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Here's How to Value Pre-commercial Timber Stands (A Second Look)

In the August 2010 edition of the Forestry Source, Professor Thomas Straka discussed how to "Value Precommercial Timber Stands." Through several numerically correct examples he demonstrated how this valuation should be conducted. Yet, owing to the inherent complexity of forest valuation, several issues require further clarification in order to help readers gain a deeper understanding of valuation methodology.

Perhaps most glaring is the omission of any reference to the soil expectation value (SEV) associated with the sample timber investment illustration carried throughout the article. The SEV provides the maximum value of an acre of bare land devoted to the perpetual production of timber crops over a given production cycle. In his article, Professor Straka assumes a simple even-aged timber investment under conditions of certainty wherein a new plantation is established on a bare acre at a cost of \$150/acre with a planned clear cut at age 25 yielding a projected harvest income of \$2550/acre. A real interest rate of 8% is used to bring all costs and revenues to a common point in time. Under Professor Straka's assumption that this cycle of costs and revenues repeats in perpetuity, the SEV associated with the investment is:

$$SEV = [-\$150*(1.08)^{25} + \$2550] / [(1.08)^{25} -1] = \$260.36/acre$$

Under the above conditions, this is the maximum amount a prudent investor will be willing to spend to purchase an acre of bare forest land and grow successive crops of timber in perpetuity and earn 8% on the investment. This is a critical piece of information to an investor because it means that any land cost greater (less) than \$260.36/acre will earn less (more) than an 8% return on investment. In fact, as Straka shows, if we assume that bare land costs \$400/acre, the return on investment drops to 6.95%. An investor requiring an 8% return would not pursue the timber investment under these assumptions.

Next, the issue of placing a value on an acre of immature timber is addressed. In the illustrative example, we wish to find the economic value of a 12-year old acre of precommercial timber. If we assume that this acre is managed under the conditions stated above, we have two ways to determine the value sought. Both of these methods were defined by Martin Faustmann in his 1849 treatise.[1] The first method provides for compounding all costs incurred at 8% until age 12. In the example, we have two costs: stand establishment and land rent. Thus, we calculate the value of the stand at age 12 as:

$$H = \$150*(1.08)^{12} + (.08*\$260.36)*[(1.08)^{12} -1] / .08 = \$773.00/acre$$

In this calculation, the land rent is \$20.83/acre (i.e., 0.08*\$260.36) and represents the annual opportunity cost of keeping the land in its current use under the stated conditions. The stand value (H)

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[1] Calculation of the Value which Forest Land and Immature Stands Possess for Forestry, 1849, Martin Faustmann. Reprinted in J. of Forest Economics 1:1 1995.

only accounts for the economic value of the precommercial crop and does not include the land value. We must add the land value (SEV) to the stand value (H) to obtain the total value of the investment (i.e., the land and timber value = $1033.36/acre).

The second method provides for discounting all revenues and costs we expect from age 12 until the end of the first rotation. Here, we calculate the value of the stand at age 12 as:

$h = \$2550/(1.08)^{13} - (.08*\$260.36)*[(1.08)^{13} -1] / [.08*(1.08)^{13}] = \$773.00/acre$

The two methods yield identical results for the stand value because we assume that the current 12-year old stand has been managed under the same economic and biological conditions as all future 12-year old stands. If this is not the case, the second method <u>must</u> be used to obtain the correct stand value (h). This is so because we must always use values associated with the best <u>future</u> use of the land in our stand value calculation. Even assuming that the land is best used for continued timber production, it is very likely that the SEV for future timber crops will be different (hopefully higher) than what we calculated when the 12-year old timber stand was established. If so, the higher land rent will exert economic pressure to harvest the current stand before age 25. This can readily be seen in the formula for the stand value (h) where the present value of the annual land rent is subtracted from the present value of the expected harvest value. If a higher future land value is assumed, a higher annual land rent is incurred each year the current stand is retained. This leads to the harvest of the current stand sooner than otherwise planned. Since further calculation is needed to determine the best time to harvest the current stand prior to age 25, we do not pursue this issue further in this comment.

Although Professor Straka initiates his investment analysis using an 8% real interest rate, he soon introduces additional interest rates into the discussion. While any interest rate can be used in an investment analysis, the rationale for doing so must be well articulated. To illustrate, if we set the real interest rate equal to 12%, our SEV = $0/acre. This means that if we desire to earn a rate of return of 12%, the most we can pay to purchase bare forest land is $0/acre. As previously described, an assumed land cost less than $260.36/acre is consistent with a return on investment greater than 8%. More specifically, an assumed land cost of $0/acre yields a 12% return on investment. As Professor Straka shows in his Table 1, if we assume that our interest rate is 12%, such that the land has no value for producing timber under the assumed conditions (i.e., SEV = $0/acre), the value of a 12-year old precommercial stand is $584.40/acre. This is simply the $150/acre stand establishment cost compounded for 12 years at 12%. Thus, the land and timber value = $584.40/acre. Suppose the real interest rate is set to 6.95%. The corresponding SEV = $399.91/acre, the value of a 12-year old stand = $831.66/acre and the land and timber value = $1231.57/acre. These stand values are shown in Table 1 of the original article, but readers must be aware that different interest rates are used when calculating each stand value shown in the table.

Table 2 in the original article further demonstrates the effects of changing interest rates on stand values. This table also illustrates why we must select the proper valuation formula when calculating stand values. For instance, using an 8% real interest rate, the SEV = $260.36/acre as previously shown. However, if we use a bare land value of $400/acre to value a 12-year old timber stand, we must use the second stand value formula to calculate h = $684.71/acre. If we incorrectly use the first stand value formula, we find H = $984.99/acre which is incorrect because the wrong land value is used in the calculation.

This example clearly demonstrates that the second stand valuation formula, which utilizes the future bare land value (i.e., $400/acre) and not the land value in use at the time the 12-year old timber crop was established (i.e., $260.36/acre) is the correct formula to use to value the 12-year old timber stand. Thus, as shown above, if the land value in effect at the time the 12-year old timber stand is valued is $400/acre, an 8% interest rate produces a stand value of $684.71/acre.

If we can purchase bare land for less than $260.36/acre when the interest rate is 8%, we should do so as our expected rate of return from the investment will increase. For example, if we can buy bare land for $100/acre and grow a timber crop as described earlier, our return on investment will increase from 8% to 9.9%. Further, the economic value of our 12-year old precommercial timber stand will decrease to $676.10/acre (see Table 1) from $773/acre as shown earlier. This lower stand value largely results from the increase in the interest rate from 8% to 9.9%.

Lastly, although not stated in Professor Straka's article, when we use a range of interest rates in our valuation determination, we need to recalculate the optimum stand establishment cost as well as the rotation age that accompanies each interest rate. It is very likely that these input parameters are sensitive to differing interest rates.