Economic Incentives for Natural Regeneration, Cut-over Planted, and Oldfield Afforestation Pine Stands

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October 1998

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Introduction

Total economic impact of forestry and forest product industries on the Southern economy was in excess of $90 billion in 1994. Currently, total softwood growth averages only 88 percent of harvest. Enhancing the growth of existing timber stands, insuring adequate regeneration following harvest, plus afforestation of marginal rowcrop land, are important forest management activities that southern timber producers can implement to increase total timber supply and profits. Common pine regeneration methods include natural regeneration or planting on cut-over sites following timber harvests and, afforestation of former agricultural cropland.

Purpose

To provide non-industrial private forest (NIPF) landowners with information about timber production incentives gained through three pine regeneration methods: natural regeneration, planting cut over sites, and afforestation of rowcrop land.

Assumptions

Three measures of financial performance are presented: *Soil Expectation Value* (SEV), *Internal Rate of Return* (IRR), and *Annual Equivalent Value* (AEV). Soil expectation value is calculated as the net present worth (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. Internal rate of return is the interest rate at which discounted revenues equal discounted costs. It assumes that all intermediate revenues are reinvested into the project. A project is considered profitable if the internal rate of return exceeds the discount rate. Annual equivalent value is the net present worth expressed as an annuity over the planning horizon, computed at the discount rate. Annual equivalent value is a useful measure for comparing investments over unequal time periods.

Natural Regeneration

Natural regeneration of loblolly pine is a common practice, both planned and unplanned, across the South. Landowners may harvest pine from their lands with the goal of allowing natural regeneration to establish the new stand. Typically a seed tree or shelterwood method is employed leaving mature seed producing pines on each acre after harvest to provide seed for the new crop. Other options include seed, or seedlings-in-place, or seeding from adjacent stands as a natural regeneration source.

While natural regeneration methods can provide low cost and effective means to establish new stands, overstocking is common when favorable weather and seedbed conditions occur. Mechanical strip thinning is a recommended practice usually by age 3 to 5 years. Costs associated with precommercial thinning increase as stands age but can still provide good economic returns.

In the natural stand, a 35 year rotation is examined with a pre-commercial thinning at age 13 years, a thinning at age 28 years, and final harvest at age 35 years. At age 13 years, the stand was precommercially thinned (PCT) by hand crews using chainsaws to an approximate 12 x 12 foot spacing leaving 302 trees per acre that averaged almost 4 inches DBH and just over 23 feet in height. At the thinning at age 28, the trees averaged 67 feet in height with a BA of 98. An average of 83 pulpwood stems per acre were harvested yielding 10.34 total cords per acre, Table 1. At final harvest at age 35, trees averaged 77 feet tall. The stand had a BA of 91 in 107 stems. A total of 32.90 cords were projected per acre. The product mix shifted to CNS and sawtimber with 25.13 cords and 7.77 cords, respectively. The 35 year rotation produced a total of 43.24 cords per acre in the two harvests. The uninflated IRR equaled 9.7 percent with an AEV of $24.83 per acre, and a SEV of $621 per acre, Table 2.

Planting Cut-over Stands

The original stand of loblolly pine was harvested and replanted with improved loblolly pine seedlings on a spacing of 6 x 10 feet (726 trees per acre). The site preparation treatment was shear, root rake, burn, disk, fertilize, and herbicide at a cost of $210 per acre. A thirty-three year rotation was chosen with thinnings at ages 18 and 25 years.

At the first thinning at age 18, average dominant height is projected at 50 feet with a BA of 137 square feet. An average of 215 stems per acre were harvested yielding 12.37 total cords per acre, Table 1. At the second thinning at age 25 years, average dominant height is projected at 64 feet with a BA of 136 square feet. An average of 127 stems per acre were harvested yielding 15.29 total cords per acre, Table 1. At final harvest at age 33, average dominant height is 75 feet, with a BA of 148 square feet in 145 stems. At 33 years, a total of 49.93 cords per acre were projected for harvest. Overall, this 33-year rotation produced a total of 77.88 cords per acre in the three harvests. The uninflated, IRR equaled 10.61 percent with an AEV of $84.19 per acre, and SEV of $2,104 per acre, Table 2.

Oldfield Afforestation

A study examined wood-flows under growing conditions expected to be found in oldfield pine plantations, i.e., some weed competition, stand mortality, as well as the maximum wood-flow attainable under stand conditions where all competing vegetation is eliminated.

This study projects that at the first thinning at age 18, the 494 oldfield site trees average dominant and co-dominant height was 62 feet with a BA of 157 square feet per acre. An average of 244 stems per acre were harvested yielding 21.16 total cords per acre, Table 1. At the second thinning at age 25 years, the 231 oldfield site trees average dominant height was 78 feet with a BA of 134 square feet. An average of 101 stems per acre were harvested yielding 18.54 total cords per acre, Table 1. At final harvest at age 33, trees average dominant height was 89 feet tall. The 33-year old stand had a BA of 136 square feet in 125 stems. At 33 years a total of 59.02 cords were projected harvested per acre. The 33 year rotation produced a total of 98.72 cords per acre in the three harvests. The uninflated IRR equaled 15.45 percent with an AEV of $133.15 per acre, and a SEV of $3,328 per acre, Table 2.

Implications

All three pine regeneration scenarios examined earned attractive returns for landowners. This indicates that in a wide range of situations, from mature forest to former agricultural land, landowners can earn profits when they take an active role in promoting pine regeneration. If a forest landowner harvests trees but cannot afford several hundred dollars an acre to replant trees on cut-over sites, planned natural regeneration is a good option. Obviously, replanting a cut-over stand with a pine plantation will earn a higher rate of return, and more total dollars per acre, than natural regeneration, $25 compared to $84 per acre per year for the two methods. But, cut-over plantations require more investment capital to be tied up while the trees are growing than does a naturally regenerated stand.

The highest returns, and easiest tree planting can be realized through afforestation of marginal rowcrop land. Several million acres of marginal rowcrop land across the U.S. South will earn higher producer returns planted to pine trees instead of to annual rowcrops. An Annual Equivalent Return of $133 per acre from trees competes favorably with most annual crops on marginal rowcrop land, Table 2. Also, with afforestation of rowcrop land, less investment capital is tied up in the growing trees compared to cut-over plantations leading to a substantially higher IRR. The attractive growth and financial performances of tree plantations established on oldfield sites deserves a closer look by those landowners and investors interested in the practice of more intensive forestry.

Which ever route is taken, landowners can earn attractive returns by keeping their trees actively growing either through selective thinning or clearcutting and prompt replanting. Trees are a natural, sustainable resource that slow soil erosion, clean water and air, and provide habitat for wildlife and plants. These benefits are realized while landowners earn attractive incomes and boost employment and the economy.

Table 1. Modeled per acre stand parameters and woodflow of naturally regenerated, cut over, and oldfield loblolly pine, U.S. South, planted 1997.

Rotation	Stand Condition			Residual Component			Harvested Component		
Length	Age	Height	PAI[a]	Basal Area	Stems	Total Cords	Basal Area	Stems	Total Cords
Natural 35 years	28	67	1.1	65	114	21.30	33	83	10.34
	35	77	1.7	Final Harvest			91	107	32.90
			1.2	Totals/acre			124	190	43.24
Cut over 33 years	18	50	1.7	80	301	17.40	57	215	12.37
	25	64	3.1	80	148	23.57	56	127	15.58
	33	75	3.3	Final Harvest			148	145	49.93
			2.4	Totals/acre			261	487	77.88
Oldfield 33 years	18	62	2.4	80	250	21.70	77	244	21.16
	25	78	3.7	80	127	28.85	54	101	18.54
	33	89	3.8	Final Harvest			136	125	59.02
			3.0	Totals/acre			267	470	98.72

[a]PAI = Periodic annual increment in cords per acre

Table 2. Projected uninflated financial performance of naturally regenerated, cut over, and oldfield loblolly pine, U.S. South, planted 1997.

Rotation	IRR %	AEV $/ac	SEV $/ac
Natural, 35-Year	9.7	25	621
Cut over, 33-Year	10.61	84	2,104
Oldfield, 33-Year	15.45	133	3,328

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Extension Forest Resources - FOR. 98-029, October 1998

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914. The University of Georgia College of Agricultural and Environmental Sciences and the U.S. Department of Agriculture cooperating.

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