

FOREST MANAGEMENT PLAN

57 O'Kelly Chapel rd. Durham, NC

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Forest Management Plan
57 O’Kelly Chapel rd. Durham, NC
Chatham County, NC

Landowner: Curtis Clark
57 O’Kelly Chapel rd. Durham, NC 57713

Total Acreage: 75.03 acres (43.0 in Management Plan)

Location: The property is approximately 6 miles west of RDU airport and approximately 2 miles east of Jordan Lake at the junction of Highway 751 and O’Kelly Chapel rd., just south of the Durham/Chatham County line.

Coordinates: (35.86473028627019, -78.94389315472723)

Prepared By: Edward Terrell

Date Prepared: April 1, 2022

Introduction

The intention of this plan is to apply the skills I learned in forestry school at NC State. The real-world application of the skills necessary to carry out a forest management plan is a different type of learning experience that will carry over into real life forestry practice in the industry. By applying these skills now instead of waiting for more training in the field is an enriching experience that will benefit not only me but my future employers and landowners also.

Executive Summary

The Property owner is interested in maintaining a partially forested property for aesthetics and bequest value. The owner does not use his forested areas directly.

The purpose of this plan is to qualify this property for present use valuation. The forested areas on the track must be brought into a healthy, productive and responsibly managed state to qualify.

The property is located in the central Piedmont of North Carolina and is approximately 75 acres of which 43 is in the management plan. The managed area has been delineated into 4 stands based on age, soils, topography and vegetative type. None of the stands on this tract are being managed for timber presently.

Management areas include upland oaks, yellow pine, oak-pine forest cover types and an early successional stand dominated by five-year-old pines with grasses, vines, and hardwood advance and advanced reproduction. The hardwood and pine-hardwood mix stands will be managed for adequate stocking levels while maintaining growth vigor. The early successional stand will be managed for natural pine in monoculture. The operations performed will be paid for by the income from harvested timber and Southern Pine Beetle Prevention Program funds in the case of the young pine stand for its pre-commercial thinning.

As this is a smaller property, operations will only be performed when every stand on the property is ready to be harvested together to make the sale more marketable.

The timber on the property is currently worth approximately \$107,313.23. The recommended silvicultural prescriptions will result in a NPV of \$95,918.00 over the next 30 years.

The use of conservation forestry on this property not only provides the owner with aesthetic benefits but also ensures the resources on the property are carried forward for the benefit of future generations.

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Tract Description and History

The primary objective of the owner is to develop a forest management plan that meets the criteria necessary to have the property placed into the present use valuation program for forestland. The intent of this program is to keep owners from being priced out of their productive forest properties by high taxes by only taxing a property based on its current use instead of its highest best use (Hamilton, Megolas and Bardon, 2019). The secondary landowner objective is aesthetic value. The owner would like to continue to enjoy the sight of mature forests on his property. A healthy forest should fulfill this objective.

The following goals were identified to develop a suitable silvicultural management plan to fulfill the landowner's objectives:

1. Conserve sensitive areas and prevent sedimentation,
2. Prevent mortality in forest stands on property from insect, disease, and senescence,
3. Promote growth vigor and ensure stand health of forested areas using silvicultural operations.

In this plan technical terms will be used as necessary for proper description, usually with an explanation. A link to a glossary of forestry terms is included in Appendix A for reference. Otherwise, this plan is to be written for a general audience.

Site Description

This tract is located at the junction of HWY 751 and O'Kelly Chapel rd. ,as shown in figure 1 in the inset at bottom right. It is about 2 miles east of the north end of Jordan lake and just south of the Durham County southern boundary in Chatham County, NC.

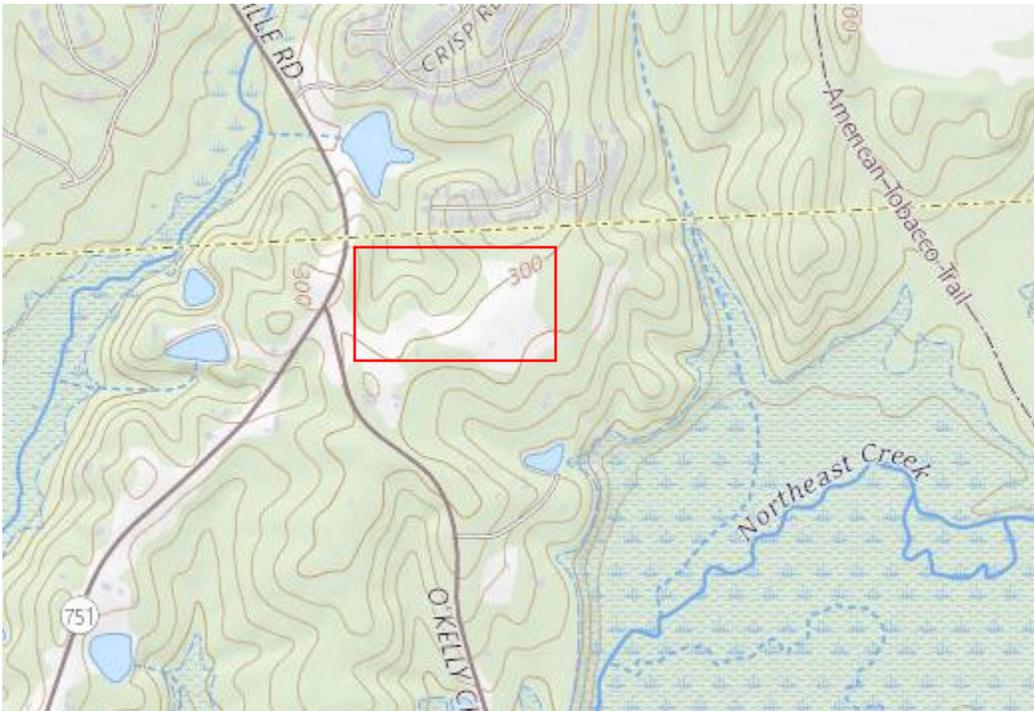
This parcel contains 70+ acres with approximately 43 acres in the management area. The forested areas are one stand to the north at the eastern entrance side of the tract and the eastern half of the property. There are fields, sparse trees and various other vegetation types in the center, west and south sides of the property. These delineations can be seen in figure 1 below.

Figure 1 - Showing the 57 O’Kelly Chapel rd. tract forest stand layout



This tract is located on a ridge at around 300 feet elevation with the aspect of the property at the north side being northwest with 2-15% slopes and south side of the property is south to southeast sloping. The field in the center of the property has low cover in the form of grasses. This portion of the property drains into the stand to the north near the property entrance. The property is well drained even on the lower areas to the north. The topography of the property can be seen in figure 2 below.

Figure 2.-Topographical Map of 57 O'Kelly Chapel Rd. Durham, NC



The red box shows the approximate location of the tract boundary and the terrain features contained within.

The stands are delineated by site, topography and vegetative type. These include early successional pine, mixed hardwood and pine hardwood mix. All stands with the exception of early successional pine do not appear to have been harvested in the last 30+ years. Historic aerial photos going back to the early 1980s show the same areas of the tract forested in the same pattern as the present with the exception of the young pine stand. The natural pine stand was last cut about 5 years ago judging from the aerial photography. Before that time, it was field. The historic aerial photography does not show any crops since the 1980s being grown in the fields on the tract.

There is only a single gravel road bisecting the property from the entrance at the west side to the forested area to the east. For any harvest activity this road may need to be upgraded to accommodate. Logging chances are fair to good on most of the property outside of buffer zones.

Soils

The soils on property are productive and well suited for forest development. The steeper areas may be prone to windthrow and accelerated erosion from logging activities. However, these areas are mostly located in the southeast of the property. The site index for three of the four soil types are 87 feet at a base age of 50 years for loblolly pine and 70-75 feet for hardwood. That is, the Loblolly pine on the property will grow to an average dominant height of 87 feet over 50 years without additional nutrients. The CcD-Carbondon-Brickhaven complex soils are only slightly less productive at 81 feet base age 50 for loblolly and 70 feet for hardwood according to Web Soil Survey. A link to the report can be seen in Appendix A.

Here is a brief description of the four soil complexes and their properties that are found on this tract. These soil descriptions come from the National Cooperative Soil Survey. The areas on the property where each is located is shown in figure 3 below.

Figure 3 -Locations of soil types on the property



CrC-Creedmoor-Green Level complex, 6 to 10 percent slopes

Major uses for this soil are woodland and recreational. This series is deep brown sandy loam with bedrock at 60+ inches. It is poorly to moderately well drained with moderate water holding capacity. This series has little to no flooding. The water table is within two feet of the surface in many places.

CrB-Creedmoor-Green Level complex, 2 to 6 percent slopes

-This series is a brown sandy loam. Major uses are woodland and recreational. Bedrock is at 60+ inches beneath the surface. This soil is somewhat poorly to moderately well drained with no flood hazard. The water table is within two feet of the surface in many places and has moderate water holding capacity.

WhC-White Store-Polkton complex, 6 to 10 percent slopes

This series is pale a brown silt loam. Dominant use is woodland. It is about 40-60 inches to bedrock with the water table less than 3 feet from the surface. There is no flood hazard. This soil has low to moderate water holding capacity.

CcD-Carbonton-Brickhaven complex, 10 to 15 percent slopes

This series is a brown silt loam. Its dominant uses are woodland and pasture. It is 20 inches to more than 60 inches to bedrock in this soil type with the water table less than 3 feet from the surface. There is no flood hazard in this soil type. This soil has low to moderate water holding capacity. There are a couple of limitations to be aware of with this soil type including windthrow and equipment caused erosion.

Climate

The climate in Chatham County NC is humid subtropical with humid and hot summers and moderately cold winters. The average temperatures are in the mid to upper 80s Fahrenheit in the summer and mid 40s Fahrenheit in the winter. The lows in the winter are below 32 Fahrenheit. The normal growing season is around 195 days per year. Frosts are, on average, between October 24th through April 12th. Evenly distributed throughout the year, precipitation is about 46 inches. The hardiness zone for Chatham County is 7b (Jones, M., 2022).

Wetlands and Streamside Management Zones

The Clark tract lies in the Piedmont region of North Carolina in the Cape Fear River basin shown in figure 4.

Figure 4 -Drainage Basins in North Carolina

North Carolina River Basins



The yellow arrow points to the tract’s general location in the Cape Fear River Basin marked by a yellow star. (Map by: Robert Allison, 2016.)

The areas along either side of perennial streams, intermittent streams and the sides of water bodies where vegetation is left in place to filter sediment to protect water quality are called streamside management zones (SMZ). There are a few SMZs on this tract. These will be set at fifty feet width from any drains and streams. There are no wetlands on this property.

In the Cape Fear River Basin where this property is located there are no specific requirements for SMZs other than statewide Best Management Practices. SMZs will be set at 50 feet and should not interfere with harvesting much since less than half of the basal area will be removed from any stand in this plan. The buffered areas can be thinned leaving cover sufficient to protect streams and stabilize banks. Since the banks near drains are not steep and the drains are not deep, these areas should be fairly easy to keep in functional condition. All requirements set out in the Forest Practice Guidelines (FPGs) are to be followed in carrying out the prescribed operations of this plan according to the North Carolina Best Management Practices (BMP’s). Links to the River Basin rules, FPGs and NC BMPs can be found in Appendix A. The SMZs on this tract can be seen in figure 5 shown below.

Figure 5. The locations of SMZs are the denoted by blue outline. There are about 3.5 acres of SMZ.



Biological Assessment

Candidate, Threatened and Endangered Species

Species lists from the Chatham County government website were consulted and species whose habitat types intersect with this tract were identified. Among those are Red-Cockaded woodpecker. This endangered species' usual habitat is in 30+ year-old long leaf pines. However, given the decline of this habitat type, they have been found to take up residence in other yellow pines. As this property has this type of habitat and at an appropriate age of 60 years, it would be advisable to look closely for this species as not to violate the Endangered Species Act. During the survey of this tract the Red-cockaded Woodpecker was not seen. Other species on the list for this county do not have habitat types that intersect with this property. However, a link to the list can be found in Appendix A.

Insects and Disease

Fusiform Rust (*Cronartium quercuum f.sp fusiforme*)

Fusiform rust is an alternate host disease that can be lethal in young pines. This disease causes galls that distort the normal growth of stem tissues and causes weakening that can result in stem breakage. Often this disease can be managed through sanitation cuts and regeneration from uninfected seed sources. Fusiform was not noted on this tract in any of the stands.

Annosus root rot and butt rot (*Heterobasidion annosum*)

This disease is caused by a fungus called *Heterobasidion annosum*. Annosus root rot spores can enter through cut stumps or breakage. The fungus travels through the roots of the infected tree and into adjacent, grafted roots of neighboring trees leading to butt rot. That is, rotting of the lower portion of the stem. This disease can be avoided through stump treatments and maintaining proper stand density in pines.

Oak Wilt (*Ceratocystis fagacearum*)

Oak wilt is caused by the fungus *Ceratocystis fagacearum*. This fungus is carried to healthy trees by insects such as bark beetles. The fungus travels through the tree and into the roots and into neighboring healthy oaks through root grafts. Foliar symptoms develop ending in defoliation and mortality. This disease can be avoided through proper forest management. Oak wilt is not common nearby but should be reported to the forest service or extension service if found.

Bark Beetles

Southern Pine Beetle, Ips and Black Turpentine Beetle are among the insect types that eat through the cambium of trees effectively cutting off nutrients between the branches and the roots. This is called girdling and can kill trees. A vigorously growing stand, through proper density management, is helpful in creating bark beetle resistance. The Southern Pine Beetle has been an issue that is addressed through the SPBP program discussed below in the “Assistance Programs” section.

Invasive Species

No invasive species were identified on this tract. There are some to be aware of, however. These include Kudzu, cogongrass, ailanthus and Chinese privet. A link can be found in Appendix A for identification and a more complete list.

Market

The landowner does not have income in his objectives. However, it would be convenient for any management practices and taxes to be paid for from timber sales. There are plenty of sawmills within 100 miles of the property location who will process pine and hardwood products. A link to a list of these mills is in Appendix A. The current prices for timber are listed in table 1 below.

Table 1 Present timber values per ton

Average stumpage prices*(\$/ton) 1st Quarter 2022				
Product	Price	Previous quarter	Percent change	
Pine pulpwood	\$ 9.98	\$ 10.76	-7.2%	
Pine chip-N-saw	\$ 23.46	\$ 20.11	16.7%	
Pine sawtimber	\$ 30.52	\$ 29.92	2.0%	
Hardwood pulpwood	\$ 8.23	\$ 8.09	1.7%	
Mixed hardwood sawtimber	\$ 32.55	\$ 28.67	13.5%	
Oak sawtimber	\$ 49.23	\$ 45.60	8.0%	

Quarterly stumpage price trend

(Stumpage price reports by: Dr. Robert Bardon 2022 NC State University)

Prices are presently up to 16% higher than in the previous quarter. However, the higher prices are offset by the higher prices of fuel. Loggers are looking for closer to 30 tons per acre and 50+ acres to be enticed to harvest a tract.

The total timber yield on the tract presently has enough volume to attract a buyer. However, the property cannot be clearcut and still fulfill the landowner’s objective for aesthetics. Given the stands’ current volumes, thinning to increase reproduction and increase vigor would not produce enough timber to entice any buyers.

Because of the lack of sufficient volume to harvest according to the local market trends, this plan will need to focus on harvesting in the future.

Tax Incentives:

Present Use Valuation:

Real property is valued at its highest and best use. Seedlings, sapling, standing timber and other forest growth is exempt from taxation according to Sec. 105-275(15), GS of the North Carolina Constitution. This has the purpose of encouraging good forest management practices and conserving NC forests. The Present Use Value program allows for the tax assessment of forested land at a lower value to reduce tax burden and thereby encourage landowners to maintain properly managed forests. (Hubbard, 2016)

For the forested areas under the PUV program the taxable value is \$360.00 per acre. For 43 acres of forested land in the management area, the value is approximately \$15,400.00. At the rate of .775/\$100.00 the tax is \$119.97 or \$2.79 per acre.

Assistance Programs:

Southern Pine Beetle Prevention Program:

This is a cost share program intended to prevent outbreaks of Southern Pine Beetle in North Carolina by helping to cover the costs associated with keeping pine stands growing in a state that helps them to resist infestation. The more vigorous the growth of a stand is the better it can resist infestation.

The program will pay up to \$100.00 per acre for precommercial thinning (thinning before timber is marketable), prescribed burning, or mid rotation herbicide application.

These are operations that release the crop trees from competing vegetation to help the stand grow faster and become more resistant to Southern Pine Beetle and other pests (North Carolina Forest Service SOUTHERN PINE BEETLE PREVENTION PROGRAM HANDBOOK, 2020).

This program will be useful in defraying expenses for managing the natural pines in stand 2.

A full explanation of this program is included in Appendix A.

Inventory:

The inventory method used was variable radius plots using a basal area factor of 20 and mil plot (1/1000th acre) fixed plots for the pine regeneration in stand 2 natural pine. The basal area factor of 20 was chosen according to stand density and variability. ArcMap 10.7 was used to delineate the tract and stands along with the Chatham County GIS database to get an understanding of the terrain, land features and parcel locations. The stands were delineated by vegetative type, age, terrain and soil type. The site was checked for the presence of sensitive areas such as streams, wetlands and cultural artifacts to be sure the property could be surveyed and managed without restrictions. The tract was cruised using the methods and intensities shown in table 2 below. The data was collected using SilviaTerra Plot Hound software according to the merchantability specifications listed in table 3 and 4 below. This information can be seen in Appendix B along with a summary of the cruise statistics for each stand and the raw cruise data. A delineated map of the stands on the tract can be seen in figure 1 introduced above.

Table 2 - Summary of Inventory Characteristics by Stand.

Stand	Acres	Method	Factor/Size	# Plots
S1	9.3	point	20	9
S2	6.5	Fixed	1/1000	6
S3	16.4	Point	20	7
S4	10.8	point	20	7

Table 3 - Merchantability Specifications for hardwood

Hardwood			
	Min DBH	Min Top Diameter	
Pulpwood	5"	-	Pulpwood
Pallet wood	8"	6"	Chip-n-Saw
Sawtimber	12"	8"	Sawtimber

Table 4 Merchantability Specifications for pine

Pine		
	Min DBH	Min Top Diameter
Pulpwood	5"	-
Chip-n-saw	8"	4"
Sawtimber	10"	6"

Cover Type Descriptions

The tract is divided into 4 stands. Delineated stand map can be referred to in figure 1 above. Stand 1 is an upland oak hardwood stand. Stand 2 is a 5-year-old “old field pine” natural stand consisting of Loblolly pine, Sweetgum, grasses and a few areas of Black berry. Stands 3 and 4 are yellow pine with hardwood and oak-pine respectively.

Stand Descriptions and Prescriptions for Management

These descriptions of the stands include site index values, dominant vegetative types and any sensitive areas. Stand characteristics such as acreage, age, diameter and volumes by product class are listed in tables 5 and 6. Removals in tons by thinning can be found in appendix B.

Table 5. Stand cover type descriptions

Stand	Cover Type	Acreage	SMZ Acres	Age (yrs)	QMD	TPA	BA (ft ²)
1	Upland Oak	9.3	0	60	13	130	111
2	Natural Pine	6.5	0	5	NA	~2300	NA
3	Pine Hardwood	16.4	2	60	12.6	169	125
4	Oak Pine	10.8	1.5	60	17.4	90	134

Table 6. Stand merchantable forest products on site

		Stand 1	Stand 2	Stand 3	Stand 4
Pine (tons/ac)	Pulpwood	0	NA	0	0
	Chip n Saw	1.22	NA	6.03	0
	Sawtimber	10.27	NA	71.1	58.08
	Top wood	1.0	NA	12.66	13.62
Mixed hardwood (tons/ac)	Pulpwood	17.22	NA	4.14	5.42
	Pallet wood	21.5	NA	14.2	5.99
	Sawtimber	21.71	NA	6.94	12.11
	Top wood	30.32	NA	13.6	24.95
Oak (tons/ac)	Sawtimber	11.92	NA	1.74	32.24
Total Tns/ac		115.16	NA	130.41	152.41
Value per acre		\$2,207.26	NA	\$2,971.01	\$3,524.18
Total value		\$20,527.56	NA	\$48,724.49	\$38,061.18

Tract Total Timber Value: **\$107,313.23**

Mixed Hardwood and Hardwood Pine Stands: S1, S3 and S4

These management prescriptions are geared toward defraying the costs associated with maintaining a healthy forest. As the main objective of the landowner is to reduce tax liability and enjoy an aesthetically pleasing forest, the methods used in these prescriptions will not create the amount of income that this land is capable of. Instead, they will focus on ecological sustainability for the forests while generating a sufficient return and remaining in an aesthetically pleasing state. Also, as was stated above, given the tract size it would be best to delay all operations until all stands can be harvested together for marketability.

The current sere (stage of stand development) for the hardwood stands is a transition to late successional. It is transitioning from intolerant (cannot reproduce successfully in shade) Pine, Sweetgum and Yellow-poplar species to more tolerant, long-lived species such as oak and hickory. A “leave alone” prescription would result in increased fire hazards from buildup of forest fuels on the property and increased mortality leading to possible insect and disease. The thinnings will focus on removing suppressed, poor form, slow growing and more financially mature trees to give way to more vigorous trees to continue the stand. The prescriptions for these three stands will focus on freeing resources to induce increased basal area growth in species that would naturally be present in the later sere while allowing the removal of valuable timber to capture value. Stand density (the number and size of trees per acre) does not affect tree height but does affect basal area (cross section of the tree in square feet). Tree value accrues at a faster rate through basal area growth than through height. Thinning can increase resources available to more valuable trees while removing trees with less desirable genetics as well as serving to regenerate the forest as it ages.

To estimate growth and yield, Forest Vegetation Simulator (FVS), a simulator created at Colorado State University using gathered research and applied experience, was used for the upland hardwoods and pine hardwood mix stands. This was done using the southeastern variant of the FVS Program. For the old field Loblolly pine stand Loblolly Decision Support System simulator (LobDSS), developed in a joint effort between North Carolina State University, Virginia State University and Virginia Polytechnic Institute, was used to predict future pine stand growth and outcomes to aid in decision making.

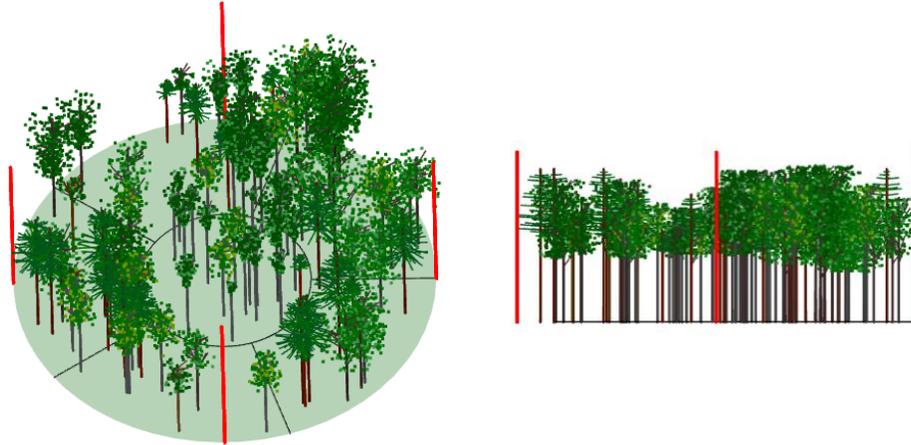
These stand prescriptions include a brief valuation of the revenues and costs from operations suggested. These are estimates only and are calculated as if the operations were started ten years from now instead of 5. This is the longest it is recommended to wait to begin thinning these stands before severe degradation may set in. For these stands the net present values of income from thinnings and tax expense are listed. Since these stands have not been brought into a reasonable cutting cycle and determining one will depend on future response to operations, soil expectation values would be difficult, likely inaccurate and are not included for the hardwood. The tax rate for timber sales is calculated at 15%. All costs and revenues were discounted to present at a rate of 5%.

Note concerning monitoring stands

Where a stand schedule says to monitor it is recommended that a trained forester should install permanent plots where stem diameters, heights and live crown ratios can be noted and tracked to measure growth response to thinnings over the 5-10 years between thinnings. Any sign of bark beetle damage, red heart or other maladies should be noted along with any invasive species presence. If insects or disease begin to cause mortality a sanitation cut may need to be scheduled.

Stand 1 Upland Oak

Figure 6. Stand 1 inventory conditions 2022



This is a fairly open stand about 60 years old. Site index (SI) base age 50 for this site is 75 for upland hardwoods and 85 for Loblolly pine. Loblolly will grow 85 feet tall in 50 years on this site. The stand has 111 square feet of basal area and approximately 130 trees per acre with a quadratic mean diameter (Dq) of 13 inches. This is the diameter of the tree with average basal area for the stand. There are white oak, red oak and hickory along with few loblolly pines in the overstory. The understory consists of hickory, red maple, post oak, southern red oak and white oak at less than 4" DBH and 15-20 feet in height at about 20-50 per acre. Advance reproduction seedlings in the understory consists of white oak, southern and northern red oak and red maples at about 50-100 stems per acre. The basal area breakdown by species and diameter class can be seen in figures 7 and 8 respectively.

Figure 7. Stand 1 basal area by species number and percentage of total at inventory 2022

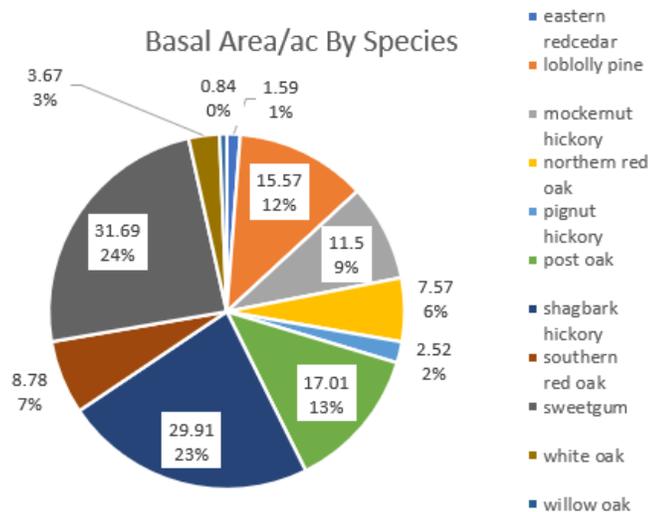
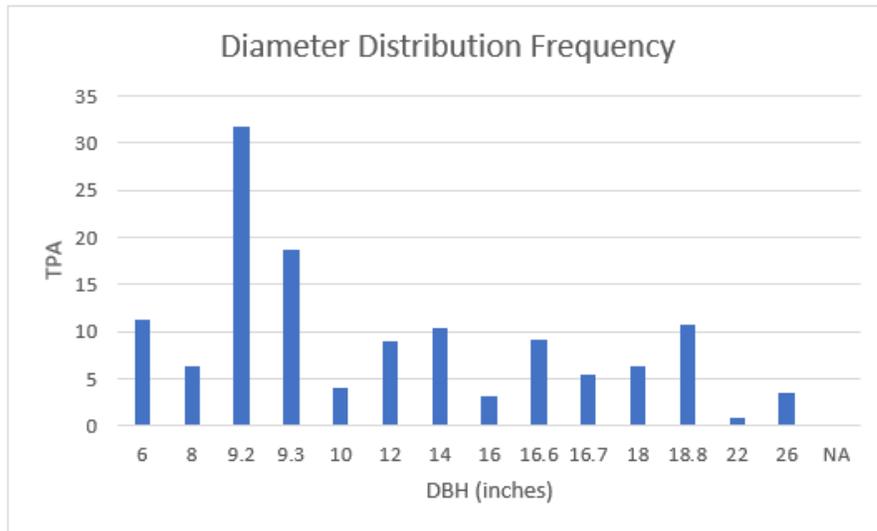


Figure 8. Number of trees per acre by diameter



This stand has a diameter distribution that suggests high grading in the past. The larger trees left on the stand are not unmerchantable, however. There are signs of fencing and livestock such as old feed buckets in places. The stand area could have merely been thinned enough to use for animals for a time.

An increment borer was used to obtain cores that showed growth rings numbering between 59 and 62. This was similar to the other stands. The cores were taken from dominant loblolly pines to ensure the sample was taken from a tree that had been there since the stand's establishment. Loblolly is a pioneer species that competes best on a young stand and is not likely to develop under a canopy.

The goal for this stand is vigor and maintaining species diversity to achieve the goals of health and aesthetics while maintaining crop trees for future merchantability. The more species types that are present the less likely any one insect pest or disease can cause catastrophic damage to the stand. These goals will be followed for the other hardwood stands as well.

Frequent, lighter, thinnings have been shown to produce more vigorous growth in hardwoods than infrequent heavier thinnings. According to the Gingrich stocking chart, removing the needed basal area for a first thin results in fewer tons than what is needed to attract timber buyers to a property this size while maintaining aesthetics.

Given this, I recommend thinning in the next 5-10 years before stand density can cause accelerated mortality. The stand should be thinned throughout the diameter range removing some of the overstory stems of commercial quality along with poor form stems and slower growing pines in the process to prevent disease and mortality. Moving forward the stand should be surveyed for a thin every ten years. To increase stand productivity the owner may elect to regenerate the stand after the second thin after year 80 by having the stand surveyed for a shelterwood cut or may have a thin from above performed to release more of the understory if a shelterwood is not aesthetically pleasing.

The residual stand should have a basal area of about 90-95ft² and 90 trees per acre with 20-25 foot spacing. Top height should be 85-90 feet. This will maintain crown closure to suppress competition. Since the stand has not been thinned, it may not respond quickly to release. It should be checked for thinning response

within 5-10 years after thinning. Notes on stand monitoring can be found on page 16 of this plan.

There are no known site limitations for this stand. Logging chances are good on every part of the stand. There is direct access via gravel driveway that accesses the main road. The only real limitation is the marketability because of the limited size of the stand. The other stands will need to be brought into alignment for operations to result in yields that are attractive to the local market.

Schedule:

2032 -Thin throughout diameter range reducing stocking level to 70% per Gingrich stocking chart and associated research recommendations. Harvest reducing basal area from 133ft² to 95ft² and 95 TPA with spacing of approximately 20x20'.

2037-2047- Monitor stand (see pg. 16 for explanation of monitoring)

2042 -Thin from below. Harvest reducing basal area from 115ft² to 90ft². Leave TPA of 90 and spacing of 23x23'.

2047 -In year 85 Monitor stand for reproduction for a regeneration prep or shelter cut if desired.

30 year NPV: \$1,140.75 per acre

Stand 2 Natural Loblolly Pine

This stand is an overgrown field with about 1200-1300 loblolly stems per acre and 800-1000 sweetgum. Both species are 1-2" diameter. The average height of the loblolly is 12-15 feet and the sweet gum is nearly the same. There are patches of blackberry present. There are various hardwood species present such as hickory, oaks and yellow-poplar. The site index here is 65 feet base age 25 for loblolly pine.

Loblolly pine is dominant on site with more average height and trees per acre than sweetgum. If the stand is left alone to grow loblolly will remain in the overstory with other pioneer species at a high stand density. This could lead to insect and disease issues such as infestation from bark beetles like Ips and Southern Pine Beetle. This stand will need to be thinned to keep it growing at a rate that is healthy. Thinning will also bring revenue to pay for the first thinning. Since this thinning will not produce any commercially marketable products the cost will be accrued to the owner until the first merchantable harvest. According to the posted prevailing rates on the North Carolina Forest Service web site for District 3, Region II the cost of pre-commercial thinning is an average of \$120.00 per acre. A crew should be hired to use brush saws and chain saws instead of the more cost intensive heavy machinery to keep cost down. The Southern Pine Beetle Prevention Program provides \$100.00 per acre for precommercial thinning. The amount paid by the owner will be calculated at \$20.00 per acre for the year 2027.

A precommercial thinning (PCT) should be scheduled for 5 years from now. That gives enough time for the winners and losers to appear. Leave trees should have better form and growth than removals. The crew should remove hardwoods and any weed species leaving 400 trees per acre with a spacing of about 10 feet x 10 feet. See figure 10 to see a diagram of this spacing. This should leave the stand with a density that is sufficient for crown closure to prevent some competition but with room to grow. The crew to perform the PCT

should be instructed to prioritize crown closure over monoculture. If there is a choice in an area of the stand whether to cut a hardwood and leave a canopy gap or to leave the hardwood, they should leave it. Sweetgums should be felled and stump painted or injected with a forestry use approved herbicide product such as a specialized Accord variant to prevent sprouting. This stand should be thinned with the surrounding hardwoods after the first thin to improve marketability of the total tract. Figure 9 shows how the residual stand will look post PCT.

Figure 9. 10'x10' Spacing 400 TPA after PCT.



Schedule:

2027: Precommercial thin by hand to 400 TPA on a 10x10' spacing removing hardwood species, suppressed and diseased pines. For every 10x10 space remove all but the tallest, straightest loblolly. Apply Accord XRT II using the cut stump or hack n' squirt method, soaking or injecting the cambium of stumps, to prevent sprouting in sweetgum.

2032: Monitor for response and condition. (see page 16 for explanation)

2042: Commercial thin to 200 TPA on a 14x15 spacing.

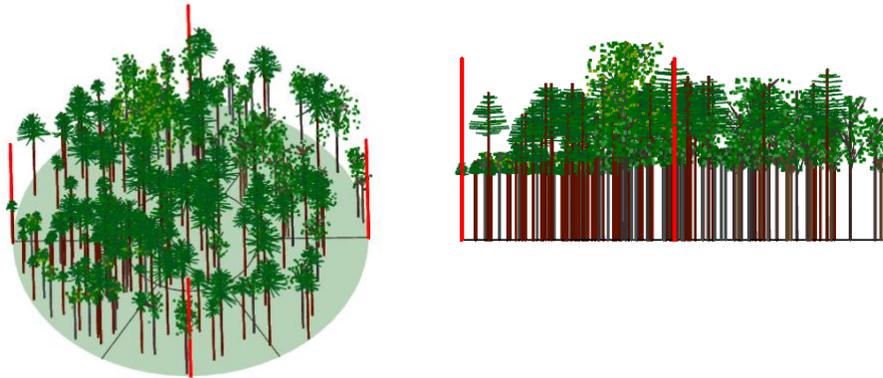
2052: Final harvest

30 year NPV: \$783.04 per acre

SEV: \$916.33 per acre

Stand 3 Loblolly Pine Hardwood Mix

Figure 10. Stand 3 inventory conditions 2022



This stand is about 60 years old with a site index of 75 for hardwoods and 85 for pine base age 50. This stand consists of a mix of about 70% Loblolly pine, 25% oak and hickory with sweetgum and yellow-poplar in the overstory and pine, oak, hickory, red maple, winged elm, American beech, dogwood and sourwood in the understory. Stand height is about 85ft with a basal area approximately 125ft² and a TPA of 168 and a Dq of 12in. Advance reproduction on site is about 100-300 seedlings per acre hickory, oak and some pine. There is muscadine grape, sourwood and Virginia creeper in low quantities. Diameter distribution and breakdown of basal area by species for this stand can be found in figures 11 and 12 below.

Figure 11. Number of trees per acre by diameter

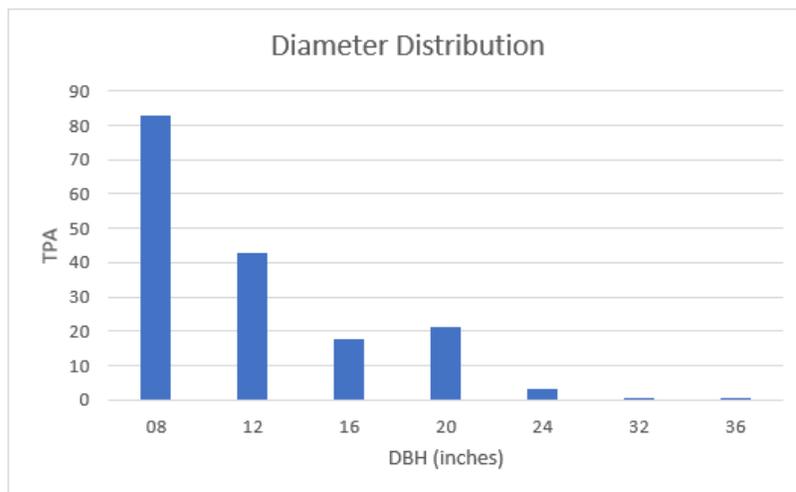
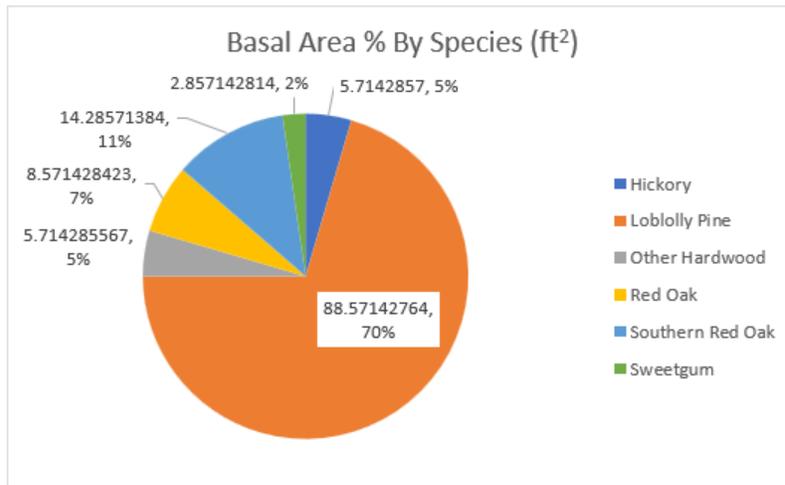


Figure 12. Stand 3 basal area by species number and percentage of total at inventory 2022



This stand has about 70% pine of which 50% or more is sawtimber size and is not growing quickly at its age. Loblolly pine is not as long lived as hardwoods. As the pines age and senescence begins oak, hickory and other shade tolerant species begin taking over the stand. The average crown ratio for loblolly on the stand is less than 30% signaling the need for thinning. Keeping a stand in pine hardwood mix has advantages such as market diversity but would require larger openings to be cut to regenerate pine. This may be considered less aesthetic than allowing succession to take its natural course.

With this in mind I recommend thinning the overstory within the next five to ten years with the other hardwood stands on the tract to release the younger hardwoods. The stand should be checked for response to release within 5-10 years afterward for the next thinning. It will take at least a few thinnings before a cutting cycle can be established.

The residual stand should have Dq of 11" a basal area of about 85ft² and 135 trees per acre with 18-20 foot spacing. Top height should be 75-80 feet. This should give the residual trees room to grow to the next diameter class before the next thinning. Since the stand has not been thinned, it may not respond quickly to release. It should be checked for thinning response within 5-10 years. If, after pines have been reduced, the stand is not producing adequate oak advance regeneration a prescribed burn may be helpful to stimulate oak regeneration.

Schedule:

2032: Thin from above targeting overstory pines prioritizing canopy closure over pine removal. Reduce to 70% stocking and BA of 85sf² with 135 TPA and 18-20ft spacing and a leave Dq of 11"

2037-2042: Monitor for response.

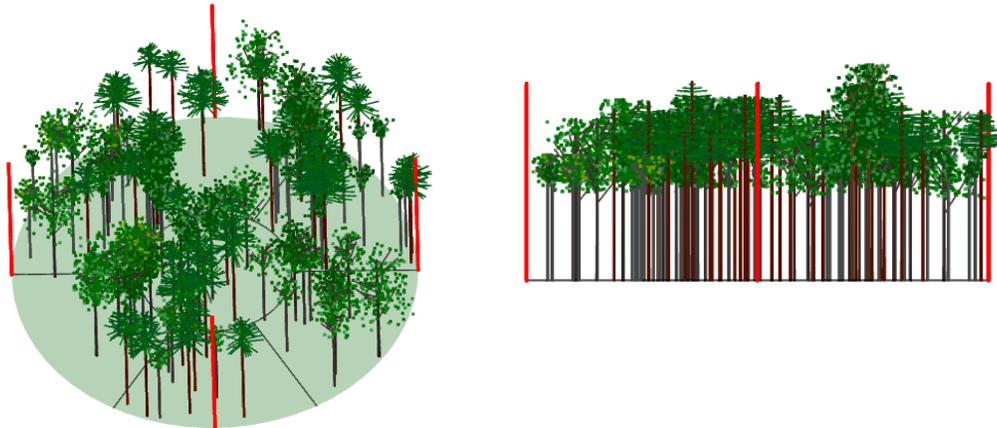
2042: Thin throughout diameter range reducing stocking to 65% and BA of 75ft² This should leave a Dq of 12" and 100 TPA with about a 20-foot spacing.

2047-2053: Monitor for response and reproduction to either schedule a prep, shelterwood, or thin

30 year NPV: \$2,699.35 per acre

Stand 4 Oak-Pine Mix

Figure 13. Stand 4 inventory conditions 2022



Stand four is about 60+ year old mix of oak and pine with a site index of 75 for upland hardwood and 85 for loblolly pine. This stand consists of loblolly pine, sweetgum, southern red oak, northern red oak, white oak, hickory and yellow-poplar in the overstory and hickory, oaks, dogwood and beech in the understory at less than 5in at about 50 or more per acre. Advance regen is white, northern and red oak, hickory, few pines at about 200+ per acre. The basal area is 135ft² with a Dq of 16.5 inches and 90 trees per acre. The breakdown of basal area by species and the diameter distribution can be seen in tables 14 and 15 below.

Figure 14. Stand 4 basal area by species number and percentage of total at inventory 2022

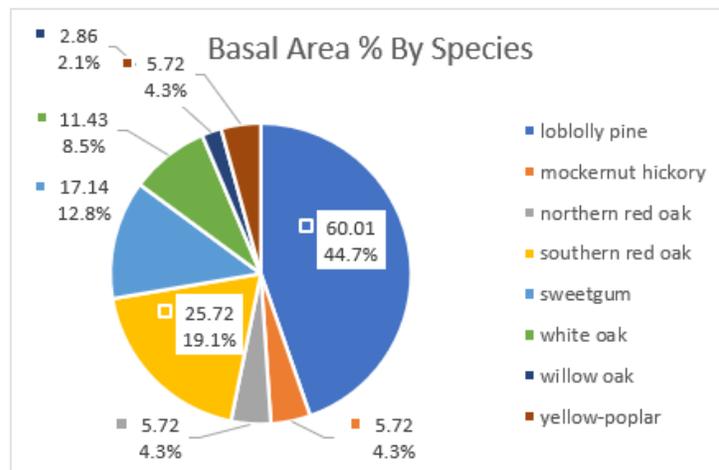
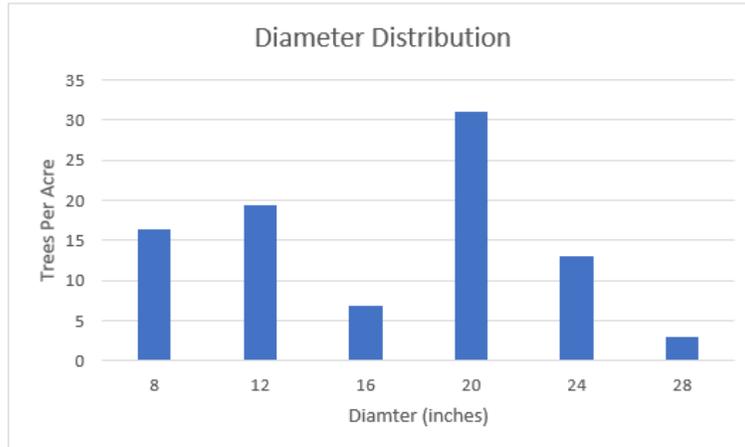


Figure 15. Number of trees per acre by diameter



As with stand 3, this stand has a great deal of pine present in the overstory at an age where it is no longer growing at a rate that promotes stand health. Removing all of the pine at once would open the canopy causing epicormic branching and weed species to begin suppressing growth of future crop trees. To prevent this a thin should be performed from above, removing pines but prioritizing crown closure. This should release the codominant hardwood species (species that receive light from the top but not the top and sides the way a dominant tree would) and precipitating the change of sere further toward a climax forest. This should put more light on the forest floor encouraging reproduction in preparation for the next stand without putting enough light into the stand to stimulate epicormic branching.

The residual stand should have Dq of 15" a basal area of about 90ft² and 70-80 trees per acre with 20-25 foot spacing. Top height should be 80-85 feet. This should give the residual trees room to grow to the next diameter class before the next thinning. Since the stand has not been thinned, it may not respond quickly to release. It should be checked for thinning response within 5-10 years.

Schedule:

2032: Thin from above targeting overstory pines prioritizing canopy closure over pine removal. Reduce to 70% stocking and BA of 90sf with a leave Dq of 15"

2037-2042: Monitor for response.

2042: Thin throughout diameter range reducing stocking to 65% and BA of 85ft² This should leave a Dq of 16.6" and 60-70 TPA with about a 20-25 foot spacing.

2047-2053: Monitor for response and reproduction to either schedule a prep, shelterwood, thin or date to recheck stand.

30 year NPV: \$3,115.35 per acre

Given the many variables that guide decisions, it is assumed that this schedule will not be followed perfectly. It is assumed that the forests on this tract will not respond perfectly as intended as well. Therefore, before any of these operations are implemented it will be necessary to have these stands re-surveyed to improve accuracy and to reassess the prudence of the operations suggested. This should be carried out by an experienced registered forester.

Schedule of operations

Stand 1

2027-2032	-First thinning
2033-2041	-Monitor stand
2042	-Second thinning
2043-2051	-Monitor stand
2052	-Survey stand for regeneration or thinning

Stand 2

2027	-pre-commercial thinning
2028-2041	-Monitor stand
2042	-Second thinning
2052	-Final harvest

Stand 3

2027-2032	-First thinning
2033-2041	-Monitor stand
2042	-Second thinning
2043-2051	-Monitor stand
2052	-Survey stand for regeneration or thinning

Stand 4

2027-2032	-First thinning
2033-2041	-Monitor stand
2042	-Second thinning
2043-2051	-Monitor stand
2052	-Survey stand for regeneration or thinning

Economic Summary

The NPV for this tract is \$95,918.00 after 30 years. This valuation includes revenues and expenditures from thinning and taxes. This does not include the income from regeneration cuts after year 30 of this plan since it is not known how these hardwood stands will respond to release after 65-70 years in its unmanaged state. Below is a total tract estimate of future incomes and expenditures discounted at 5% over 30 years.

Table 7 List of total income and expenses for stands 1-4

Mgt Yr	Year	Income	income type	Expenses	Expense Type	PV Income	PV Expenses	NPV
1	2022			\$ 119.97	Property Tax	\$ -	\$ 114.26	\$ (114.26)
2	2023			\$ 119.97	Property Tax	\$ -	\$ 108.82	\$ (108.82)
3	2024			\$ 119.97	Property Tax	\$ -	\$ 103.63	\$ (103.63)
4	2025			\$ 119.97	Property Tax	\$ -	\$ 98.70	\$ (98.70)
5	2027			\$ 130.00	PCT s2	\$ -	\$ 101.86	\$ (101.86)
5	2027			\$ 119.97	Property Tax	\$ -	\$ 94.00	\$ (94.00)
6	2028			\$ 119.97	Property Tax	\$ -	\$ 89.52	\$ (89.52)
7	2029			\$ 119.97	Property Tax	\$ -	\$ 85.26	\$ (85.26)
8	2030			\$ 119.97	Property Tax	\$ -	\$ 81.20	\$ (81.20)
9	2031			\$ 119.97	Property Tax	\$ -	\$ 77.33	\$ (77.33)
10	2032	\$ 155,654.01	s1, 3 & 4 Thinnings	\$ 23,348.10	Timber Tax 15%	\$ 95,558.06	\$ 14,333.71	\$ 81,224.35
10	2032			\$ 119.97	Property Tax	\$ -	\$ 73.65	\$ (73.65)
11	2033			\$ 119.97	Property Tax	\$ -	\$ 70.14	\$ (70.14)
12	2034			\$ 119.97	Property Tax	\$ -	\$ 66.80	\$ (66.80)
13	2035			\$ 119.97	Property Tax	\$ -	\$ 63.62	\$ (63.62)
14	2036			\$ 119.97	Property Tax	\$ -	\$ 60.59	\$ (60.59)
15	2037			\$ 119.97	Property Tax	\$ -	\$ 57.71	\$ (57.71)
16	2038			\$ 119.97	Property Tax	\$ -	\$ 54.96	\$ (54.96)
17	2039			\$ 119.97	Property Tax	\$ -	\$ 52.34	\$ (52.34)
18	2040			\$ 119.97	Property Tax	\$ -	\$ 49.85	\$ (49.85)
19	2041			\$ 119.97	Property Tax	\$ -	\$ 47.48	\$ (47.48)
20	2042	\$ 43,100.73	s1-4 Thinnings	\$ 6,465.11	Timber Tax 15%	\$ 16,244.21	\$ 2,436.63	\$ 13,807.58
20	2042			\$ 119.97	Property Tax	\$ -	\$ 45.22	\$ (45.22)
21	2043			\$ 119.97	Property Tax	\$ -	\$ 43.06	\$ (43.06)
22	2044			\$ 119.97	Property Tax	\$ -	\$ 41.01	\$ (41.01)
23	2045			\$ 119.97	Property Tax	\$ -	\$ 39.06	\$ (39.06)
24	2046			\$ 119.97	Property Tax	\$ -	\$ 37.20	\$ (37.20)
25	2047			\$ 119.97	Property Tax	\$ -	\$ 35.43	\$ (35.43)
26	2048			\$ 119.97	Property Tax	\$ -	\$ 33.74	\$ (33.74)
27	2049			\$ 119.97	Property Tax	\$ -	\$ 32.13	\$ (32.13)
28	2050			\$ 119.97	Property Tax	\$ -	\$ 30.60	\$ (30.60)
29	2051			\$ 119.97	Property Tax	\$ -	\$ 29.15	\$ (29.15)
30	2052	\$ 14,400.49	s2 Final Harvest	\$ 2,160.07	Timber Tax 15%	\$ 3,331.95	\$ 499.79	\$ 2,832.16
30	2052			\$ 119.97	Property Tax	\$ -	\$ 27.76	\$ (27.76)
Totals		\$ 213,155.23		\$ 35,702.38		\$ 115,134.22	\$ 19,216.22	\$ 95,918.00

References:

- Allison, R., 2022. *North Carolina River Basins*. [online] Robslink.com. Available at: <http://robslink.com/SAS/democd60/nc_river_basins.htm> Accessed 14 June 2022.
- Bardon, R., 2022. *Quarterly Price Report*. [ebook] Raleigh, NC: North Carolina State University. Available at: <<https://forestry.ces.ncsu.edu/wp-content/uploads/2022/04/NCPR1q2022.pdf?fw=no>> [Accessed 14 June 2022].
- Burkhart, H. E., Avery, T. E., & Bullock, B. P. 2018. *Forest measurements: Sixth edition*. Waveland Press.
- Davis, L., Johnson, Howard and Bettinger, 2001. *Forest management*. Boston: McGraw Hill.
- Dean, Thomas J.; Baldwin, V. Clark, Jr. 1993. *Using a densitymanagement diagram to develop thinning schedules for loblolly pine plantations*. Res. Pap. SO-275. New Orleans, LA: U.S. Department of Agriculture, Forest Service, Southern Forest Experiment Station. 7 p.
- Deq.nc.gov. 2020. *401 & Buffer Permitting Statutes & Rules / NC DEQ*. [online] Available at: <https://deq.nc.gov/about/divisions/water-resources/water-resources-regulations-guidance/401-buffer-permitting-statutes-rules#StatutesRules_RiparianBuffers> [Accessed 14 June 2022].
- Hubbard, A., 2016. *North Carolina Forest Service*. [online] Ncforestservice.gov. Available at: <https://www.ncforestservice.gov/Managing_your_forest/managing_presentuse.htm> [Accessed 14 June 2022].
- Hamilton, R., Megolas, M. and Bardon, R., 2019. *North Carolina's Forestry Present-Use Valuation (PUV) Property Tax Program*. [online] <https://content.ces.ncsu.edu/catalog/series/124/>. Available at: <<https://content.ces.ncsu.edu/north-carolinas-forestry-present-use-valuation-puv-property-tax-program#>> [Accessed 16 June 2022].
- Jones, M., 2022. *Chatham County Climate*. [online] Chatham.ces.ncsu.edu. Available at: <<https://chatham.ces.ncsu.edu/chatham-county-climate/>> Accessed 14 June 2022.
- Klemperer, W. D., Bullard, S., Grado, S. C., Measells, M. K., & Straka, T. J. (2021). *Forest resource economics and finance*. Stephen F. Austin University Press.
- NCDENR (2004). *Forester's Field Handbook*. NC Division of Forest Resources
- North Carolina Forestry Best Management Practices Manual to Protect Water Quality*. 2021. [ebook] Raleigh, NC: North Carolina Forest Service. Available at: <<https://www.ncforestservice.gov/publications/BMP2021/2021NCFSBMPManual.pdf>> [Accessed 14 June 2022].
- North Carolina's Forest Practice Guidelines Related to Water Quality (FPGs)*. 2018. [PDF] Raleigh, NC: North Carolina Forest Service. Available at: <<https://www.ncforestservice.gov/publications/Forestry%20Leaflets/WQ01.pdf>> [Accessed 14 June 2022].
- Soil Survey of Chatham County, North Carolina. 2022. [online] Available at: <https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/north_carolina/NC037/0/Chatham.pdf> Accessed 14 June 2022.
- US Department of Agriculture Natural Resource Conservation Service North Carolina, *Forest Stocking and Yield Tables*, n.d. USDA & NRCS NC <<https://efotg.sc.egov.usda.gov/references/Public/NC/treetable2.pdf>>. accessed 11 June 2022.
2021. *North Carolina Forestry Best Management Practices Manual to Protect Water Quality*. [ebook] Raleigh, NC: North Carolina Forest Service. Available at: <<https://www.ncforestservice.gov/publications/BMP2021/2021NCFSBMPManual.pdf>> [Accessed 14 June 2022].

Appendices

Appendix A:

Links:

Present Use Valuation Program:

[North Carolina Forest Service \(ncforests.service.gov\)](http://ncforests.service.gov)

Southern Pine Beetle Prevention Program:

[SOUTHERN PINE BEETLE PREVENTION PROGRAM \(ncforests.service.gov\)](http://ncforests.service.gov)

Glossary:

[Understanding Forestry Terms: A Glossary for Private Landowners | NC State Extension Publications \(ncsu.edu\)](http://ncsu.edu)

Price reports for timber:

[Quarterly Price Report | NC State Extension \(ncsu.edu\)](http://ncsu.edu)

Timber buyers Chatham County NC:

[tbchatham.PDF \(ncforests.service.gov\)](http://ncforests.service.gov)

Invasive Vegetative Species in North Carolina

<https://ncwildflower.org/invasive-exotic-species-list/>

North Carolina Best Management Practices Manual:

[North Carolina Forest Service \(ncforests.service.gov\)](http://ncforests.service.gov)

North Carolina's Forest Practice Guidelines Related to Water Quality

[WQ01.pdf \(ncforests.service.gov\)](http://ncforests.service.gov)

River Basin Buffer Rules:

[North Carolina Forest Service \(ncforests.service.gov\)](http://ncforests.service.gov)

Chatham County, NC Soil Survey Report:

[Soil Survey of Chatham County, North Carolina \(usda.gov\)](http://usda.gov)

Region 2 District 3 Prevailing Rates for Forest Operations

[FDP Prevailing Rates FY 2014-15.xlsx \(ncforests.service.gov\)](http://ncforests.service.gov)

Candidate, Threatened and Endangered Species

[55897 \(chathamcountync.gov\)](http://chathamcountync.gov)

Appendix: B

Stand, species and product volumes summary report

Stand 1

	Stand Mean	Standard Error	Standard Error as Percent of Mean
TPA	130.65	52.08	39.86
BAPA	111.13	24.88	22.39
QMD	13.4	1.48	11.04

Per Acre Product Volumes by Species								
Species	Product	Units	Per Acre Volume	Trees per Acre	Basal Area per Acre	QMD (inches)	Mean DBH (inches)	Avg Log Length (feet)
eastern redcedar	saw	tons	0.95	1.59	2.22	16	16	28
loblolly pine	saw	tons	10.27	9.2	13.33	16.9	16.6	51
mockernut hickory	saw	tons	2.85	2.52	4.44	18	18	22
northern red oak	saw	tons	5.34	3.5	6.67	26	26	26.7
pignut hickory	saw	tons	2.31	1.26	2.22	18	18	48
post oak	saw	tons	14.42	10.77	20	18.8	18.8	27.1
southern red oak	saw	tons	5.18	5.44	6.67	16.8	16.7	29.3
white oak	saw	tons	1.4	1.59	2.22	16	16	24
willow oak	saw	tons	1.18	0.84	2.22	22	22	16
loblolly pine	chip.n.saw	tons	1.22	6.37	2.22	8	8	32
northern red oak	pulp	tons	1.11	0	0	NA	NA	20
post oak	pulp	tons	4.45	0	0	NA	NA	20
shagbark hickory	pulp	tons	1.11	11.32	2.22	6	6	20
southern red oak	pulp	tons	1.99	1.26	2.22	18	18	36
sweetgum	pulp	tons	6.95	31.69	13.33	9.3	9.2	29.3
white oak	pulp	tons	0.64	0	0	NA	NA	16
willow oak	pulp	tons	0.97	0	0	NA	NA	20
mockernut hickory	Palletwood	tons	4.42	8.98	6.67	12	12	24
northern red oak	Palletwood	tons	1.97	4.07	2.22	10	10	32
pignut hickory	Palletwood	tons	2.2	1.26	2.22	18	18	44
post oak	Palletwood	tons	3.55	6.24	6.67	14	14	18.7
shagbark hickory	Palletwood	tons	5.84	18.59	8.89	9.3	9.3	26
southern red oak	Palletwood	tons	1.82	2.08	2.22	14	14	32
white oak	Palletwood	tons	1.7	2.08	2.22	14	14	32
eastern redcedar	topwood	tons	0.14	0	0	NA	NA	26
loblolly pine	topwood	tons	1.19	0	0	NA	NA	19.7
mockernut hickory	topwood	tons	5.75	0	0	NA	NA	67
northern red oak	topwood	tons	3.49	0	0	NA	NA	53.2
pignut hickory	topwood	tons	1.05	0	0	NA	NA	54
post oak	topwood	tons	8.76	0	0	NA	NA	54.2
shagbark hickory	topwood	tons	3	0	0	NA	NA	43
southern red oak	topwood	tons	3.43	0	0	NA	NA	56
sweetgum	topwood	tons	2.4	0	0	NA	NA	42.3
white oak	topwood	tons	1.59	0	0	NA	NA	54
willow oak	topwood	tons	0.71	0	0	NA	NA	59

Stand 4

	Stand Mean	Standard Error	Standard Error as Percent of Mean
TPA	89.55	39.32	43.9
BAPA	134.3	41.3	30.75
QMD	17.4	1.78	10.23

Per Acre Product Volumes by Species								
Species	Product	Units	Per Acre Volume	Trees per Acre	Basal Area per Acre	QMD (inches)	Mean DBH (inches)	Avg Log Length (feet)
yellow-poplar	pole	tons	2.7	0.67	2.86	28	28	48
loblolly pine	saw	tons	58.08	29.2	60.01	19.2	19	52.8
mockernut hickory	saw	tons	2.58	1.62	2.86	18	18	40
northern red oak	saw	tons	3.1	0.91	2.86	24	24	40
southern red oak	saw	tons	18.61	9.03	22.86	21.7	21.6	32.5
sweetgum	saw	tons	5.43	4.07	8.57	19.6	19.6	34.7
white oak	saw	tons	10.53	5.93	11.43	18.6	18.5	42
willow oak	saw	tons	2.08	1.31	2.86	20	20	24
yellow-poplar	saw	tons	2.02	1.08	2.86	22	22	32
southern red oak	pulp	tons	2.32	3.64	2.86	12	12	32
sweetgum	pulp	tons	3.1	16.37	5.71	8	8	32
mockernut hickory	Product.4	tons	2.09	5.24	2.86	10	10	32
northern red oak	Product.4	tons	2.87	5.24	2.86	10	10	40
sweetgum	Product.4	tons	1.03	5.24	2.86	10	10	16
loblolly pine	topwood	tons	13.62	0	0 NA	NA		45.9
mockernut hickory	topwood	tons	1.56	0	0 NA	NA		53.5
northern red oak	topwood	tons	1.91	0	0 NA	NA		51.5
southern red oak	topwood	tons	9.67	0	0 NA	NA		61.4
sweetgum	topwood	tons	4.2	0	0 NA	NA		53.2
white oak	topwood	tons	3.82	0	0 NA	NA		54.2
willow oak	topwood	tons	1.56	0	0 NA	NA		70
yellow-poplar	topwood	tons	2.23	0	0 NA	NA		77

Field data

Here are the data collected in the field. The first two plots in s1 were dropped as they were located in a thin strip connecting s1 and s4. The vegetation there was not representative of either stand.

Stand 1

Plot Number	Tree Number	Species	DBH (inches)	Height (ft)	Count (trees)	Notes	Segment Length (feet)_1	Product_1	Segment Length (feet)_2	Product_2
3	1	sweetgum	10		1			16 pulp		
3	2	northern red oak	36		1			16 saw		20 pulp
3	3	willow oak	22		1			16 saw		20 pulp
4	1	southern red oak	12		1			32 saw		
4	2	southern red oak	16		1			24 saw		
4	3	mockernut hickory	12		1			32 pallet		
4	4	southern red oak	18		1			36 pulp		
5	1	mockernut hickory	10		1			20 pallet		
5	2	sweetgum	6		1			32 pulp		
5	3	sweetgum	10		1			32 pulp		
5	4	sweetgum	10		1			32 pulp		
5	5	sweetgum	10		1			32 pulp		
5	6	sweetgum	10		1			32 pulp		
6	1	shagbark hickory	10		1			24 pallet		
6	2	mockernut hickory	18		1			20 saw		
6	3	post oak	22		1			16 saw		20 pulp
6	4	pignut hickory	18		1			44 pallet		
7	1	post oak	14		1			24 pallet		
7	2	loblolly pine	14		1			60 saw		
7	3	white oak	14		1			32 pallet		
7	4	loblolly pine	22		1			56 saw		
7	5	white oak	16		1			24 saw		16 pulp
7	6	pignut hickory	18		1			48 saw		
7	7	southern red oak	20		1			32 saw		
7	8	post oak	16		1			32 saw		
8	1	loblolly pine	20		1			64 saw		
8	2	loblolly pine	12		1			64 saw		
8	3	mockernut hickory	18		1			24 saw		
8	4	post oak	20		1			24 saw		20 pulp
8	5	post oak	16		1			24 saw		20 pulp
8	6	post oak	18		1			24 saw		20 pulp
8	7	loblolly pine	8		1			32 chip-n-saw		
8	8	mockernut hickory	14		1			20 pallet		
9	1	post oak	22		1			32 saw		
9	2	loblolly pine	22		1			48 saw		
9	3	northern red oak	10		1			32 pallet		
9	4	post oak	16		1			28 saw		
9	5	loblolly pine	16		1			20 saw		
10	1	post oak	20		1			32 saw		20 pulp
10	2	post oak	20		1			32 saw		20 pulp
10	3	post oak	14		1			16 pallet		
10	4	post oak	14		1			16 pallet		
10	5	southern red oak	14		1			32 pallet		
10	6	shagbark hickory	10		1			20 pallet		
10	7	shagbark hickory	10		1			32 pallet		
10	8	shagbark hickory	6		1			20 pulp		
11	1	shagbark hickory	8		1			28 pallet		
11	2	eastern redcedar	16		1			28 saw		
11	3	northern red oak	16		1			32 saw		
11	4	northern red oak	16		1			32 saw		

Stand 2

The field data for s2 is the same as in the summary report above.

Stand 3

Plot Number	Tree Number	Species	DBH (inches)	Merch Height (feet)	Product
1	1	loblolly pine	18	64	saw
1	2	loblolly pine	10	48	chip-n-saw
1	3	loblolly pine	24	72	saw
1	4	loblolly pine	20	72	saw
1	5	loblolly pine	20	72	saw
1	6	loblolly pine	16	56	saw
1	7	loblolly pine	16	64	saw
2	1	northern red oak	12	24	pallet
2	2	southern red oak	20	24	pallet
2	3	red maple	8	20	pallet
2	4	red maple	10	20	pallet
2	5	loblolly pine	22	56	saw
2	6	southern red oak	30	20	saw
3	1	sweetgum	6	20	pulp
3	2	loblolly pine	18	56	saw
3	3	northern red oak	8	16	pulp
3	4	northern red oak	12	32	pallet
3	5	loblolly pine	16	64	saw
3	6	loblolly pine	18	64	saw
4	1	loblolly pine	18	48	saw
4	2	loblolly pine	8	24	chip-n-saw
4	3	pignut hickory	34	32	saw
4	4	loblolly pine	18	56	saw
4	5	loblolly pine	16	48	saw
4	6	loblolly pine	12	48	saw
5	1	loblolly pine	6	20	pulp
5	2	loblolly pine	14	48	saw
5	3	loblolly pine	12	48	saw
5	4	loblolly pine	6	32	pulp
5	5	loblolly pine	16	72	saw
5	6	loblolly pine	20	72	saw
5	7	shortleaf pine	16	48	saw
5	8	mockernut hickory	6	20	pulp
6	1	loblolly pine	18	48	saw
6	2	loblolly pine	18	48	saw
6	3	loblolly pine	18	48	saw
6	4	loblolly pine	10	40	chip-n-saw
6	5	southern red oak	10	40	pallet
7	1	loblolly pine	12	48	saw
7	2	loblolly pine	18	48	saw
7	3	loblolly pine	14	40	saw
7	4	post oak	12	36	pallet
7	5	loblolly pine	18	40	saw
7	6	chestnut oak	22	36	saw

Stand 4

Plot Number	Tree Number	Species	DBH (inches)	Total Height (feet)	Merch Height (feet)	Product
1	1	sweetgum	20			32 saw
1	2	sweetgum	19			40 saw
1	3	southern red oak	20			16 saw
1	4	loblolly pine	18			48 saw
1	5	loblolly pine	22			32 saw
1	6	sweetgum	20			32 saw
2	1	loblolly pine	20			48 saw
2	2	yellow-poplar	28			48 saw
2	3	sweetgum	10			16 pallet
2	4	yellow-poplar	22			32 saw
2	5	loblolly pine	24			32 saw
2	6	loblolly pine	26			48 saw
2	7	loblolly pine	18			32 saw
2	8	loblolly pine	24			48 saw
2	9	loblolly pine	18			56 saw
2	10	sweetgum	8			32 pulp
2	11	loblolly pine	22			64 saw
2	12	loblolly pine	18			64 saw
3	1	loblolly pine	14			48 saw
3	2	southern red oak	24			32 saw
3	3	loblolly pine	22			40 saw
4	1	southern red oak	22			48 saw
4	2	white oak	18			32 saw
4	3	white oak	22			48 saw
4	4	loblolly pine	26			64 saw
4	5	sweetgum	8			32 pulp
4	6	loblolly pine	18			36 saw
4	7	loblolly pine	20			64 saw
4	8	mockernut hickory	10			32 pallet
5	1	mockernut hickory	18			40 saw
5	2	southern red oak	24			56 saw
5	3	white oak	18			40 saw
5	4	northern red oak	24			40 saw
5	5	southern red oak	24			24 saw
5	6	southern red oak	22			32 saw
6	1	loblolly pine	20			64 saw
6	2	loblolly pine	20			64 saw
6	3	loblolly pine	18			64 saw
6	4	loblolly pine	16			64 saw
6	5	loblolly pine	20			64 saw
6	6	loblolly pine	18			64 saw
6	7	northern red oak	10			40 pallet
7	1	white oak	18			48 saw
7	2	southern red oak	12			32 pulp
7	3	southern red oak	26			32 saw
7	4	willow oak	20			24 saw
7	5	southern red oak	16			20 saw

Timber Removals

Stand 1 Timber removals in tons by product

Stand 1 First Thin 2032		
PINE	Revenue by Product	Tns/ac
CnS	\$5.69	0.24
ST	\$274.04	8.98
HDWD		
Palletwood	\$14.17	0.71
ST	\$333.73	10.25
OAK		
ST	\$1,023.37	20.79
Totals	\$1,650.99	40.97 tns/ac

Stand 1 Second Thin 2042		
PINE	Revenue by Product	Total/ac
CnS	\$0.30	0.01
ST	\$214.57	7.03
HDWD		
Palletwood	\$6.26	0.31
ST	\$278.32	8.55
OAK		
ST	\$667.91	13.57
Totals	\$1,167.36	29.47 tns/ac

Stand 2 Pine timber removals in tons by product

2027 First Thin

(\$100.00 Deducted from cost per acre for PCT from SPBPP program)

	tns	price/tn	revenue	cost/ac	Net revenue/ac
cns	0	\$23.64		0	0
st	0	\$30.52		0	0
Totals	0			\$20.00	\$-20.00/ac
				NPV	\$ (16.44) /ac

2042 Second Thin

	tns	price/tn	revenue	cost/ac	Net revenue/ac
pulp	30.1	\$9.98	\$300.40		\$637.72
cns	1.8	\$23.64	\$42.55		\$338.05
st	0	\$30.52	\$0.00		\$12.21
Totals	31.9		\$342.95		\$342.95/ac
				NPV	\$ 156.52 /ac

2052 Final Harvest

	tns	price/tn	revenue	cost/ac	Net revenue/ac
pulp	43.8	\$9.98	\$437.12		\$437.12
cns	34.3	\$23.64	\$810.85		\$810.85
st	31.7	\$30.52	\$967.48		\$967.48
Totals	109.8		\$2215.46		\$2215.46/ac

Final Harvest NPV \$ 683.07 /ac

PV of Land Tax 6.5ac
30yrs \$260.69

PV of Land Tax/ac \$40.11

All revenues	Total	\$	\$2,538.41	/ac
	NPV	\$	\$783.04	/ac
	SEV	\$	\$916.33	/ac

Total Stand **NPV** \$ 4,829.07
SEV \$ 5,695.42

Stand 3 Timber removals in tons by product

Stand 3 First Thin 2032		
PINE	Revenue by	Tons/ac
CnS	\$0.00	0
ST	\$3,605.22	118.1
HDWD		
Palletwood	\$0.00	0.0
ST	\$257.44	7.9
OAK		
ST	\$894.74	18.2
Totals	\$4,757.39	144.2 tns/ac

Stand 3 Second Thin 2042		
PINE	Revenue by Product	Tons/ac
CnS	\$21.05	0.90
ST	\$828.83	27.16
HDWD		
Palletwood	\$18.80	1.40
ST	\$0.00	0.00
OAK		
ST	\$346.68	7.04
Totals	\$1,215.36	36.49 tns/ac

Stand 4 Timber removals in tons by product

Stand 4 First Thin 2032		
PINE	Revenue by Product	Tns/ac
CnS		0
ST	\$2,785.13	91.3
HDWD		
Palletwood		0.0
ST	\$485.90	14.9
OAK		
ST	\$2,496.36	50.7
Totals	\$5,767.39	156.9 tns/ac

Stand 4 Second Thin 2042		
PINE	Revenue by Product	Total/ac
CnS	\$0.00	0.00
ST	\$619.98	20.31
HDWD		
Palletwood	\$3.34	0.17
ST	\$155.15	4.77
OAK		
ST	\$155.15	8.58
Totals	\$933.63	33.82 tns/ac