FINANCIAL RETURN FROM TRADITIONAL WOOD PRODUCTS, FEEDSTOCK, AND CARBON SEQUESTRATION IN LOBLOLLY PINE PLANTATIONS IN THE SOUTHERN U.S.

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We know that planting trees is a key approach for mitigating climate change; however, we are uncertain of what planting density per unit of land and what cultural regimes are needed to optimize traditional timber products, feedstock, and carbon sequestration. This study was undertaken to determine the financial return from the aforementioned timber commodities in planted loblolly pine (*Pinus taeda* L.) stands. This study uses 17 years of data from two Florida installations of the University of Georgia Plantation Management Research Cooperative Culture x Density study on loblolly pine in the Lower Coastal Plain to examine the role of site index (SI), planting density, and silvicultural treatment on financial returns. These planted loblolly pine sites were categorized into high site index (30.7 m) and low site index (19.2 m). Each installation received two silvicultural treatments: intensive and operational. Operational plantations received standard chemical site preparation and four fertilizations through age 17 whereas intensive plantations received additional herbicide treatments resulting in complete sustained control of competing vegetation throughout their rotation and eight fertilizations. Finally, each cultural regime was planted at four different densities: 1,483; 2,224; 2,965; and 3,707 trees per ha.

Tree biomass was measured using allometric equations from Baldwin (1987) and Pienaar and others (1987). Financial calculations were made for traditional wood products, feedstock, and carbon sequestration using the discounted cash flow technique: net present value (NPV). South-wide timber product prices of the first quarter of 2012 were used for analysis (Timber Mart-South 2012). The bioenergy price was assumed to be $3 per green ton (Personal communication. 2013. Dale Greene, Professor of Forest Operations, University of Georgia, 180 E Green St, Athens, GA 30602). Carbon dioxide (CO_2) price was assumed to be $5 per green metric ton. The average costs of site preparation, plantation, herbicide, and fertilizer were inflated to the 2012 prices. Financial calculations were made with a 6 percent discount rate, and final values were reported as before tax.

On the high SI site, the operational regime produced as much biomass as the intensive regime (fig. 1). In contrast, on the low SI site, the intensive regime enhanced biomass growth and had a higher economic return than the operational regime. The lower density stands (1,483 to 2,224 trees per ha) produced higher biomass and accrued greater total financial return in terms of traditional wood products, carbon sequestration, and bioenergy feedstock than the higher density stands, except on one low SI site under operational management. On this particular site, greater densities (i.e. 2,965 to 3,706 trees per ha) were needed to produce more biomass up through age 17 (table 1 and fig. 1).

There was little sawtimber production through age 17. Optimum sawtimber harvests are typically performed on stands older than those evaluated here, when sawtimber makes up a greater proportion of the harvested material. Subsequent analysis will use a growth and yield simulator to predict optimal rotations. Feedstock from tops and branches and trees of < 4 inches diameter at breast height accrued relatively little economic return after considering logging costs. If we assume that the only product is bioenergy feedstock, at least $7 per green metric ton stumpage is needed for profitability of the study stands. In that market condition, a rotation as short as 6 years for planted pine can be

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Table 1--Net present values for traditional products, feedstock, carbon, and combined products (i.e., sum of all the products) in the Lower Coastal Plain by site index, cultural regime, and planting density[a]

	High site index							
	Intensive plantation				Operational plantation			
TPH[b]	Traditional	Feedstock	Carbon	Overall	Traditional	Feedstock	Carbon	Overall
	dollars ($)							
1483	1,168	58	1,285	2,511	2,040	63	1,512	3,615
2224	962	64	1,411	2,437	1,977	69	1,689	3,735
2965	508	51	1,269	1,828	1,217	71	1,495	2,783
3706	329	46	1,252	1,627	1,085	75	1,520	2,680
	Low site index							
1483	1,192	64	1,451	2,707	-86	48	415	377
2224	605	65	1,432	2,102	-98	53	461	416
2965	194	73	1,337	1,604	92	65	816	973
3706	-263	71	1,144	952	93	96	950	1,139

[a]Values at optimum rotation of age 16 or 17 years. Analysis made from the actual stand data.
[b]TPH = trees per hectare.

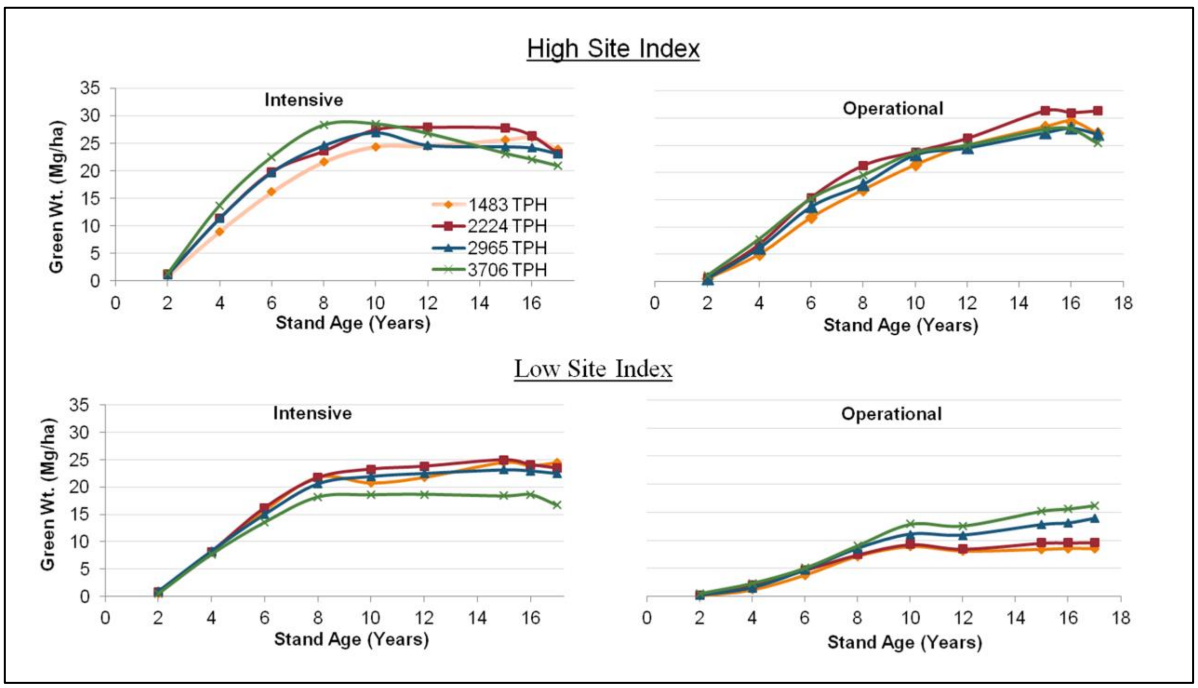

Figure 1--Mean annual increment (MAI) of planted loblolly pine in the Lower Coastal Plain by site index, cultural regime, and planting density.

anticipated in high SI operational stands. In the present bioenergy market, a modest CO_2 price of $5 per green metric ton can increase financial return by over $1,500 per ha for some sites (table 1).

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