many southern facing slopes. Underlying bedrock is composed of sandstone, siltstone, and shale.

Soils

Gilpin-Berks Complex, 20 to 50 % slopes (GoF); *(51.7 acres).* These soils are on hillsides and are in the uplands. Individual areas of this soil are 50 percent Gilpin soils and about 35 percent Berks soils. The soils in this unit have low available water capacity and are moderately permeable. Surface runoff is very rapid. The surface layer has moderate organic matter content and is friable. These soils formed in material weathered from sandstone, siltstone, and shale. Soil is moderately acid. Bedrock depth begins at around 30 inches. Moist bulk density ranges 1.2-1.5 g/cc, saturated hydraulic conductivity ranges 4.23-14.11 micro m/sec, available water capacity ranges 0.08-0.24 in/in, linear extensibility ranges 0-5.9%, and organic matter ranges 0.3-4% throughout available rooting depth. It is somewhat suited for growing black walnut. Site index is 95 for yellow poplar and 70 for black oak. Other species to manage here include: black oak, scarlet oak, shingle oak, chestnut oak, and white oak

Gilpin Silt Loam, 12 to 18 % slopes, eroded (GlD2); *(24.7 acres).* This strongly sloping soil is moderately deep and well drained. It is found on side slopes along drainages and hillsides. This soil has low available water capacity and is moderately permeable. Surface runoff is rapid. The surface layer has moderate organic matter content and is friable. These soils formed in material weathered from sandstone, siltstone, and shale. Soil is moderately acid. Bedrock depth begins at around 30 inches. Moist bulk density ranges 1.2-1.5 g/cc, saturated hydraulic conductivity ranges 4.23-14.11 micro m/sec, available water capacity ranges 0.08-0.24 in/in, linear extensibility ranges 0-5.9%, and organic matter ranges 0.3-4% throughout available rooting depth. It is

somewhat suited for growing black walnut. Site index is 95 for yellow poplar. Other species to manage here include: black oak, scarlet oak, shingle oak, chestnut oak, and white oak.

Apalona-Zanesville Silt Loam, 6 to 12 % slopes, eroded (ZnC2); *(20.9 acres).* This moderately sloping soil is deep and well drained. This soil is on uplands. It is on ridgetops and upper parts of side slopes along natural drainageways. This unit includes eroded and uneroded soils. This soil has moderate available water capacity and is slowly permeable. Surface runoff is medium. The surface layer has moderate organic matter content and is friable. Depth to a seasonal high water table ranges from 2 to 3 feet during the months of December through April. A very firm and brittle fragipan at 24 to 32 inches, restricts the downward movement of roots. These soils formed in loess over underlying sandstone and siltstone residuum. Moist bulk density ranges 1.2-1.8 g/cc, saturated hydraulic conductivity ranges 4.23-14.11 micro m/sec, available water capacity ranges 0.06-0.21 in/in, linear extensibility ranges 0-4%, and organic matter ranges 0-1.5% throughout available rooting depth. It is poorly suited for growing black walnut. Site index is 77 for black oak, 76 for chestnut oak, 70 for white oak, and 88 for yellow poplar.

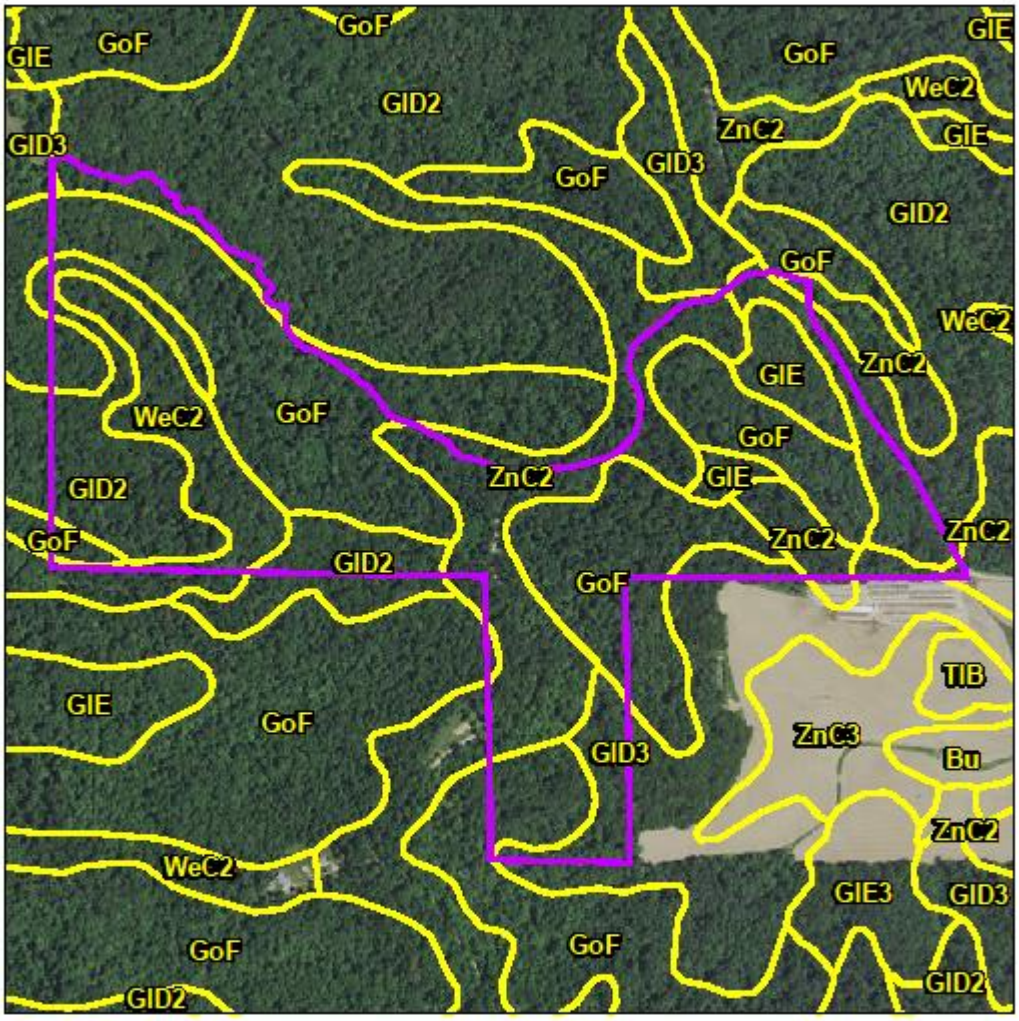
Wellston Silt Loam, 6 to 12 % slopes, eroded (WeC2); *(9.7 acres).* This moderately sloping soil is deep and is well drained. This soil is on narrow ridgetops and side slopes along drainages. This soil has high available water capacity and is moderately permeable. Surface runoff is medium. The surface layer has moderate organic matter content and is friable. These soils formed in loess over underlying sandstone, siltstone, and shale residuum. Moist bulk density ranges 1.38-1.54 g/cc, saturated hydraulic conductivity ranges 1.4-14.0 micro m/sec, available water capacity ranges 0.14-0.25 in/in, linear extensibility ranges 0.7-4%, and organic matter ranges 0-2% throughout available rooting depth. It is moderately suited for growing black walnut. Site index is 82 for black oak, 78 for chestnut oak, 66 for post oak, and 74 for white oak, and 93 for yellow poplar.

Gilpin Silt Loam, 12 to 18 % slopes, severely eroded (GlD3); *(6.5 acres).* - This strongly sloping soil is moderately deep and well drained. The soil is on uplands. It is on 12-18% side slopes along drainages. Rock outcrops are in some areas. Inclusions of other soils make up about 15-20 percent of the soil. The soil has a low available water capacity and is moderately permeable. Surface runoff is very rapid. The surface layer has low organic matter content and is friable. These soils formed in material weathered from sandstone, siltstone, and shale. Soil is moderately acid. Bedrock depth begins at around 30 inches. Moist bulk density ranges 1.2-1.5 g/cc, saturated hydraulic conductivity ranges 4.23-14.11 micro m/sec, available water capacity ranges 0.08-0.24 in/in, linear extensibility ranges 0-5.9%, and organic matter ranges 0.3-4% throughout available rooting depth. It is poorly suited for growing black walnut. Site index is 95 for yellow poplar. Other species to manage here include: black oak, scarlet oak, shingle oak, chestnut oak, and white oak.

Gilpin Silt Loam, 18 to 25 % slopes (GlE); *(5.5 acres).* - This moderately steep soil is moderately deep and well drained. This soil is on uplands. It is on hillsides and sharp breaks along drainageways. Inclusions of other soils make up 10-12 percent of the soil and can include rock outcrops. The soil has low available water capacity and is moderately permeable. Surface runoff is rapid. The surface layer has moderate organic matter content and is friable. These soils

formed in material weathered from sandstone, siltstone, and shale. Soil is moderately acid. Bedrock depth begins at around 30 inches. Moist bulk density ranges 1.2-1.5 g/cc, saturated hydraulic conductivity ranges 4.23-14.11 micro m/sec, available water capacity ranges 0.08-0.24 in/in, linear extensibility ranges 0-5.9%, and organic matter ranges 0.3-4% throughout available rooting depth. It is somewhat suited for growing black walnut. Site index is 95 for yellow poplar. Other species to manage here include: black oak, scarlet oak, shingle oak, chestnut oak, and white oak.

Soils Map



Access

Access to this tract is excellent. The tract is bounded by Taylor Hollow Road on the eastern and northeastern portion of the tract and County Road S 880 E runs through the middle of this tract into part of the lower 20 acres before passing onto private land.

Boundary

There are Dubois County survey markers posted in various places along the southern boundary. There are remnants of old fencing along the western boundary as well as along the southern boundaries. A survey should be conducted to more accurately determine lines.

Wildlife

A Natural Heritage Database Review was completed for C5T1 as part of the management guide process. If rare, threatened or endangered species were identified for this area, activities prescribed will be conducted in a manner that will not threaten viability of those species.
The Division of Forestry has instituted procedures for conducting forest resource inventories so documentation and analysis of live tree and snag tree densities is examined on a compartment-level basis in order to maintain long-term and quality forest habitats. Legacy trees and snags for all size classes meet maintenance level for Indiana bat habitat. All snags were selected to be retained during the inventory. Management practices conducted in C5T1 will be implemented in a manner maintaining long-term quality forest habitats for wildlife populations while promoting legacy tree development.

Live Legacy Trees and Snags for C5T1

	Maintenance Level	**Optimal Level**	**Inventory**	**Available Above Maintenance**
Legacy Trees*				
11"+ DBH	1071		2588	1517
20"+ DBH	357		649	292
Snags (all species)				
5"+ DBH	476	833	1308	832
9"+ DBH	357	714	968	611
19"+ DBH	60	119	136	76

*** Species Include:** AME, BIH, BLL, COT, GRA, REO, POO, REE, SHH, ZSH, SIM, SUM, WHA, WHO

Ecological Considerations

This tract contains dry upland, dry-mesic upland and mesic upland forest communities. Typically, the drier and more upland sites contain forest types dominated by various combinations of oak and hickory species with minor components of mixed hardwoods. Examples in this tract include sites were chestnut oaks are dominant in some parts and others where white and black oaks are dominant; other oak-hickory areas have species like pignut and bitternut hickory being the dominant overstory component with understory vegetation such as sassafras, dogwood, blackgum, redbud, greenbrier, white ash, and poison ivy. The mesic upland portions of this tract typically contain forest types dominated by mixed hardwood species such as yellow poplar, sugar maple and American beech with minor components of oak, hickory, elm, ash, and gum. Understory tree and shrub species include paw-paw, dogwood, ironwood, spicebush and some mapleleaf viburnum. Remnant pine plantations are a non-native plant community found in this tract, which, intensively cultivated in the past for purposes of soil and site stabilization, have served an important role in preserving integrity of surrounding native forest communities and in preventing further degradation to the landscape. These senescing communities have an understory component of mixed hardwoods and oak, oftentimes well-stocked with advanced seedlings of oak, hickory, ash, poplar, maple, and beech, positioned to become the new overstory cohort as pines, which rarely replace themselves on these sites, are removed from the community through mortality or timber harvest.

Exotic Species

Invasive and exotic species are widespread throughout southern Indiana on private and public land. Each species has a history of introduction, successful colonization of sites and dispersal. Aside from being very successful in out-competing native plants on a variety of forest sites, an additional reason for their success may be because the current forest sites are using resources inefficiently. There are niches open and available and invasive species aggressively take advantage. The land making up C5T1 had historical land uses involving clearing land for agriculture and/or pasture, probably as early as the mid-1800s to the 1940s. Many adjacent lands on the landscape also experienced similar disturbances. Erosion and degradation in the early 1900s would have further affected patterns of native shrub and herb abundance, distribution, and dispersal. The culmination of site degradation, invasive species introduction, and presence of a vacuum in the resource niche, combined with increasing deer densities during the time this forest was initiating and reorganizing, have all contributed to the presence of invasive, exotic species in C5T1. Japanese stiltgrass and multi-flora rose were observed throughout the tract at various densities. These and other invasive species, such as Autumn olive, bush honeysuckle, Japanese honeysuckle, tree of heaven, and *Paulownia* should be treated as part of a regular invasive species control program. Control options include foliar spraying with herbicide, cut-stump with herbicide, and basal spraying with herbicide. All pesticides used on state forest will be in compliance with certification standards. In addition, emerald ash borer (*Agrilus planipennis)* exists in the region, producing complete mortality in overstory ash. For this reason, it is recommended declining ash trees be included in regularly prescribed timber harvesting so value is not lost to mortality. Conversely, young healthy ash showing no sign of decline should remain for potential resistant features.

Recreation

Likely recreational activities on this tract include hunting. Currently, there are no developed recreation trails within this tract. Impacts to recreation by management prescribed in this guide may include increased accessibility due to skid trails and changes in wildlife movements. For example, one year following a timber harvest whitetail deer often change their movement patterns to follow skid trails to facilitate movement through the forest. Within five years however, skid trails will be thick with herbaceous and woody vegetation and this change will likely shift ease of movement towards other areas outside skid trails.

Cultural

Cultural resources may be present on this tract but their location(s) are protected. Adverse impacts to significant cultural resources will be avoided during any management or construction activities.

Tract Description and Silvicultural Prescription

Tract Summary Data

Total Trees/Ac. = **147 Trees/Ac.** Overall % Stocking Hardwoods = **89%** (Fully Stocked)
Basal Area = **106.2 Sq. Ft./Ac.** Harvestable Trees = **27 Trees/Ac.**
Present Volume = **7,852 Bd. Ft./Ac.**

Species and Volume Table for C5T1

Species	# Sawtimber Trees	Total Bd.Ft.
White Oak	1,363	315,800
Chestnut Oak	912	122,280
Black Oak	436	94,270
Eastern White Pine	288	85,700
Yellow Poplar	244	87,800
Pignut Hickory	508	74,900
Shortleaf Pine	281	37,300
Northern Red Oak	90	21,600
Sugar Maple	178	20,570
Shagbark Hickory	260	17,920
Post Oak	106	14,970
Red Maple	74	9,420
Virginia Pine	79	7,860
Scarlet Oak	21	7,440
White Ash	15	3,510
Blackgum	20	1,470
Bitternut Hickory	16	3,400
Black Cherry	44	2,870
American Beech	26	1,860
Per Acre Total	**42**	**7,823**
Tract Total	**4,961**	**930,940**

The tract's forest resource is composed of 3 different stratums.

Mixed Hardwoods Stratum

Mixed hardwoods tend to be variable in composition and thus may have more complicated prescriptions attached to them. The overstory is dominated by yellow-poplar, with much of the mid-story growth being beech-maple. Some white pine and white oak are present in the overstory. Regeneration consists primarily of beech-maple, with an occasional oak species and yellow-poplar. Pre-harvest invasive species control should be conducted using a situational approach to reduce competition by invasive species against desirable species such as oak and poplar in establishing a new cohort in the regeneration layer. Single tree selection cuttings are prescribed to remove mature to over-mature trees and any cull trees in poor form. There are many yellow-poplar that are currently exceeding maturity that should be the main targets for removal. This improvement cutting will enable release of quality oaks and any oak regeneration occurring in the understory. Oak-hickory is the preferred stratum type and will require removal of crown competition for release of these valued species. The result will yield an increase in timber and wildlife diversity.

Oak-Hickory Stratum

This stratum includes the Dry Oak-Hickory and Mesic Oak-Hickory types. The retention of species in this stratum is important to the Division's long-term timber management objectives.

The overstory is dominated primarily by chestnut oak, white oak, northern red oak, black oak, and pignut hickory, with much of the mid-story growth being beech-maple. There are a few sugar maple and yellow-poplar that make their way into the canopy layer along with an abundant layer of blackgum. Regeneration consists primarily of beech-maple, white ash, and some chestnut and other oaks. Pre-harvest invasive species control should be conducted using situational approach to reduce competition by invasive species against desirable species such as oak and hickory in establishing a new cohort in the regeneration layer. Single tree selection is prescribed to remove mature and over-mature, undesirable trees to release the growing stock of high quality stems, as well as promote regeneration of the oak-hickory stratum. Most of the higher quality seed trees should be left in the stand, but more of the co-dominant trees should be targeted for removal, such as beech-maple. Damaged trees that can be considered as cull trees are suggested for removal in the stand to promote a healthy forest. Most likely, regeneration will be comprised of mixed hardwoods, mainly beech-maple unless TSI is implemented, with a component of oak. Areas with an abundance of advanced oak regeneration should be considered for release through a group selection cut.

Pine Stratum

The pine plantations were found to be overstocked and in decline. Pines were typically planted for erosion control purposes during the first half of the 20th century. As these pines have matured and slowly declined, native hardwoods have become established in canopy gaps and have to an extent reached the overstory where most of the pines are now. The overstory is dominated by mature white pine, shortleaf pine, and Virginia pine. Portions of the pine plantation are also mixed with hardwoods where pine mortality has been severe. Understory growth is composed of beech-maple, blackgum and other occasional hardwood species. The main goal is to promote native hardwood regeneration with an oak-hickory component in these areas if possible, and thus, harvesting the pine is prescribed. There is an opportunity to target invasive species and understory beech-maple during post-harvest TSI. Overall, group openings are an option for management in these areas for long-term forest regeneration and sustainability. Areas where pole-sized hardwoods have emerged and entered the canopy TSI should be prescribed to release desired crop trees not adequately released during the timber harvest.

Proposed Activities Listing

Postharvest TSI should be performed along with invasive species management. A regeneration review should be conducted three years following all treatments. The tract should be inventoried again in 15-20 years. Based on this information, a managed timber harvest removing approximately 225,000-275,000 board feet over the entire tract area is prescribed within the next 5 years. During the recommended timber harvest appropriate implementation of forestry best management practices will be used to protect sediment from entering the watershed.

Proposed Management Activity	***Proposed Period***
Pre-harvest Invasive Control	CY2019-2021
Timber Sale	CY2021-2023
Post-harvest TSI	Following harvest
Regeneration Opening Review	3-5 Years Postharvest
Inventory and Management Guide	CY2034-2039

Ferdinand State Forest Compartment: **07** Tract: **02**
Tract Acreage: **79** Commercial Forest Acreage: **79**
Forester: **Evan McDivitt** Date: **10/7/2019**
Management Cycle End Year: 2039 Management Cycle Length: 20 Years

Location
C7T2, also identified as 6310702, is located in Perry County, Section 9, T4S, R3W, Clark Township.

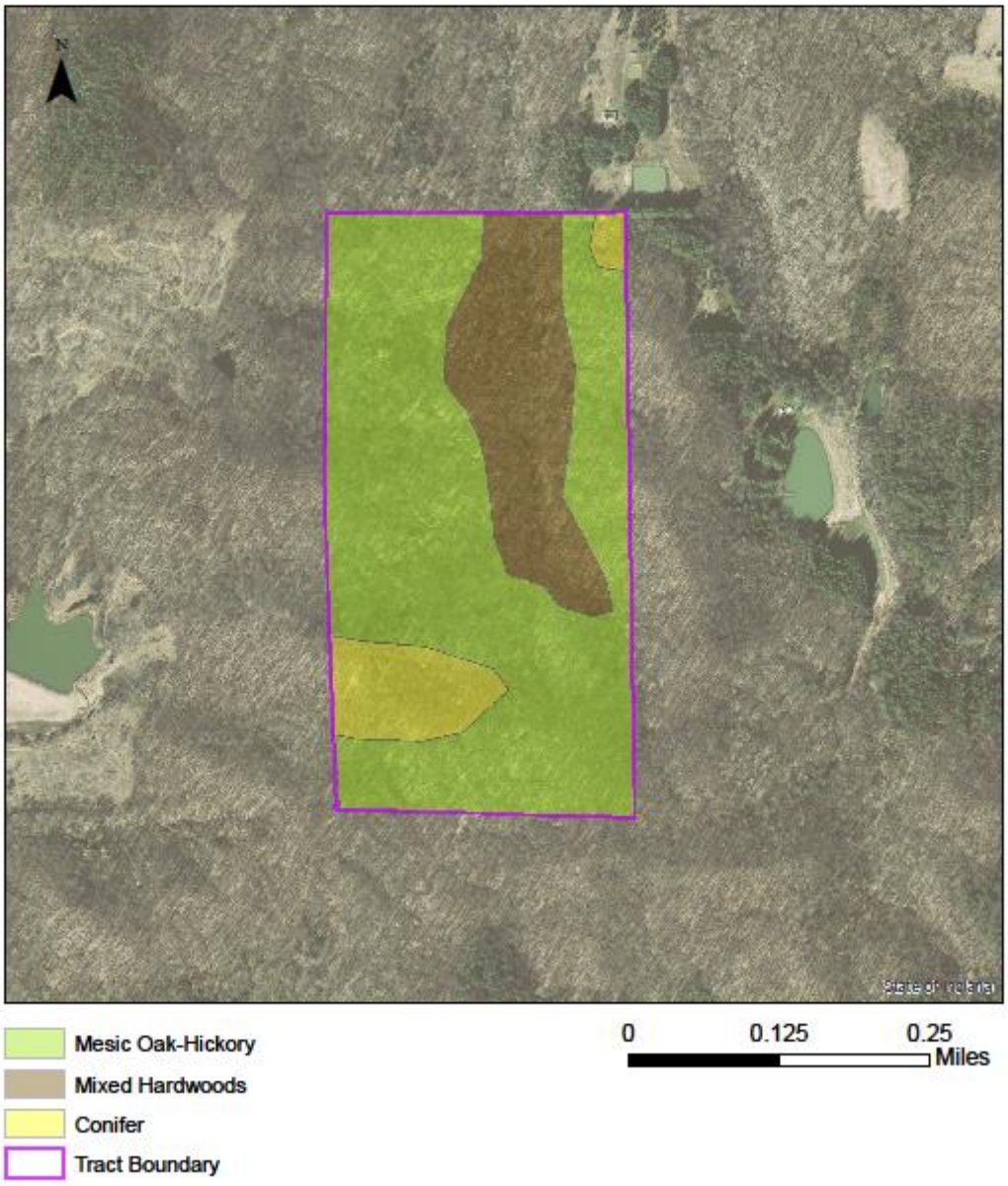
General Description
C7T2 contains 79 forested acres. Most of the tract is composed of a combination of oak-hickory and a smaller component of mixed hardwoods. There are a few pine patches throughout the tract as well.

Oak-Hickory (55.5 estimated acres): This type is found primarily on summits and south-facing slopes. Possibly some areas where oak-hickory is found in this tract may have a fire history as well. Primary species that dominate the overstory are white, northern red and black oak with some pignut hickory. In these areas, most of the understory consists of beech-maple or has an abundance of greenbrier and R*ubus*. Some areas have a decent oak advance regeneration layer.

Mixed Hardwoods (16.5 estimated acres)*:* Mixed hardwoods are found throughout the tract on various sites, typically on north-facing slopes and along ephemeral drainages. They consist primarily of yellow-poplar. Some of the mixed hardwoods are intermingled with white pine in portions close to, and often inside, old pine plantations. Overstory consists of yellow poplar, sugar maple, blackgum, American beech, and some oaks. Species in the understory include blackgum, red maple, paw-paw, white ash, sweetgum, dogwood, sugar maple, American beech, and some scattered oaks.

Conifer (7 estimated acres): There are some stagnant and declining pine plantations in this tract. These plantations contain an overstory of pine (mostly eastern white and red pine) with an understory of beech, maple, and other mixed hardwoods.

Ferdinand-Pike State Forest
Compartment 7 Tract 2
Cover Types Map



History

In September 1950 Frank Widner, an unmarried man, sold 80 acres to the State for a price of $850.40 ($10.63 per acre). The initial inventory stated that only fuel wood had been cut in the recent past and that a high percentage of the trees were 14-18 inch DBH. The composition of the tract was largely White Oak and Red Oak (20% each) with 12% Hickory. Three different areas were mapped as open areas which totaled 6 acres. These areas were planted to White, Red, and Virginia Pine, although no planting records can be located. It was suggested in the initial inventory that nothing should be cut at present, but presently there were 400 crossties. It stated that in 1945 a fire swept through most of the tract. Evidence of past fire are present in the tract.

Resource Management History

This tract was inventoried in 1973 by Ben Hubbard who found 1,329 bd.ft. per acre total volume and 744 bd.ft. per acre in harvest volume on around 54 hardwood acres. The remaining 26 acres were considered "brushy" with 15 acres in young planted pine having no merchantable volume. He advised a future salvage sale to cover the 30 acre burned area mentioned above.

In 1980, a timber sale on 65 acres totaling 169,167 bd.ft. Doyle sold for $12,705.00 to DMI Furniture, Inc. of Ferdinand.

In 1998 this tract was inventoried by Nate Orsburn who found 5,148 bd.ft. per acre total volume and 1,723 bd.ft. per acre in harvest volume on around 76 acres.

In 2000, vine TSI was conducted using a bow saw across 80 acres in this tract.

In 2003, a timber sale on 45 acres (some of these acres were in adjacent C7T1) totaling 97,809 bd.ft. Doyle sold for $37,349.90 to Werner Specialty Hardwoods of Jasper.

In 2005, opening TSI was completed using felling and girdling with treatment in the 1.2 acre opening created during the 2003 timber sale.

In 2019 this tract was inventoried by Evan McDivitt and Travis Dunn who found 8,317 bd.ft. per acre total volume on around 79 acres.

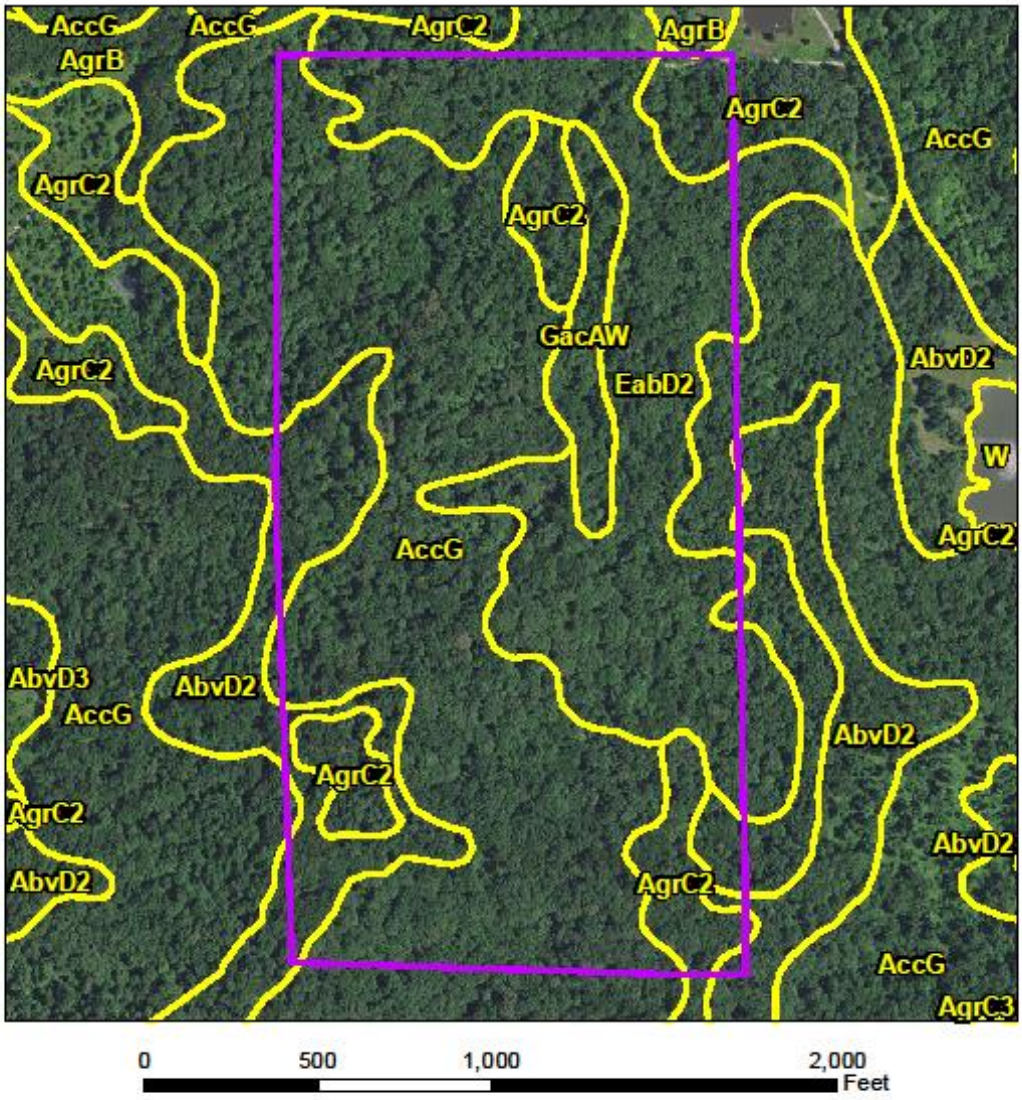
Landscape Context

This tract lies within the Crawford Upland Section of the Shawnee Hills Natural Region. The entire tract lies within the Southern Hills and Lowlands physiographic province. Additionally, the entire tract lies within the Crawford-Mammoth Cave Uplands part of the Interior Plateau ecoregion. Pre-settlement land cover for this tract has been classified as *Quercus-carya* vegetation type. Water from this tract drains into the Lower Ohio-Little Pigeon watershed. Hardwoods dominate the tract with clusters of pine canopy cover noted in a few locations. Areas within a one mile radius of this tract contain additional portions of Ferdinand State Forest as well as areas with deciduous forest, cultivated crops, developed open space, herbaceous vegetation, and hay/pasture.

Topography, Geology, and Hydrology

Topography in this tract consists of primarily upland area with a generally west facing slope. There is a small lowland area with a prominent drainage oriented north-south through the middle of the tract. This is the only mapped intermittent drainage in the tract. Underlying bedrock is composed of sandstone, siltstone, and shale.

Soils Map



Soils

Adyeville-Tipsaw-Ebal complex (AccG); *(38.3 acres)* This complex is somewhat excessively drained with Ebal component being moderately well drained. Seasonally high water table ranges from 24 inches to greater than 40 inches. Soils can be found in this tract on summits, shoulders, back slopes of structural scarps and benches, and hills and uplands with slopes of 20 to 50 percent. Native vegetation is hardwoods. Surface layer is silt loam to very fine sandy loam having moderate to high organic matter content (2.0 to 8.0 percent). Permeability is very slow (Ebal) to moderate in most restrictive layer above 60 inches. Available water capacity is low to moderate (3.3 to 7.2 inches in upper 60 inches). pH of surface layer is 3.3-5.5. Bedrock is 20 to 80 inches deep. Droughtiness and water erosion are management concerns for forest production. Site Index for northern red oak is 64 to 70; black oak is 70 to 80.

Ebal-Duechars-Kitterman complex (EabD2); *(23.9 acres)* This complex is moderately well drained. Seasonally high water table ranges from 12 inches to 36+ inches. Found in this tract on sideslopes and uplands with slopes of 12 to 24 percent. Native vegetation is hardwoods. Surface layer is channery silty clay loam to silt loam having moderately low to moderately high organic matter content (1.0 to 10.0 percent). Permeability is slow to very slow in most restrictive layer above 60 inches. Available water capacity is low to moderate (4.1 to 9.0 inches in upper 60 inches). pH of surface layer is 3.5-6.5. Bedrock is 20 to 90 inches deep. Droughtiness and water erosion are management concerns for forest production. This complex has site index for black oak ranging 65 to 80; for northern red oak it is 90, yellow poplar is 90, and white oak is 57.

Apalona silt loam (AgrC2); *(8.4 acres)* Moderately well drained. Seasonal high water table from 2.0 to 3.0 ft. Soil can be found in this tract on summits and shoulders of benches and hills. Slopes are 6 to 12 percent. Native vegetation is hardwoods. Surface layer is silt loam having moderately low to moderate organic matter content (1.0 to 3.0 percent). Permeability is very slow (< 0.06 in/hr) in most restrictive layer above 60 inches. Available water capacity is moderate (7.2 inches in the upper 60 inches). pH of surface layer is 4.5 to 6.0. Bedrock is 72 to 100 inches deep. Droughtiness and water erosion are management concerns for forest production. Site index is 80 for yellow poplar, 60 for white oak, and 60 for black oak.

Adyeville-Wellson-Deuchars silt loams (AbvD2); *(5.2 acres)* This complex is moderately well drained to somewhat excessively drained. Seasonally high water table ranges from 24 inches to greater than 40 inches. Soil can be found in this tract on summits, shoulders, back slopes, crests, head slopes, nose slopes, side slopes and uplands with slopes of 8 to 20 percent. Native vegetation is hardwoods. Surface layer is silt loam having moderately low to moderate organic matter content (1.0 to 3.0 percent). Permeability is slow (Deuchars) to moderate in most restrictive layer above 60 inches. Available water capacity is low to moderate (4.1 to 9.0 inches in upper 60 inches). pH of surface layer is 3.5-6.5. Bedrock is 20 to 80 inches deep. Droughtiness and water erosion are management concerns for forest production. This complex has site index for northern red oak ranging 64 to 90 and 90 for yellow poplar.

Gatchel laom (GacAW); *(3.2 acres) S*omewhat excessively drained. Water table depth greater than 40 inches in floodplains. Slopes are 0 to 2 percent. Native vegetation is hardwoods. Surface layer is loam having moderate to moderately low organic matter content (1.0 to 3.0 percent). Permeability is slow (.06 to 0.2 in/hr) in most restrictive layer above 60 inches. Available water capacity is moderate (6.1 inches in the upper 60 inches). pH of the surface layer is 5.6 to 7.3. Droughtiness and flooding hazards are management concerns for forest production. Site index for yellow poplar is 95.

Access

At present there is only management access to this tract. The private dirt road is the east half of the northern boundary of this tract. A log yard from a 1980 and 2003 sale is located in this corner. On the south end of this tract an old road runs east-west along the ridgetop going from the southeast corner to the pine patch on the west side. The road ends at the pine , but is visible on the west side of the pine patch and can be seen leaving the property. The north and south ends of this tract are linked by old skid trails. There are two old skid trails that follow the main drainage from the old log yard to the southern end of the tract. One additional old skid trail runs from the log yard to the northwest corner to access C7T1.

Boundary

The boundaries of most of this tract are well established. Starting at the northeast corner the road serves as the north boundary. A yellow fence post on the east line and a white pine that has been painted red are located on the south side of the road. The east line has been marked with a few State Forest signs along with rebar painted orange every 50-75 yards. There is a stone in the middle of this east line that is marked with a survey marker. The southeast corner has a survey marker and two sets of State Forest signs. The south line also appears to have been surveyed. White t-posts are placed every 75-100 yards. The southwest corner has a stone, a survey marker, State Forest signs, and a metal axle. The west line has one State Forest sign along an old road near the pine patch. The northwest corner has a State Forest sign lying on the ground. This sign apparently was fixed to a white oak which has since fallen down and decayed.

Wildlife

A Natural Heritage Database Review was completed for C7T2 as part of the management guide process. If rare, threatened or endangered species were identified for this area, activities prescribed will be conducted in a manner that will not threaten viability of those species.

The Division of Forestry has instituted procedures for conducting forest resource inventories so documentation and analysis of live tree and snag tree densities is examined on a compartment-level basis in order to maintain long-term and quality forest habitats. Legacy trees and snags for all size classes meet maintenance level for Indiana bat habitat. All snags were selected to be retained during the inventory. Management practices conducted in C7T2 will be implemented in a manner maintaining long-term quality forest habitats for wildlife populations while promoting legacy tree development.

Live Legacy Trees and Snags for C7T2

	Maintenance Level	Optimal Level	Inventory	Available Above Maintenance
Legacy Trees*				
11”+ DBH	711		2364	1653
20”+ DBH	237		679	442
Snags (all species)				
5”+ DBH	316	553	1044	728
9”+ DBH	237	474	630	393
19”+ DBH	40	79	117	78

*** Species Include:** AME, BIH, BLL, COT, GRA, REO, POO, REE, SHH, ZSH, SIM, SUM, WHA, WHO

Ecological Considerations

This tract contains dry-mesic upland and mesic upland forest communities. Typically, the drier and more upland sites contain forest types dominated by various combinations of oak and hickory species with minor components of mixed hardwoods. Examples in this tract include sites where white oaks are dominant in some parts and others where white and black oaks are dominant; other oak-hickory areas have species like pignut and bitternut hickory being the dominant overstory component with understory vegetation such as sassafras, dogwood, blackgum, redbud, greenbrier, white ash, and poison ivy. The mesic upland portions of this tract typically contain forest types dominated by mixed hardwood species such as yellow poplar, sugar maple and American beech with minor components of oak, hickory, elm, ash, and gum. Understory tree and shrub species include paw-paw, redbud, ironwood, spicebush and some mapleleaf viburnum. Remnant pine plantations are a non-native plant community found in this tract, which, intensively cultivated in the past for purposes of soil and site stabilization, have served an important role in preserving integrity of surrounding native forest communities and in preventing further degradation to the landscape. These senescing communities have an understory component of mixed hardwoods and oak, oftentimes well-stocked with advanced seedlings of oak, hickory, ash, poplar, maple, and beech, positioned to become the new overstory

cohort as pines, which rarely replace themselves on these sites, are removed from the community through mortality or timber harvest.

Exotic Species

Invasive and exotic species are widespread throughout southern Indiana on private and public land. Each species has a history of introduction, successful colonization of sites and dispersal. Aside from being very successful in out-competing native plants on a variety of forest sites, an additional reason for their success may be because the current forest sites are using resources inefficiently. There are niches open and available and invasive species aggressively take advantage. The land making up C7T2 had historical land uses involving clearing land for agriculture and/or pasture, probably as early as the mid-1800s to the 1940s. Many adjacent lands on the landscape also experienced similar disturbances. Erosion and degradation in the early 1900s would have further affected patterns of native shrub and herb abundance, distribution, and dispersal. The culmination of site degradation, invasive species introduction, and presence of a vacuum in the resource niche, combined with increasing deer densities during the time this forest was initiating and reorganizing, have all contributed to the presence of invasive, exotic species in C7T2. Japanese stiltgrass and multi-flora rose were observed throughout the tract at various densities. These and other invasive species, such as Autumn olive, bush honeysuckle, Japanese honeysuckle, tree of heaven, and *Paulownia* should be treated as part of a regular invasive species control program. Control options include foliar spraying with herbicide, cut-stump with herbicide, and basal spraying with herbicide. All pesticides used on state forest will be in compliance with certification standards. In addition, emerald ash borer (*Agrilus planipennis)* exists in the region, producing complete mortality in overstory ash. For this reason, it is recommended declining ash trees be included in regularly prescribed timber harvesting so value is not lost to mortality. Conversely, young healthy ash showing no sign of decline should remain for potential resistant features.

Recreation

Likely recreational activity, beyond hunting by adjacent landowners, is limited due to no public access to tract.

Cultural

Cultural resources may be present on this tract but their location(s) are protected. Adverse impacts to significant cultural resources will be avoided during any management or construction activities.

Tract Description and Silvicultural Prescription

Tract Summary Data

Total Trees/Ac. = **116 Trees/Ac.** Overall % Stocking Hardwoods = **79%** (Fully Stocked)
Basal Area = **95.9 Sq. Ft./Ac.** Harvestable Trees = **7 Trees/Ac.**
Present Volume = **8,317 Bd. Ft./Ac.**

Mixed Hardwoods Stratum
Mixed hardwoods tend to be variable in composition and thus may have more complicated prescriptions attached to them. The overstory is dominated by yellow-poplar, with much of the mid-story growth being beech-maple. Some white pine and white oak are present in the overstory. Regeneration consists primarily of beech-maple, with an occasional oak species and yellow-poplar. Pre-harvest invasive species control should be conducted using a situational approach to reduce competition by invasive species against desirable species such as oak and poplar in establishing a new cohort in the regeneration layer. Single tree selection cuttings are prescribed to remove mature to over-mature trees and any cull trees in poor form. There are many yellow-poplar that are currently exceeding maturity that should be the main targets for removal. This improvement cutting will enable release of quality oaks and any oak regeneration occurring in the understory. Oak-hickory is the preferred stratum type and will require removal of crown competition for release of these valued species. The result will yield an increase in timber and wildlife diversity.

Oak-Hickory Stratum
The retention of species in this stratum is important to the Division's long-term timber management objectives. The overstory is dominated primarily by white oak, black oak, northern red oak and pignut hickory, with some of the mid-story growth being beech-maple. There are a few sugar maple and yellow-poplar that make their way into the canopy layer along with an abundant layer of blackgum. Regeneration consists primarily of beech-maple, white ash, and some oaks. Pre-harvest invasive species control should be conducted using situational approach to reduce competition by invasive species against desirable species such as oak and hickory in establishing a new cohort in the regeneration layer. Single tree selection is prescribed to remove mature and over-mature, undesirable trees to release the growing stock of high quality stems, as well as promote regeneration of the oak-hickory stratum. Most of the higher quality seed trees should be left in the stand, but more of the co-dominant trees should be targeted for removal, such as beech-maple. Damaged trees that can be considered as cull trees are suggested for removal in the stand to promote a healthy forest. Most likely, regeneration will be comprised of mixed hardwoods, mainly beech-maple unless TSI is implemented, with a component of oak. Areas with an abundance of advanced oak regeneration should be considered for release through a group selection cut.

Conifer Stratum
The pine plantations were found to be overstocked as well as in decline. Pines were typically planted for erosion control purposes during the first half of the 20th century. As these pines have matured and slowly declined, native hardwoods have become established in canopy gaps and have to an extent reached the overstory where most of the pines are now. The overstory is dominated by mature white pine. Portions of the pine plantation are also mixed with hardwoods where pine mortality has been severe. Understory growth is composed of beech-maple, blackgum and other occasional hardwood species. The main goal is to promote native hardwood regeneration with an oak-hickory component in these areas if possible, and thus, harvesting the pine is prescribed. There is an opportunity to target invasive species and understory beech-maple during post-harvest TSI. Overall, group openings are an option for management in these areas for long-term forest regeneration and sustainability. Areas where pole-sized hardwoods have

emerged and entered the canopy TSI should be prescribed to release desired crop trees not adequately released during the timber harvest.

Species and Volume Table for C7T2.

Species	# Sawtimber Trees	Total Bd.Ft.
White Oak	1,176	293,851
Black Oak	383	93,944
Yellow Poplar	248	81,750
Northern Red Oak	242	72,776
Eastern White Pine	196	64,029
Pignut Hickory	207	29,218
White Ash	222	27,754
Shagbark Hickory	87	16,680
Sugar Maple	155	11,144
American Sycamore	55	10,695
Scarlet Oak	28	8,966
Chestnut Oak	19	6,229
Bitternut Hickory	22	3,894
Black Cherry	8	3,568
Red Pine	23	2,171
Blackgum	20	1,811
American Beech	14	1,496
Per Acre Total	**39**	**9,240**
Tract Total	**3,105**	**729,976**

Proposed Activities Listing

Postharvest TSI should be performed along with invasive species management. A regeneration review should be conducted three years following all treatments. The tract should be inventoried again in 15-20 years. Based on this information, a managed timber harvest removing approximately 100,000-200,000 board feet over the entire tract area is prescribed within the next 5 years.

Proposed Management Activity	***Proposed Period***
Pre-harvest Invasive Control	CY2019-2021
Timber Sale	CY2021-2023
Post-harvest TSI	Following harvest
Regeneration Opening Review	3-5 Years Postharvest
Inventory and Management Guide	CY2034-2039

Pike State Forest Compartment: **10** Tract: **04**
Tract Acreage: 280 Commercial Forest Acreage: 280
Forester: **Evan McDivitt** Date: **12/19/2018**
Management Cycle End Year: 2043 Management Cycle Length: 25 Years

Location

C10T4, also known as 6311004, is located in Pike County, in Sections 1,2,11 & 12, T2S, R7W in Marion Township. It is approximately 3.8 miles southeast of Winslow and 2.4 miles west of Velpen. This tract is in the main block of Pike State Forest and the western edge of this tract is about 0.6 miles east of the Pike State Forest Office.

General Description

C10T4 contains approximately 280 forested acres mostly in the floodplain of the Patoka River. The majority of this tract is in mixed bottomland hardwoods along with some areas in upland mixed hardwoods, pine plantation, and bottomland oak-hickory. See Table 1 for a summary of tree species identified during the inventory.

Mixed Hardwoods (249 acres): Upland Mixed hardwoods are found throughout the tract on the few mesic sites slightly more elevated than the bottomland areas. They consist primarily of yellow poplar, sugar maple, and mixed with some oaks and hickories. Some upland mixed hardwoods are intermingled with pine in portions close to, and often inside, old pine plantations where there has been mortality. Understory includes yellow poplar, beech-maple, black oak and white ash, poison ivy, and stinging nettle. The majority of this acreage, however, consists of bottomland mixed hardwoods. These areas are composed of species such as red maple, silver maple, sweetgum, green ash, American sycamore, American elm, pin oak and other bottomland oaks and hickories. Understory often includes pawpaw, grasses, silverbell, and is sometimes bare in sloughs.

Oak Hickory (25 acres): This type is found primarily on moist bottomland sites in this tract where oak and hickory species dominate. Typical overstory species include pin oak, swamp chestnut oak, shagbark hickory, swamp white oak, Shumard oak, shellbark hickory, bur oak, sweetgum, and other species. Typical understory includes sweetgum, red maple, pawpaw, poison ivy, stinging nettle, ironwood, and American elm mixed with some oak and hickory poles. Some areas contain good oak advance reproduction, others contain good hickory advance reproduction, and sloughs contain virtually no understory where silty-clay soils remain saturated with water for long periods.

Pine Plantation (6 acres): Pine in this tract consists mostly of Virginia pine. Pine is found along the eastern boundary in one area along the upland near the railroad. Overstory consists of yellow poplar, Virginia pine, sweet gum, and black gum. Understory consists primarily of American beech, poison ivy, and sweetgum.

Figure 1. Pike SF Compartment 10, Tract 4.

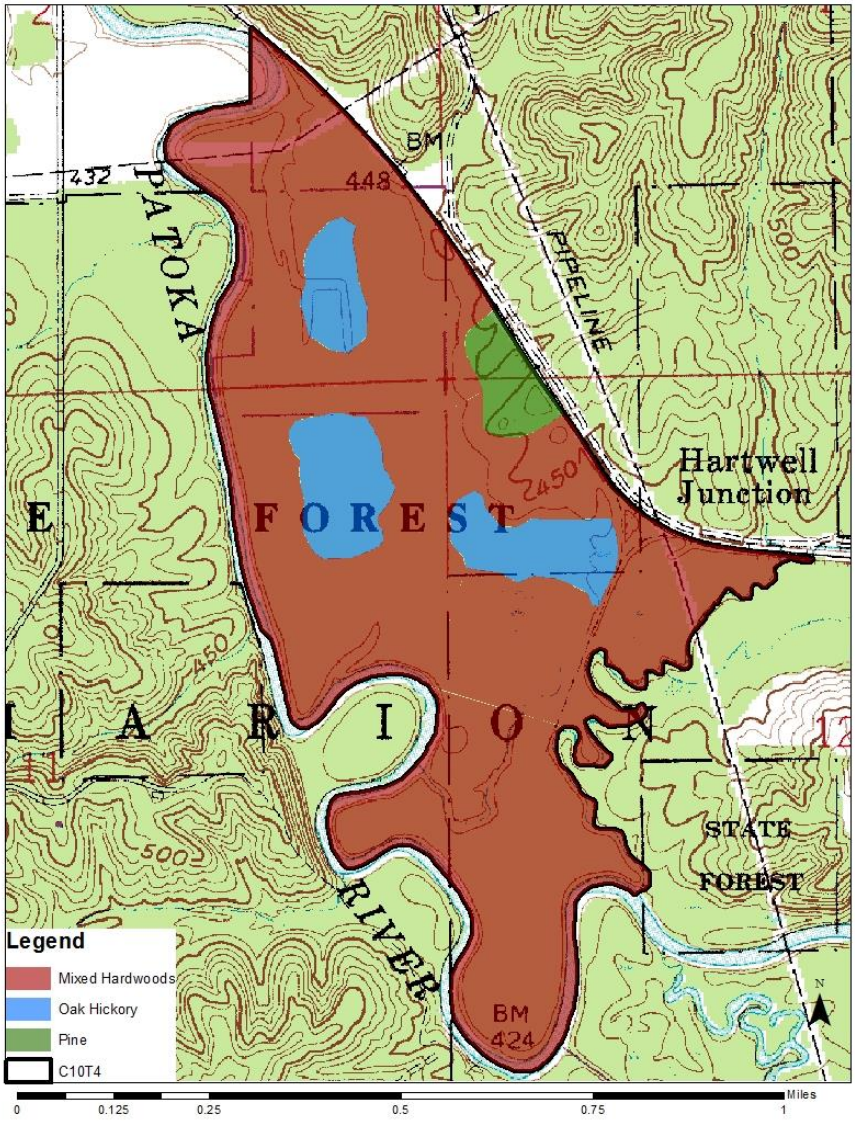


Table 1. Overview of Tree Species in C10T4 (Total # Trees in Tract-Most Abundant to Least).

Overstory Sawtimber Layer	Understory Poletimber Layer	Regeneration Layer
Red Maple	Sweetgum	American Elm
American Sycamore	Red Maple	Ironwood
Sweetgum	American Sycamore	Red Maple
Silver Maple	Silver Maple	Sweetgum
Pin Oak	American Elm	PawPaw
Green Ash	Green Ash	Red Elm
Yellow Poplar	Red Elm	Shagbark Hickory
American Beech	Ironwood	American Beech
Swamp Chestnut Oak	Boxelder	American Sycamore
Sugar Maple	Swamp White Oak	Green Ash
Shagbark Hickory	American Beech	Sugar Maple
Shumard Oak	Sugar Maple	Bitternut Hickory
Virginia Pine	Chinkapin Oak	Swamp Chestnut Oak
Hackberry	Shagbark Hickory	Boxelder
Swamp White Oak	Blackgum	River Birch
Red Elm	Pin Oak	Silver Maple
River Birch	Hackberry	
Black Cherry	Shumard Oak	
American Elm	Swamp Chestnut Oak	
Bitternut Hickory	White Oak	
Blackgum	River Birch	
Shellbark Hickory	Virginia Pine	
White Oak	Yellow Poplar	
Bur Oak	Black Cherry	
Northern Red Oak		
Black Walnut		
Pignut Hickory		
Eastern Cottonwood		
White Ash		

History

C10T4 is made up of the following parcels: approximately 39.3 acres of a 480 acre purchase in 1934 from Robert and Hazel Heuby for $1.00, 10.3 acres of a 270 acre purchase in 1935 from Arizona Corn for $3,672.00, 0.17 acres of a 35 acre purchase in 1938 from Fred McGuire for $67.16, all of a 57.5 acre purchase in 1950 from Ottis Brewster for $754.98, 15.6 acres of an 80 acre purchase in 1966 from Oda F. Dearing for $3,400.00, all of a 1.5 acre purchase in 1967 from Ottis and Mildred Brewster for $500.00, 26.47 acres of a 27 acre purchase in 1999 from James Carrico for $38,000.00, all of a 40 acre purchase in 2000 from Ruth K. Howard Estate, Old National Trust Company, Executor for $44,000.00, 27.6 acres of a 250 acre purchase in 2004 from James C. Ellis, III. and Yondell Bruce Embry, co-trustees of the James C. Ellis Estate Trust for $231,995.00, and 61.56 acres of a 550 acre purchase in 2006 from James C. Ellis, III, Trustee of the James C. Ellis Estate Trust for $545,737.50.

A survey of this tract on Indiana Geological and Water Survey's Indiana Historical Aerial Photo Index shows land cover development in this tract from 1937 to 1978. A 1937 aerial photo shows much of the tract acreage had been cleared and contained mostly pasture, cropland, or herbaceous vegetation with small trees interspersed. Areas can be seen along the Patoka River that look to have been in agricultural use. A 1949 aerial photo shows the conifer plantation visible on the hilly portion of the tract which was still mostly cleared of mature trees. The southeastern portion of the tract contained more shrubby and young forest at this time whereas the central and western portions contain only some patches of forest with mostly cleared agricultural land. By 1954 the entire tract was showing initiated forest stands mixed with aggrading forest in the southeastern portion. It is possible there were some closed-canopy conditions throughout parts of the tract. By 1978, after years of annual diameter and height growth of trees, aerial photos show larger tree crown sizes and denser forest canopy covering the tract (possibly young poletimber in the formerly cleared areas and small to medium sawtimber in the older forest areas. Historic aerial photos document 41 years of forest recovery from highly disturbed, unproductive abandoned agricultural land to closed canopy forest resource.

Resource Management History

According to the 1990 management guide, planting records showed 12 acres of jack, Virginia, and shortleaf pines planted in 1941. The remnant of this plantation is still visible, however the area is reverting to hardwoods due to gradual mortality of pines. Also, this stand contains a large component of invasive honeysuckle.

In 1971, forester Rick Burgeson inventoried the tract, which at that time was 101.5 acres bordered by not-yet-purchased private land. He found a total of 1,847 board feet per acre available for harvest with 5,939 board feet per acre total volume across 27 cruised acres. Pines were noted to be in the post and pole size class. An improvement cut was recommended across the 27 acres cruised. Many areas in this tract were identified as "scrub" land at that time (no doubt the agricultural lands abandoned in the 1940s).

On June 14, 1971 there was a timber sale of 43,160 board feet across 15 acres purchased by Ronald Allen of Winslow, Indiana for $936.00.

In 1990, forester Thomas Dearlove inventoried this tract and estimated 2,421 board feet per acre in harvest stock with 4,895 board feet per acre total volume across 104 acres. Although he said a harvest could be conducted in the pin oak areas, he did not recommend a harvest citing the need to acquire and/or improve access to the tract. He recommended timber in this tract be put on an extended rotation to increase the value of the sale area.

Little resource management history is known on parcels purchased since 1990 except what can be inferred from field inspection and tract file observations. In December 1981, for example, Charlie Keller noted a timber harvest on lands of the James Ellis estate adjacent to C10T4. He noted standing timber had been cut on state land and tree tops left across boundary lines. It was determined boundary lines were not clearly marked in this area, which was listed as a probable reason for the discrepancies.

In 2018, Evan McDivitt inventoried C10T4 and estimated 9,112 board feet per acre total volume across 280 acres.

Landscape Context

C10T4 lies within the Southern Bottomlands Natural Region. The entire tract lies within the Boonville Hills of the Southern Hills and Lowlands physiographic province. Additionally, the entire tract lies within the Green River-Southern Wabash Lowlands part of the Interior River Valleys and Hills ecoregion. This ecoregion is defined as being south of the pre-Wisonsonian till plain and having a long growing season. Also, as observed in Pike State Forest, some southern plants have reached their northernmost distributional limit in this ecoregion. Pre-settlement land cover for this tract has been classified as *Quercus-carya*. Areas within a one mile radius of this tract contain additional portions of Pike State Forest, the Slackwater Bottoms Nature Preserve, as well as parts of Patoka River National Wildlife Refuge, and private land. Additional land uses include deciduous forest with smaller amounts in conifer plantation, herbaceous vegetation, woody wetlands, and developed open space. The abandoned town of Survant, Hartwell Junction, the Pike State Forest firetower, abandoned mine land are all within one mile of this tract. Two natural gas pipelines (operated by Texas Eastern Transmission LP and Midwestern Gas Transmission Co), one ethane and one liquefied petroleum gas pipeline (operated by Enterprise Products Operating LLC) pass through C10T4 and the Norfolk Southern Railway forms the border of this tract with neighboring sections of Pike State Forest.

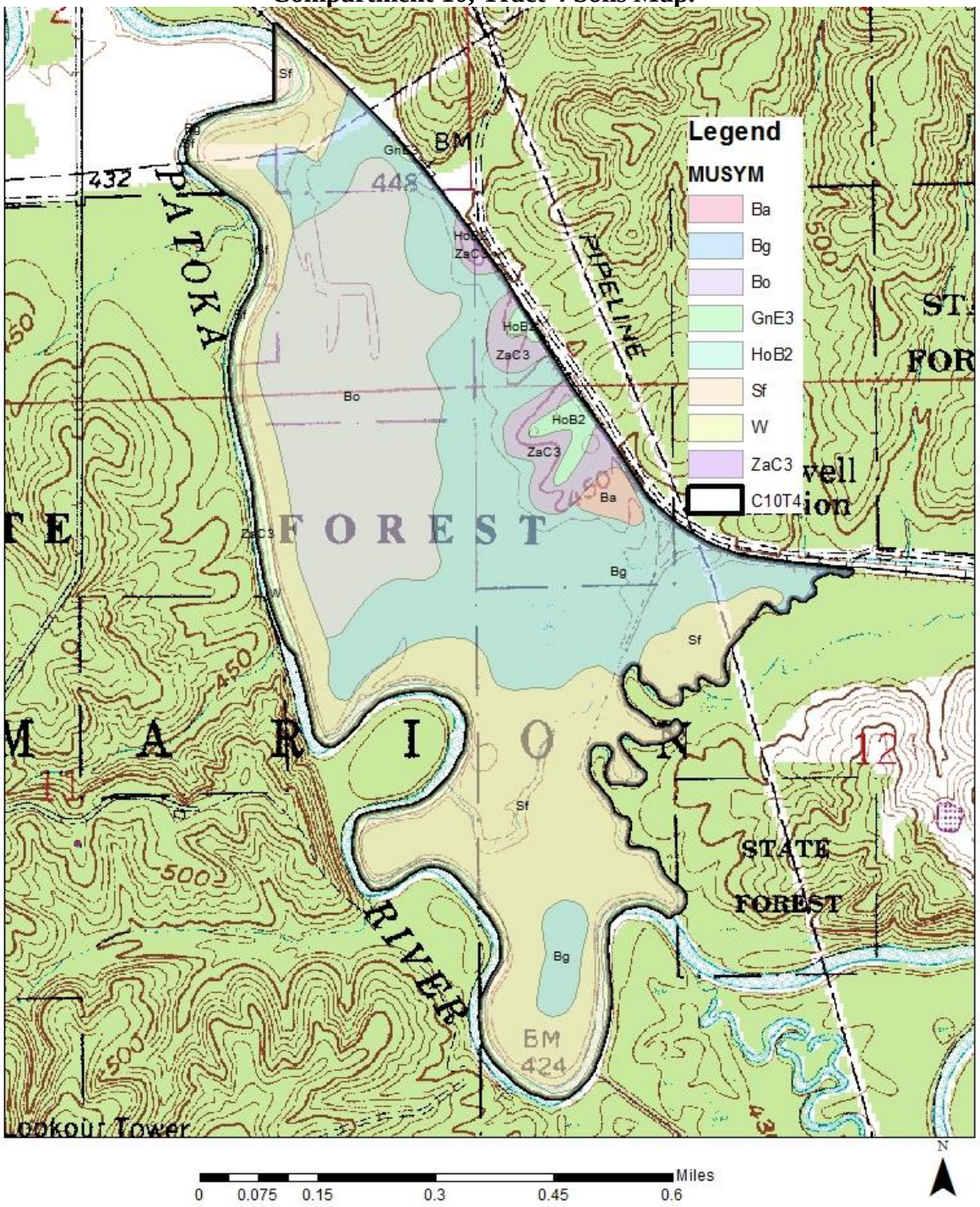
Topography, Geology, and Hydrology

Elevation ranges from approximately 422 feet in the northwest along the Patoka River to 561 feet on the east-central border where the 26 acres of south-southwest facing uplands are found. The remainder of the tract is flat. The southern portion contains sloughs or pools of standing water and there are meandering, deeply cut intermittent and ephemeral streams flowing circuitously through the tract. Water from this tract drains into the Patoka River watershed. The Patoka River is a meandering and underfit river; that is, a relatively small river compared to the large valley in which it flows. This meandering nature of the river, over long periods, has created a diversity of sites where slight differences in elevation, drainage and seasonal inundation correspond to different plant communities being situated on each site. The Patoka River experiences times with highly turbid water flow and other times with relatively clear flowing water. This is most likely due to upstream agricultural land use and erosion taking place. During saturating rain events, surface water runoff feeds sediment-laden water into the Patoka River. However, during other times when primarily ground water is feeding into the river, the water is much clearer. This tract undergoes seasonal flooding. Upland soils in this tract are derived from underlying shale and sandstone bedrock with scattered loess over residuum in parts whereas bottomland soils are formed from silty alluvium.

Soils

Forest communities, when compared across diverse sites, respond differently to varying site conditions. Because site quality controls what can grow and live on a particular forest site, it is important to discuss soil physical and chemical properties as well as water availability in the soils found in this tract. Given the forest in this tract consists mostly of bottomland hardwood species, the period of time a site is subjected to standing water and saturated soil greatly influences how tree species are distributed across this tract. Additionally, the influence of flooding plays a large part in shifting microsites suitable for certain tree species to grow. Flooding can either erode away soil or deposit new soil to the bottomland microsites in this tract, thus shifting over time soil properties enough to modify microsites for new tree species to be competitive.

Compartment 10, Tract 4 Soils Map.



Bartle silt loam (Ba); *(2.5 acres);* Consists of deep, somewhat poorly drained, very slowly permeable soils on low stream terraces. These soils formed in acid, silty alluvium. Slopes range

from 0-2%. This type typically is composed of 12% sand, 72-76% silt, and 12-16% clay, moist bulk density ranges 1.3-1.6 g/cc, saturated hydraulic conductivity ranges 4.23-14.11 micro m/sec, available water capacity ranges 0.18-0.24 in/in, linear extensibility ranges 0-2.9%, and organic matter ranges 0-2% throughout available rooting depth. Soil pH ranges 4.5-7.3. This soil has a perched water table. During the wettest season water table ranges 12-24 inches from surface. It is poorly suited for growing black walnut. Site Index is 80 for sweetgum, 85 for yellow poplar, 85 for pin oak, and 75 for white oak. Other trees to manage here include: bur oak, cherrybark oak, northern red oak, shingle oak, swamp chestnut oak, and swamp white oak. Bartle is moderately suited for log yard/haul road construction, well suited for mechanical and hand planting, moderately suited for harvest equipment operability, and is well suited for mechanical site preparation. Potential erosion hazard is slight and soil rutting hazard is severe for this soil type.

Belknap silt loam, frequently flooded (Bg); *(88.7 acres);* Consists of very deep, somewhat poorly drained soils formed in acid, silty alluvium in swells on flood plains. It is frequently flooded. Duration of flood can be brief to long. Depth to top of a seasonally high water table ranges 12-36 inches. This soil typically is composed of 5% sand, 79% silt, and 16% clay, moist bulk density ranges 1.4-1.55 g/cc, saturated hydraulic conductivity ranges1.41-14.11 micro m/sec, available water capacity ranges 0.2-0.24 in/in, linear extensibility ranges 0.4-2.2%, and organic matter ranges 0-3% throughout available rooting depth. Soil pH ranges 4.5-7.3. It is somewhat suited for growing black walnut. Site index is 90 for yellow poplar, 100 for eastern cottonwood, and 90 for pin oak. Other species to manage here include: sweetgum, red maple, and American sycamore. Belknap is poorly suited for log yard/haul road construction, well suited for mechanical and hand planting, moderately suited for harvest equipment operability, and is well suited for mechanical site preparation. Potential erosion hazard is slight and soil rutting hazard is severe for this soil type.

Bonnie silt loam, frequently flooded (Bo); *(63.7 acres);* Consists of deep, poorly drained, moderately slowly permeable soils on bottom land. These soils formed in silty alluvial sediments. Slopes range from 0-2%. It is frequently flooded. Duration of flood can be brief to long. Depth to top of a seasonally high water table ranges 6-12 inches. This soil typically is composed of 8% sand, 69-72% silt, and 20-23% clay, moist bulk density ranges 1.32-1.45 g/cc, saturated hydraulic conductivity ranges 1.41-14.11 micro m/sec, available water capacity ranges 0.21-0.25 in/in, linear extensibility ranges 1-2.7%, and organic matter ranges 0-3% throughout available rooting depth. Soil pH ranges 4.5-7.3. It is unsuitable for growing black walnut. Site index is 90 for pin oak and 100 for eastern cottonwood. Other species to manage here include: sweet gum, cherrybark oak, and American sycamore. Bonnie is poorly suited for log yard/haul road construction, well suited for mechanical and hand planting, moderately suited for harvest equipment operability, and is well suited for mechanical site preparation. Potential erosion hazard is slight and soil rutting hazard is severe for this soil type.

Gilpin Silt Loam, 15 to 25 % slopes severely eroded (GnE3); *(0.2 acres).* Consists of moderately deep, well drained, moderately permeable soils in uplands. These soils formed in material weathered from sandstone, siltstone, and shale. Slopes range 15-25%. Soil pH ranges from 3.6 to 5.5. Bedrock depth begins at 20-40 inches. This soil typically is composed of 11-35% sand, 44-68% silt, and 21% clay, moist bulk density ranges 1.2-1.5 g/cc, saturated hydraulic

conductivity ranges 4.23-14.11 micro m/sec, available water capacity ranges 0.08-0.24 in/in, linear extensibility ranges 0-5.9%, and organic matter ranges 0.3-4% throughout available rooting depth. It is somewhat suited for growing black walnut. Site index is 95 for yellow poplar and 80 for northern red oak. Other species to manage here include: black oak, scarlet oak, shingle oak, southern red oak, and white oak. Gilpin is poorly suited for log yard/haul road construction, well suited for hand planting but poorly suited for mechanical planting, moderately suited for harvest equipment operability, and is poorly suited for mechanical site preparation. Potential erosion hazard is moderate for off-road/off-trail considerations but severe for on-road/on-trail considerations, and soil rutting hazard is severe for this soil type.

Hosmer silt loam, 2 to 6 % slopes eroded (HoB2); *(3.2 acres)*; Consists of deep, well drained soils on uplands having been formed in loess more than 5 feet thick. Slopes range 2-6%. This soil has a fragipan, which restricts water flow and root penetration at 16-27 inches from surface. This soil has a perched water table. During the wettest season water table ranges 30-36 inches from surface. This soil typically is composed of 4-7% sand, 69-81% silt, and 15-24% clay, moist bulk density ranges 1.35-1.65 g/cc, saturated hydraulic conductivity ranges 4.23-14.11 micro m/sec, available water capacity ranges 0.15-0.23 in/in, linear extensibility ranges 0.9-3%, and organic matter ranges 0-2% throughout available rooting depth. Soil pH ranges 4.5-6.5. This soil is poorly suited for growing black walnut. Site index is 75 for white oak, 90 for yellow poplar, and 75 for sugar maple. Hosmer is moderately suited for log yard/haul road construction, well suited for mechanical and hand planting, moderately suited for harvest equipment operability, and is well suited for mechanical site preparation. Potential erosion hazard is slight for off-road/off-trail considerations but moderate for on-road/on-trail considerations, and soil rutting hazard is severe for this soil type.

Steff silt loam, frequently flooded (Sf); *(97.4 acres)*; Consists of deep, moderately well drained, moderately permeable soils on flood plains. These soils formed in acid, silty alluvium. Slopes range 0-2%. These soils exist on swells adjacent to stream channels and are flooded for brief periods in winter and spring. Steff soils have a seasonal high water table at 18-36 inches during winter and spring. This soil typically is composed of 13-16% sand, 65-72% silt, and 15-19% clay, moist bulk density ranges 1.35-1.49 g/cc, saturated hydraulic conductivity ranges 4.23-14.11 micro m/sec, available water capacity ranges 0.21-0.25 in/in, linear extensibility ranges 0.4-2.5%, and organic matter ranges 0.1-3% throughout available rooting depth. Soil pH ranges 4.5-7.3. This soil is moderately suited for growing black walnut. Site index is 80 for northern red oak, 82 for American sycamore, 100 for sweetgum, 120 for eastern cottonwood, and 102 for yellow poplar. Other species to manage here include: bitternut hickory, shagbark hickory, bur oak, and red maple. Steff is poorly suited for log yard/haul road construction, well suited for mechanical and hand planting, moderately suited for harvest equipment operability, and is well suited for mechanical site preparation. Potential erosion hazard is slight and soil rutting hazard is severe for this soil type.

Water (W); *(13.4 acres)*

Apalona-Zanesville silt loam, 6 to 12 % slopes severely eroded (ZaC3); *(10.9 acres);* Consists of deep, moderately well-drained soils on ridges and side slopes in uplands. Slope ranges 6-12%. Permeability is moderate above fragipan and slow in the fragipan. The slowly permeable

fragipan at a depth of about 2 feet restricts root penetration and downward movement of water. This soil has a perched water table. During the wettest season water table ranges 24-36 inches from surface. This soil typically is composed of 4-5% sand, 72-77% silt, and 18-24% clay, moist bulk density ranges 1.2-1.65 g/cc, saturated hydraulic conductivity ranges 4.23-14.11 micro m/sec, available water capacity ranges 0.15-0.21 in/in, linear extensibility ranges 1.1-3%, and organic matter ranges 0-3% throughout available rooting depth. Soil pH ranges 4.5-5.5. This soil is poorly suited for growing black walnut. Site index is 60 for northern red oak, 70 for white oak, 77 for black oak, 77 for southern red oak, 76 for chestnut oak, and 88 for yellow poplar. Other species to manage here include: mockernut hickory, pignut hickory, shagbark hickory, and sugar maple. Apalona-Zanesville is moderately suited for log yard/haul road construction, well suited for hand planting but moderately suited for mechanical planting, moderately suited for harvest equipment operability, and is well suited for mechanical site preparation. Potential erosion hazard is slight for off-road/off-trail considerations but severe for on-road/on-trail considerations, and soil rutting hazard is severe for this soil type.

Access

Access to this tract can be gained by foot or by boating down the Patoka River. Firelanes 16 and 17 can be used to get access as far as the north side of the railroad track. On the north side of the track there is an abandoned county road (county road 425 S) which could be improved. This vehicle route would entail crossing the railroad grade and track. Another possible route for heavy equipment access could be across private property and Pike State Forest Compartment 10, Tract 6 (C10T6) to the east, if landowners would allow this access. The shortest route across private property would be approximately 2 miles along a private road travelling west from State Road 257. This access route was mentioned in the 1980 management guide for C10T6 as being part of a coal mine access road which could be driven to access state forest. Following permissions, significant improvements would need to be made to allow vehicle access into this tract. Other options for accessing this tract with machinery include acquiring a portable, pre-fabricated truss bridge (*Bailey bridge* or similar) to cross the Patoka River from adjacent Pike State Forest C11T1, C12T2, C12T3, C12T4, or possibly C12T7. There is an abandoned railroad bed (owned by Southern Railway Company), elevated above the lowlands in many places, that travels from Hartwell Junction south through the middle of the southernmost oxbow in C10T4. Old pilings can still be seen from the bridge crossing the Patoka River from this point into what is now C12T7. If this railroad bed could be transferred to the state, and improved, options for equipment and recreational access to the interior of this tract could be enhanced.

Boundary

The northeastern boundary of the tract is bordered by the Norfolk & Southern railway, which runs from the northernmost point to the easternmost point of the tract. From the easternmost point, the eastern tract boundary follows an unnamed intermittent stream along its course into the Patoka River. The Patoka River makes up the southern and western boundary.

Wildlife

A Natural Heritage Database Review was completed for C10T4 as part of the management guide process. If rare, threatened or endangered species were identified for this area, activities prescribed will be conducted in a manner that will not threaten viability of those species.

Oak hickory stands will be managed for an outcome which should result in presence of many high-quality oak and hickory trees in dominant canopy positions. These current and future dominants will continue to intercept sunlight and utilize peak photosynthesis to direct energy into production of mast for a greater number of wildlife dependent on oak-hickory woodlands. In general over 50 vertebrate species including many important game and non-game animals consume acorns.

Water for wildlife includes standing water as well as the intermittent and ephemeral streams which probably have high-flow periods throughout the year and retain small drinking pools during regular dry periods. Additionally, the Patoka River is an aquatic ecosystem bordering this tract. River otters have been observed in the river as well as freshwater fish, turtles, and snakes. The river is a popular fishing spot for anglers. Also, regular flooding spills water from the river channel into the bottomland parts of this tract which, in places, contain many crawdad mounds. Mud lines observed on bottomland tree boles close to the river, an indicator of water height during flood events, range from 3 to 5 feet above ground. It is not uncommon, during flooding, to have catfish swimming through the woods.

Den trees are those containing large cavities, portions of hollow stems and large branches, or other deformities providing a place for wildlife to retreat. Many of the dominant tree species discussed provide excellent den sites for squirrels, chipmunks, owls and other bird species, various kinds of snakes and lizards, Virginia opossum and raccoon. Snags and downed logs in this tract are an important habitat for many species of invertebrates and vertebrates. Additionally, trees and root wads often fall into the Patoka River providing extra habitat structure and allochthonous inputs to this aquatic ecosystem.

Wood ducks and other waterfowl were observed utilizing pools in this tract during the 2018 inventory.

White tailed deer is an important species to this area. From 1934 to present, populations have increased in southern Indiana. Deer densities are much higher now than when present forest in C10T4 was initiated. Since deer prefer woody browse such as tree seedlings, native shrubs and also herbaceous plants, it is reasonable to expect this vegetation to have additional pressure by deer on patterns of regeneration, dispersal, abundance, and distribution across the landscape.

Bottomland areas provide a lush understory vegetation in the spring used by many young animals for protective cover.

Due to the close proximity of INDNR Fish and Wildlife Sugar Ridge and Patoka River National Wildlife Refuge properties, Pike State Forest is well situated to benefit from intellectual capital

of neighboring wildlife management agencies and to possibly pursue wildlife habitat projects at Pike State Forest utilizing these wildlife management agencies as resources and collaborators.

The Division of Forestry has instituted procedures for conducting forest resource inventories so documentation and analysis of live tree and snag tree densities is examined on a compartment-level basis in order to maintain long-term and quality forest habitats. Legacy trees and snags for all size classes meet maintenance level for Indiana bat habitat. All snags were selected to be retained during the inventory. Management practices conducted in C10T4 will be implemented in a manner maintaining long-term quality forest habitats for wildlife populations while promoting legacy tree development.

Live Legacy Trees and Snags for C10T4

	Maintenance Level	**Optimal Level**	**Inventory**	**Available Above Maintenance**
Legacy Trees*				
11"+ DBH	2520		4919	2399
20"+ DBH	840		887	47
Snags (all species)				
5"+ DBH	1120	1960	2495	1375
9"+ DBH	840	1680	1280	440
19"+ DBH	140	280	187	47

*** Species Include:** AME, BIH, BLL, COT, GRA, REO, POO, REE, SHH, ZSH, SIM, SUM, WHA, WHO

Ecological Considerations

This tract contains mesic upland and wet-mesic floodplain forest communities. Typically, the upland sites contain forest types dominated by mixed hardwoods. Mesic upland portions of this tract typically contain forest types dominated by mixed hardwoods such as yellow poplar, sugar maple and American beech with minor components of oak, hickory, elm, ash, and gum. Understory tree and shrub species include paw-paw, dogwood, ironwood, spicebush and some mapleleaf viburnum. Wet-mesic floodplain sites include bottomland species such as pin oak, sweetgum, red and silver maple, river birch, and black walnut along with other bottomland oaks such as Shumard, swamp white, swamp chestnut, bur oak and sometimes cherrybark oak. Understory is usually composed of herbaceous plant species including stinging nettle and

grasses, woody vines such as poison ivy, crossvine, trumpet creeper, and understory shrubs such as spicebush and pawapaw. One remnant pine plantation is a non-native plant community found in this tract, which, intensively cultivated in the past for purposes of soil and site stabilization, these pines served an important role in preserving integrity of surrounding native forest communities and in preventing further degradation to the landscape. Senescing pine communities have an understory component of mixed hardwoods and oak, oftentimes well-stocked with advanced seedlings of oak, hickory, ash, poplar, maple, and beech, positioned to become the new overstory cohort as pines, which rarely replace themselves on this type of site, are removed from the community through mortality or timber harvest.

Exotic Species

Invasive and exotic species are widespread throughout southern Indiana on private and public land. Each species has a history of introduction, successful colonization of sites and dispersal. These species are very successful in out-competing native plants on a variety of forest sites. Japanese stiltgrass, Japanese honeysuckle, shrub honeysuckle, and multi-flora rose were observed throughout the tract at various densities. These and other invasive species, such as Autumn olive, tree of heaven, mimosa, and *Paulownia* should be treated as part of a regular invasive species control program.

Other management activities recommended include planting native shrub species to facilitate restoration and more efficient resource utilization by native species. This could accomplish parallel wildlife objectives by enhancing understory habitat structure. See Table 2 for a list of shrubs and vines native to Pike County.

Table 2. Pike County Native Shrubs and Vines:

Form	Common Name	Latin Name	Habitat
Shrub	American mistletoe	*Phoradendron tomentosum*	*Arboreal*
Shrub	Buttonbush	*Cephalanthus occidentalis*	*Wet*
Shrub	Rough leaf dogwood	*Cornus drummondii*	*Wet to Moist*
Shrub	Eastern burning bush	*Euonymous atropurpureus*	*Moist to Upland*
Shrub	Shrubby St. John's wort	*Hypericum prolificum*	*Wet to Moist to Dry*
Shrub	Coralberry	*Symphoricarpos orbiculatus*	*Wet to Moist to Dry*
Shrub	American elder	*Sambucus Canadensis*	*Moist*
Shrub	New Jersey tea	*Ceanothus americanus*	*Dry*
Shrub	American hazel	*Corylus Americana*	*Wet to Moist to Dry*
Shrub	Possumhaw	*Ilex decidua*	*Wet*
Shrub	Virginia sweet-spire	*Itea virginica*	*Wet (tolerates upland)*
Shrub	Spicebush	*Lindera benzoin*	*Wet to Moist*
Shrub	Prairie willow	*Salix humilis*	*Dry*
Shrub	Dwarf sumac	*Rhus copallinum*	*Wet to Moist to Dry*
Shrub	Smooth sumac	*Rhus glabra*	*Wet to Moist to Dry*
Shrub	Pasture rose	*Rosa Carolina*	*Wet to Moist to Dry*
Shrub	Swamp rose	*Rosa palustris*	*Wet to Moist*
Vine	Trumpet creeper	*Campsis radicans*	*Wet to Moist*
Vine	American bittersweet	*Celastrus scandens*	*Wet to Moist to Dry*
Vine	Catbrier	*Smilax glauca*	*Dry to slightly wet*
Vine	Summer grape	*Vitis aestivalis*	*Dry*
Vine	Graybark grape	*Vitis cinerea*	*Moist*
Vine	Virginia creeper	*Parthenocissus quinquefolia*	*Wet to Moist to Dry*
Vine	Poison ivy	*Toxicodendron radicans*	*Wet to Moist to Dry*

Vine	Kentucky wisteria	*Wisteria frutescens*	*Wet to Moist*
Vine	Raccoon grape	*Ampelopsis cordata*	*Wet to Moist*

In addition, emerald ash borer (*Agrilus planipennis)* exists in the region, producing complete mortality in overstory ash. For this reason, it is recommended declining ash trees be included in regularly prescribed timber harvesting so value is not lost to mortality. Conversely, young healthy ash showing no sign of decline should remain for potential resistant features. The inventory estimate for C10T4 includes approximately 74,000 board feet of white and green ash.

Recreation

Likely recreational activities include kayaking the Patoka River, hunting, bird & other wildlife viewing, and mushroom hunting. There are no recreational trails in this tract.

Cultural

Cultural resources may be present on this tract but their location(s) are protected. Adverse impacts to significant cultural resources will be avoided during any management or construction activities.

Tract Description and Silvicultural Prescription

The current forest inventory was completed by Evan McDivitt. A tract summary is provided in this guide.

Tract Summary Data

Total Trees/Ac. = **172 Trees/Ac.** Overall % Stocking = 109**%** (Over Stocked)
Basal Area = **130.6 Sq. Ft./Ac.** Harvestable Trees = **47 Trees/Ac.**
Present Volume = **9,112 Bd. Ft./Ac.**

Mixed Hardwoods

Total Trees/Ac. = 170 Trees/Ac. Overall % Stocking = 108% (Over Stocked)
Basal Area = 129.1 Sq. Ft./Ac. Harvestable Trees = 49 Trees/Ac.
Present Volume = 8,191 Bd. Ft./Ac.

Pre-harvest invasive species TSI should be conducted to reduce competition by invasive species against desirable species such as bottomland oaks and hickories in establishing a new cohort in the regeneration layer.

In the 26 acre upland portion, single tree selection could remove mature to over-mature trees and any cull trees in poor form as well as trees having defects, broken tops, leaning trees and other low-vigor, stressed trees. There are some yellow-poplar that are currently exceeding maturity. These improvement cuttings may enable release of quality oaks and any oak regeneration occurring in the understory. Oak-hickory is the preferred stratum type and will require removal of crown competition for release of these valued species. The result may yield an increase in

timber and wildlife diversity. Group openings should be considered in areas with poor stocking or those with a high concentration of trees having poor form, low quality, or of undesirable species.

Single tree selection cuttings are prescribed in bottomland areas containing many pin, Shumard, Swamp Chestnut, Swamp White, and hickories to release these trees when appropriate and to remove mature to over-mature trees and any trees in poor health or having poor form. These improvement cuttings may enable release of bottomland oaks and encourage desirable bottomland species regeneration occurring in the understory. The result may yield an increase in timber and wildlife diversity. Group openings should be considered in areas with poor stocking and those having a high concentration of trees with poor form, low quality, or of undesirable species.

Oak Hickory

Total Trees/Ac. = 189 Trees/Ac. Overall % Stocking = 110% (Over Stocked)
Basal Area = 148.4 Sq. Ft./Ac. Harvestable Trees = 28 Trees/Ac.
Present Volume = 14,801 Bd. Ft./Ac.

The oak-hickory timber type tends to provide a very significant contribution to wildlife, timber resource, and value. The retention of species in this stratum is important to the Division's long-term timber management objectives.

Pre-harvest invasive species TSI should be conducted to reduce competition by invasive species against desirable species such as oak and hickory in establishing a new cohort in the regeneration layer.

Single tree selection cuttings are prescribed in bottomland areas containing many pin, Shumard, Swamp Chestnut, Swamp White, and hickories to release these trees when appropriate and to remove mature to over-mature trees and any trees in poor health or having poor form. These improvement cuttings may enable release of bottomland oaks and encourage desirable bottomland species regeneration occurring in the understory. The result may yield an increase in timber and wildlife diversity. Group openings should be considered in areas with poor stocking and those having a high concentration of trees with poor form, low quality, or of undesirable species. Post-harvest TSI would benefit developing crop trees by releasing them from competing vegetation.

Pine Plantation

Total Trees/Ac. = 147 Trees/Ac. Overall % Stocking = 95% (Fully Stocked)
Basal Area = 113.7 Sq. Ft./Ac. Harvestable Trees = 84 Trees/Ac.
Present Volume = **9,634 Bd. Ft./Ac.**

The pine plantation in C10T4 has reached maturity and the site never experienced good pine growth. This site, however, has recovered from the extreme erosion and degradation brought by agricultural abandonment in the early 1900s. There are many pine stems in these plantations yet

they are at risk of wind throw and decline. Understory in pine plantations often contains oak advance reproduction ready for release. In other portions understory is mixed hardwoods. Current ecologic conditions will encourage decline of the pine canopy and slow ingrowth of low quality, poorly formed mixed hardwoods suffering from years of suppression, defunct apical dominance, and poor growth. Conversion of pine acreage to native central hardwoods is therefore recommended. Post-harvest TSI is recommended to complete openings and to encourage desirable central hardwood species to establish on these sites. Wherever possible, oak regeneration should be promoted using appropriate methods including prescribed burning to control competing vegetation and allow oaks to close the canopy and grow above competition.

Proposed Activities Listing

Pre-harvest invasive species and vine control is recommended prior to timber harvest operations. Although a timber sale in C10T4 is needed, it is not recommended until tract access can be secured and improved. It is recommended to pursue all access options in order to obtain a permanent, viable route into and out of the tract allowing vehicles and harvest equipment to gain entrance to this area. This should be accomplished within the next 1-5 years. Upon securing access, a timber sale should proceed promptly to salvage the ash timber and implement single tree and group selection as well as clearcuts where appropriate. Post-harvest planting is an option to control desirable species composition in areas where regeneration has been initiated. Postharvest TSI should be performed along with invasive species follow-up, especially in large gap openings. A regeneration review should be conducted three years after conducting all treatments. The tract should be inventoried again and a new management guide written in 20 years.

Based on this information, a managed timber harvest, utilizing appropriate Best Management Practices for water quality, removing between 950,000 to 1,000,000 board feet over the entire 280 acres is recommended. Table 3 below provides volume estimates associated with each tree species. During the recommended timber harvest appropriate implementation of forestry best management practices will be used to protect sediment from entering the watershed. Effective installation of BMPs includes practices such as leaving an adequate buffer zone along watercourses.

Table 3. Species and Volume Estimates for C10T4 in 2018.

Species	# Sawtimber Trees	Total Bd.Ft.
Pin Oak	1,320	523,384
Red Maple	2,530	415,362
American Sycamore	1,781	374,385
Sweetgum	1,639	275,534
Silver Maple	1,241	265,773
Yellow Poplar	542	151,664
Swamp Chestnut Oak	318	120,222
Shumard Oak	171	76,296
Green Ash	761	71,674
American Beech	309	63,060
Shagbark Hickory	200	35,206
Sugar Maple	214	31,507
American Elm	237	21,104
Virginia Pine	130	20,822
White Oak	25	14,646
Swamp White Oak	95	12,708
River Birch	177	8,497
Blackgum	53	7,672
Red Elm	80	7,628
Black Cherry	65	7,589
Black Walnut	19	6,923
Eastern Cottonwood	15	6,422
Shellbark Hickory	26	6,231
Pignut Hickory	19	5,882
Northern Red Oak	23	5,554
Bur Oak	23	4,644
Hackberry	97	4,546
White Ash	14	2,770
Boxelder	55	1,767
Bitternut Hickory	55	1,767
Per Acre Total	**44**	**9,112**
Tract Total	**12,234**	**2,551,239**

Proposed Management Activity	***Proposed Period***
Pre-harvest TSI (invasive species and vines)	2018-2023
DHPA clearance for road / timber sale	2018-2023
Secure & improve vehicle access	2018-2023
Timber sale	2019-2024
Post-harvest TSI	Following harvest
Hardwood plantation establishment	Following harvest
Plantation survival check	1-5 Years post-harvest
Regeneration opening review	3-5 Years post-harvest
Inventory and management guide	2038-2043

Pike State Forest Compartment: **11** Tract: **1**
Tract Acreage: **91** Commercial Forest Acreage: **91**
Forester: **Evan McDivitt** Date: **11/15/2018**
Management Cycle End Year: **2038** Manage Cycle Length: **20 Years**

Location

C11T1, also identified as 6311101, is located in Pike County, the northern half being in Section 2, T2S, R7W in Marion Township; the southern half being in Section 11, T2S, R7W in Marion Township. It is approximately 3.5 miles southeast of Winslow and 2.8 miles west of Velpen.

General Description

This is a tract of dramatic vegetation changes following moisture gradients and abrupt soil-type transitions. C11T1 contains approximately 91 forested acres. The majority of this tract is in mixed hardwood stands with bottomland hardwoods, oak hickory, and pine stands throughout the tract. The Pike State Forest River Trail loops through this tract running parallel the Patoka River for part of its stretch.

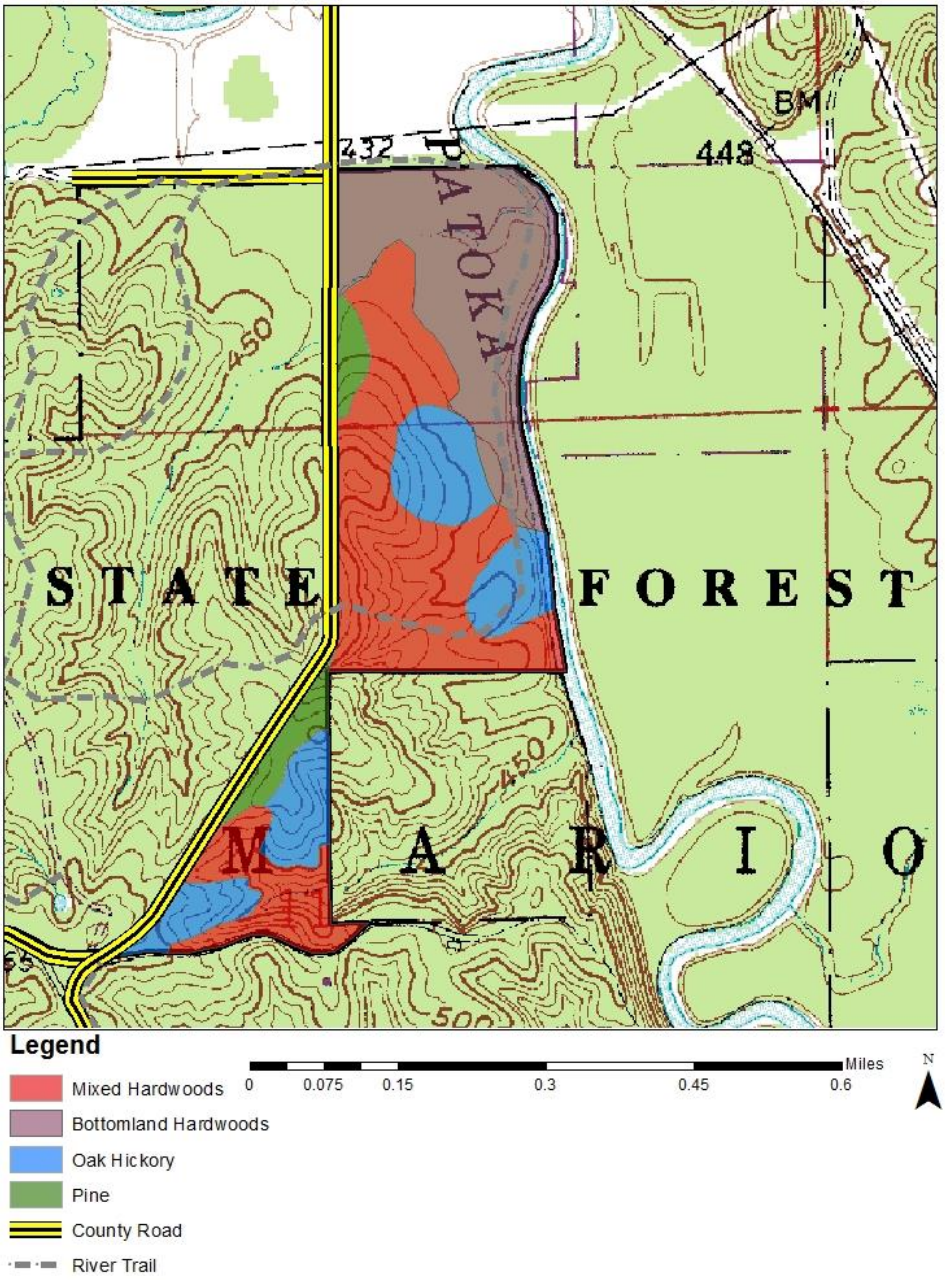
Mixed Hardwoods (35 acres): Mixed hardwoods are found throughout the tract on mesic sites that are slightly more elevated than the bottomland areas, along drainages and often on north and east facing slopes. They consist primarily of yellow poplar, sugar maple, and mixed with some oaks and hickories. Some mixed hardwoods are intermingled with pine in portions close to, and often inside, old pine plantations where there has been mortality. Understory includes yellow poplar, beech-maple, black oak and white ash.

Bottomland Hardwoods (28 acres)*:* Bottomland hardwoods are found in the north and eastern portion of the tract on floodplain sites, generally below 430 feet elevation, along the Patoka River. They consist primarily of pin oak, sweetgum, red and silver maple, along with smaller amounts of American sycamore, yellow poplar and other bottomland oaks. This area contains a diversity of herbaceous plants, woody shrubs and lianas. One woody vine species observed in this forest type is crossvine, more typically found in southern bottomland forests. Understory includes red maple, sweetgum, American sycamore, American elm, and pin oak.

Oak Hickory (21 acres): This type is found primarily on dry sites on upland areas and steep slopes in the southern and central portion of the tract. Primary species dominating the overstory are northern red oak and pignut hickory with smaller amounts of yellow poplar, black oak, and bitternut hickory. Understory consists of American beech, pignut hickory, ironwood, sweetgum, and red maple.

Pine Plantation (7 acres): Pine in this tract consists mostly of eastern white pine. Pine is found along the western boundary, mostly along the county road, in two areas; one on the northwestern and one along the southwestern border. Hardwood species, such as yellow poplar, sweetgum, Shumard oak, and black oak have also reached the overstory in places. Regeneration developing underneath pines is mostly sweetgum, dogwood, redbud, with smaller amounts of blackgum, cherry, and beech.

Pike SF Cover Type Map Compartment 11, Tract 1.



History

This tract was originally Compartment 3, Tract 1. The tract file indicates this land was purchased from Mahlon and Melinda Brown in 1935. About 30 acres were old, eroded fields or pasture which were no longer productive.

A survey of this tract on Indiana Geological and Water Survey's Indiana Historical Aerial Photo Index shows land cover development in this tract from 1937 to 1978. 1937 aerial photos show much of this tract acreage had been cleared and contained mostly pasture, cropland, or herbaceous vegetation with small trees interspersed. Large ravines in the tract show a canopy of larger sized trees. The Patoka River also appears to have a narrow strip of trees growing along its banks. A 1949 aerial photo shows conifer plantations visible along the county road in western portions of this tract. A 1954 aerial photo shows the entire tract having tree canopy and possibly closed-canopy condition throughout much of the acreage as hardwoods recolonized the site and experienced years of height and diameter growth. By 1978 aerial photos show larger tree crown size and denser forest canopy covering the tract. Historic aerial photos document 41 years of forest recovery from highly disturbed, unproductive abandoned agricultural land to closed canopy forest resource.

Resource Management History

White and red pine were planted on upland ridges to prevent further erosion and rebuild soil. In 1936 there was an oak plantation established in the center of the tract. Parts of this plantation still exist today containing atypical oak species for Pike State Forest, such as a 12 inch and 22 inch dbh chestnut oak. Red oak was the main species planted however.

The tract was inventoried by forester Rick Burgeson in March 1971 who recommended an improvement cut in hardwoods ten years later. He noted that, "should a market for poles, posts, or pulp be found, the pine stands should be thinned."

In March 1981 records show a total of 8 white pine logs from this tract sold to Mark Bailey, totaling approximately 597 board feet.

In August 1988 a timber sale was conducted over 1.8 acres in the southwestern portion in order to establish an oak plantation facilitating conversion to hardwoods. 51,200 board feet of white pine were sold to Brett Nalley for $66.66 per MBF.

With the purpose of determining if oak will survive when planted after harvest of white pine and to compare survival and growth of oak when planted after various site preparation treatments, the 1.8 acre area was planted with red and white oak at 8 foot x 8 foot spacing by Charlie Keller, Ben Hubbard, Thom Kinney, Tomas Dearlove, Janet Eger, Alan Faith, and Brian Abrell in April 1989. In June 1991 an inspection found initial competition from annual and perennial weeds as well as natural regeneration consisting of yellow poplar, white pine, sassafras, and white ash. An October 1992 inspection found planted oaks surviving but growing slowly compared to natural regeneration, which was already at heights 3 – 12 feet tall. A September 1995 inspection by John Zvirblis reports an overall oak survival rate of 49%. At this time yellow poplar ranged 12-15 feet tall, 0.5-1.5 inch dbh; sassafras ranged 10-12 feet tall, 0.5-1 inch dbh. Most oaks had been overtopped but some places oaks averaged 4.5 feet tall with some being 8-10 feet tall at this time. Many oaks had resprout and were around 2 feet tall or less. At this time Charlie Keller recommended crop tree release for all white and red oaks, even resprouts with a control area where no crop tree release would be performed. Also Charlie recommended a fire in plots to kill competing vegetation and release oaks, but noted it may be impractical. Steve Brandsasse

favored doing no crop tree release concluding the 1.8 acre site was obviously a good yellow poplar site and so yellow poplar should be grown there. He recommending thinning yellow poplar when 12-15 years old and 25 feet tall, thus allowing best genetic trees to dominate and be selected as crop trees. In September 1998 TSI was performed in the plantation by forester Doug Brown and Nate Orsburn to release oaks and other desirable species as well as thin poplar. Doug Brown noted at this time there was "very little oak left to release. Effort was on removing undesirable species (black locust and elm) and thinning yellow poplar."

The entire tract was inventoried in 1990 by forester Thomas Dearlove who estimated 1,837.6 bd.ft. per acre in harvest stock and 5,226.7 bd.ft. per acre total volume on 76 acres. He recommended a white pine harvest of 88,288 bd.ft. "within small openings totaling 4 acres." He also noted the Virginia pine plantation had begun to experience blowdowns and was generally in decline and conversion to hardwoods. He recommended a 200 foot visual enhancement area along the county road for the harvest. A re-inventory was recommended in 2005.

In 1994 the Division of Forestry granted Phil Etienne's Timber Harvest permission to use a log yard and skid trail inside this tract in order to access a timber sale on the Hartke inholding on the southern border of this tract. The log yard and skid trail were along Firelane #13, which has since been abandoned.

On May 31, 1996 a tornado crossed the county road from west to east into this tract, blowing down approximately 3 acres of white and red pine plantation. On August 20, 1996 approximately 85,609 bd.ft. and 23 cords of mostly white pine was sold to Virgil Werner Sawmill for $70.21 per MBF. Sale area was 3.3 acres including 2.8 acres in C11T1 with remaining area in adjacent C11T3. Timber harvest was conducted in the fall of 1997 using a feller buncher. Very good residual stand surrounding the openings was reported as well as proper skid trail and log yard close-out. Post-harvest TSI was performed by Pike State Forest labor crew in February 1998.

In 2017 this tract was inventoried by Evan McDivitt who estimated 8,695 bd.ft. per acre total volume on 91 acres.

Landscape Context

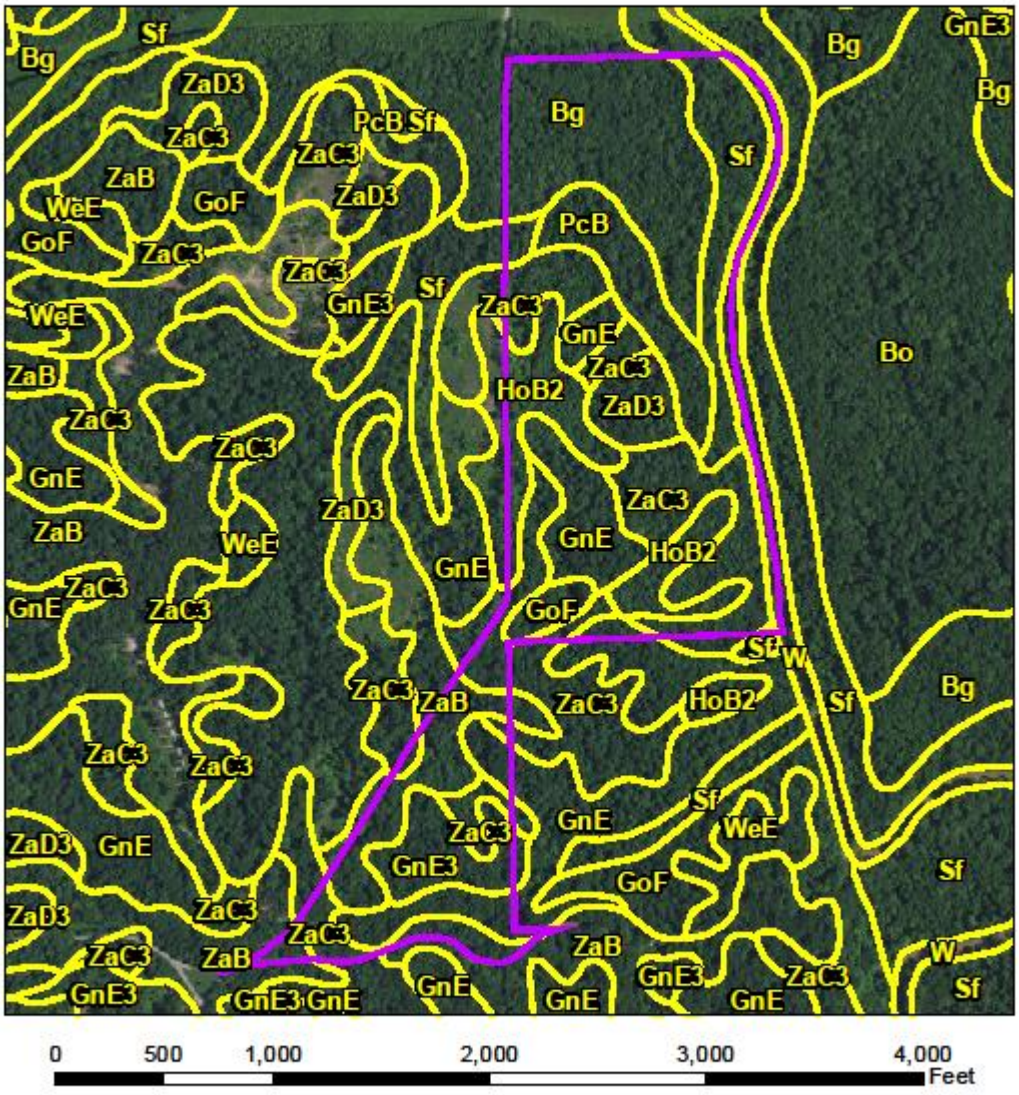
All except approximately 1.5 acres in the extreme southwest corner of C11T1 lies within the Southern Bottomlands Natural Region, with the remainder being in the Driftless Section of the Southwestern Lowlands Natural Region. The entire tract lies within the Boonville Hills of the Southern Hills and Lowlands physiographic province. Additionally, the entire tract lies within the Green River-Southern Wabash Lowlands part of the Interior River Valleys and Hills ecoregion. This ecoregion is defined as being south of the pre-Wisconsonian till plain and having a long growing season. Also, as observed in Pike State Forest, some southern plants have reached their northernmost distributional limit in this ecoregion. Pre-settlement land cover for this tract has been classified as *Quercus-carya*. Water from this tract drains into the Patoka River watershed. The Patoka River is a meandering and underfit river; that is, a relatively small river compared to the large valley in which it flows. This meandering nature of the river, over long periods, has created a diversity of sites where slight differences in elevation, drainage and

seasonal inundation correspond to different plant communities being situated on each site. The Patoka River experiences times with highly turbid water flow and other times with relatively clear flowing water. This is most likely due to upstream agricultural land use and erosion taking place. During saturating rain events, surface water runoff feeds sediment-laden water into the Patoka River. However, during other times when primarily ground water is feeding into the river, the water is much clearer. Areas within a one mile radius of this tract contain additional portions of Pike State Forest as well as parts of Patoka River National Wildlife Refuge, and private land. Additional land uses include deciduous forest with smaller amounts in conifer plantation, herbaceous vegetation, woody wetlands, and developed open space. The abandoned town of Survant, Hartwell Junction, the Pike State Forest firetower, abandoned mine land, two natural gas pipelines (operated by Texas Eastern Transmission LP and Midwestern Gas Transmission Co), one ethane and one liquefied petroleum gas pipeline (operated by Enterprise Products Operating LLC), and a Norfolk Southern railroad track are all within one mile of this tract.

Topography, Geology, and Hydrology

This tract contains moderately sloping terrain with primarily east and south east facing slopes. Ridgetops are mostly found along the county road while ridge fingers extend out in various directions. Elevation ranges from approximately 422 feet in the northeast corner along the Patoka River to 563 feet on the county road in the southwestern tip of the tract. The northern portion is relatively flat with an intermittent, northeast-flowing stream. There is one ravine approximately 90 feet wide extending from the county road northeast towards the river. Another ravine approximately 100 feet wide extends from the southern portion east into the Hartke inholding. This ravine contains an intermittent stream for approximately 400 feet before meeting the property boundary. Much of the southern tract is classified as eroded or severely eroded while the northern portion is classified as frequently flooded. Soils in this tract are derived from underlying shale and sandstone bedrock with scattered loess over residuum in parts.

Pike State Forest
Compartment 11 Tract 1
Soils Map



Soils

Zanesville silt loam (ZaC3); *(20 acres);* This soil is widespread, moderately well-drained occuring on 6-12% slopes and is severely eroded. Available water capacity is moderate, permeability is moderate above fragipan and slow in the fragipan, and surface runoff is rapid in cultivated areas. The slowly permeable fragipan at a depth of about 2 feet restricts root penetration and downward movement of water. This type is moderately suited for harvest equipment operability. Unless operations occur at proper moisture content, compaction and clodding can occur. This soil has a site index of 60 for northern red oak and 90 for yellow-poplar.

Belknap silt loam (Bg); *(17.4 acres);* This soil is very deep, somewhat poorly drained formed in acid, silty alluvium on flood plains. It is frequently flooded, having depth to top of a seasonally high water table ranging from 12-24 inches. It is somewhat suited for growing black walnut. This type is moderately suited for harvest equipment operability. Site index is 90 for yellow poplar, 100 for eastern cottonwood, and 90 for pin oak. Belknap silt loam areas in this tract, being flat, should have no difficulty with harvest equipment operability as long as operations occur at proper moisture content preventing compaction, rutting, and clodding. Also due to flatness, these areas would be suitable for hardwood tree plantation establishment and generally would have good access for large-scale tree planting equipment.

Gilpin Silt Loam, 15 to 30 % slopes (GnE); *(15.7 acres).* This soil is strongly sloping to steep, moderately deep and well drained. It is eroded and contains 1-3% organic matter. It is moderately permeable at 0.6 to 2 inches per hour above 60 inches and available water capacity is low at 3.9 inches above 60 inches, and can be subject to drought. pH ranges from 3.6 to 5.5. Bedrock depth begins at 20-40 inches. It is somewhat suited for growing black walnut. This type is moderately suited for harvest equipment operability and has a site index of 95 for yellow poplar and 80 for northern red oak.

Steff silt loam (Sf); *(9.5 acres)*; This soil is nearly level, deep, moderately well drained found on flood plains. It is flooded for brief periods in winter and spring. Available water capacity is high, permeability is moderate, surface runoff is slow. It has a seasonal high water table at depth 1.5-3.0 feet during winter and spring. Most areas of this soil are used for cultivated crops. Some are wooded. The soil is well suited to corn and soybeans but poorly suited to small grain, which can be damaged by floodwater during winter and spring. Wetness is a major limitation, and flooding is a major hazard. The soil is well suited to trees. Plant competition is the main management concern however it can be controlled by adequate site preparation. This soil has a site index of 80 for northern red oak and 95 for yellow poplar. Steff silt loam areas in this tract, being flat and typically used for crop production, should have no difficulty with harvest equipment operability as long as operations occur at proper moisture content preventing compaction, rutting, and clodding. Also due to flatness, these areas would be suitable for hardwood tree plantation establishment and generally would have good access for large-scale tree planting equipment.

Hosmer silt loam (HoB2); *(9.3 acres)*; This soil is gently sloping, deep, well-drained on 2-6% eroded slopes, having a fragipan, which restricts water flow and root penetration, from 20-36 inches deep. These soils are deeper than Zanesville and typically formed from deeper loess caps.

Available water capacity is moderate. Permeability is moderate above fragipan and very slow in the fragipan. Surface runoff is medium. This soil is well suited to trees although there is a windthrow hazard from fragipan. Site index is 75 for white oak; 90 for yellow poplar; 75 for sugar maple.

Zanesville silt loam, 2 to 6 % slopes (ZaB); *(7.6 acres)*; This soil is a widespread, moderately well-drained soil with a depth of 24-39 inches to seasonal water table. It occurs on 2-6% slopes in upland areas is eroded, and allows very high surface runoff rate. Organic matter content is moderately low at 1-2% and permeability is very slow. Available water capacity is around 8.2 inches above 60 inches. pH ranges from 4.5 to 6.0. Bedrock begins at a depth of 50-90 inches. This soil can have a fragipan at 20-32 inches. Site Index is 68 for northern red oak, 70 for white oak, 77 for black oak, and 88 for yellow poplar.

Pekin silt loam, 2 to 6 % slopes (PcB); *(6.7 acres)*; This soil is gently sloping, deep, moderately well drained found on low stream terraces. Individual areas are generally narrow and irregularly shaped. Available water capacity is moderate. Permeability is moderate above fragipan and very slow in the fragipan. Surface runoff is medium. A seasonal high water table is present at depths of 2-6 feet during late winter and early spring. The firm fragipan restricts downward movement of water and penetration of roots. This soil has a site index of 70 for white oak, 85 for yellow poplar, and 75 for sugar maple.

Zanesville silt loam, 12 to 18 % slopes (ZaD3); *(3.3 acres)*; This soil is similar to ZaB and ZaC3 except it occurs on 12-18% slopes in upland areas and is severely eroded. Site Index is 60 for northern red oak.

Gilpin-Berks loam, 25 to 50 % slopes (GoF); *(1.5 acres)*; This soil is steep, moderately deep, well drained found on side slopes in uplands. Generally found intermixed at a ratio of 60% Gilpin and 25% Berks. Available water capacity is low in Gilpin and very low in Berks. Permeability is moderate in Gilpin and moderately rapid in Berks. Surface runoff is very rapid on both soils. Use of equipment is severely limited due to the slope. Special logging methods, such as yarding logs uphill with a cable, are needed because rubber-tired and tracked equipment cannot be operated safely on these slopes. Gilpin has site index of 80 for northern red oak and 95 for yellow poplar; Berks has site index of 70 for northern red oak and 70 for black oak.

Access

Access is good due to S County Road 650 E on the west side. There is an abandoned firelane (#13) which is grown over and could be opened up to provide access off the county road for a short distance before hitting the boundary with private land. There is also good access in the southern half due to the state forest road leading along Dogwood Ridge toward the family campground and shelter house area.

Boundary

The eastern boundary is bordered by the Patoka River. The southern boundary is delineated by the road, along Dogwood Ridge, through the family campground and shelter house area. The

western side of the tract is bordered by south county road 650 east, which leads to the northern boundary. The northern boundary is bordered by Patoka River National Wildlife Refuge, which has been planted to hardwoods in recent years but used to be open crop land. There is a forty acre parcel of private property that lies within the southern half of the tract.

Wildlife

A Natural Heritage Database Review was completed for C11T1 as part of the management guide process. If rare, threatened or endangered species were identified for this area, activities prescribed will be conducted in a manner that will not threaten viability of those species. Oak hickory stands will be managed for an outcome which should result in presence of many high-quality oak and hickory trees in dominant canopy positions. These current and future dominants will continue to intercept sunlight and utilize peak photosynthesis to direct energy into production of mast for a greater number of wildlife dependent on oak-hickory woodlands. In general over 50 vertebrate species including many important game and non-game animals consume acorns.

Water for wildlife includes the northern and southern intermittent streams which probably have high-flow periods throughout the year and retain small drinking pools during regular dry periods. Additionally, the Patoka River is an aquatic ecosystem abutting this tract. River otters have been observed in the river as well as freshwater fish, turtles, and snakes. The river is a popular fishing spot for anglers. Also, regular flooding spills water from the river channel into the bottomland parts of this tract which, in places, contain many crawdad mounds. Mud lines observed on bottomland tree boles close to the river, an indicator of water height during flood events, range from 3 to 5 feet above ground.

Den trees are those containing large cavities, portions of hollow stems and large branches, or other deformities providing a place for wildlife to retreat. Many of the dominant tree species discussed provide excellent den sites for squirrels, chipmunks, owls and other bird species, various kinds of snakes and lizards, Virginia opossum and raccoon. Snags and downed logs in this tract are an important habitat for many species of invertebrates and vertebrates. Additionally, trees and root wads often fall into the Patoka River providing extra habitat structure and allochthonous inputs to this aquatic ecosystem.

Wildlife species observed during the 2017 inventory include red fox, box turtle, a yellow colored warbler, and a hatchling bird nesting in an understory shrub.

White tailed deer is an important species to this area. From 1935 to present, populations have increased in southern Indiana. Deer densities are much higher now than when the present forest in C11T1 was initiated. Since deer prefer woody browse such as tree seedlings, native shrubs and also herbaceous plants, it is reasonable to expect this vegetation to have additional pressure by deer on patterns of regeneration, dispersal, abundance, and distribution across the landscape.

Bottomland areas provide a lush understory vegetation in the spring used by many young animals for protective cover.

The Division of Forestry has instituted procedures for conducting forest resource inventories so documentation and analysis of live tree and snag tree densities is examined on a compartment-level basis in order to maintain long-term and quality forest habitats. Legacy trees and snags for all size classes meet maintenance level for Indiana bat habitat. All snags were selected to be retained during the inventory. Management practices conducted in C11T1 will be implemented in a manner maintaining long-term quality forest habitats for wildlife populations while promoting legacy tree development.

Live Legacy Trees and Snags for C11T1

	Maintenance Level	**Optimal Level**	**Inventory**	**Available Above Maintenance**
Legacy Trees*				
11"+ DBH	819		1,277	458
20"+ DBH	273		284	11
Snags (all species)				
5"+ DBH	364	637	777	413
9"+ DBH	273	546	556	283
19"+ DBH	46	91	118	72

*** Species Include:** AME, BIH, BLL, COT, GRA, REO, POO, REE, SHH, ZSH, SIM, SUM, WHA, WHO

Ecological Considerations

This tract contains dry-mesic upland, mesic upland, and wet-mesic floodplain forest communities. Typically, the drier upland sites contain forest types dominated by various combinations of oak and hickory species with minor components of mixed hardwoods. Examples in this tract include sites where red, white and black oaks are dominant; other oak-hickory areas contain species like pignut and bitternut hickory being dominant overstory components with understory vegetation such as sassafras, dogwood, blackgum, redbud, greenbrier, white ash, and poison ivy. Mesic upland portions of this tract typically contain forest types dominated by mixed hardwoods such as yellow poplar, sugar maple and American beech with minor components of oak, hickory, elm, ash, and gum. Understory tree and shrub species include paw-paw, dogwood, ironwood, spicebush and some mapleleaf viburnum. Wet-mesic floodplain sites include bottomland species such as pin oak, sweetgum, red and silver maple, river birch, and black walnut along with other bottomland oaks such as Shumard, swamp white,

swamp chestnut, and sometimes cherrybark oak. Understory is usually composed of herbaceous plant species including stinging nettle and grasses, woody vines such as poison ivy, crossvine, trumpet creeper, and understory shrubs such as spicebush and pawapaw. Remnant pine plantations are a non-native plant community found in this tract, which, intensively cultivated in the past for purposes of soil and site stabilization, have served an important role in preserving integrity of surrounding native forest communities and in preventing further degradation to the landscape. These senescing communities have an understory component of mixed hardwoods and oak, oftentimes well-stocked with advanced seedlings of oak, hickory, ash, poplar, maple, and beech, positioned to become the new overstory cohort as pines, which rarely replace themselves on these sites, are removed from the community through mortality or timber harvest.

Exotic Species

Invasive and exotic species are widespread throughout southern Indiana on private and public land. Each species has a history of introduction, successful colonization of sites and dispersal. These species are very successful in out-competing native plants on a variety of forest sites. Japanese stiltgrass, Japanese honeysuckle, shrub honeysuckle, and multi-flora rose were observed throughout the tract at various densities. These and other invasive species, such as Autumn olive, tree of heaven, mimosa, and *Paulownia* should be treated as part of a regular invasive species control program. Control options include foliar spraying with herbicide, cut-stump with herbicide, and basal spraying with herbicide. All pesticides used on state forest will be in compliance with certification requirements.

In addition, emerald ash borer (*Agrilus planipennis)* exists in the region, producing complete mortality in overstory ash. For this reason, it is recommended declining ash trees be included in regularly prescribed timber harvesting so value is not lost to mortality. Conversely, young healthy ash showing no signs of decline should remain for potential resistant features.

Recreation

Likely recreational activities include kayaking the Patoka River, horseback riding, hunting, bird watching, wildlife viewing, and mushroom hunting. The River Trail is the only trail passing through this tract. It is a designated horseback riding trail.

Impacts to recreation by management prescribed in this guide may include increased accessibility due to skid trails and changes in wildlife movements. For example, one year after a timber harvest whitetail deer will change their movement to follow skid trails to facilitate movement through the forest. Within five years however, skid trails will be thick with herbaceous and woody vegetation and this change will likely shift ease of movement towards other areas outside skid trails. The River Trail which runs through this tract will be protected through management activities and remain in its current condition.

Cultural

Cultural resources may be present on this tract but their location(s) are protected. Adverse impacts to significant cultural resources will be avoided during any management or construction activities.

Tract Description and Silvicultural Prescription

The current forest inventory was completed Evan McDivitt. 39 prism points were sampled over 91 acres (1 point for every 2.333 acres). A tract summary is provided in this guide.

Tract Summary Data

Total Trees/Ac. = **171 Trees/Ac.** Overall % Stocking = 101**%** (Over Stocked)
Basal Area = **120.8 Sq. Ft./Ac.** Harvestable Trees = **48 Trees/Ac.**
Present Volume = **8,695 Bd. Ft./Ac.**

Mixed Hardwoods

Total Trees/Ac. = **191 Trees/Ac.** Overall % Stocking = 98**%** (Fully Stocked)
Basal Area = **113.8 Sq. Ft./Ac.** Harvestable Trees = **55 Trees/Ac.**
Present Volume = **7,215 Bd. Ft./Ac.**

Pre-harvest invasive species TSI should be conducted using a situational approach to reduce competition by invasive species against desirable species such as oak and poplar in establishing a new cohort in the regeneration layer.

Approximately one to two years following a good mast year for oaks, a mid-story removal (also called an oak shelterwood) is recommended. This mid-story removal is recommended on soils considered intermediate to high-quality sites for oaks (upland oak site index > 65). The procedure should remove the mid-story shade tolerant species such as beech and maple underneath oak-dense areas, while leaving dominant oak overstory completely intact. The mid-story removal may be accomplished through 1.) herbicide treatment (individual tree treatments such as tree injection, hack and squirt, or basal bark application only so as not to harm oak advance reproduction); 2.) prescribed fire (which would give oak rootstock a competitive advantage upon resprouting); or 3.) a combination of both. Following the mid-story removal, once desirable oak advance regeneration has been allowed to reach approximately 3-4 feet in height, a regeneration harvest is recommended as soon as possible before advance oaks lose apical dominance. This mid-story removal may be restricted to places within the mixed-hardwood stratum where dominant oaks are present in the overstory. The mid-story removal should be utilized in areas where good oak regeneration can be expected and potentially where group openings are planned. The mid-story removal is a method which could be incorporated into a regular timber sale. A timber sale, combined with TSI removing the non-oak mid/understory, in delineated high-quality oak areas, should achieve the oak shelterwood method.

Single tree selection cuttings are prescribed to remove mature to over-mature trees and any cull trees in poor form. There are many yellow-poplar that are currently exceeding maturity that should be the main targets for removal, some ranging up to +30" DBH. These improvement

cuttings may enable release of quality oaks and any oak regeneration occurring in the understory. Oak-hickory is the preferred stratum type and will require removal of crown competition for release of these valued species. The result may yield an increase in timber and wildlife diversity. Group openings should be considered in areas with a high concentration of trees having poor form, low quality, or of undesirable species.

Included in mixed hardwoods is the 1.8 acre oak plantation from 1988. Inclusion here is because the overstory is dominated by yellow poplar. Pole-sized and smaller poplars have outcompeted oaks on this site with many oaks remaining in the understory regeneration layer. The largest oak observed was approximately 2 inches dbh and 30 feet tall. Most surviving oaks are approximately 4.5 feet tall and have lost apical dominance. However, these shade intermediate oaks have been able to persist in a suppressed condition for approximately 30 years displaying a life history trait which at least partially explains how slower-growing oaks end up in dominant canopy positions throughout a stand. That is, longer-living shade intermediate oaks can persist and continue to survive long enough for an event removing an overtopping tree and releasing the oak to advance closer to filling the canopy gap, possibly repeating this process a few times before becoming positioned in the main crown canopy. In general oaks can respond to release very well up to approximately 20 inches dbh. Oak rootstock is present on this site and could be released through poletimber harvest, prescribed burn, TSI, or combination of these. This plantation still has value as a demonstration site for central hardwoods silvicultural techniques and such management could be performed as a continuation of the former research on this site. Since emphasis of some silvicultural research is in getting oaks to regenerate and dominate high-quality mesic sites, outcomes from this site could be an addition to that body of knowledge attempting to elucidate patterns and processes of central hardwood forest competition and regeneration.

Bottomland Hardwoods

Total Trees/Ac. = **169 Trees/Ac.** Overall % Stocking = 108**%** (Over Stocked)
Basal Area = **130.4 Sq. Ft./Ac.** Harvestable Trees = **32 Trees/Ac.**
Present Volume = **7,743 Bd. Ft./Ac.**

Pre-harvest invasive species TSI should be conducted to reduce competition by invasive species against desirable species in establishing a new cohort in the regeneration layer.

Single tree selection cuttings are prescribed to remove mature to over-mature trees and any cull trees in poor form. These improvement cuttings may enable release of bottomland oaks and any desirable bottomland species regeneration occurring in the understory. The result may yield an increase in timber and wildlife diversity. Group openings should be considered in areas with a high concentration of trees having poor form, low quality, or of undesirable species.

Group selection openings could be considered for post harvest planting of high quality bottomland species such as cherrybark, swamp white, and swamp chestnut oak, as well as black walnut, pecan, shellbark hickory, and pin oak. Any plantation established would need periodic survival checks within the initial 5 years as well as TSI to control competition.

Oak Hickory

Total Trees/Ac. = **150 Trees/Ac.** Overall % Stocking = 92**%** (Fully Stocked)
Basal Area = **110.3 Sq. Ft./Ac.** Harvestable Trees = **51 Trees/Ac.**
Present Volume = **7,378 Bd. Ft./Ac.**

The oak-hickory timber type tends to provide a very significant contribution to wildlife, timber resource, and value. The retention of species in this stratum is important to the Division's long-term timber management objectives.

Pre-harvest invasive species TSI should be conducted if practicable to reduce competition by invasive species against desirable species such as oak and hickory in establishing a new cohort in the regeneration layer.

An oak shelterwood cut could be applied in areas appropriate for oak regeneration. A preparatory cut removes the mid-story to enhance conditions for seed production. . This mid-story removal is recommended because soils in this tract are considered intermediate to high-quality sites for oaks (upland oak site index > 65). The procedure will remove the mid-story shade tolerant species such as beech and maple, while leaving the dominant oak overstory completely intact. The mid-story removal may be accomplished through 1.) herbicide treatment (individual tree treatments such as tree injection, hack and squirt, or basal bark application only so as not to harm oak advance reproduction); 2.) prescribed fire (which would give oak rootstock a competitive advantage upon resprouting); or 3.) a combination of both. Following the mid-story removal, once desirable oak regeneration is present the establishment cut is made to provide enough sunlight penetration to allow regeneration to continue growth. The final harvest, removal cut, removes the remaining overstory to allow the new cohort to advance. The mid-story removal is a method which could be incorporated into a regular timber sale. A timber sale, combined with TSI removing the non-oak mid/understory, in delineated high-quality oak areas, should achieve the oak shelterwood method.

Group selection openings could be considered for post-harvest planting of high quality upland species such as northern red, white, black, and scarlet oak along with hickory. Any plantation established would need periodic survival checks within the initial 5 years as well as TSI or prescribed burning to control competition and to facilitate oak growing above the competition.

Pine Plantation

Total Trees/Ac. = **141 Trees/Ac.** Overall % Stocking = 110**%** (Over Stocked)
Basal Area = **149.8 Sq. Ft./Ac.** Harvestable Trees = **70 Trees/Ac.**
Present Volume = **18,791 Bd. Ft./Ac.**

Pine plantations in C11T1 have reached maturity and some sites never experienced good growth. These sites, however, have recovered from the severe erosion and degradation brought by agricultural abandonment in the early 1900s. There are many high quality pine stems in these plantations yet they are at risk of windthrow and decline due to very high density. Understory in

pine plantations often contains oak advance reproduction ready for release. In other portions understory is mixed hardwoods. Current ecologic conditions will encourage decline of the pine canopy and slow ingrowth of low quality, poorly formed mixed hardwoods suffering from years of suppression, defunct apical dominance, and poor growth. Conversion of pine acreage to native central hardwoods is therefore recommended as much as possible this management cycle. Post-harvest TSI is recommended to complete openings and to encourage desirable central hardwood species to establish on these sites. Wherever possible, oak regeneration should be promoted using appropriate methods including prescribed burning to control competing vegetation and allow oaks to close the canopy and grow above competition.

Species and Volume Table for C11T1

Species	# Sawtimber Trees	Total Bd.Ft.
Yellow Poplar	765	207,948
Eastern White Pine	713	154,888
Pin Oak	403	113,252
Northern Red Oak	218	58,083
Sweetgum	231	46,920
Black Oak	163	35,364
Pignut Hickory	213	25,616
Silver Maple	110	21,420
American Sycamore	121	20,536
Bitternut Hickory	151	20,203
White Oak	128	19,730
Shumard Oak	60	16,662
Shagbark Hickory	69	12,301
Red Maple	81	9,883
American Beech	53	6,813
White Ash	46	4,478
Shortleaf Pine	13	2,733
Black Cherry	30	2,546
Swamp Chestnut Oak	8	2,337
American Elm	46	2,120
Shellbark Hickory	12	2,062
Green Ash	5	1,764
Chestnut Oak	9	1,750
Black Walnut	19	970
Sugar Maple	22	895
Per Acre Total	**41**	**8,695**
Tract Total	**3,689**	**791,274**

Proposed Activities Listing

Invasive species control is recommended prior to timber harvest operations. The beech-maple and undesirable understory components may require TSI to promote oak-hickory regeneration. This could range from standard pre-harvest TSI to a 2 or 3-phase mid-story removal, appropriately timed with prescribed timber harvest. Postharvest TSI should be performed along with invasive species follow-up, especially in large gap openings. A prescribed burn may help with setting back invasive species and promoting oak regeneration as part of the pre and/or post-harvest TSI, especially in those areas of the tract where regeneration has been initiated and where adequate oak regeneration is present. Post-harvest planting is an option to control desirable species composition in areas where regeneration has been initiated. A regeneration review should be conducted three years after conducting all treatments. The tract should be inventoried again and a new management guide written in 15-20 years.

Based on this information, a managed timber harvest removing approximately 250-300 MBF over the entire 91 acres is recommended. During the recommended timber harvest appropriate implementation of forestry best management practices will be used to protect sediment from entering the watershed. Effective installation of BMPs includes practices such as leaving an adequate buffer zone along watercourses.

Proposed Management Activity	***Proposed Period***
Pre Harvest TSI (invasive species and other)	2019-2021
DHPA Clearance	2019-2021
Timber Sale	2019-2024
Post-Harvest TSI	Following harvest
Inventory and Management Guide	CY2033-2038