

Series paper #6
**Economics of growing slash and loblolly pine to a 33-year rotation –
impact of thinning at various stumpage prices**

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Abstract

Since early 1998 forest industry, forestland ownership, global markets, and wood supply and demand (pulpwood, sawtimber, chips, etc.) regionally and world-wide have changed dramatically. Non-industrial private forest (NIPF) landowners have realized reduced product market availability and increased price uncertainty during this period in the southeastern United States. Lower Atlantic and Gulf Coastal Plain NIPF landowners seek management options utilizing two commonly available pine species; loblolly (*Pinus taeda* L.) and slash (*Pinus elliotii*, Engelm.) to enhance feasibility, profitability, and cash-flow of production forestry enterprises. At the same time, NIPF landowners desire heightened flexibility across time required to achieve marketable forest products. This paper examines feasibility, profitability, and cash flow of forest management options affecting wood-flow for slash and loblolly pine plantations including thinning at various stumpage prices. Financial measures of profitability calculated include net cash flow, soil expectation value, annual equivalent value, and rate of return.

Introduction

Pine sawtimber (ST) is down approximately 23%, chip-n-saw (CNS) is down 28%, and pulpwood (PW) down 60% since historic highs in 1997-98 (Figure 1). Private non-industrial forest landowners (NIPFLs) question whether thinning their stands with today's depressed pulpwood prices makes economic sense. To address this question, we used the Georgia Pine Plantation Simulator (GaPPS 4.20) growth and yield Model developed by Bailey and Zhao (1998) for loblolly and slash pine on a 33-year rotation with two thinnings.

Methodology

Common assumptions

The rotation age was set at 33-years with a thinning at ages 15- and 24-years for slash and loblolly pine plantations. Net cash flow was calculated in this paper as the present value of returns minus the present value of costs. A discount rate of 8 percent was used to calculate soil expectation value (SEV) and annual equivalent value (AEV). Rate of return (ROR) was also calculated. Fire protection cost was assumed \$2/ac/yr., stand management at \$2/ac/yr., and property taxes at \$5/ac/yr. Thus, the total annual cost for each year of the rotation was \$9/acre. This value cost goes in the transaction table as an annual cost during the rotation. The present value of this net, annual cost flow

was \$103.62 during the 33-year rotation (Table 3). Results were reported in constant dollars, before taxes. Land was assumed to be owned throughout the scenarios.

Site Preparation and Planting Costs

► The relatively low site preparation and planting (SP+PL) cost of \$125/acre was assumed for this paper. SP+PL could include machine planting and the use of a post plant herbicide to control herbaceous weeds on an old-field site or glyphosate @ 1 gallon/ac or prescribe burning site preparation and roughland or hand planting on a cutover site.

Site preparation options and associated costs vary extensively by location, prior stand history, harvesting utilization, landowner objectives, monies available, and anticipated future stumpage value and demand. The assumption used was that level of site preparation intensity matched the level of competition control needed so that wood-flows were comparable within site productivity levels, after site preparation and planting.

Product class specifications

Product class specifications are:

- pulpwood (PW) at a d.b.h. of 4.6 to 9 inches to a 3 inch top;
- chip-n-saw (CNS) at a d.b.h of 9 through 12 inches to 6 inch top; and,
- sawtimber (ST) with a d.b.h greater than 12 inches to a 10 inch top (inside bark) were assumed (Table 1).

Georgia stumpage prices, reported through Timber Mart-South[®] (TM-S) for 1st quarter year 2004 average, used in this analysis for loblolly and slash, were net of property taxes at harvest (2.5%) and net of marketing costs (8%). The low TM-S prices for pulpwood and chip&saw were used for thinning prices and average TM-S prices for pulpwood, CNS, and ST are used for the clearcut. Net converted prices are found in Table 2.

Thinning

All scenarios for both pine species include two thinnings; @ age 15- and 24-years-old. Residual basal area (RBA), after thinning (5th row with selection from below) is set at 65 sq. ft/ac. Thinning stumpage prices started at the low cash (TM-S 2004) prices of \$5.04/ton for PW and \$21.36/ton for CNS sized trees (Table 1 and 2). Stumpage prices were reduced starting at \$4.50/ton for all thinned wood and decreased by \$1/ton to \$0.00/ton for all pulpwood harvested in the two thinnings. Net cash flow, SEV, AEV, and IRR were calculated for each of these reduced (all wood or PW) price scenarios and compared to the base (thin @ low TM-S 2004 PW and CNS prices) scenario for slash and loblolly pine (Table 4 and 5).

Species-specific assumptions

The slash pine scenarios assumed 500 living trees per acre (TPA) at age 5-years-old. A mean annual increment of 1.91 cd/ac/yr (5.26 tons/ac/yr) through age 33-years without fertilization and the two thinnings was assumed. The base slash scenario

woodflow was approximately 12 percent less than base loblolly woodflow (Shiver and others 1999) at age 33-years (Figure 2a).

The loblolly pine survival is assumed to be 500 TPA at age 5-years-old. A mean annual increment for loblolly was assumed to be 2.15 cds/ac/yr (5.95 tons/ac/yr) through age 33-years without fertilization and the two thinnings. The base loblolly woodflow is approximately 12 percent greater than the slash base woodflow (Shiver and others 2000) at age 33-years (Figure 2b).

Scenarios

The following are the six slash (Table 4) and loblolly (Table 5) pine scenarios:

- (1) thin (at age 15- and 24-years to an RBA of 65 ft²/ac) @ \$5.04/ton for pulpwood and \$21.36/ton (cash, before taxes and fees) for chip-n-saw sized trees,
 - (2) thin (as #1) @ \$4.50/ton for all thinned wood,
 - (3) thin (as #1) @ \$3.50/ton for all PW sized trees,
 - (4) thin (as #1) @ \$2.50/ton for all PW sized trees,
 - (5) thin (as #1) @ \$1.50/ton for all PW sized trees,
 - (6) thin (as #1) @ \$0.00/ton for all PW sized trees,
- with a clear-cut @ age 33-years-old using medium stumpage prices for pulpwood, CNS, and ST (Table 2).

Results

Impact of thinning at various prices on net cash flow

Thinning at age 15- and 24-years @ \$5.04/ton and \$21.36/ton (cash before taxes and fees, scenario #1) had a \$346/acre and \$442/acre greater net cash flow compared to the thinnings @ \$4.50/ton for all wood scenario for slash (Table 4) and loblolly pine (Table 5), respectively. Net cash flow for the thinning all PW @ \$0.00/cd was \$152 and \$172/acre less than the net cash flow for scenario #1 for slash and loblolly pine, respectively (Table 4 and 5).

Impact of thinning at various prices on soil expectation value (SEV)

SEVs for the thinning at age 15- and 24-years at low TM-S 1st quarter Georgia 2004 stumpage prices for pulpwood and chip-n-saw were greater than the slash and loblolly pine thin all wood @ \$4.50/ton price scenario (Table 4 and 5) by \$67/acre and \$83/acre, respectively. Thinning all PW at \$0/ton SEVs were \$37 and \$43/acre less than the thin scenario @ low PW and CNS prices for both slash and loblolly pine, respectively.

Impact of thinning at various prices on annual equivalent value (AEV)

Thinning at age 15- and 24-years at low TM-S 1st quarter Georgia 2004 stumpage prices for pulpwood and chip-n-saw improved AEVs by \$5/acre/yr and \$7/acre/yr for slash and loblolly pine, respectively compared to the thin twice @ \$4.50/ton for all wood scenario (Table 4 and 5). AEVs for thinning at \$0/ton for PW trees were \$3/ac/yr than the thin @ low TM-S PW and CNS prices for both pine species.

Impact of thinning at various prices on rate of return (ROR)

Thinning at age 15- and 24-years at low TM-S 1st quarter Georgia 2004 stumpage prices for pulpwood and chip-n-saw improved IRR values by 0.95% and 1.06% for slash and loblolly pine, respectively compared to the thin all wood @ \$4.50/ton scenario (Table 4 and 5). IRR values for thinning all PW at \$0/ton were 0.54% and 0.57% less than the thin @ low TM-S Georgia 2004 prices scenario for slash and loblolly pine, respectively.

Summary

Wood flow

The 1.91 (5.26 tons/ac/yr) to 2.15 cd/ac/yr (5.95 tons/ac/yr) productivity levels at age 33-years-old for slash and loblolly, respectively, are realistic on most cut-over sites with sufficient site preparation and stand management (Pienaar and Rheney 1996) and is conservative on most old-field sites. Exceptions would be the deep sands (Typic Quartzipsamments) of the Sand Hills or shallow, rocky soils of the Piedmont physiographic region.

Thinning at reduced prices (\$4.50 for all wood and thin all PW @ \$3.50 to \$0.00/ton) had lower net cash flows, SEVs, AEVs, and RORs than the thin at low TM-S Georgia 2004 PW and CNS prices scenario for slash and loblolly pine (Table 4 and 5). This illustrates that greater net cash flows, SEVs, AEVs, and RORs are realized when a forest landowner gets current stumpage prices for each product class under these assumptions

Discussion

Non-industrial private forest landowners do have some attractive forest management options with both slash and loblolly pine when using low to medium stumpage prices. Thinning at stumpage prices lower than TM-S Georgia 2004 produced RORs that were 0.11% to 1.07% less than the thinning at low TM-S prices. To maximize AEV, SEV, and ROR under a multi-thin management regime, a forest landowner should get as much wood in the more valuable CNS class in the thinnings as possible and get the CNS price versus an across the board PW price. The financial measures of profitability calculated in this paper (SEV, AEV, and ROR) would change with different establishment costs, pine stand growth rates, product class distributions, and stumpage values.

Literature Cited

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Table 1. Product class specifications.

Product/Item	Pulpwood	Chip-N-Saw	Sawtimber
Small end diameter (inches)	3	6	10
Minimum length (feet)	5	8	8
Length Increment (feet)	1	4	8

Table 2. Product prices, cash and net (net of property taxes and marketing costs) per cord stumpage prices used in the profitability analysis of slash and loblolly scenarios, Georgia State average, price per ton (1stQ TM-S 2004).

Item, Price level	Cash or net	Pulpwood (\$/Ton)	Chip-N-Saw (\$/Ton)	Sawtimber (\$/Ton)
Low	Cash	5.04	21.36	35.91
	Net	4.51	19.12	32.14
Medium	Cash	6.42	25.80	40.97
	Net	5.75	23.09	36.51

Table 3. Stand management cost including active stand management, fire protection, and prescribed fire for loblolly and slash plantations 33-year rotation discounted at 8%.

Rotation	Management cost (\$/ac/yr)	Present value of Management cost year 1, (\$/ac)
33 years	9	103.62

Table 4. Slash 33-year rotation financial results ¹, medium site index ², site prep. and plant at \$125/ac., low, net prices ³ at thinning, medium net prices ⁴ at clear-cut. Then, examine thin PW at \$4.50, \$3.50, \$2.50, \$1.50, & \$0/Ton (\$12.37, \$9.60, \$6.86, \$4.11, & \$0/cd.).

Harvest Schedule	Harvest Price Schedule	Net cash flow ⁵ \$/ac.	SEV ⁶ \$/Ac.	AEV ⁷ \$/Ac./Yr.	ROR ⁸ %
Thin @ 15 & 24 ⁹ cc@33	Thin @ low, net prices ³ CC @ medium net prices ⁴	\$3294	127	10	9.86
	1 st & 2 nd Thin all @ \$4.50/ CC @ medium net prices ⁴	2948	60	5	8.91
	1 st & 2 nd Thin PW @ \$3.50/Ton CC @ medium net prices ⁴	3259	119	10	9.74
	1 st & 2 nd Thin PW @ \$2.50/Ton CC @ medium net prices ⁴	3226	111	9	9.62
	1 st & 2 nd Thin PW @ \$1.50/Ton CC @ medium net prices ⁴	3191	102	8	9.50
	1 st & 2 nd Thin PW @ \$0.00/Ton CC @ medium net prices ⁴	3142	90	7	9.32

Table 5. Loblolly 33-year rotation financial results ¹, medium site index ², site prep. and plant at \$125/ac., low, net prices ³ at thinning, medium net prices ⁴ at clear-cut. Then, examine thin PW at \$4.50, \$3.50, \$2.50, \$1.50, & \$0/Ton (\$12.37, \$9.60, \$6.86, \$4.11, & \$0/cd.).

Harvest Schedule	Harvest Price Schedule	Net cash flow ⁵ \$/ac.	SEV ⁶ \$/Ac.	AEV ⁷ \$/Ac./Yr.	ROR ⁸ %
Thin @ 15 & 24 ⁹ cc@33	Thin @ low, net prices ³ CC @ medium net prices ⁴	\$3723	176	14	10.41
	1 st & 2 nd Thin all @ \$4.50/ CC @ medium net prices ⁴	3281	93	7	9.35
	1 st & 2 nd Thin PW @ \$3.50/Ton CC @ medium net prices ⁴	3684	166	13	10.28
	1 st & 2 nd Thin PW @ \$2.50/Ton CC @ medium net prices ⁴	3646	157	13	10.16
	1 st & 2 nd Thin PW @ \$1.50/Ton CC @ medium net prices ⁴	3607	147	12	10.03
	1 st & 2 nd Thin PW @ \$0.00/Ton CC @ medium net prices ⁴	3551	133	11	9.84

¹ Uninflated, 8% discount rate, before taxes, GaPPS v 4.20

² Slash Mean Annual Increment (MAI) = 1.91 cds/5.13 tons /ac/yr for thinned. Lob MAI = 2.15 cds/5.34 tons /ac/yr for thinned.

³ Low, net prices at thin, \$4.51 PW, \$9.51 CNS, \$32.14 ST/Ton (Net of property taxes (2.5%) and marketing costs (8%)).

⁴ Medium net prices at clearcut, \$5.75 PW, \$23.09 CNS, and \$36.51 ST.

⁵ Net cash flow = PV receipts – PV expenses.

⁶ SEV = Soil Expectation Value, calculated from perpetual rotations.

⁷ AEV = Net Annual Equivalent Value, net present worth as annuity.

⁸ ROR = Rate of Return (percent).

⁹ Thinning to residual basal area (RBA) = 65 ft²/ac. from below

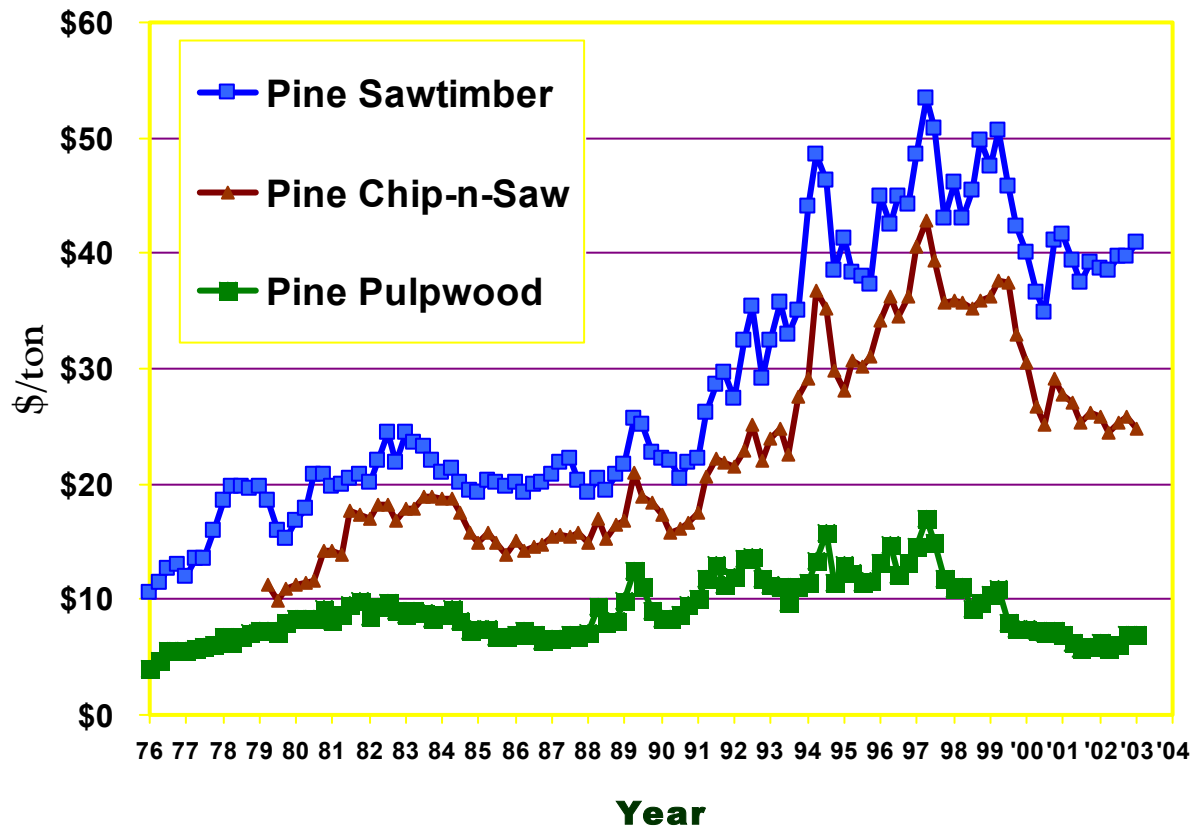


Figure 1. Historic pine stumpage prices for Georgia (1976 – 2003, TM-S 2004)

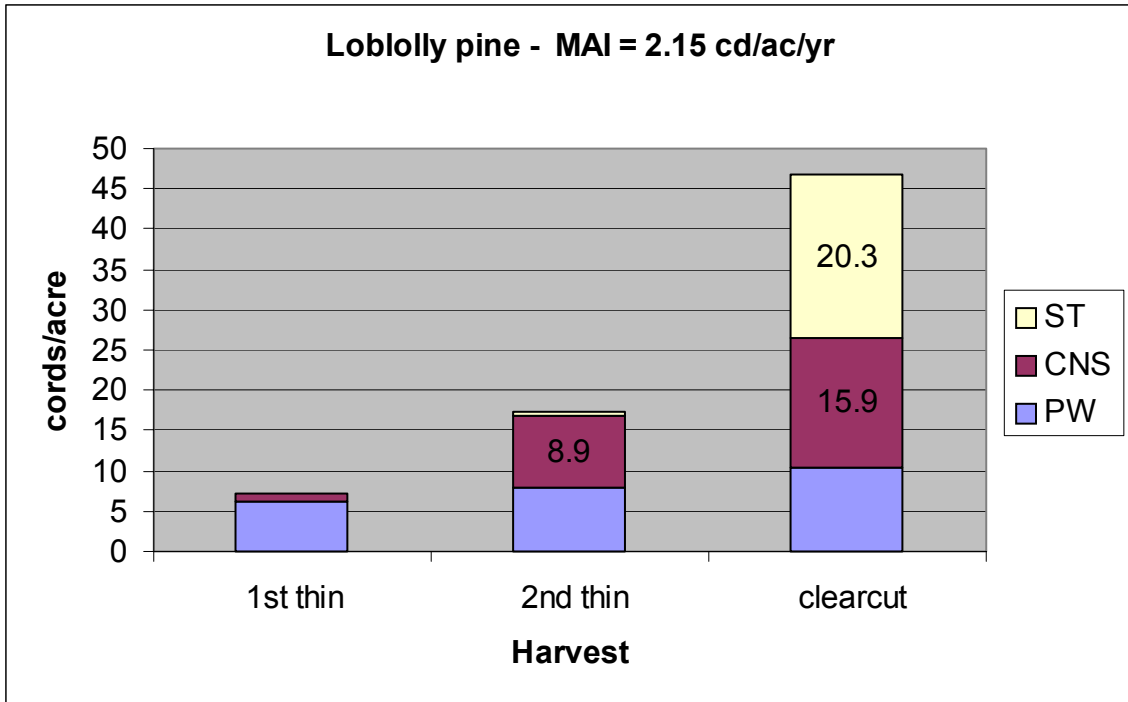
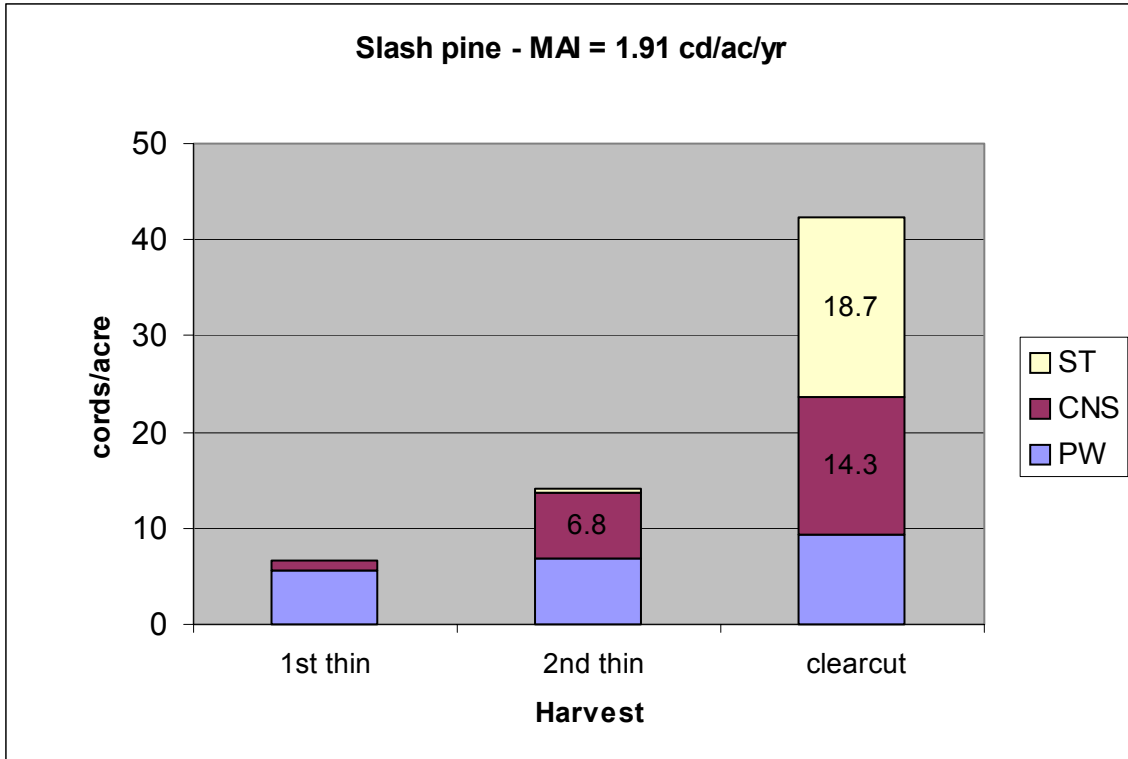


Figure 2. (a) Slash and (b) loblolly pine 33-year rotation wood flow (thin @ age 15- and 24-years to 65 ft²/ac, no straw, no fertilization) PW=pulpwood; CNS=chip-n-saw; ST=sawtimber; MAI=mean annual increment.