

## Series paper #9

# The economic impact of changing stumpage prices when growing slash and loblolly pine under a 24- and 33-year rotation

September 2007

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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 elliottii*, 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 the profitability and cash-flow for slash and loblolly pine plantations under two rotation lengths, 24- and 33-years, using two sets of published pine stumpage prices from (1) 2004 and (2) the period mean of 1982 to 1992. Financial measures of profitability calculated include net cash flow, soil expectation value (SEV), annual equivalent value (AEV), and rate of return (ROR).

## Introduction

Private non-industrial forest (NIPF) landowners in the Atlantic and Gulf Coastal Plain from South Carolina to Mississippi question whether to plant loblolly or slash pine on cut-over and old-field sites. They also question spending moderate to relatively large sums of money in intensive forest management and different rotation ages under the current and anticipated stumpage prices and economic uncertainty. To address these questions, we used the Georgia Pine Plantation simulator (GaPPs 4.20) growth and yield Model developed by Bailey and Zhao (1998). The economics (SEV, AEV, and ROR) of changing pine chip&saw and sawtimber stumpage prices from recently reported values (TM-S 2004) to means from the period of 1982-1992 (18 to 41% lower than the 2004 values; Figure 1) 24-year rotation and a 33-year rotation for slash and loblolly pine are the focus of this paper.

## Methodology

### Common assumptions

The rotation age was set at either 24- or 33-years for loblolly and slash pine plantations. 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 costs 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 is \$94.75 during the 24-year rotation and \$103.62 for the 33-year rotation. Results are 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 cost of \$125/acre was assumed for this paper. This site preparation and planting cost 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 (low level) 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 was matched to level of competition control needed so that woodflows were comparable within site productivity levels, after site preparation and planting.

#### *Pine Stumpage Prices*

Georgia stumpage Prices, reported through Timber Mart-South<sup>®</sup> (TM-S) for two price scenarios: (1) 1<sup>st</sup> quarter year 2004 average and (2) the 1982 to 1992 TM-S pine stumpage price means for pine chip&saw and sawtimber (2004 prices for pulpwood), were used in this analysis for loblolly and slash were net of property taxes at harvest (2.5 percent) and net of marketing costs (8 percent). The low TM-S prices for pulpwood and chip&saw were used for thinning prices and average TM-S prices for pulpwood (PW), chip&saw (CNS), and sawtimber (ST) are used for the clearcut. Cash and net converted prices are found in Table 1. Product class specifications are: PW at a d.b.h. of 4.5 to 9 inches to a 3 inch top; CNS at a d.b.h of 9 to 12 inches to 6 inch top; and, ST with a d.b.h greater than 12 inches to a 10 inch top (Table 2).

#### **Species specific assumptions**

The slash pine scenarios assumed 500 living trees per acre (TPA) at age 5-years-old. Base mean annual increments of 1.91 cd/ac/yr (5.26 tons/ac/yr) @ age 33-years-old and 2.09 cd/ac/yr (5.77 tons/ac/yr) @ age 24-years-old without fertilization and thinning were assumed (Table 6 and 8). The base slash scenario woodflow was approximately 12 to 15 percent less than base loblolly woodflow (Shiver and others 1999) for the 24- and 33-year rotations.

The loblolly pine survival was assumed to be 500 TPA at age 5-years-old. The base mean annual increments for loblolly were assumed to be 2.15 cds/ac/yr (5.95 tons/ac/yr) through age 33-years and 2.35 cd/ac/yr (5.83 tons/ac/yr) through age 24-years without fertilization or thinning (Table 7 and 9). The base loblolly woodflow was approximately 11 to 15 percent greater than the slash base woodflow (Shiver and others 2000) at age 24- and 33-years.

## **Scenarios for the 24- and 33-year Rotations**

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

- (1) 24-yr rotation → thin (at age 15-years to 65 ft<sup>2</sup>/ac), no straw, no fertilization (Figure 2), and
- (2) 33-yr rotation → thin (at ages 15- and 24-years to 65 ft<sup>2</sup>/ac), no straw, no fertilization (Figure 3).

## **Forest management activities**

### *Thinning*

For the 24-year rotation, a single thinning at 15-years-old was assumed. For the 33-year rotation, two thinnings; @ age 15- and 24-years-old were assumed. Residual basal area (RBA), after thinning (5<sup>th</sup> row with selection from below) is set at 65 sq. ft/ac for both rotation ages.

### *Wood Flow*

The 1.91 and 2.15 (33-year rotation) and 2.09 and 2.35 cd/ac/yr (24-year rotation) productivity levels for slash and loblolly, respectively, are realistic on most cut-over sites with chemical site preparation (Pienaar and Rheney 1996) and is conservative on most old-field sites.

## **Results**

When considering results, more weight should be given to the relative differences among scenarios than to the numeric values calculated for any one scenario. Among-scenario differences are more important than absolute values because scenarios were analyzed under a common set of conservative assumptions. Values realized for your individual case may be greater or less than those of this study. However, the relative difference between and ranking of the scenarios should remain the same under a different set of underlying assumptions.

### *Effect of changing stumpage prices on economic parameters*

Reducing the pine stumpage CNS by 18% (low 2004 vs 1982-92 mean) and 32% (medium 2004 vs 1982-92 mean) and ST by 33% (low 2004 vs 1982-92 mean) and 41% (medium 2004 vs 1982-92 mean, Table 1) reduced all economic parameters.

### *Net Revenues*

Net revenues per acre for the slash and loblolly pine 24-year rotation age scenarios were reduced by 37% and 38% or \$708 and \$849 per acre, respectively when comparing the use of the 2004 to the 1982-92 mean CNS and ST stumpage prices (Table 4). Net revenues per acre for the slash and loblolly pine 33-year rotation scenarios were reduced by 43% and 44% or \$1438 and \$1639 per acre, respectively when comparing the use of the 2004 to the 1982-92 mean CNS and ST stumpage prices (Table 4).

### *Soil Expectation Values*

Soil expectation values (SEVs) for the slash pine 24-year rotation scenarios were \$26 and \$171 per acre for the 1982-92 mean and 2004 stumpage prices, respectively. Slash pine SEVs for the 33-year rotation were -\$34 and \$127 per acre for the 1982-92 mean and 2004 stumpage prices, respectively. Loblolly pine 24-year rotation SEVs were \$68 and \$247 per acre the 1982-92 mean and 2004 stumpage prices, respectively. Loblolly pine 33-year SEVs were -\$9 and \$176 per acre the 1982-92 mean and 2004 stumpage prices, respectively (Table 4).

### *Annual Equivalent Values*

Annual equivalent values (AEVs) for the slash pine 24-year rotation scenarios were \$2 and \$14 per acre per year for the 1982-92 mean and 2004 stumpage prices, respectively. Slash pine AEVs for the 33-year rotation were -\$3 and \$10 per acre per year for the 1982-92 mean and 2004 stumpage prices, respectively. Loblolly pine 24-year rotation AEVs were \$5 and \$20 per acre per year the 1982-92 mean and 2004 stumpage prices, respectively. Loblolly pine 33-year AEVs were -\$1 and \$14 per acre per year the 1982-92 mean and 2004 stumpage prices, respectively (Table 4).

### *Rate of Return*

Rate of return (ROR) values for the slash pine 24-year rotation scenarios were 2.35 percentage points lower (8.55% vs 10.89%) when comparing the use of the 1982-92 mean stumpage prices to 2004 stumpage prices. Slash pine ROR values for the 33-year rotation were 2.50 percentage points lower (7.36% vs 9.86%) when comparing the use of the 1982-92 mean stumpage prices to 2004 stumpage prices. Loblolly pine 24-year rotation ROR values were 2.56 percentage points lower (9.35% vs 11.91%) when comparing the use of the 1982-92 mean stumpage prices to 2004 stumpage prices. Loblolly pine 33-year ROR values were 2.57 percentage points lower (7.84% vs 10.41%) when comparing the use of the 1982-92 mean stumpage prices to 2004 stumpage prices (Table 4).

## **Summary**

- ▶ The reduction of pine chip&saw and sawtimber prices by 18% to 41% reduced all economic decision-making criteria in these cases.
- ▶ The use of two sets of stumpage prices (1982-92 mean and 2004) for chip&saw and sawtimber illustrate the large difference in overall wood value revenues, SEVs, AEVs, and RORs generated from slash and loblolly pine stands under these assumptions.
- ▶ The wood value losses equate to \$708 (slash) and \$849 (loblolly) per acre with the 24-year scenarios. The wood value losses equate to \$1438 (slash) and \$1639 (loblolly) per acre with the 33-year rotation scenarios.
- ▶ IRR values were reduced by 2.35 to 2.57 percentage points for the slash and loblolly scenarios.

## **Discussion**

This economic series paper illustrates that large stumpage differences in the more valuable product classes (chip&saw and sawtimber in this case) can have large economic ramifications when selling timber. Other incomes for the non-industrial private forest landowners pine stands such as pine straw and hunting leases (see Economic series papers 1-7, revised in 2007) can partially offset reduced stumpage prices at the time of timber sale(s).

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**Table 1.** Product prices, per ton stumpage used in the analysis of slash and loblolly scenarios.

Price level <sup>1</sup>	Cash <sup>2</sup> or net	Pulpwood 2004\$/Ton	Chip-N-Saw 2004\$/Ton	Sawtimber 2004\$/Ton	Chip-N-Saw <sup>3</sup> 1982-92\$/Ton	Sawtimber <sup>3</sup> 1982-92\$/Ton
Low	Cash	5.04	21.36	35.91	17.50	24.00
	Net	4.51	19.12	32.14	15.66	21.48
Medium	Cash	6.42	25.80	40.97	--	--
	Net	5.75	23.09	36.51	--	--

<sup>1</sup> South Georgia, average stumpage prices, reported through Timber Mart-South<sup>®</sup> for 1<sup>st</sup> Quarter 2004. Low price is the South Georgia, low average price reported and used for both thinning and clear cut. Medium price is when low prices are used for thinning, average prices are used for clear cut. High price is when average prices are used for thinning and high prices are used for clear cut.

<sup>2</sup> Cash price is actual TM-S South Georgia price reported, net price is net of property taxes at harvest (2.5%) and net of marketing costs (8%).

<sup>3</sup> Prices set at level equivalent to lower and relatively stable period, Georgia state average, early 1980s to early 1990s (TM-S, 2004).

**Table 2. 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 3. Stand management cost** including active stand management, fire protection, and prescribed fire for loblolly and slash plantations with 24- and 33-year rotations calculated at 8%.

Rotation	Management cost (\$/ac/yr)	Present value of Management cost year 1, (\$/ac)
24 years	9	96.07
33 years		103.62

**Table 4.** Slash and Loblolly, 24-year and 33-year rotation financial results <sup>1</sup>, medium site index, site preparation and plant at \$125/ac., with low, net prices <sup>2</sup> at thinning(s) and clear-cut, set at levels equivalent to a lower and relatively more stable price period of Georgia state average, early 1980s to early 1990s (Low), compared to current prices (Base, TM-S 2004).

Species Rotation	Price Period (yrs)	Mean Annual Increment (MAI) Ton, Cord	Harvest Schedule	Net Cash Flow <sup>3</sup> \$/ac.	SEV <sup>4</sup> \$/Ac.	AEV <sup>5</sup> \$/Ac./Yr.	ROR <sup>6</sup> %
Slash 24-yr	Low(82-92)	5.40, 2.01	Thin @ yr. 15	1198	26	2	8.55
	Base (04)			1906	171	14	10.89
Lob 24-yr	Low(82-92)	5.61, 2.26		1381	68	5	9.35
	Base (04)			2230	247	20	11.91
Slash 33-yr	Low(82-92)	5.13, 1.91	Thin @ yr. 15 & 24	1856	-34	-3	7.36
	Base (04)			3294	127	10	9.86
Lob 33-yr	Low(82-92)	5.34, 2.15		2084	-9	-1	7.84
	Base (04)			3723	176	14	10.41

Uninflated, 8% discount rate, before taxes, GaPPS v 4.20, No fertilizer, No Pinestraw.

<sup>2</sup> Low, net prices at thin and clear cut, \$4.51 PW, \$15.66 CNS, \$21.48 ST/Ton, Net of property taxes (2.5%) and marketing costs (8%).

<sup>3</sup> Net cash flow = PV receipts – PV expenses.

<sup>4</sup> SEV = Soil Expectation Value, calculated from perpetual rotations.

<sup>5</sup> AEV = Net Annual Equivalent Value, net present worth as annuity.

<sup>6</sup> ROR = Rate of Return of the investment scenario (percent).

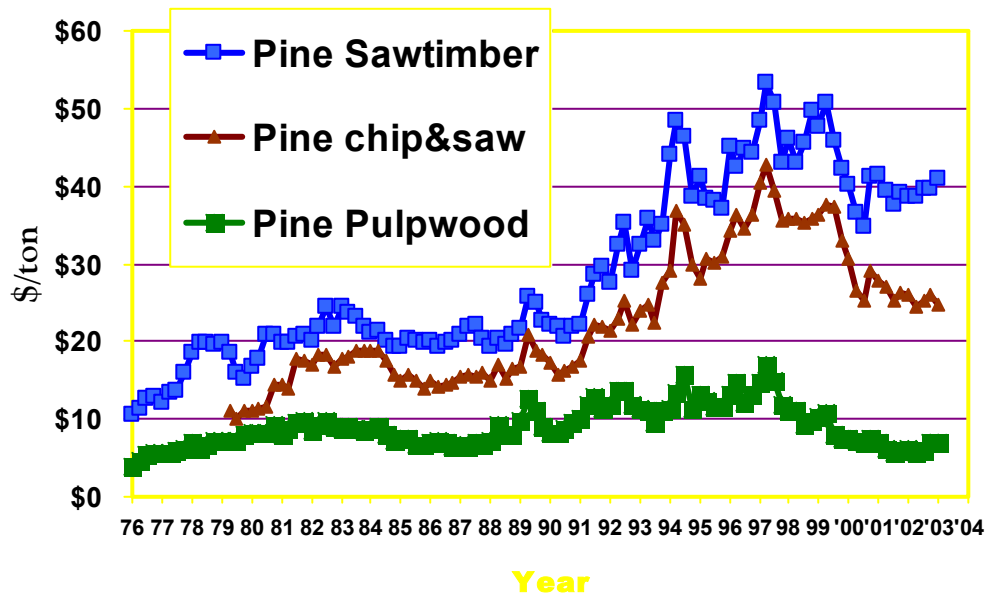


Figure 1. Pine stumpage prices for Georgia from 1976 through 1<sup>st</sup> quarter 2004.



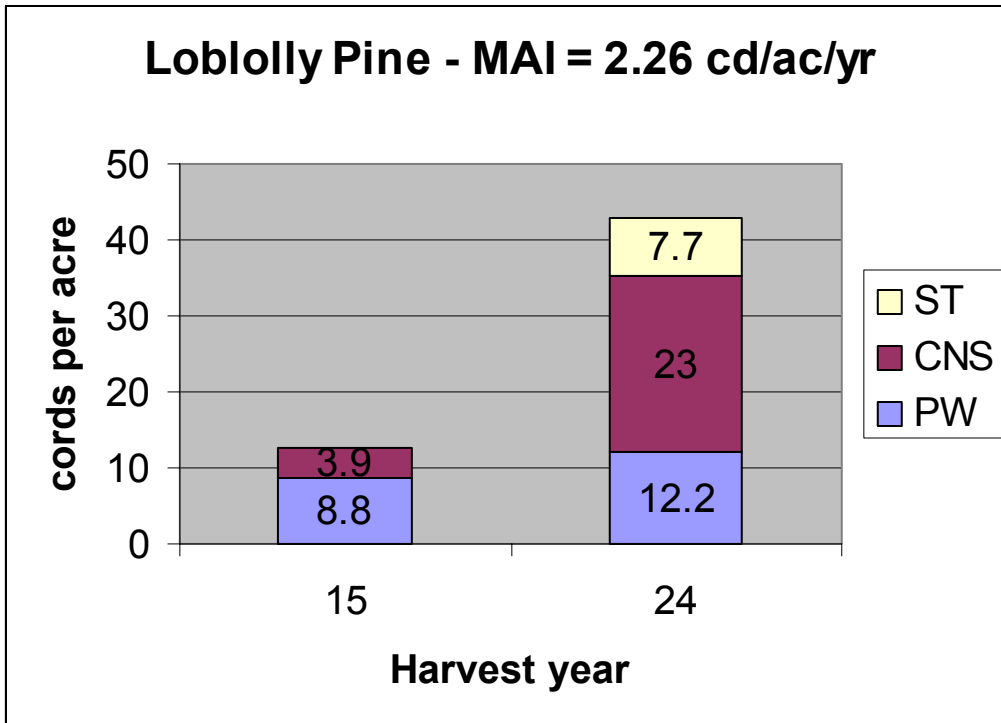
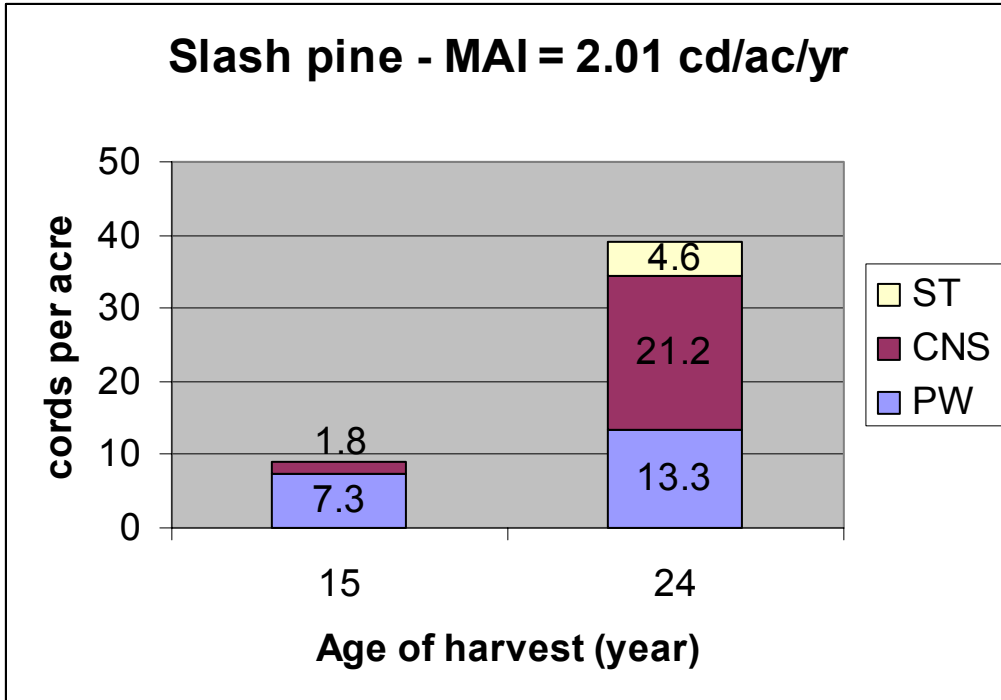


Figure 2. Slash and loblolly pine 24-year rotation wood flow (one thin, no fertilization, no pine straw). PW=pulpwood; CNS=chip-n-saw; ST=sawtimber; MAI=mean annual increment

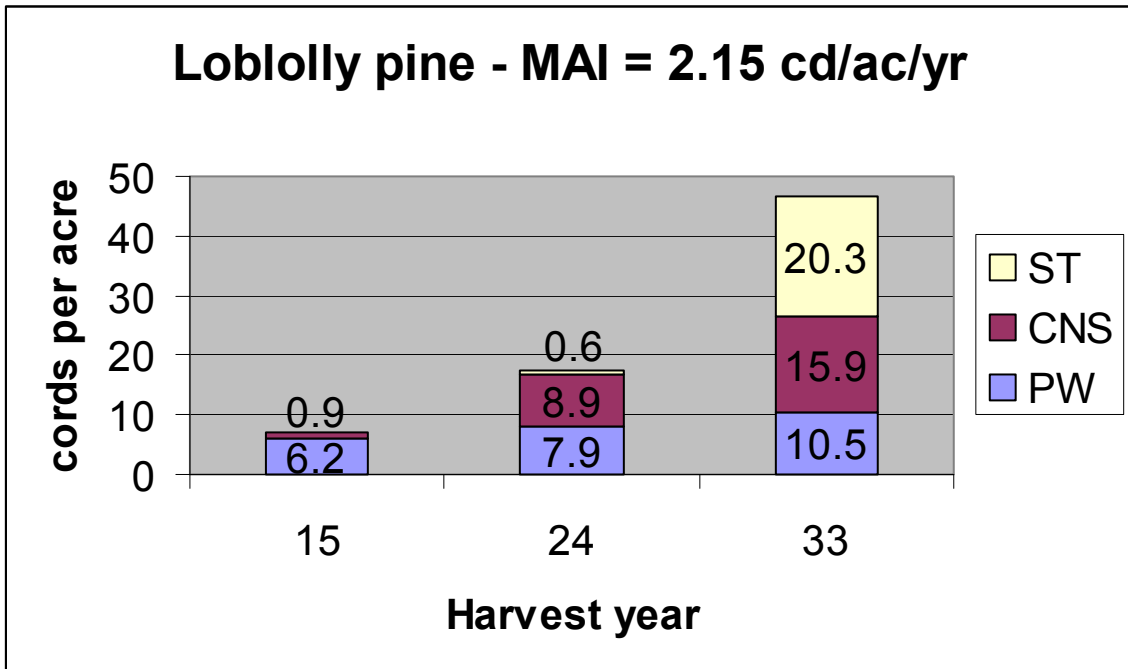
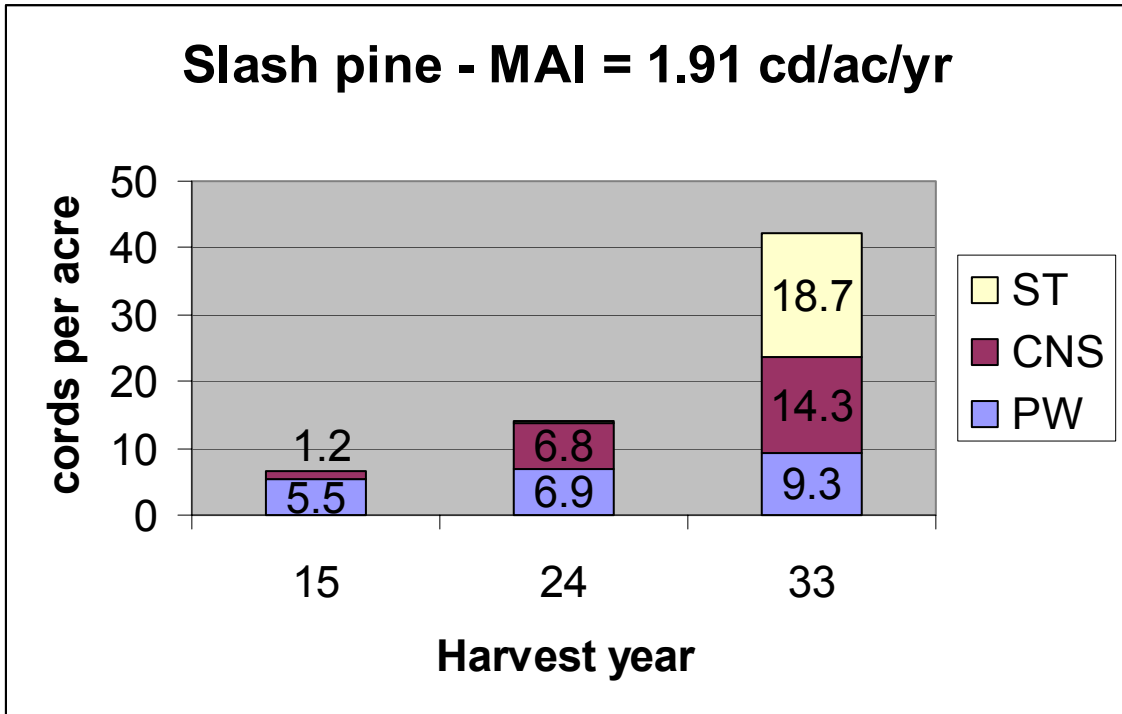


Figure 3. Slash and loblolly pine 33-year rotation wood flow (no fertilization, no pine straw). PW=pulpwood; CNS=chip-n-saw; ST=sawtimber; MAI=mean annual increment