Series paper # 7

Financial analysis of growing loblolly pine in a 33-year rotation, with wildlife food plot and hunting lease assumptions

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Abstract

Since 1998 forest industry, forestland ownership, global markets, and wood supply and demand (pulpwood, sawtimber, chips, etc.) regionally and worldwide have changed dramatically. In the southeastern United States, non-industrial private forest (NIPF) landowners have experienced reduced product market availability and increased price uncertainty during this period. Non-industrial private forest landowners from northern Virginia to central Florida and east Texas need additional management options for the most commonly grown southern pine species - loblolly pine (*Pinus taeda*). Profitability and cash flow of production forestry enterprises need to be improved. At the same time, NIPF landowners desire heightened flexibility across the timeframe required to achieve marketable forest products. This paper examines feasibility, profitability, and cash flow of a mixed product, 33-year rotation with management options for loblolly pine plantations that incorporate management activities such as thinnings, wildlife food plots, and hunting leases, under alternative levels of productivity and product prices. Calculated financial measures of profitability include soil expectation value (SEV), annual equivalent value (AEV), and internal rate of return (IRR). With 7% of the acreage in food plots and hunting lease values of $8, $10, $12, and $14 per acre per year, IRR values were 11.14%, 11.62%, 12.13%, and 12.67%, respectively.

Introduction

Private non-industrial forest (NIPF) landowners from northern Virginia to central Florida and east Texas question whether to plant loblolly pine on cut-over and old-field sites. They also question spending moderate to relatively large sums of money in intensive forest management under the current and anticipated stumpage prices and economic uncertainty. Landowners seek options to maximize returns from their forestland. Hunting leases can provide an additional income stream for some landowners. Simple hunting leases may require little

financial investment by the landowner. However, lease prices can often be improved by incorporating forestry practices such as thinning and land management practices such as creating food plots. Landowners need information on the financial benefits of these practices (Glover and Conner 1988).

In 2003, hunting leases for white-tailed deer (*Odocoileus virginianus*) had an estimated farm gate value of 70.7 million dollars in Georgia (Boatright and McKissick 2003). The economic impacts of deer hunting in Georgia exceeded $613 million in 2001 (IAFWA 2002).

To address these questions, we used the Georgia Pine Plantation Simulator (GaPPS 4.20) growth and yield Model developed by Bailey and Zhao (1998). Other authors have discussed related issues such as non-timber forest product enterprises (Chamberlain and Predny 2003), timber management for northern bobwhite quail and gray squirrel (Barlow and others 2003), and compatibility of agriculture and natural resource based enterprises (Waide 2003).

Methodology

Common assumptions

Cost figures for food plots are difficult to obtain - numbers are available in the wildlife literature but are very variable due to assumptions made by previous authors. The total cost to produce one ton of forage can vary from $45.76 per acre to $107.20 per acre (Wear and others 1997). Costs include lime, fertilizer, and seed. Equipment cost is sometimes ignored, as is labor cost because it is often assumed that the landowner and/or hunter perform the work.

General recommendations are for 5 to 10 percent of the tract to be in food plots in order to have any measurable impact on ecological carrying capacity and thus, herd size. However, individual animal size and hunter probability of successfully harvesting any deer increase with even one small food plot. White-tailed deer readily use food plots (Kammermeyer and others 1993, Hehman and Fulbright 1997, McDonald and Miller 1995). No one knows how much larger the individual animal will become, nor does any literature indicate the difference in harvest probability.

We will assume a landowner has 160 acres (1/4 section) and puts seven percent of the acres into food plots (1/2 in cool-season forage; 1/2 in warm season forage). That would amount to 11.2 acres of food plots in this example. These acres could be 11 one-acre food plots evenly distributed over the tract. Alternatively, there could be planted several two- or three-acre plots strategically located for deer, with one larger acreage plot planted to attract doves (*Zenaida macroura*) and/or turkeys (*Meleagris gallapavo*).

Food plot area is now foregone timber income, i.e., timber income is reduced seven percent. We assume a mid-range cost of the food plots ($60/ac or $672 on the 160-acre tract). The average price of a deer lease in Georgia is $8.00 per acre per year, or $1,280 per year for 160 acres (Boatright and McKissick 2003)

The rotation age was set at 33 years for loblolly pine plantations with two thinnings to produce an even mix of pulpwood, chip-n-saw, and sawtimber (Table 1). We used a discount rate of 8 percent for the next-best alternative investment to calculate soil expectation value (SEV) and annual equivalent value (AEV). The calculation of internal rate of return (IRR) assumes that intermediate, positive cash flows are reinvested in the enterprise at the IRR, not the discount rate. We assumed fire protection cost at $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 is $103.63 during the 33-year rotation (The multiplying factor for present value of an annual terminating series at eight percent for 33 years is 11.51389). We report results in constant dollars, before taxes. Throughout the scenarios, we assume the land is already owned.

Site Preparation and Planting Costs

Site preparation and planting (SP&PL) costs total $125/acre (Dubois and others 1999). These costs represent the following site preparation and planting scenario

► The relatively low site preparation and planting cost of $125/acre could include machine planting and the use of a post-planting herbicide to control herbaceous weeds on an old-field site or glyphosate @ 1 gallon/ac or prescribe burning (low level) site preparation and roughland machine 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 level of competition control needed so that wood-flows were comparable within site productivity levels, after site preparation and planting. If the establishment cost is greater than the relatively low SP&PL cost used in this paper, then SEV, AEV, and IRR will be reduced (see Economic Series papers #s 4 and 5).

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-and-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© (TMS) for 1st quarter year 2004 average, used in this analysis for loblolly pine, were net of property taxes at harvest (2.5 percent) and net of marketing costs (8 percent). The low TMS prices for PW and CNS were used for thinning prices and average TMS prices for pulpwood, CNS, and ST were used for the clearcut. Net converted prices are found in Table 2.

Thinning

All scenarios include two thinnings at 15 and 24 years old (Table 3) for the 33-year rotation. Residual basal area (RBA), after thinning (5th row with selection from below), is set at 65 sq. ft/ac.

Species-specific assumptions

The loblolly pine survival is assumed to be 500 TPA at age 5-years. The mean annual increment (MAI) for loblolly is assumed to be 2.15 cds/ac/yr (5.77 tons/ac/yr) through age 33-years with the two thinnings.

Scenarios

The ten loblolly pine scenarios we examined were (Table 3):

(1) No food plots, no hunting lease, i.e., 100% forested tract,
(2) 7% unplanted openings, no hunting lease,
(3) 7% food plots, no hunting lease,
(4) 7% food plots, $2/ac/yr hunting lease,
(5) 7% food plots, $4/ac/yr hunting lease,
(6) 7% food plots, $6/ac/yr hunting lease,
(7) 7% food plots, $8/ac/yr hunting lease,
(8) 7% food plots, $10/ac/yr hunting lease,
(9) 7% food plots, $12/ac/yr hunting lease, and
(10) 7% food plots, $14/ac/yr hunting lease.

Results

Internal rate of return ranges

Internal rate of return (IRR) for all ten scenarios ranged from 9.47-12.67 (pine scenarios with site preparation and planting cost of $125/ac, food plot establishment costs of $60/ac, seven percent of area in food plots and variable hunt lease price using the aforementioned assumptions - Table 3, Figure 1). Generally, the levels of forest management are economically justifiable in these cases, even using low to medium 1st quarter 2004 stumpage prices (TMS 2004) for Georgia.

Impact of food plots on internal rates of return

Establishing the entire tract in pine with no food plot or hunting lease resulted in an IRR value of 10.41 percent. Keeping seven percent of the tract out of pine production and with forest openings, but no food plots, lowered the IRR value to 10.1% (Table 3, Figure 1). However, establishing seven percent of the tract in food plots, but with no hunting lease, further lowered IRR to 9.47 percent.

Impact of hunting lease income on internal rates of return

Adding income in the form of a hunting lease changes the IRR values as expected. Greater income from a hunting lease leads to higher IRR values in a nearly linear fashion (Figure 1). Compared to the 100 percent forested tract, the tract with seven percent of the acreage in food plots and a hunting lease of approximately $5 per acre per year earns a comparable IRR.

Impact of management inputs on internal rate of return

Generally, increasing management, including addition of food plots and securing a hunting lease, increased internal rates of returns for our 160-acre tract of land.

Summary

Wood flow, fertilization responses, and pine straw

Other papers in this series address scenarios of thinning, fertilization and pine straw production. Adding pine straw income from the plantation would greatly improve IRRs. The 2.15 cds/ac/yr MAI (5.77 tons/ac/yr) productivity levels at age 33-years-old for loblolly can be achieved on cut-over sites with good fertility and soil moisture holding capacity soils using a low cost chemical site preparation to achieve adequate competition control (Pienaar and Rheney 1996) and is

conservative on most old-field sites. Exceptions would be the deep sands (Typic Quartzipssamments) of the Sand Hills or shallow, rocky soils of the Piedmont physiographic region.

We did not include management expenses for liability insurance or hunting lease administration. Doing so would lower final IRR values but not significantly, and would not change the rankings of scenarios. There are intangible benefits to having a hunting lease that were not included in our scenarios. Benefits such as boundary marking, fence repair, patrol and observation, reduced poaching and trash cleanup flow from the hunting lease/leasor relationship. These benefits are difficult to assign numerical value but are generally considered positive. Open gates, increased traffic and trash can be a negative outcome of hunting leases.

Establishment costs for food plots were estimated at the mid-range of published values. Food plot establishment on old fields or pasture, rather than cutover land, should be less than assumed here.

Discussion

The profitably of food plots is influenced by several factors including timber price, forage yield and lease price. The tendency of food plots to attract and hold deer depends on surrounding habitat. We know of no studies that document the certainty of food plots to produce high quality deer or more deer in the absence of sound wildlife management. While producing a mature buck takes $\geq$ 3 years (McBryde 1995) and trophy buck management can be inefficient (DeYoung 1989, 1990) the installation of food plots can have an immediate impact on deer harvest. However, unlike cattle producers or row-crop production, timber growers who convert acreage from pine production to food plots may not easily revert to pine. In this case, a commitment to forego timber must be recognized as a long-term (as least through the current pine rotation) investment.

The value of food plot management for non-economic returns such as non-game wildlife, plants, and insects is largely unknown. We recognize that non-game values are increasing. Net economic value of wildlife watching has been estimated at $51/day (USFWS 2003). Nature-based tourism, turkey hunting leases and duck hunting leases have an estimate annual value in Georgia of $42 million, $4.6 million, and $1.1 million, respectively (Boatright and McKissick 2003). Values for wildlife watching activities nationwide are also increasing (USFWS 2003). Potential returns from all wildlife values, when coupled with our analysis of financial returns for deer hunting leases, shows that wildlife management and timber management can increase the financial returns to landowners.

We note that our financial analysis does not include management fees for items such as legal advice or liability insurance. We acknowledge the importance of

liability coverage. However, insurance rates are difficult to determine. Individual factors (including history, size of the hunt club, number of acres, location of the property, and coverage amount) determine premium rates. For example, one company in South Carolina advertises a minimum premium rate of $364 per million dollars of coverage. Landowners should have liability insurance and should require lessees to acquire adequate liability coverage amounts. Wright and others (2003) concluded that the myth and perception of liability is greater that the actual risks but landowners must educate themselves and act to protect their interests.

Non-industrial private forest landowners do have some attractive forest management options with loblolly pine even when using low to medium stumpage prices (Georgia 1st Qtr 2004, TM-S 2004). Generally, increasing forest management activities (thinning, fertilization, adding pine straw) increased internal rates of return at the wood growth increments used (see Economic Series papers # 1-6).

If an internal rate of return of eight percent or better is a landowner goal with the stumpage prices used (Georgia 1st Qtr 2004, TM-S 2004) and the wood production rates of 2.15 cd/ac/yr (5.77 tons/ac/yr), then all loblolly pine scenarios at the lower site preparation and planting establishment costs achieved that as shown by models in other papers of this series. Food plot establishment costs do not push IRR value below 9.5 percent.

If an internal rate of return of 10 percent or better is a landowner objective under the aforementioned assumptions, then a hunting lease for as little as $4/ac achieve that. This price is well below the $8/ac average deer hunting lease price reported for Georgia counties.

An internal rate of return of 12 percent or better is realized at the highest deer hunting lease prices of $12/ac and $14/ac. These prices are reasonable and we have anecdotal evidence of deer hunting lease prices approaching $25/ac in some areas of Georgia.

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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 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. A comparison of loblolly pine plantation management scenarios[1], under a 33-year rotation with thinning in years 15 and 24 to residual basal area (RBA) = 65 ft^2/ac, and their effect on financial performance, with site prep and plant (SP&PL) cost of $125/acre, food plot costs of $60/plot acre with 7% plot area and varying levels of hunting lease rates/acre over total acres.

Scenarios	PW %	CNS %	St %	MAI[2] Ton, Cord	Net Cash Flow[3] $/ac	SEV[4] $/ac	AEV[5] $/ac	IRR[6] %
No Food Plots, No Hunting Lease	34	37	29	5.77, 2.15	3723	176	14	10.41
7% Unplanted Openings, No Hunting Lease				5.40, 2.01	3454	147	12	10.10
7% Food Plots, No Hunting Lease					3418	107	9	9.47
7% Food Plots, $2/ac/yr Hunting Lease					3441	132	11	9.86
7% Food Plots, $4/ac/yr Hunting Lease					3464	157	13	10.26
7% Food Plots, $6/ac/yr Hunting Lease					3487	182	15	10.69
7% Food Plots, $8/ac/yr Hunting Lease					3510	207	17	11.14
7% Food Plots, $10/ac/yr Hunting Lease					3533	232	19	11.62
7% Food Plots, $12/ac/yr Hunting Lease					3556	257	21	12.13
7% Food Plots, $14/ac/yr Hunting Lease					3579	282	23	12.67

[1] Uninflated, 8% discount rate, before taxes, GaPPS v 4.20.
[2] MAI = Mean Annual Increment of wood growth for 33 yrs., tons & cords/A/yr.
[3] Net cash flow = PV receipts – PV expenses.
[4] SEV = Soil Expectation Value, calculated from perpetual rotations.
[5] AEV = Net Annual Equivalent Value, net present worth as an annuity.
[6] IRR = Internal Rate of Return of the investment scenario (percent).

Figure 1. Relationship of hunt lease price to internal rate of return (IRR in %) and annual equivalent value (AEV in $s/ac/yr) value for a 160-acre tract of a 33-year loblolly pine plantation. Rotation has thinning in years 15 and 24 to a residual basal area (RBA) of 65 square feet per acre, with site prep and plant (SP&PL) cost of $125/acre. Comparison is made between a 100 percent forested tract, a tract with no hunting lease with seven percent of tract in unplanted openings, and a tract assumed to have seven percent of area in food plots with increasing levels of hunting lease price per acre. Food plot establishment costs were set at a mid-range of $60/acre. MAI =2.01 cds/ac/yr (5.40 tons/ac/yr), wood-flow = 34% PW, 37% C-N-S, 29% ST.