Intensive Forest Management

2. Shifting Rowcrop and Pasture Land to Tree Crops in Georgia: Woodflow and Financial Returns for Oldfield Timber Crops Examined

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PURPOSE

This purpose of this publication is to:

1) provide a format to examine woodflow and financial returns of forest tree crops grown on forest land in Georgia;
2) model estimates for varying rotation lengths, management treatments, intensity, capital, and costs;
3) discuss potential land lease rates for full-rotation tree crops; and,
4) examine implications for policy makers, educators, and agricultural credit lenders to consider, with respect to environmental quality and sustainable and profitable cropping of natural resources.

INTRODUCTION

RESEARCH BASED

A study done by Pienaar and Rheney (1996) examined the growth of oldfield pine plantations enrolled in the Conservation Reserve Program (CRP) (EWG 1995, Glaser 1986, USDA-ASCS 1993, USDA-ERS 1994). They examined the maximum wood-flow attainable under stand conditions where all competing vegetation is eliminated, as well as wood-flows under growing conditions expected to be found in oldfield pine plantations, i.e., some weed competition and stand mortality. In all cases, growth rates were substantially greater than those used to develop oldfield models on these sites in the past.

At stand age 16 years, Pienaar and Rheney estimated total merchantable volume yield for oldfield loblolly pine plantations to be 6,278 ft$^3$ per acre with an average annual growth rate of 392 ft$^3$ per acre. This projects that new plantations can provide the same level of total production on only 59 percent of the acres of the former land base in previous plantations. The basis for the increased production is in a higher level of competition control than previously practiced.

These expected growth rates from Pienaar and Rheney have been approximated in the modeling for this current study, and are intended to serve as a guide for landowner and forest industry expectations of future oldfield growth rates and financial returns.

SITUATION

Pine production in Georgia, on marginal crop and pasture soils can return higher producer profits than crops commonly grown on these soil types (Alig et al. 1988, Dangerfield et al. 1991, Moorhead and Dangerfield 1996, Shideed et al. 1989, USDA-FS 1988). Recent research conducted through The University of Georgia Warnell School of Forest Resources (Pienaar and Rheney 1996, Borders and Bailey 1997) has demonstrated that current pine productivity of 1 to 2 cords per acre per year can, at a maximum, be doubled or tripled through application of intensive pine plantation establishment and management practices. As a result, pine plantation productivity in the U.S. South can rival that of the most productive areas in the world.

Most current, intensive forest management practices are aimed at short-rotation production of fiber. Intensive practices enable current 20- to 25-year pulpwood rotations to be reduced to 12 to 15 years or less, while producing the same fiber volumes. Conservative, operational projections indicate that intensive-pine-plantation management practices could produce a sustainable level of current annual fiber supply on 70 percent of the land base currently in forest production.

In addition to pulpwood production, enhanced chip-n-saw and sawtimber production may be achieved in the same stands by careful application(s) of fertilizers, tree spacing, thinning(s), and pruning(s) to meet wood quality standards of harvested wood-flow. Increased per acre production results in more efficient land use.
While intensive management requires relatively large per acre capital investment, increased management activity, and careful attention to product and market demands, returns are attractive. Demand for fiber stumpage, through competition among the 13 pulp/paper mills in Georgia, generally results in attractive pulpwood stumpage prices to the landowner. The approximate 50 large pine sawmills do the same for sawtimber stumpage. Over the period 1990 to 2040, softwood harvests from U.S. forests should rise by 35 percent. Hardwood harvests should rise by more than 51 percent (Hays 1995).

In addition, as a result of increasing stumpage demand across the South, leases for timberland are becoming more common in the region (Green 1979, Siegel 1973, 1974). Leasing practices are currently being applied through the private sector for full-rotation tree crops targeted for the millions of marginal agricultural crop and pasture acres in the U.S. South.

Marginal lands converted from annual rowcrop and pasture production to tree crops can reduce soil erosion, improve water quality, and produce more profitable returns for the landowner.

**METHODS**

Oldfield loblolly pine scenarios were computer-modeled using GaPPS Version 4.11 (Zhou and Bailey 1996). Scenarios were examined using common assumptions, where possible. Site productivity (indicated site index (SI)), averaged 68 feet at 25 years (Dangerfield and Moorhead 1997). This SI can be described as highly productive and would be expected where additional inputs such as site preparation, weed competition control, and fertilizer are added.

Financial parameters were set with a 28 percent marginal federal tax bracket and a 4.0 percent, uninflated, before-tax discount rate, to provide a conservative alternative investment return. Stumpage prices were projected uninflated (Timber Mart-South 1996). Total harvest expenses were computed at 12.5 percent of the harvest value, including 10 percent for marketing and 2.5 percent for ad valorem property taxes on timber harvested (Dangerfield et al. 1993). Planting costs were charged at $50 per acre. Competition control at planting was charged at $50 per acre. Management was charged at $1 per acre per year. Results are reported uninflated, before taxes.

Medium management includes weed competition control. High management includes fertilization approximately six-to-eight years before harvest, at a cost of $85 per acre in year 14 with a modeled wood-flow increase of one-half cord per acre per year for six to eight years after application (Zhou and Bailey 1996).

Even thinnings were modeled as third-row removals, with no selection. Selection thinnings were modeled as fifth-row removals, with selection removals of smaller and less desirable trees in the remaining four rows. Target residual basal area in the thinning operation was 80 square feet per acre.

Other modeled parameters are detailed in footnotes to Table 1. Variables such as hunting leases, and pine straw harvests were omitted from the assumptions as they would be common to each scenario and would add no real new information to this comparative study.

Three measures of financial performance are presented: Soil Expectation Value (SEV), Internal Rate of Return (IRR), and Annual Equivalent Value (AEV) (Barry et al. 1983, Gunter and Haney 1984).

SEV is calculated as the net present worth, (NPW, revenues discounted to present year less costs discounted to present year at the discount rate) of perpetual repetitions of the investment. SEV is useful for comparing investments of unequal time length and for determining bare land value (BLV).

IRR is the interest rate at which discounted revenues equal discounted costs. The calculation of IRR assumes that all intermediate revenues are reinvested into the project. A project is considered profitable if IRR exceeds the discount rate.

AEV is the NPW expressed as an annuity over the planning horizon, computed at the discount rate. AEV is a useful measure for comparing investments over unequal time periods.

**RESULTS:**

Estimates shown in Table 1 are made for average conditions in the U.S. South. Calculations show average estimated values in Upper Coastal Plains and Piedmont areas of the South where most of the CRP tree acres and marginal rowcrop and pasture acres are located.

Very productive land in areas with good timber markets may earn producer returns and/or land lease offers a little higher than those shown as AEV returns in Table 1. Land
that is poorly productive in areas of limited timber markets, may earn timber returns and/or lease offers a little lower than those shown. Also, profits could be higher than that shown if the stand of trees is above average quality, or lower if tree stand quality is below average. Other factors causing returns to vary include: soil and land capability class, stand age, season of the year, tract size, road access, distance to mill, etc.

Management decisions regarding silvicultural treatments such as timing and method of thinning, and fertilization, in conjunction with stumpage price levels, influence financial performance. Achievement of high stumpage prices, even with a relatively short 15 year rotation, yields high returns as measured by SEV, IRR, and AEV. The increase in management intensity, such as with fertilizer applications, could increase wood-flow by as much as or more than one cord per acre per year for the last six-to-eight years of the rotation.

Relative wood-flow and financial performance of oldfield loblolly pine, based on management intensity and stumpage price levels, is presented in Table 1. Combinations of medium stumpage prices and high management, in the 20- and 24-year rotations, boost AEV returns to the $100 per acre range with impressive SEV and IRR returns also. Even and selection thinnings, with medium prices and management, actually decrease total wood-flow slightly, compared to unthinned stands, while raising financial performance as much as two percentage points for IRR and $10 per acre for AEV. It appears that length of these pulpwood rotations are too short to realize full benefit of total volume increases from either even third-row or fifth-row with selection thinnings. Financial benefits of thinning, shown in increases in SEV, IRR, and AEV, are mainly the result of moving cash flows forward to year 14.

Table 1. Oldfield Loblolly Pine Plantation, upper coastal plain, U.S. South, 19981.

<table>
<thead>
<tr>
<th>Rotation years</th>
<th>Thin type (yr.)</th>
<th>Prices $/cd5</th>
<th>Mgt.</th>
<th>Wood-flow (cord equivalents)</th>
<th>SEV2 S/A</th>
<th>IRR3 %</th>
<th>AEV4 $/A/yr.</th>
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1 Uninflated, 4% discount rate, before taxes, 650 trees per acre at age 5 years. GaPPS v 4.11, General PMRC model with treatment. Beginning SI = 68.
2 SEV = Soil Expectation Value, calculated from perpetual rotations
3 IRR = Internal Rate of Return of the investment scenario
4 AEV = Annual Equivalent Value, net present worth expressed as an annual annuity
5 Prices: Low = PW- 35; C-N-S- 60; Med = PW- 50, C-N-S-75; High = PW- 60, C-N-S-85 All ST = 213/mbf (106/cd); all big ST = 240/mbf (120/cd)
6 cc = clear cut
7 MAI = Mean Annual Increment of wood growth, cord equivalents per acre per year

BUGWOOD 98-013 http://www.bugwood.caes.uga.edu/
A relatively small decrease in mean annual increment (MAI) of wood-flow and financial performance of the selection thinning compared to the even thinning is shown in the 20-year rotation. In the selection thinning, more trees of smaller size, reduced quality, and reduced volume were removed to leave a residual basal area of 80 square feet per acre. Thus, the smaller volume removed with selection thinning, earned less cash-flow in year 14 of the 20-year rotation as compared to the even third-row thinning.

The slightly longer rotation of 24 years with selection thinning shows slight financial performance improvement over the even-row thinning scenario. MAI and total wood-flow for even and selection thinning is the same for the 24-year scenarios.

Three longer rotations of 28, 35, and 36 years are also presented in Table 1. These rotations were specified by an array of thinning schedule, level of management, and product prices, and were then optimized by SEV. In these results, a 28-year non-thinned rotation with high stumpage prices and management intensity performs only slightly better than the 24-year rotation under similar assumptions. Thus, the financial performance curve between 24 and 28 years is fairly flat, affording a relatively wide window of decision opportunity for timing of final harvest.

The longer 35- and 36-year rotations are achieved as SEV optimizations through selection thinnings. It appears in the 36-year rotation that one selection thinning at year 14 is too early, by itself, to earn the higher MAI, total wood-flow, and financial performance of the 35-year scenario shown with two thinnings.

SUMMARY/CONCLUSIONS

Landowners with good forestry management skills, or with access to hired skills, can earn forestry investment returns well above those of annual crop production systems on marginal crop or pasture land. A wide range of financial performance returns are possible. Factors influencing these returns include the level of investment in management (including weed competition control, fertilization, and thinnings), product prices earned through marketing, and length of scenario rotation (planning horizon).

There appears a wide range of financial performance between 20-year rotations with medium management and prices and 24-year rotations with high management and prices. This range allows landowners with relatively lower management skills to earn higher forestry investment returns by leasing out land for production of long-term tree crops. Landowners with relatively higher management skills can earn higher forestry investment returns by planting and managing their own land for production of long-term tree crops. In addition, the range also allows potential lessees, with relatively high management skills, to purchase long-term leases at a cost low enough to earn attractive financial returns.

RECOMMENDATIONS

When considering long-term uses for marginal rowcrop and pasture land, landowners must prioritize landownership/production objectives. Alternative land uses should be evaluated by examination of:

1) soil productivity classes present on the land tract;
2) prospects for future rowcrop and timber markets in the area; and,
3) landowner willingness to assume land management responsibilities under alternative crop production scenarios;

If tree crops are selected, they should be managed responsibly as any other agricultural crop. Also, landowners should be aware of the importance and costs of reforesting cut-over timberland at the final harvest of a long-term timber crop.

IMPLICATIONS FOR MARGINAL CROP AND PASTURE LANDOWNERS, POLICY MAKERS, EDUCATORS, AND AGRICULTURAL CREDIT LENDERS

Landowners with marginal rowcrop or pasture land can earn their greatest monetary returns by growing their own trees from planting to financial maturity. But, more landowner inputs, including management ability, are required to grow their own trees. Generally, fewer dollars are earned by landowners leasing out their marginal crop and pasture land for long-term production of tree crops, compared to those landowners growing the trees themselves.

Realize that less landowner inputs are required when leasing land out. However, with leasing, annual cash-flow is greatly improved compared to the landowner with a relatively small-acreage timber tract. In addition, the landowner has less risk of high or low returns under leasing. In total, leasing remains an important option and can be a win/win experience for certain landowners and lessees.

Converting marginal rowcrop and pasture acres to tree crop acres can have long-term impacts on communities. Since 1956, tree plantings from the original Soil Conservation
Reserve Program (SCRP) have remained almost totally in production forest. CRP tree plantings from the 1985-1993 period are expected to remain likewise (Kammholz et al. 1995, Kurtz et al. 1993). Contracts for 599,377 acres (85% of the total) in the CRP in Georgia, will have expired by the end of 1998.

Lease offerings for production of long-term tree crops on marginal crop and pasture land, through the private sector, could partially substitute for public policy programs designed to convert land use to long-term sustainable tree crops.

Keeping the CRP land that was planted to trees in trees, as well as converting marginal crop and pasture acres to tree crop production, will reduce soil losses to erosion as well as increase the future supply of timber in the U.S. South.

On land enrolled in the CRP in Georgia, the average erosion rate before the CRP was 13.59 tons/acre/year, and was reduced to 1.08 tons/acre/year on soils in the program (EWG 1995).

Other benefits of keeping and placing land in tree crops include improved water quality, enhanced fish and wildlife habitat, reduced stream and road-side sediment, and reduced production of surplus agricultural commodities. In addition, total pesticide and fertilizer application on forest land is greatly reduced relative to rowcrop and pasture land.

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Literature Cited


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