Financial Aspects of Donated Timberland for Foundations

March, 2013 **SREF-FM-016**

Phillip Lee Ward, Graduate Research Assistant, Clemson University
Dr. Thomas J. Straka, Professor, Clemson University

Land donations to university foundations are common, but timber and timberland can pose special financial and acquisition problems. Timber resources increase the complexity of a land transaction and make a donation difficult to value. Periodic harvesting generates revenue patterns that impact the economic attractiveness of the property. Timber investments, while profitable overall, can produce negative cash flows for lengthy periods of time. These sustainability and valuation issues can be difficult to address and require foundation managers to understand the fundamentals of forestry.

Introduction

Over half of the forestland in the United States is in private hands. Just over 10 million individual and family owners control about 60% of this private forestland. These owners are families, individuals, trusts, estates, family partnerships, and other nonincorporated groups of individuals. Ownership of family forests changes on a regular and rapid basis; sometimes within the family, from generation to generation, and sometimes to outside of the family.

These ownership transfers can result in family dilemmas. Often forestland has been in a rural-based or agricultural family for generations and the family gradually loses it rural roots or desires to monetize the assets, rather than manage a family property. Or, siblings might each desire smaller, equal parcels. Some families actively pursue options that preserve the family property and keep it intact. Forestland and timber are also increasingly being donated to foundations as older donors look for tax-advantaged means to gradually transfer natural resource-based assets to new owners who offer long-term protection to the natural values of the properties.

This bulletin addresses important considerations for assessing the financial value of donated timberland. Periodic timber harvests from the forest are equivalent to periodic cash flows. The "mechanics" of this process is described, as well as how the process can be manipulated to produce favorable cash flows. Foundation administrators and board members will find this discussion serves as a useful primer for performing an initial evaluation of a potential donation of forestland or timber. A complementary bulletin, SREF-FM-017, is a primer on production forestry and addresses the managerial issues posed by donated timberland. The discussion below follows the timber volume flow to the cash flow to the financial flow of a timberland donation.

Calculating Timber Volume

Timber volume will be a function of the age class distribution of the forestland; therefore, the starting point for calculating timber volume is determining age classes. A key determinant of the value of donated timberland is the distribution of different timber age classes due to its impact on cash flow. The older the timber is, the greater the timber volume will be, and with an older stand, it is more likely to have a greater proportion of high value timber products (ones that require larger trees). Proper forest management includes selecting the best tree species for a site, using

the correct regeneration method (planting or natural regeneration), and ensuring that stocking levels are controlled to produce optimum growth, both in volume and timber products. Forest stands may be thinned periodically to improve stocking levels and to generate timber revenue (this is called a mid-rotation harvest).

Age class distribution is related to tree diameter distribution (older stands tend to have larger trees). Trees are often grouped into 2 inch diameter classes; for example, a 10 inch tree would vary from 9.00 inches to 10.99 inches. Larger trees produce more valuable products and higher timber revenue. In the South, pulpwood is commonly trees in size from 6 inches to 10 inches (using 2 inch diameter classes, from 5.00 to 9.99 inches), chip-n-saw (small sawtimber) is commonly 10 to 12 inches, and sawtimber is 14 inches and above. Keep in mind the larger diameter products have significantly higher values. Pulpwood might be worth $8 per ton on the stump, while chip-n-saw could be worth $20 per ton, and sawtimber could be worth $30 per ton. Poles and plywood quality sawtimber might be worth $45 per ton.

For example, consider the simple case of a natural loblolly stand in Virginia. As the stand grows throughout the years, more and more of the timber volume becomes sawtimber, a higher valued commodity. Figure 1 illustrates this with real-world data. This illustration is for just pulpwood and sawtimber to keep the example simple. If chip-n-saw was included, much more of wood would be sawtimber; plus, poles and plywood-quality sawlogs would add more value if included. The difference is more pronounced if the illustration is viewed in terms of value. For pulpwood valued at $8 per ton and sawtimber valued at $30 per ton, the comparison shows how much value is added by the sawtimber (Figure 2). Age class distribution will be highly correlated with tree size or the diameter distribution of the stand, and that controls the

proportions of forest products that eventually control the cash flows from the stand and overall profitability.

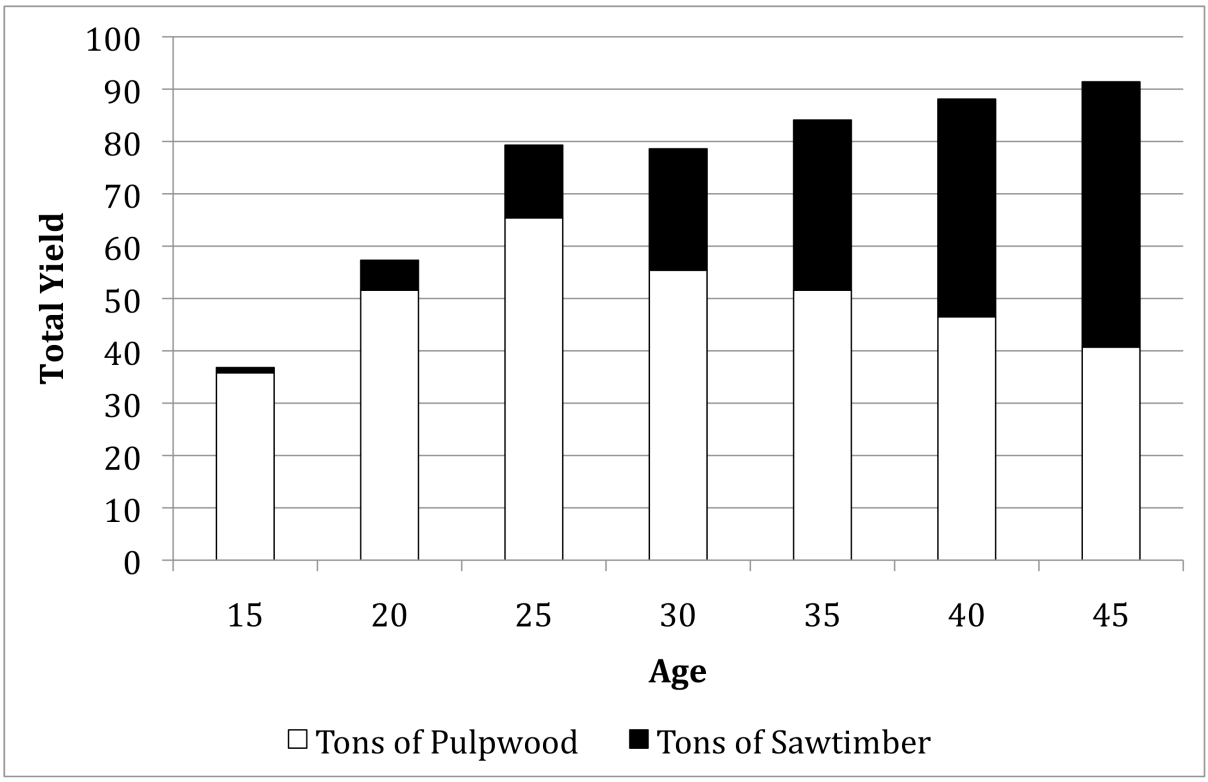

Figure 1. Yield of pulpwood and sawtimber for a natural loblolly stand, site index 80, basal area 110, Virginia coastal plain.

Thus, one of the first questions that should be asked about donated timberland is the age distribution of the stands. Where is the timber in terms of its growing cycle? Is it premerchantable timber (too young to have value), young timber about to become sawtimber, or mature timber ready for the market? Was it properly managed for growth? While the overall volume of timber per acre is relevant, the overall proportions of various timber products are even more important.

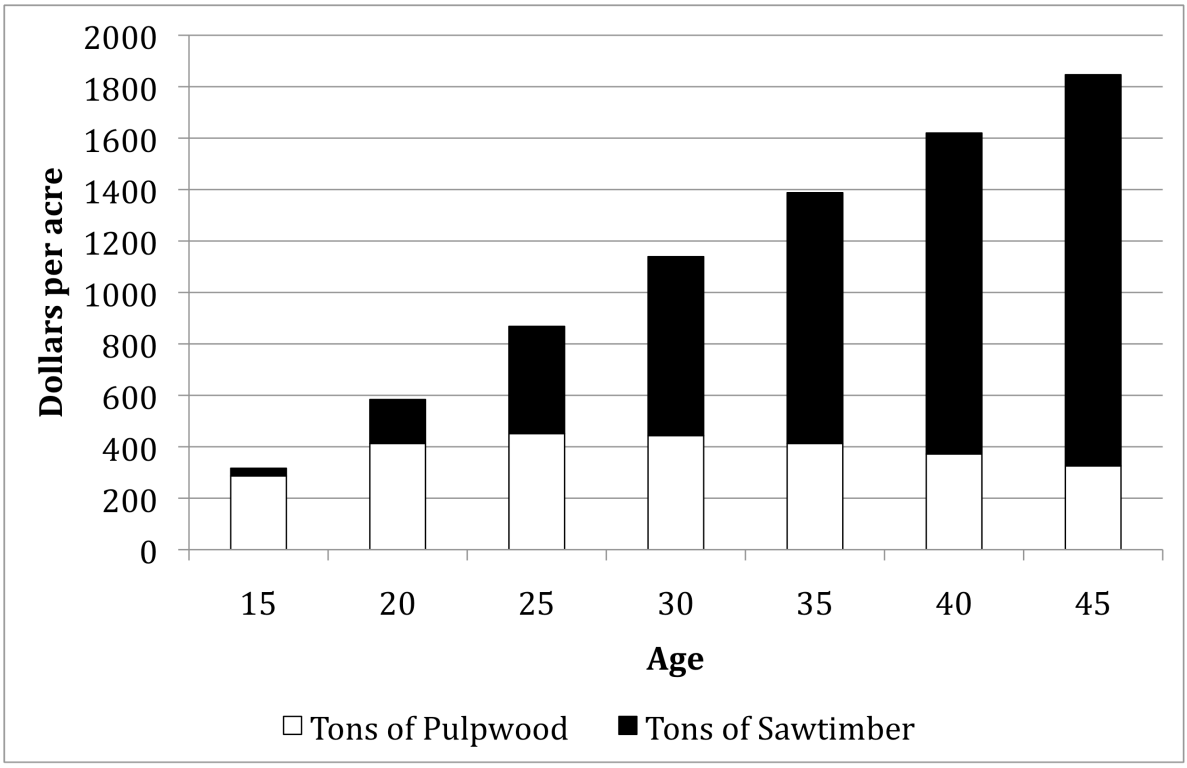

Figure 2. Proportionate value of pulpwood and sawtimber for a natural loblolly stand, site index 80, basal area 110, Virginia coastal plain.

Cash Flow Distribution

The age class distribution of the forested land will drive the cash flow distribution. Donated timberland property can have negative or positive annual cash flows. Cash flow is the financial term a foundation would likely use. A revenue is a positive cash flow and a cost is negative cash flow. For a year, the positive and negative cash flows would be combined to produce an annual net cash flow that could be positive or negative. Young stands, in particular, can generate annual costs that greatly exceed any annual revenue (negative cash flow). The age class distribution controls the sequence of thinning and harvest revenues. Often, in the absence of significant

annual revenue sources (like revenue from leasing the land to hunters), annual cash flow can be negative.

Consider the typical loblolly pine management regime in Table 1. The value of forestland managed under this management system with Table 1 costs and revenues is $1,000.00 per acre based on discounted cash flows over a perpetual time horizon. This is called land expectation value (LEV) and the calculation will be explained later. A single rotation of timber has a net present value (NPV) of $624.88 per acre; an infinite number of these rotations has a NPV of $1,000.00 per acre. NPV is the value of all the costs and revenues in the 25-year management regime considering the 4% interest. If the forest owner held the investment for one rotation (25 years) his or her NPV would be $624.88; for two rotations NPV would be $859.28; for three rotations NPV would be $947.21; for four rotations NPV would be $980.19; and for five rotations NPV would be $992.56. If the forest was held in the family for an infinite number of rotations, NPV would be $1,000.00. That is the concept of LEV.

Table 1. Hypothetical timber management regime for loblolly pine with actual and discounted cash flows per acre.

Year	Activity	Cash Flow	Discounted Cash Flow @ 4%
0	Sire prepare/plant	-$200.00	-$200.00
1	Weed control	-75.00	-72.12
18	Thinning revenue	+300.00	+148.09
25	Harvest revenue	+2,204.71	+827.02
1-25	Annual cost	-5.00	-78.11
		Net present value per acre =	$624.88
		Net future value (at end of rotation) =	$624.88(1.04)^{25} = $1,665.84
		Land expectation value (bare land value) per acre =	$1,000.00

Several key characteristics of forestland management and its stage of growth impact the financial potential of any timberland donation. First, unless the forest is already established,

there are usually potentially large initial costs. Bare land will mean significant initial costs. Site preparation, planting, herbaceous weed control, and fertilization are costs that occur at or near the beginning of a forestry investment. Second, the age class structure and related diameter distribution, as already discussed, will control cash flows. If the age class structure is limited, potential revenue might be infrequent and delayed. Fortunately, timber yields from any age class distribution can be easily predicted. Third, forestry investments tend to be long-term. A single timber rotation in the South can range up to 35 or more years. In the West the range can be 50 to 100 years. Of course, a forest can have many age classes.

Consider the cash flow generated by the management regime in Table 1. There are negative cash flows until the timber is thinned at year 18 and even then the cumulative cash flow considering interest is negative. However, at final harvest the major positive cash flow occurs, but that is at year 25. The cumulative cash flow considering interest at year 25 is $1,665.84 (unless the planting and site preparation cost of the next rotation is considered and the cash flow is reduced to $1,465.84).

Table 2 and Figures 3 to 6 illustrate the huge impact of age class distribution on donated timberland. Notice if the timberland is donated as bare land (needing site preparation and planting), it has a negative cumulative cash flow until the final harvest at age 25 (Table 2, Age Zero Donation). This is the situation where LEV or bare land value is calculated and this bare land donation would have a value of $1,000 per acre at 4% interest. When more mature timber is donated, say 10-year old premerchantable timber, the negative cash flow is only for eight years and then the cumulative cash flow remains positive (Table 2. Age 10 Donation). If the timber was a thinning age of 18-years old, then the cumulative cash flow is always positive (Table 2,

Age 18 Donation). If a mature timber stand of age 25-years is donated, there is an immediate huge cash flow (Table 2, Age 25 Donation).

Table 2. Cash flows per acre with 4% interest for loblolly pine tract donated at ages 0, 10, 18 and 25 years.

Year	Annual Cash Flow	Cumulative Cash Flow with Interest			
		Age 0 Donation	Age 10 Donation	Age 18 Donation	Age 25 Donation
0	-$200.00	-$200.00			
1	-80.00	-288.00			
2	-5.00	-304.52			
3	-5.00	-321.70			
4	-5.00	-339.57			
5	-5.00	-358.15			
6	-5.00	-377.48			
7	-5.00	-397.58			
8	-5.00	-418.48			
9	-5.00	-440.22			
10	-5.00	-462.83	-$5.00		
11	-5.00	-486.34	-10.20		
12	-5.00	-510.79	-15.61		
13	-5.00	-536.23	-21.23		
14	-5.00	-562.68	-27.08		
15	-5.00	-590.18	-33.16		
16	-5.00	-618.79	-39.49		
17	-5.00	-648.54	-46.07		
18	+295.00	-379.48	+247.08	+$295.00	
19	-5.00	-399.66	+251.96	+301.80	
20	-5.00	-420.65	+257.05	+308.87	
21	-5.00	-442.47	+262.33	+316.23	
22	-5.00	-465.17	+267.82	+323.88	
23	-5.00	-488.78	+273.54	+331.83	
24	-5.00	-513.33	+279.48	+340.10	
25	+2,199.71	+1,665.84	+2,490.27	+2,553.41	+2,199.71

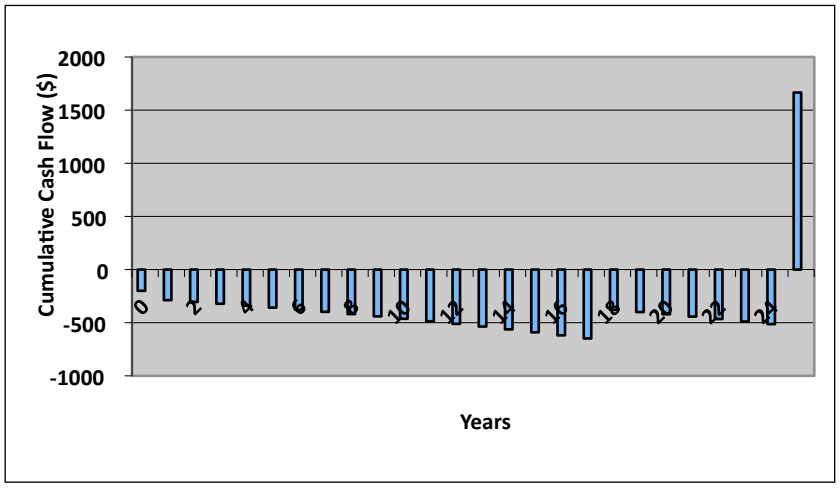

Figure 3. Cumulative cash flow per acre for a donated loblolly pine forest at age 0, including interest.

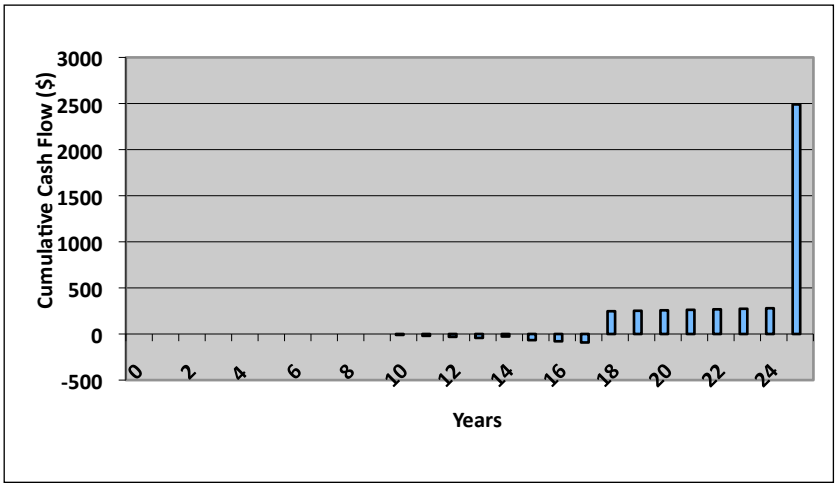

Figure 4. Cumulative cash flow per acre for a donated loblolly pine forest at age 10, including interest.

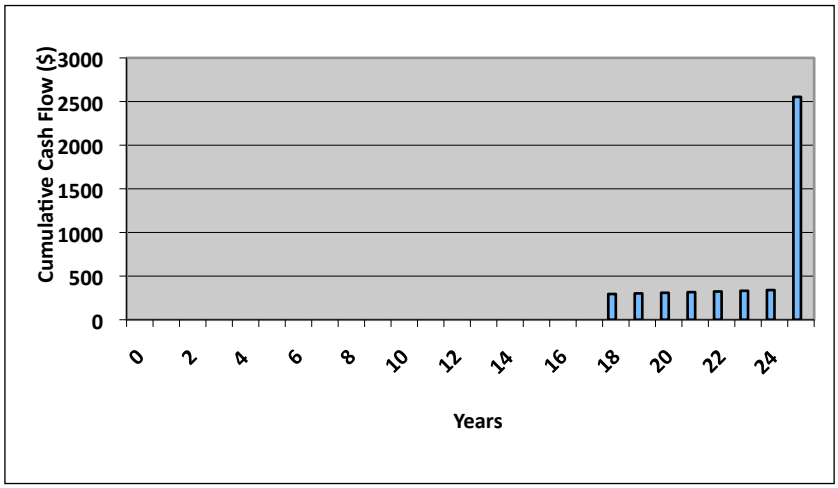

Figure 5. Cumulative cash flow per acre for a donated loblolly pine forest at age 18, including interest.

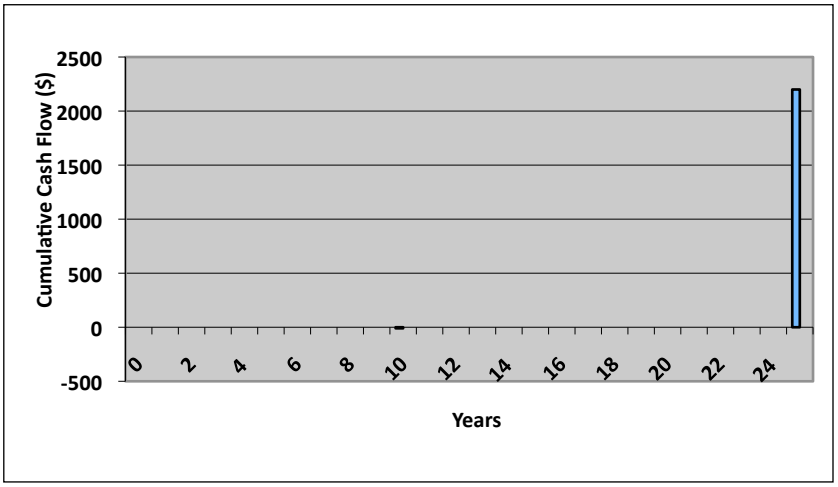

Figure 6. Cumulative cash flow per acre for a donated loblolly pine forest at age 25, including interest.

Converting Cash Flow into Donation Value

A timberland investment or donation can be, in many ways, evaluated just like any other investment or donation. Consider the loblolly pine stand described in Tables 1 and 2. The structure of the cash flows can be determined from the management regime and discounted cash flow analysis can be used to determine the standard financial criteria. The net present value of a single rotation is calculated as $624.88 per acre at a 4% interest rate. Internal rate of return for this investment is 9.02%. Like net present value, it is calculated in the standard financial manner.

One interesting financial criterion used in forestry is "equal annual income." The investment's net present value is multiplied by the formula to convert a single sum into an annual payment series to obtain the equivalent equal annual cash flow. Foresters sometimes use this criterion to compare timber investments with annual investments, like agricultural crops. For this example, equal annual income is $40.00 per acre. At a 4% discount rate, a cash flow of $40 per year for 25 years is equal to a single sum (or net present value) of $624.88 at year 0. A positive cash flow of $40 per acre might seem reassuring, but keep in mind that this investment would have a negative cash flow for 23 of the 25 years.

This calculation is actually quite simple. In Table 1 the NPV of the management regime is calculated as $624.88 per acre at 4% interest. Any NPV can be converted into a series of equal payments using a standard installment payment formula. This is the same formula used to calculate automobile or home loans. The formula for the equal payment equals NPV times $i(1 + i)^n/(1 + i)^n - 1$, where i equals the interest rate, expressed as a decimal, and n equals the number of compounding periods or years. In the example the equal annual payment equals

$624.88[0.04(1.04)^{25}/[(1.04)^{25} – 1]] = $40.00 per acre per year for 25 years. At 4% interest the cash flow in Table 1 is equivalent to a cash flow of $40.00 per acre per year.

Finally, LEV or bare land value is the net present value of an infinite number of timber rotations on a forested tract. The criterion assumes the land is bare and the management regime will be repeated forever. The basic formula for the present value of a perpetual periodic cash flow series is used to calculate LEV. For the loblolly pine stand in Table 1, LEV is $1,000.00 per acre. This is the value of a string of timber rotations based on Table 1 that extends forever. This means if an investor paid $1,000.00 for bare land and grew timber according to the management regime in Table 1 forever, the rate of return earned on the investment would be 4%. This is because LEV is a type of discounted cash flow value calculation and it was calculated using the same 4% interest rate as in this example. LEV = $1,665.84/[$(1.04)^{25}$ -1] = $1,000.00. The $1,665.84 was calculated in Table 1.

Recall the age zero timber stand is worth $1,000 per acre at 4% interest; the age 10-years timber stand would be worth $1,938.02 per acre; the age 18-years timber stand would be worth $2,700.30 per acre; and the age 25-years timber stand would be worth $3,199.71 per acre. Figure 7 shows the donation value for all ages between 0 and 25 years. While each of the age classes represents a forest stand with timber present, each has a distinct value based on the cash flows that will be generated. Donated timberland requires a similar analysis to determine the cash flows that will be generated, especially the possibility of long-term negative cash flows.

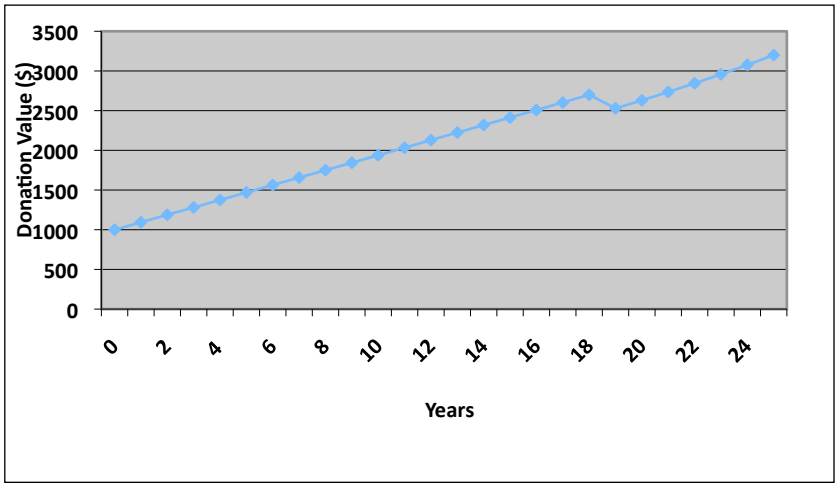

Figure 7. Donation value of loblolly pine stand per acre for various stand ages, value of discounted remaining cash flow in rotation plus discounted LEV at 4% interest.

. Donation value is calculated in each case from the data in Table 2. At each age the remaining cash flow is discounted for the years remaining in the rotation; added to that is LEV discounted for the same time period; adding up to donation value. For example, at age 25 the cash flow from the first rotation is $2,199.71. The donor received that harvest value plus has a perpetual flow of timber harvest revenue (LEV) worth $1,000. The donation value is $3,199.71.

If the donation was an 18-year old stand, the donor would have the cash flow in Table 2 that has a future value in seven years of $2,553.41. In seven years the LEV will be worth an additional $1,000.00. So donation vale is $3,553.41 discounted for seven years at 4% interest, or $2,700.30. Likewise, a 10-year-old donated timber stand would be worth $3,490.27 discounted for 15 years at 4% interest, or $1938. 02. Finally, the zero-aged timber stand donation would be worth $2,665.84 discounted for 25 years at 4%, or $1,000.00. All the other aged timber stand donation values were calculated in a like manner.

Conclusion

Donated timberland is not easy to value. It can produce years of negative cash flows and comes with annual costs like management expenses and property taxes. The age class structure of the forestland will control the expected cash flows from the property and the net present value of these cash flows should equate to market value. LEV is a forestry valuation calculation that values a forest in terms of the perpetual cash flows it will generate. This would be the value of the donated timberland.

Foundations need to be careful of timberland investments. They have unique managerial requirements and require a professional forester to properly appraise value. Donated timberland that was recently clearcut, for example could produce decades of negative cash flows. This bulletin alerts foundation administrators and boards to the complexity of these assets. The companion bulletin to this publication and the references below are a good beginning point in understanding timberland's financial and managerial complexities.

References

Bettinger, P., K. Boston, J.P. Siry, and D.L. Grebner. . 2009. *Forest Management and Planning*. Burlington, MA: Academic Press.

Butler, B.J. 2008. *Family Forest Owners of the United States, 2006* (General Technical Report NRS-27). Newtown Square, PA: USDA Forest Service, Northern Research Station.

Bullard, S.H., and T.J. Straka. 1998. *Basic concepts in Forest Valuation and Investment A*nalysis. 2nd ed. Jackson, MS: Forestry Suppliers.

Chung, H.-F. 2012. *Timberland Investment: A Primer*. Brookline, MA: Timberland Investment Resources L.L.C.

D'Amato, A.W., P.F. Catanzaro, D.T., Damery, D.B., Kittredge, and K.A. Ferrare. 2010. Are family forest owners facing a future in which forest management is not enough? *Journal of Forestry* 108(1):32-38.

Kays, J.S., G.R. Goff, P.J. Smallidge, W.N. Grafton, and J.A. Parkhurst. (Eds.). 1998. *Natural Resources Income Opportunities for Private Lands – Proceedings of the Conference.* College Park, MD: University of Maryland Cooperative Extension Service.

Kilgore, M.A., J.L. Greene, M.G. Jacobson, T.J. Straka, T. J., and S.E. Daniels, S.E. 2007. The influence of financial incentive programs in promoting sustainable forestry on the nation's family forests. *Journal of Forestry* 105(4):184-191.

Klemperer, W.D. 1996. *Forest Resource Economics and Finance*. New York, NY: McGraw-Hill, Inc.

Sampson, N., and L. DeCoster. 2000. Forest fragmentation: Implications for sustainable private forests. *Journal of Forestry* 98(3):4-8.

Smith, W.B., P. D. Miles, C.H. Perry, and S.A. Pugh. 2009. *Forest Resources of the United States, 2007* (General Technical Report WO-78). Washington, DC: USDA Forest Service, Washington Office.

Straka, T.J., and S.H. Bullard, S.H., and W.F. Watson. 1985. Primer on forestry investment. *Forest Farmer* 45(2):10-11.

Straka, T. J., and S.H. Bullard. 1996. Land expectation value calculation in timberland valuation. *Appraisal Journal* 64: 399-405.

Straka, T.J. 1997. Forest management plans for small holdings. *Forest Landowner* 56(5): 34-35, 38-39.

Straka, T. J. S.H. Bullard, and M.R. Dubois. 2001. Introduction to forestry investment analysis, part I: Basic investment characteristics and financial criteria. *Forest Landowner* 60(6):9-12, 14.

Straka, T. J., S.H. Bullard, and M.R. Dubois. 2002. Introduction to forestry investment analysis, part II: Taxes, inflation, and other issues. *Forest Landowner* 61(1): 39-44.

Straka, T. J., and J.L. Greene. 2002. Do your clients understand how taxes affect their timber investments? *The Consultant* 47(4): 27-29.

Straka, T.J. 2009. Does your client own timberland? *Financial Advisor* 10(11):95-96.

Straka, T.J. 2009. Forest products finances: Institutional investors. *Forest Products Equipment* 17(9):12-13, 21.

Zinkhan, F. C., W.R. Sizemore, G.H. Mason, G. H., and T.J. Ebner. 1992. *Timberland Investments: A Portfolio Perspective.* Portland, OR: Timber Press.