Indiana Department of Natural Resources

Indiana Department of Natural Resources – Division of Forestry
Draft Resource Management Guides
Ferdinand State Forests
Document Number: FSF 2019-1

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 500-1,000 acres in size and their subunits (tracts) are 20-200 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 1,700 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 for the following Compartments and Tracts contained in this document are part of tracts under review this year for Ferdinand State Forest.

State Forest	Compartment	Tract
Ferdinand	**4**	**10**
Ferdinand	**7**	**6**
Ferdinand	**7**	**7**

To submit a comment on this document, go to:
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You must indicate the Document Number, or the State Forest Name, Compartment and Tract numbers 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 www.in.gov/dnr/forestry/3634.htm

Note: Some graphics may distort due to compression.

State Forest: **Ferdinand State Forest** Compartment: **04** Tract: **10**
Tract Acreage: **91** Commercial Forest Acreage: **78.5**
Forester: **Evan McDivitt** Date: **12/6/2017**

Location
C4T10 is located in Perry County, Section 23, T3S, R3W in Clark Township. State Road 145 cuts through the western portion of the tract. This tract is approximately one mile north of I-64 exit 72 at Kitterman Corners.

General Description
C4T10 contains approximately 88.5 forested acres with the remaining 2.5 acres occupied by S.R. 145 ROW. Approximately 10 acres of mixed hardwoods along the Anderson River lie west of S.R. 145 and are separated from the rest of the tract. The remaining 78.5 acres to the east of S.R. 145 are composed of mostly oak-hickory stands with a smaller amount of mixed hardwoods and pine plantation. Table 1 summarizes tree species identified during the inventory. The tract's forest resource is composed of three general strata.

Oak-Hickory (40 total acres): This type is found primarily on the dry sites on ridgetops and steep slopes. Oak-hickory is more commonly found along southwest facing slopes in this tract. The primary species that dominate the overstory are white oak, black oak, northern red oak, and pignut hickory. In these areas, most of the understory consists of beech-maple and greenbrier.

Mixed Hardwoods (39 total acres)*:* Mixed hardwoods are found throughout the tract on various mesic and floodplain sites. They consist primarily of yellow-poplar. Some of the mixed hardwoods are intermingled with white pine in portions close to, and often inside, the old pine plantations. The understory contains a variety of species but most of the overstory consists of yellow poplar, sugar maple, blackgum, shagbark hickory, and black oak. Species in the understory include blackgum, red maple, paw-paw, white ash, dogwood, sugar maple, and some scattered oaks.

Pine (9.5 total acres): Pine in this tract consists of an overstory of mostly white pine with some Virginia pine. White pine is found along the north-central portion and in the south-western portion of this tract. Most of the understory contains a composition of vigorous beech-maple growth with other competing mixed hardwoods, spicebush, and paw-paw patches.

Figure 1. Ferdinand SF Compartment 04 Tract 10.

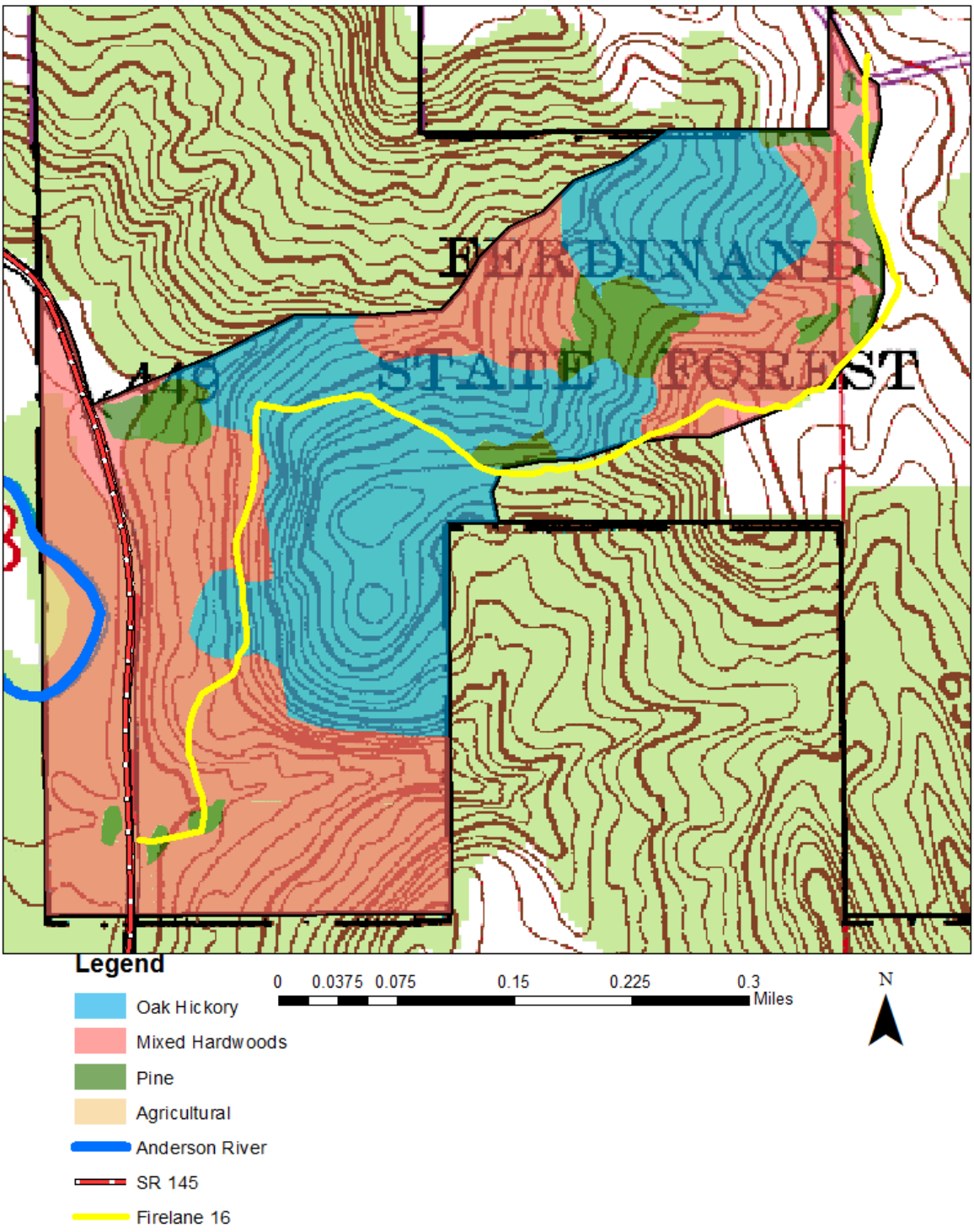


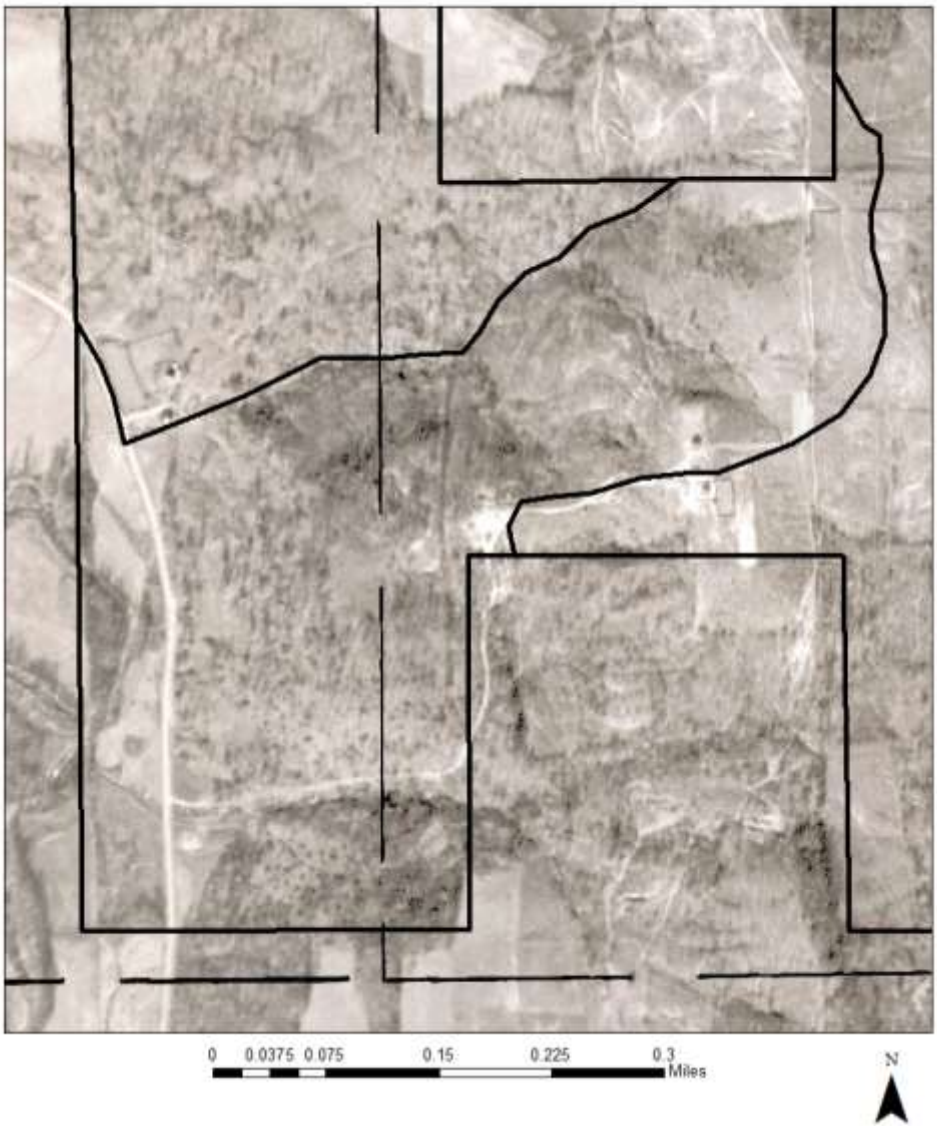
**Table 1. Overview of Tree Species in C4T10 –
(Descending order of abundance)**

Overstory Sawtimber Layer	Understory Poletimber Layer	Regeneration Layer
Yellow Poplar	Sugar Maple	Sugar Maple
Black Oak	Yellow Poplar	Yellow Poplar
White Oak	Virginia Pine	American Beech
Eastern White Pine	Blackgum	Dogwood
Northern Red Oak	Pignut Hickory	Blackgum
Pignut Hickory	American Beech	Redbud
Sugar Maple	Eastern White Pine	Chinkapin Oak
American Sycamore	Shagbark Hickory	White Oak
White Ash	Persimmon	
Virginia Pine	Chinkapin Oak	
Shagbark Hickory	White Oak	
Chinkapin Oak	Black Oak	
American Beech	Northern Red Oak	
Bitternut Hickory	Bitternut Hickory	
Black Cherry	American Elm	
Black Walnut	Red Maple	
Pin Oak	Black Cherry	
Swamp White Oak	Red Elm	
Shumard Oak	American Sycamore	
	White Ash	

History

This tract was purchased from 3 private landowners in the late 1940's and early 1950's. Anthony & Iva Main were the first to sell in March of 1947. They added the small piece (1.5 acres) northeast of the northeast stone in this tract. They sold 69 acres total to the State. Elzie and Elsie Eckert were the next to sell in April of 1950 (120 acres total) adding about 40 acres, which is now the eastern leg of the tract. In June of 1950 Fred & Rose Price sold 80 acres which makes up the western portion of the tract. In their deed it explains that they have one year to remove any buildings or they will become property of the State. When originally inspected (1940's) there was a barn on one of the documented homesites. It is unknown if it was removed by them or the State.

Ferdinand State Forest
Compartment 4, Tract 10
Aerial Photography - 1937



As can be seen from the above aerial photograph from 1937, before this area was state forest, natural resources in this tract were being intensively used by people for open area, pasture and possibly other agriculture, roads, homesites, and industry in addition to a small amount of closed canopy forest, mostly in the north-central and south-eastern portions of the tract area.

Resource Management History

It appears parts of this tract were open fields and/or pasture at one time. Planting records show that in 1952, 725 Virginia pine and 625 pitch pine were planted and that eastern white pine was planted around 1960.

In 1983 the tract was inventoried by Janet Eger who estimated 429.3 bd.ft. per acre in harvest stock and 2,633.4 bd.ft. per acre total volume on 80 acres. She noted an area of at least 15 acres on a west slope within the tract that had been burned several years earlier. It was recommended

to TSI or utilize burned trees for firewood. Thinning of pine and converting Virginia pine stands to hardwoods was also recommended.

One year later a Department of Corrections crew was sent to perform TSI in the pine in the southwest corner of the tract. In 1986 additional TSI was completed in a small patch near the Y of the firelane. The success of both TSI attempts was difficult to see in subsequent inventories. In 1992 firelane 16 was rerouted to avoid private property. This new firelane created great access to the tract.

In 1998 an inventory was performed by Nate Orsburn who estimated 5,495.2 bd.ft. per acre total volume on 98 acres. There appears to have been some acreage transferred to Compartment 4 Tract 9. At that time the tract was estimated to contain 13 acres of pine with Virginia pine showing signs of mortality and windthrow. A timber harvest was recommended with silvicultural prescription including a light thinning to remove overmature black oak, yellow poplar, and pignut hickory. It was recommended the white oak component remain intact, leaving over 85% of volume for future production. Further, it was recommended white oak become the main focus for the next couple of cutting cycles in this tract. 2,263 bd.ft. per acre in harvest stock over 63 acres was recommended as well as pre- and post-harvest TSI for vines.

Also noted in 1998 was the major ATV damage causing erosion and compaction problems in this tract. Nate Orsburn speculated ATV riders were coming in from the nearby private campground. Finally, it was recommended to resolve northwest boundary issues, the agricultural trespass, and the status of the private, gated access road going to the fishing shack in the southwest corner of the tract. No record exists for resolving agricultural trespass or for determining status of private gated road in southwest corner.

On April 24, 2003, a timber sale applying the single-tree selection method was conducted with 81,390 bd.ft. over 35 acres sold to Phil Etienne's Timber Harvest (St. Croix, IN) for $30,745.00. The timber harvest concluded June 9, 2003 and records exist showing BMPs being installed effectively. Additionally, tree tops were used by loggers to close unauthorized ATV trails. This tract was inventoried in 2017 by Evan McDivitt who estimated 2,560 bd.ft. per acre in harvest stock and 8,155 bd.ft. per acre total volume on 78.5 acres.

Landscape Context

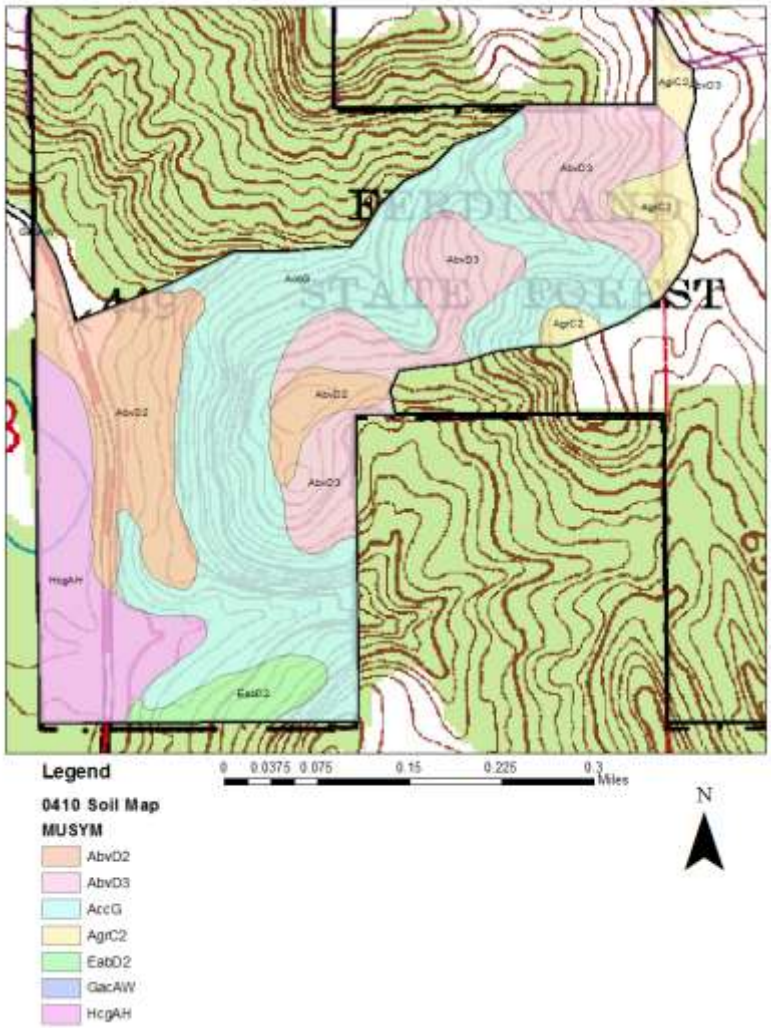
This tract lies within the Crawford Upland Section of the Shawnee Hills Natural Region. The entire tract lies within the Southern Hills and Lowlands physiographic province. Additionally, the entire tract lies within the Crawford-Mammoth Cave Uplands part of the Interior Plateau ecoregion. Pre-settlement 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. A ridge, known as Fox Ridge, is a USGS natural feature located within 1.3 miles to the northeast of this tract. 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

This tract contains relatively rugged terrain with a steep scarp wrapping around the ridge from north to southeast, in an almost-circular pattern in the central portion of the tract. From the center of the tract to the west, topography changes dramatically, flattening out along the Anderson River in the area west of S.R. 145. Elevation ranges from approximately 430 feet along the Anderson River to 640 feet on ridgetops. In the southern part of the tract, an ephemeral stream runs from east to west and contains steep banks and a rocky channel. A similar-looking ephemeral stream comprises the northern boundary of the tract, flowing from northeast to southwest. The northeast part of the tract contains ridge fingers running in a northwest direction with accompanying ravines having steep slopes. Soils in this tract are derived from residuum from interbedded sandstone, siltstone, and shale in some parts; loess over residuum in others; and silty alluvium in soils near the river.

Soils

Figure 2. Compartment 04, Tract 10 Soils.



Adyeville-Tipsaw-Ebal Complex (AccG); *(38.1 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. Soil can be found in this tract on sideslopes 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.

Adyeville-Wellston-Deuchars, severely eroded (AbvD3); *(18.6 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 sideslopes 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.

Adyeville-Wellston-Deuchars, eroded (AbvD2); *(15.3 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 sideslopes 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.

Haymond silt loam, frequently flooded, brief duration (HcgAH); *(11.8 acres).* Well drained. Soil can be found in this tract on the bottomlands adjacent to Anderson River with slopes of 0 to 2 percent. Native vegetation is hardwoods. Depth to restrictive layer is more than 80 inches. Subject to crusting due to content of organic matter in surface layer of 2 percent and less. Soil is occasionally to frequently subject to flooding during the growing season. Available water capacity is moderately high to high (12.0 – 14.4 inches in upper 60 inches). pH of surface layer is 6.1. Site Index for yellow poplar is 100. Listed species suitable for planting are cherrybark, bur, Shumard, and swamp chestnut oak.

Apalona silt loam (AgrC2); *(4.5 acres).* Moderately well drained. Seasonal high water table from 2.0 to 3.0 ft. Soil can be found in this tract on sideslopes on uplands. 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.

Ebal-Deuchars-Kitterman Complex (EabD2); *(3.2 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.

Gatchel loam (GacAW); *(0.03 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.

Roads and Access

Access to this tract is good. Highway 145 runs north-south near west boundary. This gives highway access to firelane 16. There is a pull-off/parking area where the firelane meets 145. Firelane 16 gives good access to the interior and eastern side of the tract. The northeast corner can be accessed also by a gravel county road which leads to highway 145.

Boundary

This tract is bounded on the north by other Ferdinand State Forest land and also by a private land owner. The east is bounded by firelane 16 until it meets the old firelane. At this point it follows the old firelane south to the property line marked by a stone. South from the middle stone, the tract is bounded by private property. The south portion of this line has a fence line as well as rock piles that are consistent with the boundary. From the south stone going west, more evidence of an old fence line is present as well as long strips of rock piles fairly consistent with the boundary. The western boundary is shared with three private property owners. The southwest corner may have a trespass with an unauthorized road. There is a significant trespass by ATV users in this tract. The firelane, especially in the northern extent, has been worn down to bare mineral soil as have many illicit ATV trails within this tract and across the boundary on private lands. The main trail appears to be from a private camp accessing another property they own adjoining state forest. Some boundary posting work was completed adjacent to the neighboring camp, with more planned as time allows.

Wildlife

A Natural Heritage Database Review was completed for tract C4T10 as part of the management guide process. If rare, threatened or endangered species were identified for this area, the

activities prescribed in this guide will be conducted in a manner that will not threaten viability of those species.

Through previous timber harvesting, utilizing appropriate silvicultural and management methods, this tract appears to have enhanced the oak-hickory component through selection of non-oak/hickory species for removal and by other silvicultural strategies to control species composition in the tract. The outcome of this management is presence of many high-quality oak and hickory trees in dominant canopy positions intercepting sunlight and utilizing peak photosynthesis to direct energy into production of mast for a greater number of wildlife dependent on oak-hickory woodlands.

Water for wildlife in this tract consists of a portion of the Anderson River to the west and a small wildlife pond, as well as the northern and southern ephemeral streams which probably have high-flow periods throughout the year and retain small drinking pools during regular dry periods. 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 in this tract 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.

The Division of Forestry has instituted procedures for conducting forest resource inventories so the documentation and analysis of live tree and snag tree densities are examined on a compartment-level basis in order to maintain long-term and quality forest habitats. The number of snags for all size classes except 19+ inches meets the optimal maintenance level, and Legacy Trees in the tract are above the available maintenance for optimal Indiana Bat habitat in all size classes. All snags were selected to be retained during the inventory. Management practices conducted on C4T10 will be implemented in a manner that will maintain the long-term and quality forest habitats for wildlife populations, and promote Legacy Tree development.

Table 2. Live Legacy Trees and Snags for C4T10

	Maintenance Level	Inventory	Available Above Maintenance
Legacy Trees *			
11"+ DBH	819	1,761	942
20"+ DBH	273	461	188
Snags (all species)			
5"+ DBH	364	892	528
9"+ DBH	273	304	31
19"+ DBH	46	19	-26

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

Communities

This tract contains dry upland, dry-mesic upland, mesic upland, and a small portion of bottomland 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 white oaks are dominant in some parts and others where red and black oaks are dominant; other oak-hickory areas have species like pignut hickory being the dominant overstory component with understory vegetation such as sassafras, dogwood, redbud, greenbrier, poison ivy, and a small amount of blueberry. The mesic upland portions of this tract typically contain forest types dominated by mixed hardwood species, such as yellow poplar, sugar maple, American sycamore, and American beech with minor components of the oaks, hickories, elms, ashes, and gums. Understory tree and shrub species include flowering paw-paw, dogwood, ironwood, spicebush and some mapleleaf viburnum. The small bottomland portion in this tract contains a floodplain forest type composed of mixed hardwoods such as yellow poplar, American sycamore, pin oak, ashes, elms, some black walnut with understory trees and shrubs such as bladdernut, paw-paw, and spicebush. Also, in the floodplain portion west of S.R. 145, a small community of native giant cane (*Arundinaria gigantea)* was observed growing in the understory along the road. 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 the 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 oaks, oftentimes well-stocked with advanced seedlings of oak, hickory, ash, poplar, maple, and beech, positioned to become the new overstory cohort as pines, which do not replace themselves on these sites, are removed from the community through mortality or timber harvest.

Exotic Species

Japanese stiltgrass can be found growing along S.R. 145 and along firelane. Multi-flora rose was found throughout the tract and along firelane. Problem occurrences of these and other invasives, such as Autumn olive, bush honeysuckle, and tree of heaven should be treated as part of a regular invasive species control program. While control measures are advised, these are common species throughout the area and their eradication is not feasible.

In addition, emerald ash borer (*Agrilus planipennis)* exists in the region, producing near complete mortality in overstory ash. For this reason, it is recommended ash trees be included in regularly prescribed timber harvesting ahead of the killing wave so value is not lost to mortality and regeneration of the species can be fostered before loss of seed bearing trees. Ash that survive the killing wave and are in healthy condition should be retained in the stand.

Recreation

Likely recreational activities on this tract include hiking along the firelane, hunting, bird watching, wildlife viewing, and mushroom hunting. Currently, there are no developed recreation trails within this tract. Illegal ATV use has created trails throughout the northern portion of 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

Tract Summary Data

Total Trees/Ac. = **128 Trees/Ac.** Overall % Stocking Hardwoods = 94**%** (Fully Stocked)
Basal Area = **108 Sq. Ft./Ac.** Harvestable Trees = **41 Trees/Ac.**
Present Volume = **8,155 Bd. Ft./Ac.**

The current forest resource inventory was completed by Evan McDivitt. 38 prism points were sampled over 91 acres (1 point for every 2.4 acres). The table below provides volume estimates associated with each tree species.

Species	Total Volume (Bd.Ft. Doyle)
Yellow Poplar	174,066
Black Oak	121,168
Eastern White Pine	96,591
White Oak	91,046
Northern Red Oak	79,370
Pignut Hickory	37,995
Sugar Maple	32,797
American Sycamore	25,914
White Ash	14,543
American Beech	13,295
Shagbark Hickory	12,239
Virginia Pine	11,708
Bitternut Hickory	9,616
Chinkapin Oak	4,973
Black Cherry	4,434
Pin Oak	3,624
Swamp White Oak	2,470
Black Walnut	2,240
Shumard Oak	1,849
Post Oak	1,294
American Elm	918
Tract Totals (bd. Ft.)	**742,142**
Per Acre Totals (bd. Ft./Ac.)	**8,155**

The tract's forest resource is composed of three general strata.

Oak-Hickory Stratum

The retention of species in this stratum is important to the Division's long-term timber management objectives. This stratum occupies around 40 acres, covering roughly 44% of the acreage. The average total basal area for this stratum is around 107.4 square ft./acre. The

overstory is dominated primarily by 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 blackgum. Regeneration consists primarily of beech-maple, white ash, poplar, blackgum, and some oak. This is a common problem in the Central Hardwood Region; dominant stands of oak-hickory forest contain prevailing numbers of non-oak or hickory species in the midstory and understory. Remedies may include harvesting low-quality, non-oak/hickory species in areas where single tree selection method is used while leaving high-quality oaks and hickories to grow for an additional 2 or 3 cutting cycles; selecting poorly formed or low vigor oaks and hickory species in areas where a better quality oak or hickory may be released from the competition; and also, combining these methods with appropriate strategies to promote development of oak and hickory advance regeneration.

Pre-harvest invasive species control should be conducted where practicable to reduce competition by invasive species against desirable species such as oak and hickory in establishing a new cohort in the regeneration layer. Additionally, a midstory removal (oak shelterwood method) may be beneficial in promoting oak advance regeneration and apical dominance of seedlings.

Certain areas in the tract were observed to be very high-quality soils for growing northern red oak, particularly those containing the Deuchars component. These soils have a site index of 90 for northern red oak which is very competitive with yellow poplar, which usually grows much faster than oak species. In the nearby soil complex, yellow poplar also has a site index of 90. These areas were evident in the tract, showing pole-sized northern red oaks in dominant and codominant positions in the canopy and containing high number of northern red oak advance regeneration. These areas were often classed as mixed hardwoods in the inventory but have potential for conversion to oak hickory with appropriate management. A prescribed fire in areas of good quality soils for growing oaks could promote oak-hickory regeneration by eliminating shading thin-barked competitors from the mid and understory and allowing fire-adapted oak species to vigorously resprout, following fire, to get above fast growing non-oak competitors, such as yellow poplar and cherry.

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 with a component of oak unless some TSI is implemented. Areas with an abundance of oak regeneration should be considered for release through a group selection, or shelterwood harvest system.

Mixed Hardwoods Stratum

Mixed hardwoods tend to be variable in composition and thus may have more complicated prescriptions attached to them. This stratum occupies about 39 acres, covering roughly 43% of

the acreage. The average total basal area for this stratum is around 121.4 square ft./acre. The overstory is dominated by yellow-poplar, with much of the codominant and intermediate growth being American sycamore with beech-maple. Some oak and hickory species are present in the overstory. Regeneration consists primarily of beech-maple, with an occasional oak/hickory species, yellow-poplar, and American sycamore.

Pre-harvest invasive species control should be conducted where practicable to reduce competition by invasive species against desirable species such as oak and poplar in establishing a new cohort in the regeneration layer. Additionally, a midstory removal (oak shelterwood method) may be beneficial in promoting oak advance regeneration and apical dominance of seedlings.

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A single tree selection harvest is 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 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 may yield an increase in timber and wildlife diversity.

Pine Stratum

The pine plantations were found to be mostly in decline. Number of trees per acre ranged between 145 and 200, and basal area ranged 137 to 145 sq.ft. per acre. 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. This stratum occupies approximately 9.5 acres, covering roughly 10% of the acreage. The overstory is dominated by mature white pine and Virginia pine but portions of the plantation are mixed with hardwoods where pine mortality has been severe. Understory growth is composed of beech-maple, blackgum, with other occasional hardwood species, including areas with very abundant advance oaks which have reached 4.5 feet tall.

For this tract, some white pine could be retained for wildlife and the rest, along with the Virginia pine, removed so native hardwoods can return to the site. 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. Most of the pine in this plantation are in decline and have succumbed to over-maturity, resulting in large snags that can be preserved along with downed woody debris. This has provided canopy gaps, in which there is an opportunity for TSI of invasives and other undesirable vegetation. 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 should be prescribed TSI for croptree release if not adequately released during the timber harvest.

Proposed Activities

Overall, a managed timber harvest removing 150,000 to 200,000 board feet over the 78 acres east of S.R. 145 is prescribed to help meet stand objectives.

Invasive species control is recommended prior to timber harvest operations. The beech-maple and undesirable understory components may require pre- and or post harvest TSI to promote oak-hickory regeneration in select areas. Postharvest TSI should be performed along with invasives follow-up, especially in large gap openings. A prescribed burn may help with setting back invasives and promoting oak regeneration as part of the post-harvest TSI, especially in those areas of the tract where regeneration has been initiated and where adequate oak seed source is present. Enrichment planting with native oak species is also an option where regeneration and seed source is lacking. A regeneration review should be conducted three years after conducting all treatments. The tract should be reinventoried in 15-20 years.

ATV trespass activity is to be monitored and resolved should activity persist.

Proposed Activities Listing

Proposed Management Activity	***Proposed Period***
Monitor ATV trespass and resolve	CY 2019-
Invasive control and possible pre-harvest treatment	CY 2017-2019
Timber Sale	CY 2018-2022
Post-harvest TSI	Following harvest
Regeneration Opening Review	3-5 Years Postharvest
Reinventory and Management Guide	CY 2034-2039

State Forest: **Ferdinand State Forest** Compartment: **07** Tract: **06**
Tract Acreage: **104** Commercial Forest Acreage: **104**
Forester: **Evan McDivitt** Date: **9/6/2018**

Location
C7T6 is located in Perry County, Section 16, T4S, R3W, Clark Township.

General Description
C7T6 contains 104 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. Table 1, below summarizes tree species identified during the inventory. For management purposes the tract is divided into the 3 stratum noted below.

Oak-Hickory (52.7 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. Additionally, the eastern 2005 regeneration opening contains a good component of young oak and hickory cover type. 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*.

Mixed Hardwoods (43.8 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.

Pine (7.5 estimated acres): There are some stagnant and declining pine plantations in this tract. The Virginia pine plantation in the northwest corner of the 64 acres contains an overstory of pine with an understory of beech, maple, and even a decent component of chestnut oak.

Figure 1. Ferdinand SF Compartment 07 Tract 06.

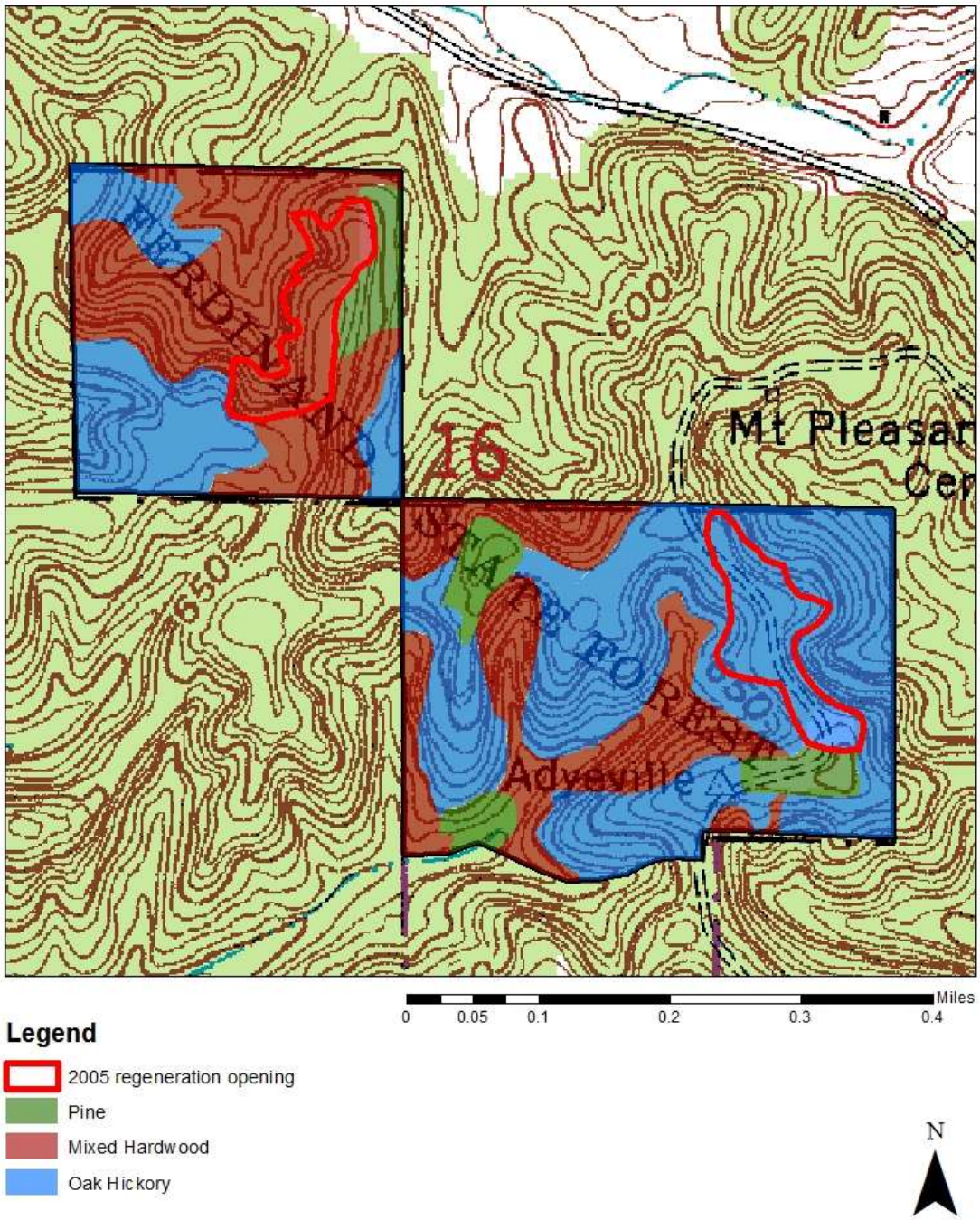


Table 1. Overview of Tree Species in C7T6
(Descending order of abundance)

Overstory Sawtimber Layer	Understory Poletimber Layer	Regeneration Layer
Chestnut Oak	Sugar Maple	Virginia Pine
Yellow Poplar	Blackgum	American Beech
White Oak	Chestnut Oak	Dogwood
Black Oak	Yellow Poplar	Redbud
Pignut Hickory	Pignut Hickory	Sugar Maple
Virginia Pine	American Beech	Blackgum
Sugar Maple	Virginia Pine	White Oak
White Ash	White Ash	Black Cherry
Scarlet Oak	Dogwood	Chestnut Oak
Northern Red Oak	Sassafras	Yellow Poplar
Shagbark Hickory	White Oak	Black Oak
Blackgum	Shagbark Hickory	Pignut Hickory
Eastern White Pine	Black Oak	White Ash
Black Walnut	Bitternut Hickory	Red Maple
Bitternut Hickory	Eastern White Pine	Basswood
		Pawpaw
		Shagbark Hickory

History

James Ashly Mills and his wife sold 60 acres to the State in January of 1953. This is all but the 4 acres along the south line of the 64 acre piece. The property was purchased for $15/acre and initial inventories show 10 acres needed to be planted. Also, there was not timber of sufficient size to sustain a harvest since a harvest two years prior took most of the large timber. Ona and Abe L. Aders sold 40 acres (which makes up the north portion of this tract) to the State in July of 1951 for $10/acre. Of the 40 acres, 16 were open land. An 8 acre fire travelled through this tract in the early 1940's. Elizabeth and Leonard Weisman sold 80 acres to the State for $15/acre in October of 1958, six acres on the south line of the tract, and the remaining acreage is located in C7T7. There was a timber sale in 1952 in the north half of the Weisman's 80 acres. At the time of initial inventory nothing was left to harvest. Chestnut oak was the majority of stocking.

Resource Management History

The Indiana Geological and Water Survey's Indiana Historical Aerial Photo Index shows canopy development in this tract from 1940 through 1979. In 1940, the road passing through the eastern side of the 64 acres from north to south was much more established and seems to have been in good condition. There was a road splitting off from the main road which travelled along the northern ridge going east to west and this is still visible today but is in much worse condition. Most of the ridgetops were cleared of forest vegetation at this time while steeper hills and ravines

were forested. 1953 photos show much the same conditions as those in 1940. By 1958 young forest had initiated open areas but open areas were still clearly distinguished from denser forest areas. By 1967 the entire tract was showing denser forest conditions throughout the tract with canopies closing and trees maturing. By 1979 the area was showing almost continuous canopy cover within tract boundaries.

According to planting records, Virginia, Eastern White, and red pine were planted in April 1954 on the north 40 acres and in the southern 64 acres. Trees were planted at 8 x 8 foot spacing.

The tract was inventoried in 1973 by Bill Hahn who estimated 1,488 board feet per acre in harvest volume and 2,925 board feet per acre total volume on 45 hardwood acres. He found oak-hickory, walnut, tulip poplar, and mixed pine timber types. Size class was small sawtimber with pine in posts and small poles. Pine and an abundance of chestnut oak were found on ridgetops. Drainages and lower slopes contained the best quality tulip poplar and oak-hickory. He recommended a harvest in 10 years.

There was a hardwood timber sale in December 1982 in which 1,740 board feet per acre across 28 acres was sold to DMI Furniture, Inc. for $107.11 per MBF. Logging operations were completed by July 1983. It was found that sold trees, having been appropriately marked, contained internal defect speculated to be from either fire or grazing damage. Trees were found to be 60-100 years old and had been growing slowly especially in the 10 years prior to harvest.

Post-harvest TSI was marked in November 1984 but no record exists of completion.

The tract was inventoried in 1999 by Nate Orsburn who estimated 1,848 board feet per acre in harvest volume across 90 acres and 5,782 board feet per acre total volume on 106 acres. At this time pines were 45 years old, mostly in the 14-18 inch dbh class, with some pine areas converting to hardwood as pine was blowing down and gradually being replaced by hardwood species. He prescribed a timber harvest with pre- and post-harvest TSI.

In March 2000 Doug Brown & Tom Merkley completed vine TSI. Ailanthus control was performed in 2004.

There was a timber sale in May 2005 in which 4,025 board feet per acre across 41 acres was sold to Waninger Timber and Trucking Co. for $302.04 per MBF. This sale included approximately 9.8 acres of regeneration openings. Logging operations were completed by August 2005. Ailanthus control was conducted throughout 2005 and 2006 as well.

In January 2007 Doug Brown reported 88 acres of TSI in which 41 acres (including 9.8 acres in openings) was post-harvest TSI in which much of the non-opening area was treated as a shelterwood with extensive understory control. The other 47 acres was unharvested and mainly crop tree release and some thinning.

In Spring 2006 a prescribed burn was conducted on the eastern 5-acre regeneration opening to encourage hardwood regeneration and to control Japanese honeysuckle.

In Summer 2017 the road system from Mt. Pleasant cemetery extending through the north-south portion of this tract was improved with a dozer and rock. The east-west road was opened up with a dozer.

In 2018 this tract was inventoried by Evan McDivitt who estimated 1,140 board feet per acre in harvest volume and 7,841 board feet per acre total volume across 104 acres. Across much of the hardwoods was found a very dense understory of saplings, greenbrier, and *Rubus* growing in between sawtimber trees. Sawtimber pines were found to be mostly in the 16 to 20 inch dbh range with some Virginia and white pines reaching 26 inches. There was found to be a significant component of Virginia pine saplings present in regeneration openings from 2005. Additionally, the regeneration opening having the prescribed burn was found to contain a significant component of desirable oak regeneration competing very well with poplar and other species such as black cherry.

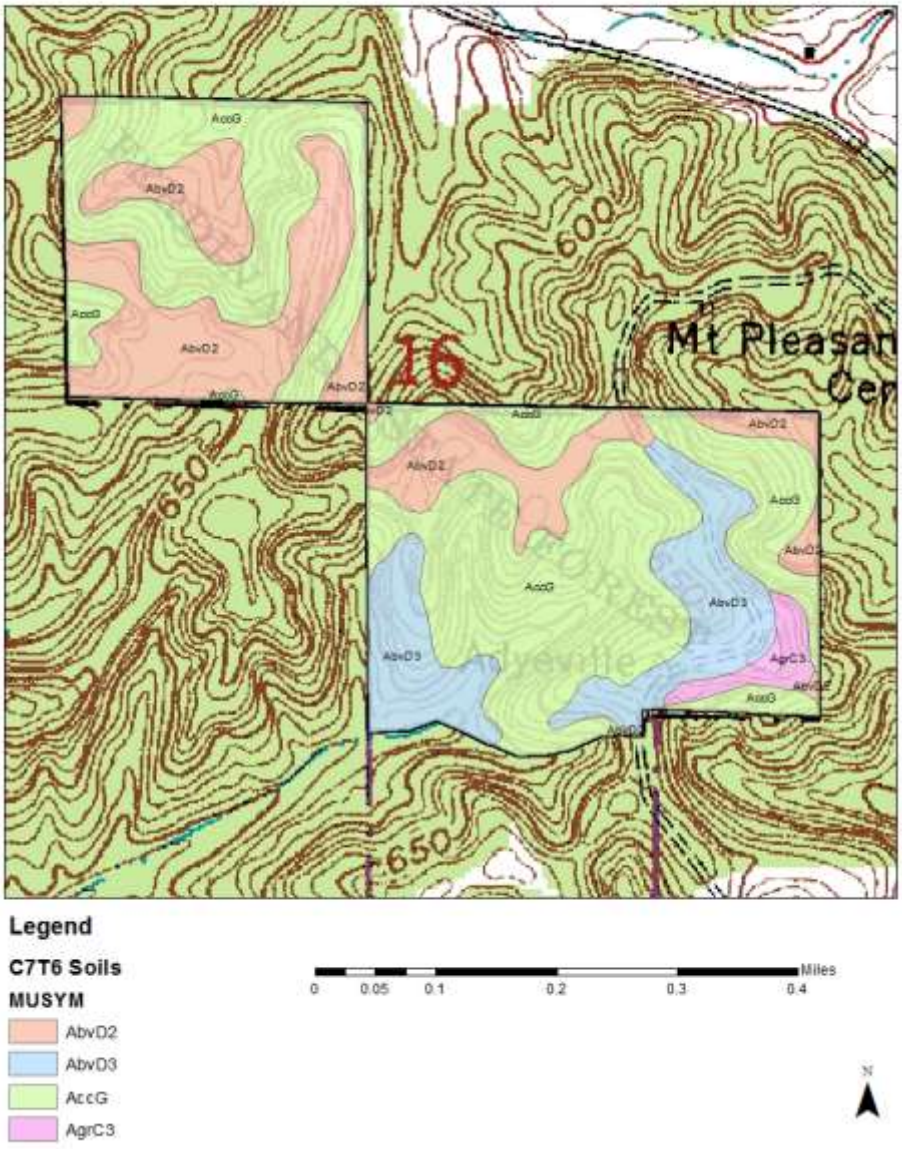
Landscape Context

This tract lies within the Crawford Upland Section of the Shawnee Hills Natural Region. This tract is in the Southern Hills and Lowlands region of the Crawford Upland Physiographic Province. Additionally, the entire tract lies within the Crawford-Mammoth Cave Uplands of the Interior Plateau Ecoregion. Pre-settlement land cover for this tract has been classified as *Quercus-carya* vegetation type. Areas within a one mile radius of this tract contain sizable areas in deciduous forest, herbaceous cover, conifer plantation, hay/pasture; with a smaller amount in cultivated crops, shrubland, developed open space, and open water.

Topography, Geology, and Hydrology

This tract contains rolling to rugged terrain throughout and it has one intermittent stream flowing from the southwest portion of the lower 64 acre portion. Water from the 64 acres drains into Lanman Run. Water from the north 40 acres drains into Rockhouse Branch. These streams are a part of the Lower Ohio-Little Pigeon Watershed. There are many southerly aspects and xeric ridgetops, especially in the 64 acre portion. The north 40 contains more northerly aspects with xeric ridgetops. Elevation ranges from approximately 530 feet in the stream bottom in the north 40 acres to 697 feet on ridgetops in the southeast corner of the 64 acres. Ridgetops in the north 40 acres roughly form a U-shape with gentle to steep slopes bisected by small ravines facing generally north. The majority of the lower 64 acres is ridgetop with some small ephemeral streams cut out between ridge fingers. One large ravine conducts the intermittent stream out of the tract in the southwest corner. Soils in this tract are derived from residuum from interbedded sandstone, siltstone, and shale with scattered loess over residuum.

Figure 2. Compartment 07, Tract 06 Soils.



Adyeville-Wellston-Deuchars, eroded (AbvD2); *(28 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.

Adyeville-Wellston-Deuchars, severely eroded (AbvD3); *(16 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.

Adyeville-Tipsaw-Ebal Complex (Accg); *(58 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.

Apalona silt loam, severely eroded (AgrC3); *(2 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.

Roads and Access

Historically, this tract could be accessed by County Road 147 (Oak Ridge Rd) from the south and 42 from the north. These roadbeds still exist and reach the tract in the northeast and southeast corners. They may be passable for much of the year and are connected. Further, access to the 40 acres is only possible by travelling through a different private landowner to the west of the 64 acres. Perry County Highway Department discussed county road access to this portion of Ferdinand State Forest with Doug Brown in 1996. They were directed by the county attorney to maintain only roads on the state highway inventory map at that time. It was discussed the 1977 Perry county highway map showed N. Oak Ridge Road (CR 147) as an unimproved road with uncertainty whether it was discontinued or a township road at that time. There was no record found at this time when status of the road changed. It was also brought up there may be no formal record of status change due to prevalence of "informal handshake

agreements" in the past. In 2017, IDNR Fire Headquarters performed dozer work to open up northern access to this tract. This route passes through private property and has a locked gate to limit unauthorized access.

Boundary
The following is from January 2000: "Only three established corners exist on this tract with only one being considered accurate. On the northern forty acres, the north east corner has the only cornerstone. This corner is marked with a steel "T" post, a survey marker and a plastic state forest sign. The stone is buried beneath a large tree. The east line was established using compass as well as following an apparent "fence hump" or tree line. Approximately half way a metal state forest sign was located on or near the line on a sassafras tree. The south east corner is very tentative. This corner was established using the intersection of the east and south lines. A private property sign is located on state land near the corner. The southern line was found by compass and seemed to follow a tree line. No evidence was found at the south-west corner. The west line had been flagged previously by the neighbors with orange ribbon. Fence was located nearby, but was off of the line. The north-west corner was found near a large oak where a metal state forest sign was found on the ground. The northern line was found by compass and followed fencing remnants. For the southern portion of the tract, the north-west corner is a common corner with the northern forty acres. The northern line had no evidence other than private property signs and ribbon put up by neighbors. The north-east corner is approximate. A steel pipe painted orange set in the creek bed was considered to be the corner for this survey. However, Don Hoppenjans projected the corner approximately 20 feet to the north. An old metal state forest sign was posted nearby. The east line showed evidence of past surveys; pink ribbon was put up. The southern line follows the drainage. Finally, the west line seemed to follow a tree line. All property lines were flagged in January 2000 with pink ribbon by Doug Brown and Gretchen Herbaugh.

Wildlife
A Natural Heritage Database Review was completed for C7T6 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.

Through previous timber harvesting, utilizing appropriate silvicultural and management methods, this tract appears to have enhanced the oak-hickory component through selection of non-oak/hickory species for removal and by other silvicultural strategies to control species composition. This managed outcome has resulted in presence of many high-quality oak and hickory trees in dominant canopy positions. These dominants are intercepting sunlight and utilizing 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 ephemeral streams and southern intermittent stream which probably have high-flow periods throughout the year and retain small drinking pools during regular dry periods.

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 in this tract 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.

White tailed deer is an important species to this area. From 1940 to present, populations have increased in southern Indiana. Deer densities are much higher now than when present forest in C7T6 was initiated. Since deer prefer woody browse such as tree seedlings, native shrubs and also certain herbaceous plants, it is reasonable to expect such vegetation to have additional pressure by deer on patterns of dispersal, abundance, and distribution across the landscape.

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. All legacy trees and snags for all size classes, except 20+ inch legacy trees, meet maintenance level for Indiana bat habitat. All snags were selected to be retained during the inventory. Management practices conducted in C7T6 will be implemented in a manner maintaining long-term quality forest habitats for wildlife populations while promoting legacy tree development.

Table 2. Live Legacy Trees and Snags for C7T6

	Maintenance Level	Inventory	Available Above Maintenance
Legacy Trees *			
11"+ DBH	936	1171	235
20"+ DBH	312	275	-37
Snags (all species)			
5"+ DBH	416	670	254
9"+ DBH	312	314	2
19"+ DBH	52	60	8

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

Communities

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 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 C7T6 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 C7T6.

Ailanthus, Japanese honeysuckle, and multi-flora rose were observed throughout the tract at various densities. Problem occurrences of these and other invasives, such as Autumn olive, bush honeysuckle, Japanese stiltgrass, and paulownia should be treated as part of a regular invasive species control program.

In addition, emerald ash borer (*Agrilus planipennis)* exists in the region, producing near complete mortality in overstory ash. For this reason, it is recommended ash trees be included in regularly prescribed timber harvesting ahead of the killing wave so value is not lost to mortality and regeneration of the species can be fostered before loss of seed bearing trees. Ash that survive the killing wave and are in healthy condition should be retained in the stand.

Recreation

Recreational activities are likely limited in this tract due to a lack of public access. Illegal ATV use has been documented on this tract and abutting private property to the east and west.

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. = **146 Trees/Ac.** Overall % Stocking Hardwoods = **80%** (Fully Stocked)
Basal Area = **94.5 Sq. Ft./Ac.** Harvestable Trees = **16 Trees/Ac.**
Present Volume = **7,841 Bd. Ft./Ac.**

The table below provides volume estimates associated with each tree species.

Species	Total Volume (Bd.Ft. Doyle)
Yellow poplar	265,440
Chestnut oak	185,220
White oak	108,510
Black oak	50,570
Pignut hickory	44,010
Eastern white pine	33,670
Northern red oak	25,590
Scarlet oak	23,100
Virginia pine	21,650
Sugar maple	17,060
Shagbark hickory	16,290
White ash	14,430
Blackgum	4,280
Black walnut	2,890
Bitternut hickory	2,750
Tract Totals (bd. Ft.)	**815,440**
Per Acre Totals (bd. Ft./Ac.)	**7,841**

Mixed Hardwoods Stratum

Mixed hardwoods tend to be variable in composition and thus may have more complicated prescriptions attached to them. This stratum occupies about approximately 44 acres, covering roughly 42% of the acreage. The average total basal area for this stratum is around 96 square ft./acre.

Mixed hardwoods tend to grow on mesic sites. Mesic sites in C7T6 contain an overstory of trees having high vigor and good form mixed with codominant, intermediate, and suppressed trees which have the lowest vigor and generally poorer growing characteristics. Mesic sites are good sites for growing trees and so oaks and hickories have increased competition from a greater number of species. Fast growing shade intolerants like yellow poplar and sycamore tend to have much faster height growth than the slower growing oaks and hickories. However, when oak trees do establish dominance on mesic sites, trees of excellent quality and health can be grown. Current ecologic conditions in this type favor dominance by moisture-needing, fast growing

shade intolerants alongside slow growing shade tolerants. Because this stratum is 82% stocked, there are many areas where trees are growing with appropriate levels of competition from neighboring trees. There are pockets where trees are growing densely especially in the areas not harvested in 2005 or 1983, and there are trees of poor form and having other undesirable characteristics which ideally could be removed to relieve stress and promote growth on healthier trees. However, the mixed hardwood stands are, on average, growing well with appropriate spacing between crop trees. In many areas within the 2005 harvest area, the understory is thick with greenbrier, *Rubus*, and small saplings. This is evidence stocking in these stands was reduced low enough, by the previous harvest and subsequent management, to stimulate regeneration over a wide area. The crop trees selected for in the residual stand of 2005 in some places exist as overwood in the shelterwood system. Epicormic sprouts have proliferated down to the butt log of these trees. The western regeneration opening from 2005, currently in the stem-exclusion phase, seems to be returning as a mixed hardwood stand with a strong component of oak. This opening could be thinned while young to promote survival of oaks and other acceptable growing stock in order to enhance oak growth and prevent oaks from being suppressed by faster growing species.

It is recommended to perform a prescribed burn in those mesic mixed hardwood stands with the highest oak component in order to clear competing understory vegetation and subsequently promote new and existing oak advance reproduction. Then, after this has been accomplished, a regeneration survey is recommended to assess oak advance reproduction levels in these stands. If satisfactory levels can be obtained, then areas with overwood should have a complete overstory removal to promote regeneration and even-age stand development. In denser mixed hardwood stands, a future single-tree selection harvest, leaving the best quality crop trees in the residual stand may be warranted. Group selection will be an option for management in some areas for long-term forest regeneration and sustainability. Best sites for group opening are areas with advanced oak regeneration having reached 4.5 feet tall. Areas where pole-sized hardwoods have emerged and entered the canopy should be prescribed TSI for croptree release if not adequately released during timber harvest.

Invasive species control should be conducted if practicable to reduce competition by invasive species against desirable species such as oak and poplar in establishing a new cohort in the regeneration layer.

Oak-Hickory Stratum

The retention of species in this stratum is important to the Division's long-term wildlife and timber management objectives. This stratum occupies around 53 acres, covering roughly 51% of the acreage. The average total basal area for this stratum is around 92.7 square ft./acre.

Invasive species control should be conducted where practicable to reduce competition by invasive species against desirable species such as oak and hickory in establishing a new cohort in the regeneration layer. Additionally, TSI utilizing a 3-4-sided crop tree release should be conducted in the 5 acre regeneration opening to reduce competition on oak and hickory saplings and poles in this area.

Because this stratum is 76% stocked, there are many areas where trees are growing appropriate levels of competition from neighboring trees. There are pockets where trees are growing densely especially in the areas not harvested in 2005 or 1983, and there are trees of poor form and having other undesirable characteristics which ideally could be removed to promote growth on healthier trees. However, the oak-hickory stands are, on average, growing well with appropriate spacing between crop trees. In many areas within the 2005 harvest area, the understory is thick with greenbrier, *Rubus*, and small saplings. This is evidence stocking in these stands was reduced low enough, by the previous harvest and subsequent management, to stimulate regeneration over a wide area. In denser oak-hickory stands, a future single-tree selection harvest, leaving the best quality crop trees in the residual stand may be warranted. Group selection will be an option for management in some areas for long-term forest regeneration and sustainability. Best sites for group opening are areas with advanced oak regeneration having reached 4.5 feet tall. Or 1.5 inch root collar diameter.

Pine Stratum

This stratum occupies approximately 7 acres, covering roughly 7% of the acreage. Understory growth is composed of beech-maple, sweetgum, sassafras, and blackgum for the most part, with other occasional oak and hickory species. Basal area for this stratum is around 100.7 square feet per acre. The pine stratum is approximately 100% stocked with pines although there are areas where mixed hardwoods have grown into dominant and codominant portions of the main crown canopy. Generally more shade tolerant hardwoods, with some parts having good shade intermediate oak regeneration, grow underneath the pine plantations. Long-term growth of hardwoods under pine overstory can lead to the future stand having many hardwood trees with poor form and poor vigor due to years of suppression by pines. These areas, along with those having good oak regeneration, typically are good candidates for group openings in order to convert the site from pine to native central hardwoods. A future group selection opening may be warranted in the pine areas in this tract, with some high vigor, tall white pine being left for wildlife.

Invasive species control should be conducted where practicable to reduce competition by invasive species against desirable species such as oak and hickory in establishing a new cohort in the regeneration layer. TSI should be performed to release desirable crop trees.

Proposed Activities

TSI, invasive species control and a light timber harvest is recommended. A prescribed burn is recommended to promote oak advance regeneration prior to removing overstory in shelterwood areas and other nearby mixed hardwood and oak-hickory areas as practicable. A regeneration survey is then recommended to assess oak advance regeneration levels 3 years post treatment. The tract should be re-inventoried and updated management guide developed in 15-20 years. ATV trespass activity is to be monitored and resolved should activity persist.

Proposed Activities Listing

Proposed Management Activity	***Proposed Period***
Monitor ATV trespass and resolve	CY2019-
TSI & Invasive Control	CY2019-+
Prescribed Burn Plan	CY2019+
Prescribed Burn	CY2019+
Regeneration Survey in burn area	3 years post-burn
Timber harvest	CY 2019-2025
Re-inventory and Management Guide	CY2033-2038

State Forest: **Ferdinand State Forest** Compartment: **07** Tract: **07**

Tract Acreage: 76 Commercial Forest Acreage: **76**
Forester: **Evan McDivitt** Date: **10/30/2018**

Location
C7T7 is located in Perry County, the northern half being in Section 16, T4S, R3W in Clark Township; the southern half being in Section 21, T4S, R3W in Clark Township. It is approximately one-half mile southwest of Mount Pleasant Cemetery which is located at the intersection of Cattail, Collard, and Candlestick Roads.

General Description
C7T7 contains approximately 76 forested acres. The majority of this tract is in oak-hickory stands with some mixed hardwoods and pine plantation interspersed throughout the tract. Old firelane 26 runs through the tract on the main ridgetop. See table 1 for a summary of tree species identified during the inventory.

Oak-Hickory (50 acres): This type is found primarily on dry sites on ridgetops and steep slopes. Oak-hickory is more commonly found along south and southwest facing slopes as well as on xeric ridge tops in this tract. Primary species dominating the overstory are chestnut oak, white oak, black oak, and bitternut hickory. Understory consists of mostly beech-maple, blackgum and greenbrier.

Mixed Hardwoods (16 acres)*:* Mixed hardwoods are found throughout the tract on mesic sites, primarily on north and east facing slopes. They consist primarily of yellow poplar, sugar maple, and American beech. Some mixed hardwoods are intermingled with pine in portions close to, and often inside, old pine plantations. Understory includes yellow poplar, beech-maple, and white ash.

Pine plantation (10 acres): Pine in this tract consists mostly of white pine with some Virginia and red pine. Pine is found along the north-central to north-west portion and in the south-eastern portion of this tract. Understory contains a composition of vigorous beech-maple with other competing mixed hardwoods, spicebush, and some advanced oak regeneration.

Figure 1. Ferdinand SF Compartment 7, Tract 7.

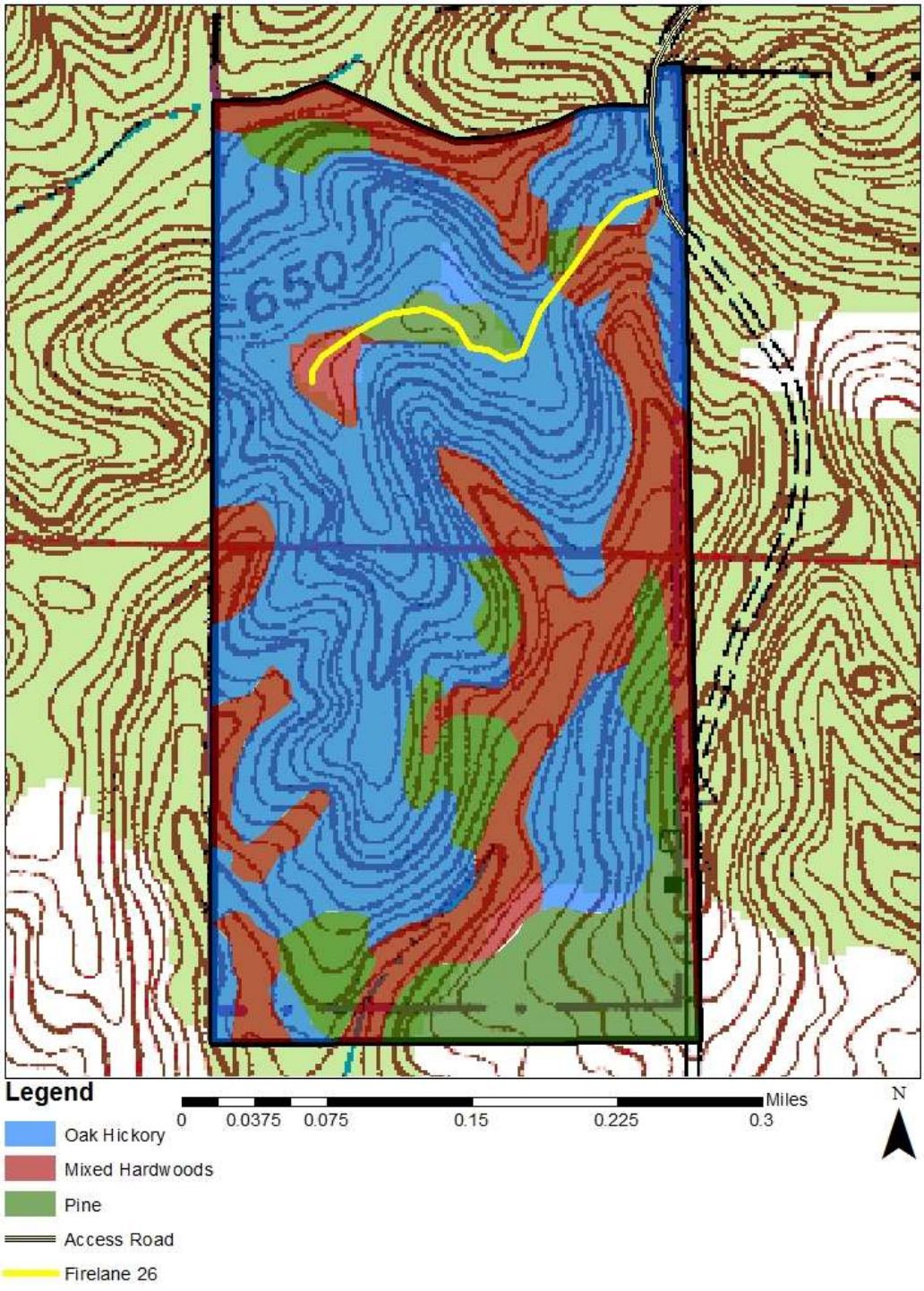


**Table 1. Overview of Tree Species in C7T7 –
(Descending Order of Abundance)**

Overstory Sawtimber Layer	Understory Poletimber Layer	Regeneration Layer
chestnut oak	sugar maple	sugar maple
yellow poplar	blackgum	American beech
eastern white pine	chestnut oak	blackgum
white oak	white ash	pignut hickory
black oak	yellow poplar	red maple
bitternut hickory	shortleaf pine	shagbark hickory
sugar maple	shagbark hickory	white ash
pignut hickory	red pine	eastern white pine
American beech	eastern white pine	hackberry
northern red oak	white oak	persimmon
shortleaf pine	pignut hickory	
shagbark hickory	bitternut hickory	
white ash	dogwood	
Virginia pine	black oak	
blackgum	American beech	
American sycamore	Virginia pine	
mockernut hickory	black cherry	
scarlet oak	persimmon	

History

This land, and 6 acres now in tract 6, was purchased from Leonard and Elizabeth Weisman in 1958 for $15.00 per acre. The Land Examination Report stated timber on the north 40 acres was cut around 1952 leaving nothing bigger than tie size trees. However, the report noted that it was "tall and straight and good growing young timber." The timber on the south 40 acres was larger, up to 18 inches on the stump. It was recommended that 18 acres of open ground be planted to pines. Pines were then planted, probably within the next few years, but no record of this was found.

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 1940 to 1979. 1940 aerial photos show the north and west portions along with the south and east portions of this tract apparently in the aggradation (young developing forest) phase of succession. Prior to this, these areas were probably cleared, being used for open field, pasture, or perhaps limited cultivation. The large valley extending from southwest to northeast through the tract remained in mostly closed canopy forest cover during this time. Trees in this steep, rocky valley likely were sparsely harvested due to inaccessibility and abundance of more-easily harvested timber elsewhere. Open areas in this tract probably underwent severe erosion in the 1950's and early 1960's. By 1967, presence of pine plantation can be seen from aerial photos along the southern boundary. By 1979 pines were developing and hardwoods had grown in to solidify the forest structure and set in motion species composition that Bill Hahn referred to in the initial entry in resource management history for this tract.

Resource Management History

This tract was inventoried by Bill Hahn in 1973. He noted timber in this area had most likely been harvested, apparently in a diameter-limit cut, many years ago. He noted old roads, which today are barely noticeable. He found 941 board feet per acre total volume with an average basal area of 98 square feet per acre on 43 acres of hardwoods. No harvest was recommended. Another inventory was recommended in eight to ten years.

In November 1993, approximately 3 acres were moved from tract 7 into tract 6, to the north by Doug Brown. This turned the drainage into the boundary, allowing the 3 acres to be better managed with tract 6 instead of tract 7.

Also in 1993 Doug Brown inventoried this tract, finding an estimated 1,735 board feet per acre in harvest stock and 6,347 board feet per acre total volume across 61 commercial forest acres. Basal area for this tract was found to be 105 square feet per acre. A light harvest was prescribed to remove chestnut oak, the few mature or overmature black oaks, and damaged or defective trees in order to improve growth, quality and species composition. Conversion of pine to hardwoods was also prescribed. Also it was recommended to investigate status of roads, whether or not they belonged to the county road system. This was in an effort to discourage illegal ATV/vehicle use of this and adjacent tracts and to assess public access. Pre and post harvest TSI was recommended as well. Another inventory was prescribed for 2008.

In Spring of 1996 records show correspondence between St. Meinrad Abbey Forester and Doug Brown regarding mutual attempts to limit illegal ATV trails along the shared western border of this tract.

In May 1996 a timber sale applying single tree and group selection was conducted with 58,979 board feet over 41 acres sold to Lasher Lumber, Inc (Tell City, IN) for $14,760.00. The harvest concluded November 7, 1996. Records exist documenting effective installation of Best Management Practices (BMPs) throughout this sale. Post-harvest TSI was completed in 1999.

This tract was inventoried in July 2017 by Andrew Jones, Cameron Scott, and Evan McDivitt who estimated 3,389 board feet per acre in harvest stock and 10,424 board feet per acre total volume across 76 acres.

Landscape Context

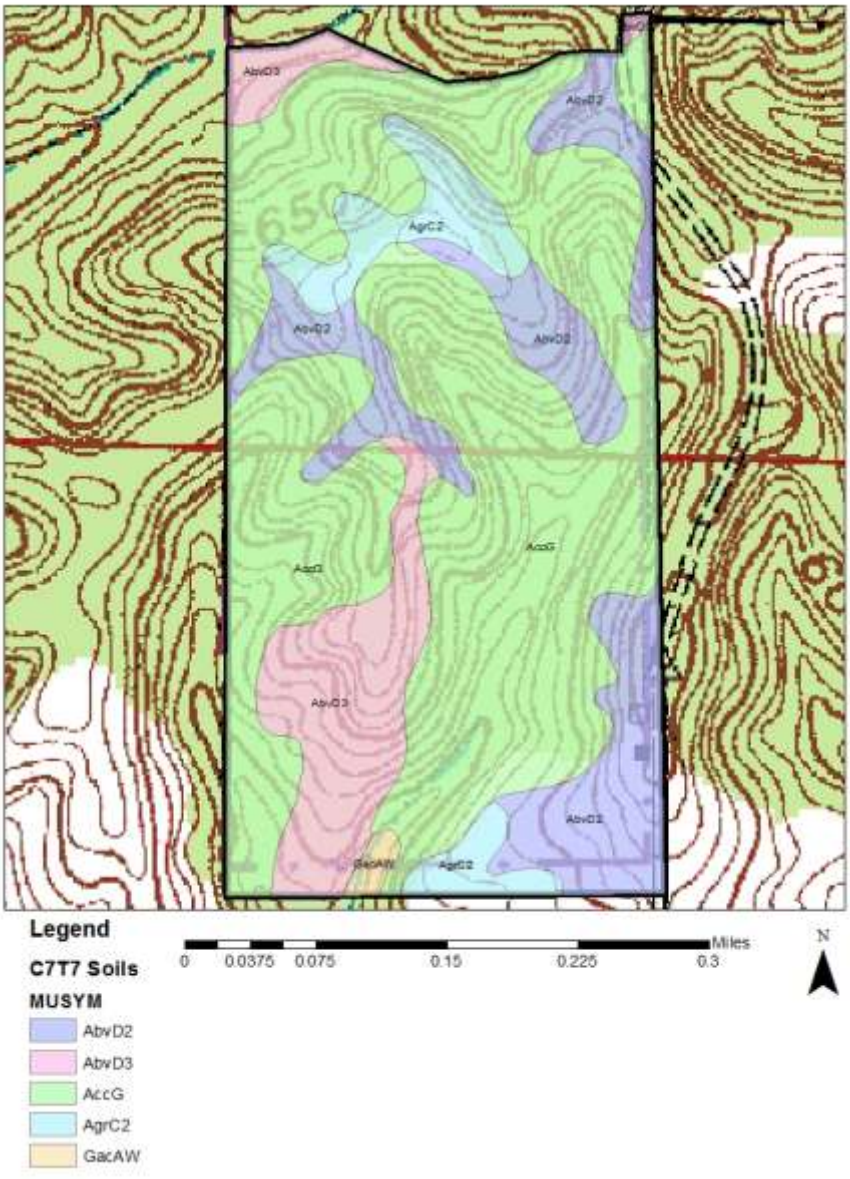
C7T7 lies within the Crawford Upland Section of the Shawnee Hills Natural Region. The entire tract lies within the Southern Hills and Lowlands physiographic province. Additionally, the entire tract lies within the Crawford-Mammoth Cave Uplands part of the Interior Plateau ecoregion. Pre-settlement land 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 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 sizable areas in deciduous forest, herbaceous cover, and conifer plantation; with a smaller amount in hay/pasture, developed open space, shrubland, old strip mine, cultivated crops, and open water. An Old Indian Treaty Boundary was located approximately one-fifth of a mile south from the southwest corner of this tract.

Topography, Geology, and Hydrology

This tract contains relatively rugged terrain with steep, narrow valleys and a few rock outcroppings and rock faces. There are many southerly aspects and xeric ridgetops. Elevation ranges from approximately 528 feet in the southwest corner to 690 feet on ridgetops in the northeastern portion of the tract. A valley, approximately 800 feet wide from ridgetop to ridgetop and 80 feet deep, cuts from southwest to northeast, forming a "Y" through the middle of the tract. This valley contains an intermittent stream for approximately one fifth of a mile on the southern stretch. Many small ridge fingers extend off the main ridgetop and have steep ravines approximately 200-300 feet wide from ridgetop to ridgetop, ranging around 40 feet deep. Much of the tract is classified as eroded or severely eroded. Soils in this tract are derived from residuum from interbedded sandstone, siltstone, and shale with scattered loess over residuum.

Soils

Figure 2. Compartment 7, Tract 7 Soils.



Adyeville-Tipsaw-Ebal Complex (AccG); *(47 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. Found in this tract on sideslopes 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. A fair amount of chestnut oak is found growing on this complex.

Adyeville-Wellston-Deuchars, eroded (AbvD2); *(14 acres).* This complex is moderately well drained to somewhat excessively drained. Seasonally high water table ranges from 24 inches to greater than 40 inches. Found in this tract on sideslopes 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 for yellow poplar it is 90.

Adyeville-Wellston-Deuchars, severely eroded (AbvD3); *(9.6 acres).* This complex is moderately well drained to somewhat excessively drained. Seasonally high water table ranges from 24 inches to greater than 40 inches. Found in this tract on sideslopes 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 for yellow poplar it is 90.

Apalona silt loam (AgrC2); *(5 acres).* Moderately well drained. Seasonal high watertable from 2.0 to 3.0 ft. Found in this tract on sideslopes on uplands. 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.

Gatchel loam (GacAW); *(0.4 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.

Roads and Access

Historically, this tract could be accessed by County Road 147 (Oak Ridge Rd) from the south and 42 from the north. These roadbeds still exist and reach the tract in the northeast and southeast corners. They may be passable for much of the year and are connected. There is also an unmaintained, old road bed crossing the tract along the main ridge and is currently used as old firelane 26. Perry County Highway Department discussed county road access to this tract with Doug Brown in 1996. They were directed by the county attorney to maintain only roads on the state highway inventory map at that time. The 1977 Perry county highway map showed N. Oak Ridge Road (CR 147) as an unimproved road with uncertainty whether it was discontinued or a township road at that time. There was no record found at this time when status of the road changed. It was also brought up there may be no formal record of status change due to prevalence of "informal handshake agreements" in the past. In 2017, IDNR Fire Headquarters performed dozer work to improve northern access to this tract. This route passes through private property but previous access via the closed county road allows for continued legal use by state forest staff.

Boundary

This tract is bounded on the north by an unnamed drainage. The south line has some fence remnants and part of it borders open fields. There is also a cornerstone in the southwest corner. There are some fence remnants in the south half of the west line and a cornerstone in the middle. However, the fencing is somewhat erratic. There may be evidence of tree lines and cutting edges along the east or west line but nothing certain. The south half of the east line is marked by some fencing and the county road.

Wildlife

A Natural Heritage Database Review was completed for C7T7 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.

Through previous timber harvesting, utilizing appropriate silvicultural and management methods, this tract appears to have enhanced the oak-hickory component through selection of non-oak/hickory species for removal and by other silvicultural strategies to control species composition. This managed outcome has resulted in presence of many high-quality oak and hickory trees in dominant canopy positions. These dominants are intercepting sunlight and utilizing 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.

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 in this tract 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.

Wildlife species observed during the 2017 inventory include pileated woodpecker, wood thrush, blue jay, tufted titmouse, eastern towhee, gray tree frog, eastern tent caterpillar, American daggermoth caterpillar, and an eastern box turtle was observed. In addition, the exposed rock faces should provide den sites for coyote, fox, and/or bobcat. Abundance of chestnut oak, a good wildlife food for deer and turkey, is plentiful here.

White tailed deer is an important species to this area. From 1940 to present, populations have increased in southern Indiana. Deer densities are much higher now than when present forest in C7T7 was initiated. Since deer prefer woody browse such as tree seedlings, native shrubs and also certain herbaceous plants, it is reasonable to expect such vegetation to have additional pressure by deer on patterns of dispersal, abundance, and distribution across the landscape.

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 C7T7 will be implemented in a manner maintaining long-term quality forest habitats for wildlife populations while promoting legacy tree development.

Table 2. Live Legacy Trees and Snags for C7T7

	Maintenance Level	**Inventory**	**Available Above Maintenance**
Legacy Trees *			
11"+ DBH	684	1,280	596
20"+ DBH	228	297	69
Snags (all species)			
5"+ DBH	304	1,233	929
9"+ DBH	228	552	324
19"+ DBH	38	125	87

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

Communities

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 C7T7 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 C7T7.

Japanese stiltgrass and multi-flora rose were observed throughout the tract at various densities. Problem occurrences of these and other invasives, 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.

In addition, emerald ash borer (*Agrilus planipennis)* exists in the region, producing near complete mortality in overstory ash. For this reason, it is recommended ash trees be included in regularly prescribed timber harvesting ahead of the killing wave so value is not lost to mortality and regeneration of the species can be fostered before loss of seed bearing trees. Ash that survive the killing wave and are in healthy condition should be retained in the stand.

Recreation

Recreation in this tract is likely limited due to no legal public access. Currently, there are no developed recreation trails within this tract. Illegal ATV use has been documented on this tract and abutting private property to the west, owned by Saint Meinrad Archabbey.

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 Andrew Jones, Cameron Scott, and Evan McDivitt. 32 prism points were sampled over 76 acres (1 point for every 2.375 acres). A tract summary is provided in this guide. Pre harvest and post harvest stocking is indicated by the red line in Figure 3.

Tract Summary Data

Total Trees/Ac. = **133 Trees/Ac.** Overall % Stocking = 100**%** (Fully Stocked)
Basal Area = **124 Sq. Ft./Ac.** Harvestable Trees = **56 Trees/Ac.**
Present Volume = **10,424 Bd. Ft./Ac.**

Species and Volume Summary Tract 0707

Species	Total Volume (Bd.Ft. Doyle)
Chestnut oak	198,900
Yellow poplar	160,290
Eastern white pine	115,720
Black oak	81,170
White oak	76,640
Northern red oak	24,670
Bitternut hickory	20,890
Pignut hickory	18,340
American beech	17,250
Sugar maple	11,730
American sycamore	7,550
White ash	6,260
Shortleaf pine	6,240
Virginia pine	4,860
Shagbark hickory	4,840
Mockernut hickory	2,020
Scarlet oak	1,960
Blackgum	1,640
Tract Totals (bd. Ft.)	**760,970**
Per Acre Totals (bd. Ft./Ac.)	**10,013**

Current ecologic conditions in C7T7

Oak-Hickory: Areas of disturbance dependent, high quality oak-hickory canopy situated overtop a shade tolerant mid story

Total Trees/Ac. = **120 Trees/Ac.** Percent of Entire Tract = **66%**
Basal Area = **118 Sq. Ft./Ac.**

In the central portion of this tract and elsewhere high quality timber trees were observed during the inventory. Some of the white and black oak-dominated cover types in this tract contain well-formed crop trees. These long-lived trees should be able to continue for 2 or 3 management cycles while producing a seed source with genetics matched to the site. Many of these oak-hickory sites contain a midstory or understory of beech-maple, blackgum, greenbrier thicket, and even a dense white ash layer here and there. In some areas, the midstory maple is so dense the forest floor is bare, having very little herbaceous or woody vegetation growing. This creates opportunities for deer movement through the understory. But the increased concentration of deer in these areas facilitates browsing on the few plants that do grow here and promotes maintenance of low vegetation diversity. Current ecologic conditions in these areas will lead to development

of a future cohort of beech-maple, blackgum, and yellow poplar with some oak and hickory in the future dominant canopy layer. Currently, high quality genetic stock acorns and hickory nuts that germinate will be outcompeted on most sites by other species and future forest managers may experience a decline in the oak and hickory component.

Mixed Hardwoods: Areas of high quality mesic mixed hardwood sites

Total Trees/Ac. = **128 Trees/Ac.** Percent of Entire Tract = **21%**
Basal Area = **111 Sq. Ft./Ac.**

Mesic sites in C7T7 contain an overstory of high quality trees having high vigor and good form mixed with codominant, intermediate, and suppressed trees. Yellow poplar, sycamore, sugar maple, American beech, white ash and northern red oak of good quality are distributed well throughout these sites. Some white and black oaks are scattered here and there. Mesic sites are better sites for growing trees and so oaks and hickories have increased competition from a greater number of species. Fast growing shade intolerants like yellow poplar and sycamore tend to put on much faster height growth than the slower growing oaks and hickories. However, when oak trees do establish dominance on mesic sites, trees of excellent quality and health can be grown. Current ecologic conditions in this type favor dominance by moisture-needing, fast growing shade intolerants alongside slow growing shade tolerants regularly reaching the canopy.

Pine Plantations: Areas of successful erosion control and senescing pines

Total Trees/Ac. = **211 Trees/Ac.** Percent of Entire Tract = **13%**
Basal Area = **175 Sq. Ft./Ac.**

Pine plantations in C7T7 have reached maturity and some sites never experienced good growth. These sites, however, have recovered from the extreme 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 good 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 and poor growth. Some areas which have undergone earler gap formation in the pine canopy may see higher quality trees reach the canopy. Lower quality pine sites, which have provided the right light conditions for oaks in previous years, will have a higher oak component in the understory ready for release.

Tree damage, poor health, poor form, and senescence

In chestnut oak cover types, mainly on ridgetops and xeric sites, there is high mortality in old, senescing chestnut oak trees found here. Mainly in the eastern-central portion of the tract with a few additional areas there exists some blown down, mature chestnut oak; an indication these trees are reaching the end of their natural life and are being taken by mortality. In pine plantations there are many senescing white, Virginia and red pine beginning to be lost to mortality. As trees in a dense stand fall over, additional trees in various states of health are likewise damaged by branches being broken, bark being scraped off allowing rot-forming and harmful fungi and disease to enter, and also through the sheer force of a large falling tree uprooting an adjacent tree causing a domino effect. Other forms of tree damage in this tract include previously high vigor trees becoming stressed through various agents like extreme cold, extreme drought, soil conditions poorly matching silvical requirements, and short and long-term weather patterns. Also damage can be caused from wildlife interacting with trees in various ways. Throughout the tract there are trees that did not grow under favorable light conditions or experienced heavy crowding by adjacent trees and so grew directing terminal shoots to accommodate available space and light conditions. Such trees, now mature or nearly so, occupy space inefficiently; have poorly formed stems; are often suppressed by more dominant and straight individuals; and may be suppressing high quality trees in an advanced position for release. These trees are often unhealthy; succumb to damages from poor form, such as cracking and weight stress; and in many other ways they often decline over a period of 15-20 years. There is little likelihood these trees will be alive during the next inventory. Finally, in both mixed hardwood and oak-hickory cover types, there are many overmature trees of various species that will most likely begin declining in health and quality by the next inventory. These trees are oftentimes shading high quality trees that could grow in their place if liberated.

Abandoned agricultural land, invasive species, and vacant understory niches

As discussed previously, C7T7 has progressed through agricultural abandonment, invasive species introduction, increasing deer density, and shade tolerant mid story development. Resultant understory conditions have included diminished native shrub and vine diversity, abundance of shade tolerant tree seedlings ready to become the next canopy layer, and increasing invasive species density.

Past silvicultural practices in C7T7

Uneven age silvicultural methods, single tree and group selection, are evident in this tract. These methods, along with pre and post harvest TSI, have promoted growth of high quality crop trees. Single tree canopy gaps, mimicking ecological conditions such as single tree windthrow or death, have begun to be utilized by shade tolerant tree seedlings like sugar maple and American beech and to lesser degree by more intolerant yellow poplar, white ash and blackgum. Minor group openings, mimicking a larger natural disturbance event, have been utilized by seedlings of shade intolerants like yellow poplar, sycamore, white ash and black cherry and shrubs like *Rubus*, greenbrier and others. In xeric sites, both canopy gaps have been utilized by oaks and hickories as well as the previous species listed. Previous skid trails through this tract are often

barely noticeable from surrounding woods. The log yard, approximately one quarter acre in size has likewise returned to seedlings and saplings.

Oak-Hickory Stratum

Objectives include maintenance and enhancement of the oak-hickory component, continuing to grow high quality and high vigor canopy dominants, especially long-lived white oak for an additional 15-20 years. Additionally, it is recommended to manage high quality sites for oak-hickory regeneration to begin establishing the next cohort. Options include harvesting low-quality, non-oak/hickory species in areas where single tree selection method is used while leaving high-quality oaks and hickories to grow for an additional 2 or 3 cutting cycles; selecting poorly formed or low vigor oaks and hickory species in areas where a better quality oak or hickory may be released from the competition; and also, combining these methods with appropriate strategies to promote development of oak and hickory advance regeneration.

Pre-harvest invasive species control should be conducted where practicable to reduce competition by invasive species against desirable species such as oak and hickory in establishing a new cohort in the regeneration layer. Additionally, a midstory removal (oak shelterwood method) may be beneficial in promoting oak advance regeneration and apical dominance of seedlings.

A prescribed fire in areas of good quality soils for growing oaks could promote oak-hickory regeneration by eliminating shading thin-barked competitors from the mid and understory and allowing fire-adapted oak species to vigorously resprout, following fire, and to get above fast growing non-oak competitors, such as yellow poplar and cherry.

Single tree selection is prescribed to remove mature and over-mature, undesirable trees to release growing stock of high quality stems. Most high quality seed trees should be left in the stand but co-dominants, such as beech-maple, should be targeted for removal. Damaged trees that can be considered as cull trees are suggested for removal in the tract to promote a healthy forest. Most likely, regeneration will be comprised of mixed hardwoods, mainly beech-maple with a component of oak unless some TSI is implemented. Areas with an abundance of oak regeneration should be considered for release through a group selection cut.

Mixed Hardwoods Stratum

Objectives include maintenance and enhancement of mesic mixed hardwood sites promoting high quality, high vigor species that are growing on appropriate sites for an additional 15-20 years.

Pre-harvest invasive species control should be conducted where practicable to reduce competition by invasive species against desirable species such as oak and poplar in establishing a new cohort in the regeneration layer. Additionally, a midstory removal (oak shelterwood

method) may be beneficial in promoting oak advance regeneration and apical dominance of seedlings in certain areas.

A prescribed fire in areas suited for growing oaks could promote oak-hickory regeneration by eliminating shading thin-barked competitors from the mid and understory and allowing fire-adapted oak species to vigorously resprout, following fire, to get above fast growing non-oak competitors, such as yellow poplar and cherry.

Single tree selection cuttings are prescribed to remove mature to over-mature trees and any cull trees in poor form. Improvement cutting will enable release of any quality oaks and 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.

Pine Stratum

Objectives include converting pine to native hardwoods within the next 1-5 years.

Some white pine could be retained for wildlife and the rest, along with the Virginia and red pine, removed so native hardwoods can return to the site. 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.

Group openings are ideal in managing these areas for long-term forest regeneration and sustainability. Best sites for group opening are areas with advanced oak regeneration having reached 4.5 feet tall. Areas where pole-sized hardwoods have emerged and entered the canopy should be prescribed TSI for croptree release if not adequately released during the timber harvest.

Summary of proposed activities

Overall, a managed timber harvest removing 250,000 to 300,000 board feet over the 76 acre tract is prescribed to help meet stand objectives.

Invasive species control is recommended prior to timber harvest operations if practicable. 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 invasives follow-up, especially in large gap openings. A prescribed burn may help with setting back invasives and promoting oak regeneration as part of the post-harvest TSI, especially in those areas of the tract where regeneration has been initiated and where adequate oak regeneration is present. Enrichment planting with native oak species is also an option where regeneration and seed source is lacking. A regeneration review should be

conducted three years after conducting all treatments. The tract should be reinventoried and a new management guide written in 15-20 years.

ATV trespass activity is to be monitored and resolved should activity persist.

Proposed Activities Listing

Proposed Management Activity	***Proposed Period***
Monitor and resolve ATV trespass	CY 2019-
Pre-harvest TSI (invasives and other)	2019-2020
Timber Sale	2019-2022
Post-harvest TSI and prescribed fire	Following harvest
Regeneration Opening Review	3-5 Years Postharvest
Reinventory and Management Guide	CY2033-2038