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Introduction to forestry investment analysis: Part II. Taxes, inflation, and other issues

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INTRODUCTION TO FORESTRY INVESTMENT ANALYSIS

Part II: Taxes, Inflation, and Other Issues

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Part I of this article covered the basics of compounding and discounting. You were introduced to forestry investment analysis. However, several complications were not discussed. What about inflation, taxes, and risk? Part II addresses basic complications. It also includes more detailed forestry investment analyses.

Accounting for Inflation

Inflation must be considered in any analysis involving revenues and/or costs that occur in the future. You account for inflation by making sure that the discount rate and all values in the analysis are either in inflated terms (current dollar approach) or that they are all in uninflated terms (constant dollar approach). The key is consistency—use entirely inflated or uninflated values in the analysis, and if your analysis includes uninflated values, be certain the discount rate does not include inflation.

An exception exists if the analysis involves costs that have been capitalized for tax purposes. Since taxes are paid on "inflated dollars," only the current dollar approach should be used for after-tax investment analysis. If taxes are not a consideration, either approach will produce the same financial results.

The current dollar and constant dollar approach can best be illustrated with a simple example. Assume the inflation rate is 3% and the real interest rate you need to earn is 5% (recall "real" means net of inflation). Then the discount rate for the current dollar approach will be 8.15%. We assume the two rates affect each other, so the combined rate is a little more than adding 3% to 5% to get 8%; it is calculated as (1.03)(1.08) - 1 = 0.0815 = 8.15%. Consider the simple rotation below with one cost and two revenues. For the current dollar approach, we assume the costs and revenues increase at the inflation rate. Note that both approaches produce the same NPV (see Table 1).

Accounting for Taxes

After-tax investment analysis also involves a consistency requirement. All of the numbers involved should be expressed on an after-tax basis. That means all revenues and all costs should have taxes subtracted before discounting takes place, and an after-tax discount rate should be used. Generally, timber income is subject to the lower capital gains tax rate. Thus, reforestation costs must be capitalized and allocated against timber income as it is realized. In this example, we will not consider the possible 10% tax credit and 7-year amortization available on $10,000 of reforestation expenses annually.

Table 1 illustrates why the current dollar approach is required in after-tax investment analysis. Notice in Section B

Table 1. Inflation example: current and constant dollar approach.

			Section A Current Dollar not inflation adjusted		Section B Constant Dollar inflation adjusted
Year	Item	Amount/ Acre	Amount with 3% Increase	Discounted Value @ 8.15%	Discounted Value @ 5%
0	Establishment Cost	-$160.00	-$160.00	-$160.00	-$160.00
15	Thinning Revenue	350.00	545.29	168.36	168.36
23	Final Harvest Revenue	2,200.00	4,341.89	716.26	716.26

Table 2. Example of after tax analysis.

Year	Item	Amount/ Acre	Amount with 3% Increase	Adjusted for Taxes	Discounted Value @ 5.87%
0	Establishment Cost	-$160.00	-$160.00	-$160.00	-$160.00
15	Thinning Revenue	350.00	545.29	445.83	189.49
23	Final Harvest Revenue	2,200.00	4,341.89	716.26	941.42
					NPV=$970

the dollars are not increased by the inflation rate. In Section A, the dollar amounts are increased by the inflation rate. Capital gain is calculated in the current dollars of Section A.

To convert Section A to an after-tax basis, taxes would need to be subtracted from each item. Establishment cost is capitalized at the beginning of the rotation and no tax deduction is allowed. Thus, the $160 cost is the same before- and after-taxes. The thinning revenue is another story. Let's assume the thinning represents 30% of the stand's volume, then 30% of the related establishment cost (or $48) can be applied against the sales revenue. So the $545.29 is reduced by $48 for a taxable capital gain of $497.29. Note that the government does not allow the establishment cost to be indexed to inflation. Assuming a capital gains tax rate of 20%, the tax due would be $99.46. The after-tax cash flow is $545.29-$99.46 or $445.83.

The final harvest produces revenue of $4,341.89 and all the remaining establishment cost ($112) would be allocated against this income. The taxable capital gain would be $4,341.89-$112=$4,229.89 and a 20% tax rate equates to $845.98 tax due. The after-tax cash flow is $4,341.89-$845.98=$3,495.91. Because interest is deductible, the appropriate interest rate is the nominal or stated rate reduced by (1 - marginal tax rate). Let's assume this taxpayer has a marginal tax rate of 28%. Then the tax-adjusted discount rate in Secton A of Table 1 example becomes 8.15% (1-0.28)=5.87%. Table 2 illustrates this same example on an after-tax basis. Note that the reduction in the discount rate actually caused the NPV to increase.

Accounting for Opportunity Costs

When a resource is put to a particular use, opportunities for using the resource in other ways are affected—some alternative uses, or opportunities, for the resource may no longer be possible. These opportunities are foregone, and foregone opportunities often include foregone revenues or other benefits. Alternative uses therefore often involve "opportunity costs"—revenues foregone by using a resource such as land or capital for a specific purpose. By using a positive interest rate to account for the time value of money in an investment analysis, we're recognizing the fact that the funds have alternative uses; by investing funds in a specific forestry project, we're foregoing the income that would be earned on the funds if they were invested in other forestry or non-forestry activities.

There are many examples of opportunity costs in forestry investment analysis. A very important example is the opportunity cost of forestland. The fact that we are using a specific tract of land for a forestry investment means that the dollar value of the land is "tied up" during the period of the investment. Consider an example where you've got $150 per acre "tied up" in the land for the entire period of the investment unless you add this value to the cash flows of your investment, the NPV, ROR, or other criteria that are calculated will be overstated. They simply will not reflect all of the costs that are relevant to your investment.

Consider the example in Table 3. It uses the constant dollar approach of Table 1. Land opportunity cost would reduce the NPV of Table 1 by $101.16. Unless there is a valid reason that the land has no market value (cannot be sold for legal or family reasons, for example), land opportunity cost is a necessary component of any forestry investment.

Accounting for Sunk Costs

Project analysis is often called "marginal analysis" since only the added costs and added benefits of a potential investment are considered. Costs that have already been incurred, meanwhile, are "sunk" in the sense that they have already been made and cannot be changed. "Sunk" costs are outside the realm of current decisions, and therefore should not be included in calculating NPV, ROR, or other financial criteria for a specific project.

A forestry rotation provides a good example. Assume you spent $150/acre last year for site preparation and planting. You are now considering the need for herbicide application that will increase seedling survival. The $80 per acre you've already spent cannot be changed and is therefore not relevant to your herbicide decision. It should not be used to evaluate the herbicide treatment.

What is relevant? The physical characteristics of the site and the current biological opportunities for release are quite

relevant to your analysis and decision—you now have an asset that has attributes related to the site prep and planting. The actual expenses you incurred to achieve the attributes of your stand, however, cannot be changed and are not relevant to future decisions.

A forestry rotation also provides a good example for sunk costs. Assume you spent $150/acre last year for site preparation and planting. One year later you are now considering an expenditure of $80/acre for a herbicide application. This example involves a sunk cost (the $150; it is irrelevant to the decision at hand) and an incremental cost (an extra $80 cost) and an incremental revenue (you expect an extra $440 at final harvest). This type of calculation is called an incremental analysis because it only involves the relevant incremental costs and revenues. In this case, the investment opportunity is good at a 5% real interest rate because it increases NPV. Note the values were calculated relative to year 1 (when the decision is being made) and the $440 is discounted for 22 years. (See Table 4.)

Accounting for Uncertainty

Rarely are all the physical and financial values of an investment known with certainty. Cost savings, future yields and revenues, sales and profit increases, etc. are typically estimated based on the best information available at the time a potential forestry project is evaluated.

Various techniques to account for uncertainty have been advanced in financial analysis and engineering economy texts and articles. The techniques include such methods as calculating "certainty equivalents" and methods to adjust the discount rate upward for riskier projects. A frequently applied means of considering the potential impacts of uncertainty is "sensitivity analysis"—an orderly or systematic examination of how different assumptions influence NPV, ROR, or other criteria, and therefore how they may influence the accept/reject decision for a project. You may feel there is a great deal of uncertainty in projecting timber prices at the end of a rotation that is several decades long, for example. You may also find, however, that because they are discounted for long periods, considering wide ranges of future prices in your analysis has relatively little impact on NPV or other financial criteria.

Table 5 illustrates a simple sensitivity analysis. Assume you are uncomfortable with the real interest rate of 5% used in Table 2. Perhaps it is too high or low. What impact does interest rate have on this particular investment? In this case, the interest is changed by 2% to 3% and 7% and the impact on NPV evaluated. Obviously, this problem is very interest rate sensitive.

Obtaining a Discount Rate

The discount rate used to evaluate a specific project should be consistent with the rest of the numbers in the analysis in terms of taxes and inflation. That is, the rate used may be real or inflated, and it may be specified as before or after taxes; how the rate is specified should be consistent with the overall analysis. In many cases, the actual rate of interest that's appropriate to use in forestry and natural resources analyses depends on who owns the land or other resource.

Public Agencies: Discount rates for public agencies are often specified by law. The federal government, for example, requires that agencies use a "real" rate (uninflated) of 10% unless a special rate, formula, or other guideline is set by law. The USDA Forest Service currently uses a "real" rate of 4% for long-term investments (generally more than 10 years), and 10% for other, shorter-term investments.

Table 3. Impact of land opportunity cost.

Year	Item	Amount/ Acre	Discounted Value @ 5%
0	Buy Land	-$150.00	-$150.00
23	Sell Land	150.00	48.84
		Decrease in NPV=	$101.16

Table 4. Illustration of sunk cost.

Year	Item	Amount/ Acre	Discounted Value @ 5%
0	Herbicide	-$80.00	-$80.00
23	Additional Harvest Revenue	440.00	150.84
		Decrease in NPV=	$101.16

Table5. Uncertainty in forestry investments.

Year	Item	Amount/ Acre	Discounted Value @ 5%		
			3%	5%	7%
0	Establishment Cost	-$160.00	-$160.00	-$160.00	-$160.00
15	Thinning Revenue	350.00	224.65	168.36	126.86
23	Final Harvest Revenue	2,200.00	1,114.72	716.26	464.08
		NPV=	$1,179.37	$724.62	$430.94

Corporations: Publicly-held corporations usually define discount rates as a weighted average cost of capital (the cost of debt capital and the cost of equity capital weighted by the firm's percentage of debt and equity). Privately-held companies typically specify a discount rate by considering alternative uses for the capital (the "alternative" rate), or by the interest rate paid on borrowed capital.

Private Individuals: Individuals may specify their discount rate by considering alternative uses for their capital—alternative rates may thus be the rate they expect to earn on other investments, or they may be the rates they are paying on borrowed capital. Each landowner is different, however, and discussion may be needed to elicit an individual landowner's preferences for money today versus money in the future. While many factors may influence an individual's rate of time preference for money, perhaps the most important one is their current wealth—the amount of money and other assets they already have available for current and expected future needs.

Example of a Simple Forestry Investment Analysis

Consider the simple example of a timberland investment outlined in Table 6. A real dollar approach (no inflation) is used in the example and no price appreciation is assumed. Also note the example is on a before-tax basis with no opportunity to sell the land.

Table 6 presents cash flows for the forestry investment. Cash flow is the cash generated for each year of the investment (cash receipts minus cash payments). If payments are more than receipts for any year, a "negative cash flow" results. The basic information needed to evaluate an investment is how much cash is generated or paid out and when does each cash receipt or payment occur. Once the timing of cash flow is known, the investment's rate of return can be determined.

First, let's consider NPV and Equivalent Annual Income (EAI) for this investment. We've discussed interest rate. As long as NPV is positive, you are earning the interest rate used in the analysis plus the dollar amount of the NPV. If the net present value is negative, you are not earning the specified interest rate. Net present values are very dependent on the interest rate used. The average investor needs to be aware of net present value, but probably has a better understanding of the straightforward rate of return method for evaluating investments. The NPV's and EAI's for the example at 4%, 7%, and 10% are illustrated in Figure 1.

Note how sensitive the net present values are to the interest rate used. Since the rate of return for this investment is 10.4%, the net present value would be zero at a 10.4% interest rate. This is what the rate of return represents.

A third method of evaluating timberland investments produces a bare land value. This is the net present value of bare timberland used in permanent timber production. Since it is a type of net present value, it is very dependent on the interest rate used. It is the theoretical value of the land for timber growing, but subject to the assumptions used to obtain the net present value. The bare land values for the example at 4%, 7%, and 10% are illustrated in Figure 2.

The interest rate (or discount rate) used in the investment analysis will affect the NPV, EAI, and BLV. The investor specifies the interest rate used in the analysis. It again should be the rate of return he could obtain from his best alternative investment, such as a certificate of deposit from a bank. An investor's alternative rate of return is not always easy to estimate. A main disadvantage of the rate of return approach is that an alternative investment rate does not have to be estimated.

A fourth method, rate of return, does not depend on an interest rate. It is an interest rate, specifically the one that produces a NPV of zero (so you are exactly earning that interest rate). At 10% above we've noted the NPV is approaching zero. The rate of return earned by this forestry example is 10.4%. Since this is a real rate of return, the forestry example will earn more than 10% above the inflation rate.

Sensitivity Analysis

An investor should ask a series of "What if . . .?" questions when evaluating any investment. The idea is to determine how sensitive the rate of return or other methods are to the assumptions used. We have already noted the sensitivity of net present value and bare land value to the interest rate. Table 8 illustrates the effects of changing various assumptions on the rate of return.

Simple changes in the basic assumptions can change the rate of return by about plus or minus 3%. Forest farmers

Figure 1.

Interest Rate	Net Present Value	Equivalent Annual Income
4%	$725.58	$41.96
7%	234.80	18.92
10%	18.57	1.97

Figure 2.

Interest Rate	Bare Land Value
4%	$1,049.01
7%	270.31
10%	19.70

should perform this type of "What if . . .?" analysis anytime they invest to earn certain rates of return. Note that forestry still retains significant tax advantages (10% investment tax credit and early amortization of capitalized costs). This is why the rate of return remained basically unchanged after taxes were considered.

Key Questions

We have identified some key questions you need to ask when considering a timberland investment: What's the site index of the land? What kinds of yields can I expect? What are stumpage prices expected to do? What levels of property tax and management expenses are expected? How will taxes affect my investment? What kind of real rate of return can I expect from this investment?

This article covers merely the basics of timberland investments. Don't be afraid to invest in the advice of a professional forester to answer these questions. The problems you may avoid by the simple investment in a forester are very likely to produce a reasonable "return."

For More Information

Dr. Steve Bullard of Mississippi State University and Dr. Tom Straka of Clemson University have written a 330-page workbook titled "Basic Concepts in Forest Valuation and Investment Analysis". The book has many examples and details of forestry investment analysis, including the important question of premerchantable timber value. Computer software titled FORVAL for Windows is distributed with the workbook by PRECEDA Education & Training in Auburn, AL (334/821-9222). This software includes the ROI approach for estimating the investment value of premerchantable stands.

Table 6. Simple example of a one-acre investment in a southern pine plantation (no land cost).

Year	Item	Per Acre Dollar Amount Cash Flow
0	Site Preparation/Plant	-$150.00
1-30	Property Taxes	-2.50
1-30	Annual Management Expenses	-2.50
17	Net Thinning Revenue	+210.00
24	Net Thinning Revenue	+530.00
30	Net Final Harvest Revenue	+2,100.00

Table 7. Sensitivity analysis of changes in assumptions of Table 1 and the effect on rate of return.

What if . . .?	Resulting Rate of Return
1. What if no changes are made in Table 1?	10.4%
2. What if timber prices increase 2% annually over inflation?	12.8%
3. What if site preparation and planting costs $225 per acre?	9.0%
4. What if land must be purchased at $200 an acre?	7.3%
5. What if low site index or poor timber management costs reduce yield by one-third?	8.6%
6. What if property taxes and annual management costs double?	9.4%
7. What if an old-field is planted with regeneration cost of $50 per acre?	14.1%
8. What if taxes (28% rate) are considered?	10.5%