

REFORESTATION TAX INCENTIVE IMPACTS ON FINANCIAL RETURNS OF LOBLOLLY PINE PLANTATIONS FOR NONINDUSTRIAL PRIVATE FOREST LANDOWNERS IN MISSISSIPPI

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ABSTRACT

Forest plantation investment returns depend not only on survival and growth rates, but also on costs and revenues associated with various practices. Beyond that, tax-related issues are very important, but are often not addressed and thus most forest financial assessments can be defined as before-tax. Mississippi landowners can reduce reforestation cost burdens through two important tax-related opportunities. Firstly, the Federal reforestation deduction and amortization provisions, and secondly the State-based reforestation tax credit. Impacts of these two income tax reduction opportunities on unthinned loblolly pine (*Pinus taeda*) financial returns were examined for three planting densities (454, 519, and 605 seedlings per acre) for an 80-acre clearcut with a site index of 65 feet (base age 25) at age 26. For Federal tax purposes, a landowner classified as an investor within the 22 percent Federal income tax bracket was assumed. Whether before- or after-tax assessment, the financially optimal planting density was 454 seedlings per acre.

INTRODUCTION

Federal and State cost-share programs and reforestation tax incentives are extremely important for landowners to obtain reasonable financial returns on investment and in helping to maintain this important supply of wood for the State's economy. The Federal Income Tax Reforestation Deduction and Amortization incentives are available to many landowners across the country (Li and others 2022). In addition, the State of Mississippi currently has the unique Reforestation Tax Credit, which provides a tax credit against State income tax liability of up to \$10,000 annually to offset costs of practices leading to the reforestation of a property. This analysis examines how much these two reforestation incentives can help reduce the costs of establishing loblolly pine (*Pinus taeda*) plantations, thus leading to maximizing financial returns in Mississippi. Additionally, for these analyses, it is assumed that a landowner is not

seeking any reforestation payments from Federal or State cost-share programs.

Federal Income Tax Reforestation Deduction and Amortization Incentives

For any justified (qualified) reforestation expenditure in a particular year, a landowner can deduct up to \$10,000 for any qualified timber property (QTP). For any amount of justified (qualified) reforestation costs greater than \$10,000 in a particular year, a landowner can amortize that amount over an 84-month period, over 8 tax years due to the half-year convention. In the first tax year (the year in which the expense occurred, or tax year 0) and the last, or eighth, tax year (tax year 7), 1/14th of the reforestation expenses in excess of \$10,000 can be deducted, but in tax years 1 through 6, 1/7th of the expenses can be deducted.

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There are some limitations in the applicability of these incentives to a landowner. Landowners with forests classified as investment (investors) or business (or trade) can use these two provisions. A landowner with a forest classified as a hobby, or personal use, could justify the use of these two provisions by claiming they are planting and caring for the trees for production of timber products, but not for profit. Any use of these two incentives, or provisions, reduces the landowner's timber tax basis by the amount deducted or amortized.

These Federal provisions are highly advantageous as well because they can be used to offset any source of income, whether it be wage, salary, or capital gain. Ironically, these provisions (particularly the amortization) may reduce taxes owed to a greater extent for landowners who spend more on reforestation, or those with higher incomes and hence higher income tax brackets and marginal tax rates.

The definition of a QTP is subjective and can lead to confusion. For simplicity, here it is assumed to be a particular loblolly pine plantation. These reforestation tax incentives offer some extremely important advantages when compared to cost-share programs; there is no sign-up period and no ranking system or waiting in line.

Mississippi State Income Tax Reforestation Tax Credit (MRTC)

The State of Mississippi offers nonindustrial private forest landowners (NIPF) the opportunity to use up to 50 percent of the costs incurred during a year associated with conducting approved reforestation activities to offset that tax year's income tax liability (Tanger 2020). The maximum credit amount that can be received annually is \$10,000. To clarify though, the credit only offsets income tax liability. Thus, if a landowner's income tax liability is <\$10,000 or any other amount of tax credit received, the remainder of the credit carries over to subsequent tax years until it is fully utilized. For example, if a landowner owes \$2,000 in State income tax during the year in which the reforestation costs were incurred, and assuming the landowner qualified for \$10,000 of tax credit, the \$10,000 annual tax credit will only offset the

\$2,000 income tax liability, and the remaining \$8,000 will carry over for use in subsequent tax years to offset State income tax liability, and so forth. Each tax year, beginning with the tax year in which reforestation costs were first incurred, a landowner can earn up to a \$10,000 tax credit, and tax credit amounts incurred in each year can be carried forward to succeeding tax years to offset State income tax liability up to a lifetime total of \$75,000 in tax credit.

As with the Federal income tax provisions, there are certain restrictions for landowners to qualify; a partial description follows. Firstly, only Mississippi taxpayers reforesting Mississippi land can claim the credit (e.g., Mississippi Department of Revenue Individual Income Tax Form 80-315). Secondly, a landowner must have an approved reforestation plan produced by a Registered Forester. Thirdly, in most cases, any costs of practices conducted on acres receiving Federal or State cost-share assistance funds for that same practice are not eligible for the tax credit. Fourthly, there are only certain practices approved by the Mississippi Forestry Commission (MFC), and each tax year the MFC establishes reasonable average costs for each practice (to avoid abuse). Practices include the costs of seedlings (different prices for bareroot versus container), costs of labor for the actual planting of seedlings, various site preparation activities, and a first-year herbaceous weed control treatment. Total reforestation costs eligible for the credit is 50 percent of the lesser of either 1) the actual costs for approved reforestation practices or 2) the average costs as established by the MFC for approved reforestation practices (to avoid abuse). Currently, for loblolly pine plantations, the targeted planting density per acre must be ≥ 450 seedlings, and there does not appear to be any direct restrictions on planting configuration (e.g., rectangularity).

Reducing Reforestation Costs Via Silviculture

Landowners should consider other methods to reduce reforestation costs such as reducing their planting density and establishing seedlings in varying degrees of rectangularity (as opposed to a square configuration). Planting fewer seedlings

per acre decreases the cost of purchasing the seedlings and the cost of placing the seedlings into the ground. Beyond that, the costs of any operation that depends on the number of passes on a property, such as bedding, subsoiling/ripping, banded herbaceous weed control treatments, will likely be decreased when planting density is reduced. Plus, fewer rows resulting from a decrease in planting density may result in lowering the amount of chemical applied to a property, which is beneficial both economically and environmentally.

For the same planting density per acre, rectangular plantings can reduce reforestation costs because once again the number of passes on the property should be less, and thus the associated benefits as described in the previous paragraph also apply. Greater degrees of rectangularity should result in a greater reduction in reforestation costs. However, one should consider reductions in yields resulting from extreme degrees of rectangularity. For loblolly pine, it has generally been found that rectangularity ratios of between row to within row spacing that are 3:1 or less result in decreased reforestation costs with minimal impacts on yields (Adams and Clason 2002, Amateis and others 2004, VanderSchaaf and South 2004).

Lower planting densities, within a reasonable range, can also be beneficial financially because yields of the more valuable chip-n-saw and sawlog classes can be obtained at an earlier age, and that across time, greater yields of these more valuable product classes can be obtained (Amateis and Burkhart 2012, Land and others 2004). Given poor stumpage prices in southwestern Mississippi (Measells 2022), and that pulpwood prices continue to decrease, landowners want to use a planting density that not only reduces the amount of pulpwood, but that also reduces the age at which chip-n-saw and sawlog production begins. Planting densities ranging from around 300 to 625 seedlings per acre, given the quality of seedling being planted today, should produce a quality stand. Planting densities at the lower end of this range will result in obtaining sawlogs at an earlier age and will likely result in more sawlog production across time. Plus, lower planting densities will likely eliminate the need for a pulpwood-dominated first thinning.

The objective of this analysis was to assess the impacts of these two income tax reduction opportunities, along with reducing planting density per acre, on loblolly pine financial returns. To determine how reduced reforestation costs from lower planting densities may impact financial returns, planting densities of 454, 519, and 605 seedlings per acre were examined for an 80-acre stand with a site index of 65 feet (base age 25). Varying degrees of rectangularity when planting seedlings were assumed, reducing reforestation costs. For Federal tax purposes, a landowner classified as an investor in the 22 percent Federal ordinary income tax bracket was assumed.

METHODS

Projections

Projections from an Excel-based (Microsoft, Redmond, WA) simulator entitled GulfLOB produced by the lead author, from which a copy can be obtained, were used for this analysis. The majority of the cutover plantations used in model development were established in the 1960s and 1970s, with a few in the 1980s, in Louisiana, southern Mississippi, and east Texas (Baldwin and Feduccia 1987). To account for the effects of improved genetics, better nursery practices, improved site preparation activities, better vegetation control, among other factors, a 2-year age-shift was used and an increase of 15 percent in the carrying capacity was assumed. Simulations were for three planting densities [i.e., 454 (16 feet by 6 feet), 519 (12 feet by 7 feet), and 605 (12 feet by 6 feet) trees per acre] and for land with a site index of 65 feet (base age 25). No fertilization treatments were considered. It has generally been found that rectangularity ratios of between row to within row spacing of 3:1 or less do not meaningfully impact loblolly pine yields (Adams and Clason 2002, Amateis and others 2004, VanderSchaaf and South 2004); thus, no direct adjustments in yield estimates were made for a particular planting density.

Silvicultural Activities and Associated Costs

GulfLOB does not allow for a direct response in growth and yield to various site preparation activities. However, it was assumed an aerial chemical treatment was applied in July and mechanical treatments were applied in November of tax year 0. Assumed initial costs were \$84.58 and \$131.44 per acre, respectively; these costs were based on Maggard (2021) for the year of 2020. Due to substantial increases in inflation, costs from 2020 found in Maggard (2021) were increased by 15 percent on an annual basis in both 2021 and 2022. Thus, the chemical and mechanical site preparation treatments were assumed to cost \$111.86 and \$173.83 per acre in 2023, respectively. Additionally, a banded first-year herbaceous weed control treatment was conducted in April (tax year 1), and due to assumed rectangularity in the planting configurations, a reduction factor in costs was assumed (VanderSchaaf and South 2004).

However, given inflation, which for simplicity was assumed to offset any reduction in banded herbicide application costs due to rectangular plantings (i.e., fewer passes resulting in less fuel, labor, maintenance), the herbaceous weed

control cost reported in Maggard (2021) was maintained at a cost of \$56.09. Since the 519 and 605 planting densities both used 12-foot row spacings, they were considered the standard and the entire \$56.09 was applied. However, for the 454 planting density, because 16-foot row spacings reduce the number of passes on the property (hence reduce fuel, labor, and chemical), the first-year herbaceous weed control costs were reduced to \$42.07 per acre for the 454 spacing. This reduction in cost was obtained based on the relative values of the number of passes on the property. The square root of 43,560 square feet is 208.71, and this value was then divided by 12 feet and 16 feet. Thus, for the 519 and 605 planting densities there were 17.39 passes and for the 454 planting density there were 13.04 passes. The relative value of 13.04/17.39 was multiplied by \$56.09 to produce \$42.07.

Costs by tax year and planting density are shown in table 1. Outright deduction and amortization values by tax year and planting density are shown in table 2. Table 3 contains calculations related to the MRTC. For the 2022 tax year, in relation to the MRTC, the MFC reimbursed landowners \$54 per acre for the purchase of seedlings (\$54 x 80 acres = \$4,320), \$60 per acre for the labor of planting (\$60 x 80 acres = \$4,800),

Table 1—The timing and costs per acre by planting density (seedlings per acre) of reforestation activities, and associated State and local timber severance and Federal and State income taxes

Component	Operation	Tax year	Planting density		
			454	519	605
Reforestation	Chemical site preparation	0	\$111.86	\$111.86	\$111.86
	Mechanical site preparation	0	\$173.83	\$173.83	\$173.83
	Seedlings (Elite mass-control pollinated)	0	\$114.41	\$130.79	\$152.46
	Hand planting	1	\$77.18	\$88.23	\$102.85
	First-year herbaceous weed control (banded)	1	\$42.07	\$56.09	\$56.09
Severance taxes	Pulpwood (\$0.30/cord)	26	\$2.71	\$2.94	\$3.25
	Chip-n-saw (\$0.12/ton)	26	\$12.42	\$13.82	\$15.42
	Sawtimber (\$0.12/ton)	26	\$8.75	\$8.23	\$7.60
Income taxes	Federal (15% capital gains)	26	\$381.98	\$389.15	\$397.00
	State (5% ordinary)	26	\$127.33	\$129.72	\$132.33

Total costs of reforestation operations incurred during tax year 1 were discounted 1 year at a 5 percent interest rate. Total discounted reforestation costs for the 454, 519, and 605 planting densities per acre were \$513.67, \$553.93, and \$589.52, respectively. Total severance taxes at age 26 for the 454, 519, and 605 planting densities per acre were \$23.88, \$24.98, and \$26.27, respectively. Pulpwood included both whole-tree pulpwood and topwood.

Table 2—Per acre recovery (dollars) from the outright deduction in tax years 0 and 1 and amortization schedule by planting density

YI	PD	Type	Tax year										NDT	DT
			0	1	2	3	4	5	6	7	8			
0	454	D	27.50	—	—	—	—	—	—	—	—	27.50	27.50	
	519		27.50	—	—	—	—	—	—	—	27.50	27.50		
	605		27.50	—	—	—	—	—	—	—	27.50	27.50		
1	454	D	—	26.23	—	—	—	—	—	—	—	26.23	24.98	
	519		—	27.50	—	—	—	—	—	—	—	27.50	26.19	
	605		—	27.50	—	—	—	—	—	—	—	27.50	26.19	
0	454	A	4.32	8.65	8.65	8.65	8.65	8.65	8.65	4.32	—	60.54	51.28	
	519		4.58	9.16	9.16	9.16	9.16	9.16	9.16	4.58	—	64.12	54.33	
	605		4.92	9.84	9.84	9.84	9.84	9.84	9.84	4.92	—	68.88	58.37	
1	454	A	—	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
	519		—	0.30	0.61	0.61	0.61	0.61	0.61	0.61	0.30	4.25	3.43	
	605		—	0.53	1.07	1.07	1.07	1.07	1.07	1.07	0.53	7.47	6.03	

The amortization schedule is of costs in excess of the \$10,000 annual outright deduction. Recovery values were calculated using 0.22 (landowner Federal income marginal tax rate) and then divided by 80 acres. For the 454 seedling per acre planting density during tax year 1, there are no amortization recoveries because the total reforestation costs incurred in tax year 1 did not exceed the maximum annual allowable outright deduction of \$10,000. The discounted total recovery of the reforestation costs incurred in both tax year 0 and 1 and for both the outright deduction and amortized deduction for the planting densities (seedlings per acre) of 454, 519, and 605 are \$103.76, \$111.45, and \$118.09, respectively.

YI = tax year in which reforestation costs were incurred; PD = planting density (seedlings per acre); Type = type of tax incentive, where D refers to a deduction and A refers to an amortization; NDT = nondiscounted total; and DT = discounted total using a 5-percent interest rate.

\$100 per acre for chemical site preparation (\$100 x 80 acres = \$8,000), \$190 per acre for mechanical site preparation (\$190 x 80 acres = \$15,200), and \$75 per acre for postplanting site preparation (\$75 x 80 acres = \$6,000). For the purposes of the tax credit, postplanting site preparation is defined as a practice to reduce or control undesirable competition within the first growing season of an established crop of trees and is commonly referred to as a first-year herbaceous weed control treatment. In total, across the 80 acres, MFC averaged costs eligible for consideration of the tax credit were \$38,320. Actual, nondiscounted, reforestation costs for the planting densities of 454, 519, and 605 seedlings per acre were \$41,547.64, \$44,863.84, and \$47,767.20, respectively. Regardless of planting density, the MFC costs of approved reforestation activities (2022 tax year) were lower relative to the actual reforestation costs. Hence, the landowner is entitled to a tax credit of either 1) 50 percent of the MFC average costs for approved reforestation activities, a value of \$19,160, or 2) \$10,000—whichever is less. Thus, the landowner is entitled to a tax credit of \$10,000.

Table 3—Mississippi Reforestation Tax Credit calculations

Tax year	Income tax liability offset	Credit remaining	Per acre	Discounted to Year 0
~~~~~dollars~~~~~				
0	2,176.00	7,824.00	27.20	27.20
1	2,176.00	5,648.00	27.20	25.90
2	2,176.00	3,472.00	27.20	24.67
3	2,176.00	1,296.00	27.20	23.50
4	1,296.00	0.00	16.20	13.33
<b>Total</b>	10,000.00		125.00	114.60

The Mississippi Reforestation Tax Credit only offsets income tax liability, thus the table shows the recovery of the tax credit per tax year assuming the landowner incurs \$2,176.00 annually in Mississippi income tax (ordinary tax rate of 5 percent). Per-acre values were calculated assuming a plantation of 80 acres. An interest rate of 5 percent was used for discounting.

## Seedling and Planting Costs

Mass-control pollinated Elite (ArborGen, Inc., Ridgeville, SC) bareroot seedlings at a cost of \$252 per thousand were planted by hand. It is assumed that seedlings were purchased in June of tax year 0. Seedling costs were based on observation of common prices for the 2022–2023 planting season. Hand planting per seedling was initially

assumed to cost \$0.13 (Maggard 2021). Similar to site preparation costs, a 15-percent increase in both 2021 and 2022 was assumed, and hence final planting costs per seedling was \$0.17. Seedling planting costs occurred in tax year 1.

### Merchandizing Specifications, Stumpage Revenues, and Interest Rate

Upper stem diameter outside bark of 8 inches, 4 inches, and 2 inches were assumed to represent sawtimber, chip-n-saw, and pulpwood merchantable classes, respectively. Minimum diameters at breast height were 12 inches, 8 inches, and 4 inches for sawtimber, chip-n-saw, and pulpwood merchantable classes, respectively. The harvesting of upper-stem pulpwood, or topwood, was assumed. Stumpage values per green ton for pine pulpwood, chip-n-saw, and sawtimber were \$3.27, \$12.93, and \$23.46, respectively, and were obtained from the 2nd quarter of 2022 for southwestern Mississippi (Measells 2022). An interest rate of 5 percent was used. No sources of revenue beyond pulpwood, chip-n-saw, and sawlog markets were assumed. Table 4 contains estimated yields per acre by product class (based on assumed merchandizing specifications) and planting density, and revenues per acre based on predicted yields and stumpage values.

### Landowner Forest Property Income Tax Classification

It was assumed that each planting density generated a single, but distinct, QTP. It was assumed the landowner owned the property

(hence no mortgage interest). Beyond that, it was assumed the landowner was classified as an investor for their forest ownership because the landowner had a profit motive for their property (hence they are not personal use or hobby), and they had a management plan demonstrating their profit motive, but they did not have the activities required to classify their forest ownership as a trade or business. Landowners with forests classified as business (both material participant and passive) generally have superior tax benefits because they have less restrictions to deduct the costs of ordinary and necessary practices associated with carrying on their business during the year in which they were incurred. However, in order to be classified as a business, a landowner must spend a meaningful amount of time (and thus cost) visiting and managing their property or attending educational activities. The landowner must demonstrate through documentation to the Internal Revenue Service that indeed they conduct practices justifying the business classification.

### Capitalized Ad Valorem Property Taxes and Maintenance/Firelane Costs

In addition, an annual property tax (ad valorem) of \$5 per acre per year was assumed, and annual property maintenance/firelane costs of \$4 per acre per year was assumed. An ad valorem tax rate of \$5 was based on revenues and acreages from 2018 across the State of Mississippi (\$4 per acre per year) but increased slightly to bring forward to 2023. Since the landowner was considered an investor, and essentially operating expenses had been excluded from being deducted

**Table 4**—Yield and revenue per acre by product class and planting density (seedlings per acre) at age 26

Planting density	Pulpwood				Revenue
	Whole trees	Topwood	Chip-n-saw	Sawlog	
<i>seedlings per acre</i>	<i>~~~~~ tons per acre ~~~~~</i>				<i>dollars</i>
454	8.4	15.1	103.5	72.9	3,126.00
519	10.5	14.9	115.2	68.5	3,180.34
605	13.5	14.6	128.5	63.4	3,239.93

for tax years 2018 to 2025 when classified as an investor due to the Tax Cuts and Jobs Act of 2017, property maintenance/firelane costs (\$4 per acre per year) were capitalized. Stated differently, they were added to an investor's timber tax basis. Beyond that, because the standard deduction was taken each year as opposed to itemizing deductions, all annual ad valorem property taxes (\$5 per acre per year) were also capitalized. Thus, these annual costs were placed into the timber tax basis and were used to reduce the capital gains (timber harvest revenues minus timber tax basis minus timber severance taxes minus timber sale administrative costs) from the clearcut at age 26. At age 26, for all three planting densities, the value of the operating expenses (maintenance and firelanes) was \$108 per acre (\$4 for tax years 0 to 26) and the value of the carrying charges (ad valorem property taxes) was \$135 per acre (\$5 for tax years 0 to 26).

## Timber Severance Tax Reducing the Amount of Capital Gain

Mississippi leverages a timber severance tax on timber harvested. This money is partially used to fund the Forest Resource Development Program cost-share (80 percent of tax) and parts of it are returned directly to the county government (20 percent) in which the timber sale occurred. The Mississippi tax code intends for the landowner (grower) to pay the severance tax; however, it is stated in the code that if the landowner does not pay these taxes, then the liability is passed to the purchasers and they need to pay them. Often the mill will pay severance taxes in Mississippi, and if not, then the logger will pay them. Currently, within Mississippi, the severance tax rates per

ton (or cord for pulpwood) are fairly low and thus severance taxes are not significant on a per acre basis. Although purchasers of stumpage may operationally pay the severance tax, for illustrative purposes and this analysis, we assumed the landowner (grower) incurred the cost.

For each sawlog ton (and assumed chip-n-saw ton), a severance tax of \$0.12 is charged and each 128-cubic foot cord of pulpwood is taxed \$0.30 (Mississippi Code 27-25-1). Thus, because tons is utilized in this assessment, the reported pulpwood tonnage from the simulator was converted to a 128-cubic foot cord by dividing tons by 2.6. The value of 2.6 was obtained by dividing 5,200 pounds per cord (Mississippi Code 75-27-39) by 2,000 pounds per ton. This was equivalent to a severance tax of \$0.1154 per ton for pulpwood (\$0.30/2.6).

Nonetheless, for Federal and Mississippi State income tax purposes, if paid by the landowner (grower), severance taxes can be subtracted from timber revenues, thus reducing the amount of capital gain that is taxed. Table 5 contains total severance tax amounts and by product class for each planting density.

## Assumed Investor Annual Taxable Income and Federal and State Capital Gain Tax Rates

For this analysis, the single landowner annual taxable income, prior to any timber related deductions or amortizations, was assumed to be \$70,000. Thus, this landowner was within the Federal 22 percent income tax bracket for the 2022 tax year. As an investor, because the standing

**Table 5**—Severance taxes per acre associated with the clearcut at age 26 by planting density

Planting density	Pulpwood				Revenue
	Whole trees	Topwood	Chip-n-saw	Sawlog	
<i>seedlings per acre</i>	<i>~~~~~ dollars ~~~~~</i>				
454	0.97	1.74	12.42	8.75	23.88
519	1.22	1.72	13.82	8.23	24.98
605	1.56	1.69	15.42	7.60	26.27

Sawtimber and chip-n-saw product classes are taxed at \$0.12 per ton while pulpwood is taxed at \$0.30 per cord (Mississippi Code 27-25-1). To convert from cords to tons, \$0.30 was divided by 2.6 producing a value of \$0.1154 per ton.

timber would have been owned for more than 1 year before any harvesting operation, and the timber sale would be conducted under a lump-sum contract, the Federal long-term capital gains tax rate applies. It was assumed the landowner was within the 15 percent capital gains tax rate bracket. Within Mississippi, there was no special capital gain tax rate, and thus all income was taxed at the ordinary income tax rate of 5 percent.

It was assumed the landowner's plantation was 80 acres. The acreage impacts the benefits on a per acre basis obtained from the Federal and State income tax provisions. For example, if a landowner owns 100 or 1,000 acres, the \$10,000 annual Federal Deduction maximum and the MRTC annual maximum amount of \$10,000 still both apply. Table 6 contains capital gain amounts by planting density after subtracting from the per acre revenues the timber tax basis (annual carrying charges of ad valorem property taxes and operating costs of site and firelane maintenance), severance taxes, and timber sale administration costs. The table also contains income tax amounts based on the Federal capital gains tax rate of 15 percent (as opposed to the ordinary income tax rate of 22 percent) and the Mississippi State ordinary income tax rate of 5 percent. Remember the State of Mississippi does not have special capital gains tax rates. A parcel of 80 acres was also selected to reduce the complexity of the analysis due to factors such as the net investment income tax (3.8 percent) on timber income of high earners (\$250,000 adjusted gross income married filing jointly or \$200,000 adjusted gross income single taxpayer) classified as an investor.

## Final Taxable Amounts

For the final clearcut operation, a 10-percent timber sale administration and consulting fee was charged by a consulting forester. This was a common percentage used by consulting foresters (Chhetri and others 2022, Self 2019) and it has been used in recent timber harvest tax assessments (Baral and others 2020, Li and others 2020). Thus, the Federal capital gain at age 26 (table 6) can be expressed as:

$$CG = \text{Revenue} - \text{Timber Tax Basis} - \text{Severance Tax} - \text{Timber Sale Administration Costs} \quad (1)$$

where

*CG* = capital gain amount per acre by planting density at age 26

*Revenue* = amount of revenue received per acre from pulpwood, chip-n-saw, and sawlog yields per acre and their associated stumpage values at age 26

*Timber Tax Basis* = ad valorem taxes of \$135 plus maintenance costs of \$108

*Severance Tax* = presented in table 5

*Timber Sale Administration Costs* = 10 percent of revenue

At age 26, the timber tax basis only contains the annual ad valorem property taxes (\$135 per acre) and the operating expenses (\$108 per acre) associated with maintaining the property and firelanes. All reforestation costs were recovered near the time of planting through the Reforestation Tax Deduction and Amortization

**Table 6**—Capital gains per acre by planting density

Planting density	Revenue	Maint	Property	Admin	Severance	Capital gain	Income tax	
							Federal	State
seedlings per acre	~~~~~ dollars ~~~~~							
454	3,126.00	108.00	135.00	312.60	23.88	2,546.52	381.98	127.33
519	3,180.34	108.00	135.00	318.03	24.98	2,594.32	389.15	129.72
605	3,239.93	108.00	135.00	323.99	26.27	2,646.67	397.00	132.33

Revenue is total revenue across all product classes at the clearcut age of 26 years (see table 4).

Maint = operating costs for site maintenance and firelane construction or maintenance (\$4 annually from tax year 0 to 26); Property = carrying charges of ad valorem property taxes (\$5 annually from tax year 0 to 26); Admin = 10 percent of the revenue per acre; Severance = severance taxes at age 26 (see table 5); Capital gain = revenue minus maint, property, admin, and severance (equation 1); Federal = the amount of income tax owed resulting from the capital gain, using the capital gains tax rate of 15 percent; and State = the amount of income tax owed to Mississippi based on the ordinary income tax rate of 5 percent.

provisions. Timber sale administration costs were \$312.60, \$318.03, and \$323.99 per acre for the 454, 519, and 605 planting densities per acre, respectively.

One final note: it currently is not entirely clear for Mississippi State income tax purposes if a landowner can deduct and amortize reforestation costs in excess of the amount of tax credit received by the landowner from the MRTC (Tanger 2020). Thus, to some degree, recovery of reforestation costs could be increased further beyond what has been reported in this analysis.

## RESULTS AND DISCUSSION

### Impacts of Taxation on Financial Returns

Most forest financial assessments of southern forests are calculated before tax. This is most likely because of the difficulty in understanding all aspects of taxation and their associated calculations, but also because of the variability among State and local taxation. This analysis is specifically for Mississippi; however, the Federal taxation component of this paper should be applicable to landowners regardless of the State in which they live. Beyond that, results will differ based on IRS landowner classification, complicating analyses. Being classified as a business, particularly a material participant, would be advantageous in terms of tax deductions relative to an investor. For instance, the

operating expenses of site maintenance and the maintaining of firelanes and ad valorem property tax carrying charges could be deducted in the year in which the costs were incurred. This is advantageous for at least four reasons. First, the deductions would offset income at the ordinary income tax rate of 22 percent rather than the capital gains tax rate of 15 percent such as at the time of harvest. Second, the negative impacts of discounting would be less. Third, the recovery revenues could be put into another investment to gain interest (e.g., the bank). Fourthly, timber income of high earning (\$250,000 married filing jointly or \$200,000 single taxpayer) business landowners is not subject to the net investment income tax (3.8 percent). However, a high earning landowner classified as an investor is subject to the net investment income tax (3.8 percent).

Given the assumptions of this analysis, for a particular planting density, when compared to a before-tax financial assessment, landowner net revenues were reduced when conducting an after-tax financial assessment (table 7). However, the optimal planting density of 454 seedlings per acre did not change when an after-tax assessment was conducted. Hence, the increased revenues associated with using a lower planting density, resulting from reduced reforestation costs and a greater amount of sawlog production at the time of harvest, was stronger than the ability of tax provisions, allowing landowners to recover greater amounts of reforestation costs for higher planting densities.

**Table 7**—After-tax assessment discounted revenues and costs

PD	Discounted revenues (5%)				Discounted costs (5%)						
	Rev	Ded	Amort	MRTC	RC	ST	Maint	Prop	Admin	Fed	State
<i>Seedlings per acre</i>	<i>~~~~~ dollars ~~~~~</i>										
454	879.16	52.49	51.28	114.60	513.67	6.72	61.50	76.88	87.92	107.43	35.81
519	894.44	53.69	57.76	114.60	553.93	7.03	61.50	76.88	89.44	109.44	36.48
605	911.20	53.69	64.40	114.60	589.52	7.39	61.50	76.88	91.12	111.65	37.22

Total discounted revenues for the planting densities of 454, 519, and 605 seedlings per acre were \$1,097.52, \$1,120.49, and \$1,143.89, respectively, while the total discounted costs were \$889.91, \$934.70, and \$975.28, respectively. After-tax net present value per acre for planting densities of 454, 519, and 605 seedlings per acre was \$207.61, \$185.79, and \$168.61 per acre, respectively. Before-tax net present value per acre for planting densities of 454, 519, and 605 seedlings per acre was \$365.49, \$340.51, and \$321.68 per acre, respectively (Rev minus RC). An interest rate of 5 percent was used.

PD = planting density (seedlings per acre); Rev = stumpage values received (table 4); Ded (table 2) = recovered costs from the Federal Reforestation Tax Deduction and Amortization (Amort) tax provisions (assuming an ordinary income tax rate of 22 percent); MRTC = recovered reforestation costs from the Mississippi Reforestation Tax Credit, assuming an annual state income tax liability of \$2,176.00 (table 3); RC = reforestation costs of the chemical and mechanical site preparation operations, seedling purchase and planting costs, and a first-year herbaceous weed control treatment (table 1); ST = severance taxes (table 5); Maint = operating costs for site maintenance and firelane construction or maintenance (\$4 annually from tax year 0 to 26); Prop = carrying charges of ad valorem property taxes (\$5 annually from tax year 0 to 26); Admin = 10 percent of Rev per acre; Fed = Federal income taxes (15 percent capital gains tax rate, table 6); and State = income taxes (5-percent tax rate, table 6).

## CONCLUSIONS

Regardless of whether a financial assessment was before or after tax, for the assumptions used here, the financially optimal planting density was 454 seedlings per acre. Currently, pulpwood markets in Mississippi as a whole are poor (Measells 2022). Beyond that, chip-n-saw markets, and even sawtimber markets, are relatively poor. When a landowner is classified as an investor, reducing reforestation costs by planting fewer seedlings and the use of rectangularity when planting, and associated increases in stumpage values resulting from earlier and greater production of the more valuable sawlog product class, seems to have a greater impact on loblolly pine plantation financial returns than reforestation tax provisions. When only analyzing revenues from traditional timber markets, this analysis suggests that often before-tax financial assessments will result in the same ranking of alternative planting densities as after-tax financial assessments for loblolly pine plantations.

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