Land Value Differentials Resulting from Variability between the Sales Comparison and Income Approaches in Timberland Valuation

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Abstract

Timberland appraisal can be complex as it involves intricate knowledge of timber as a commercial product and the value of the underlying land as the "factory" that produces a timber crop. In a timberland transaction, the timber crop adds contributory value, and a disaggregation technique is used to determine timber and land values. Once the timber value is established, an allocated land value is often calculated by subtracting the timber value from the overall tract value of comparable sales. When this comparable sales land value is compared to land value determined by an income approach, the two often disagree by an amount called a land value differential. A common way that foresters value land is the bare land value calculation. Bare land value is a specialized income approach model in forestry adapted to perpetual timber production and is primarily dependent upon the parameters of discount rate, site index (a determinant of forest yield), and stumpage price appreciation. This study uses actual data to evaluate each of the parameters and determine the adjustment factors and the magnitude of adjustments that result in the lowest land value differential. The results show that bare land value is most responsive to site index and discount rate adjustments, and less responsive to stumpage price appreciation. Timberland appraisers can use these findings to evaluate the results of their income approach model when comparing the two valuation approaches, and also when identifying adjustment factors for inherent differences among timberland properties in their adjustment process.

Introduction

Timberland appraisal often involves the services of a forester to estimate timber value for distinct commercial products and the value of the underlying land, which can be viewed as a "factory" that produces a perpetual timber crop. This article discusses some of the fundamental complexities in valuing timberland to increase appraisers' understanding of issues that arise in obtaining timberland component values.

In a timberland transaction, a timber crop provides contributory value and the disaggregation technique is commonly used to separate the total tract value into timber and land components.[1] Estimation of timber volume and the corresponding value on a timberland property often requires technical expertise from a forester in terms of converting standing timber into projected products (cash flows) that are measured in different units (like tons, cords, or board feet), with market prices heavily dependent on multiple quality factors

1. Kim M. Kobriger, Cameron Boone, James Weiss, and Andrew Chambers, "Revisiting the Valuation of Timberland—Terminology, Methods, and Case Studies," The Appraisal Journal (Summer 2011): 212–222.

(like knots and straightness), and even timber harvesting constraints due to factors like streamside management zones.[2] Those timber complexities pose potential liabilities from misestimation of timber value and are the common reason an appraiser usually leaves this task to the forester.

Once the value of the timber is established, an allocated land value (ALV) is often calculated by subtracting the timber value from the overall sales comparison tract market value, a calculation resulting in a residual that is more complex than it seems.[3] This study examines and reports on factors that are important in explaining the land value differential (LVD); that is, the amount in which the allocated land value commonly differs from a typical bare land value (BLV) calculated using the income approach.

Timberland Valuation Methods

The two most common valuation methods used in timberland valuation are the sales comparison and income approaches.[4] The sales comparison approach poses two major problems in application: a limited number of directly comparable sales and the problematic conundrum of adjusting between sales due to inherent differences in tree species and sizes, and the resulting commercial timber products derived from those trees.[5]

Timberland appraisal of large-acreage tracts usually involves land with a highest and best use of timber production, which is often valued using the discounted cash flow method. This approach involves making reliable estimates of critical variables that are property specific, like current and future stumpage prices, the length of optimal timber rotations, forest yield, site index, reforestation cost, and the costs related to management and silvicultural applications.[6] Certainly both the sales comparison and discounted cash flow approaches are commonly used in timberland valuation, often one as a subsidiary approach in support of values obtained using the other method.[7]

Timberland valuation may take into consideration the relevant site index. Site index is a standard forestry term that may be confusing to appraisers. The site index has nothing to do with location, except it does tend to vary by region (between the Lower Coastal Plain and the Piedmont in South Carolina, for example). Site index is an indicator of soil productivity and a key component in the estimation of timber product yield. It is a measure of how tall a tree will grow in 25 or 50 years (the base age in the current study was 25 years, typically used for pine plantations in the South). Tree height is strongly related to tree yield, so the site index is also strongly related to tree yield.

Timberland has its own specialized valuation method using the income approach, called land expectation value. It is more commonly known as bare land value, which is simply a discounted cash flow method with a strict assumption of growing timber in perpetuity.[8] Bare land value (BLV) is widely accepted by timberland appraisers and is exactly what it sounds like, "the value of bare land in permanent timber production that is in need of immediate regeneration, or simply the value of the 'dirt'."[9] It is important to realize that a BLV resulting from an income approach is completely different from an ALV extracted from a comparable sale.

This discussion centers on the difference between a typical BLV, calculated under the standard assumptions, and an ALV extracted from sales comparisons; therefore, references to

2. Ervin G. Schuster and Michael J. Niccolucci, "Comparative Accuracy of Six Timber Appraisal Methods," The Appraisal Journal (January 1990): 96–108.
3. Terry Gilmore and Martin J. Healy, Jr., "What Is the Dirt Worth?" The Appraisal Journal (July 1991): 395–401.
4. Gary Allen Burns, "Timber and Timberland Appraisal," ASA Valuation (December 1983): 75–82.
5. Martin J. Healy, Jr., and Kevin Bergquist, "The Sales Comparison Approach and Timberland Valuation," The Appraisal Journal (October 1994): 587–595.
6. Thomas J. Straka and Steven H. Bullard, "Land Expectation Value Calculation in Timberland Valuation," The Appraisal Journal (October 1996): 399–405.
7. Kobriger et al., "Revisiting the Valuation of Timberland."
8. Thomas J. Straka, "Valuation of Bare Forestland and Premerchantable Timber Stands in Forestry Appraisal," Journal of the American Society of Farm Mangers and Rural Appraisers (2007): 142–146.
9. W. David Klemperer, "Segregating Land Values from Sales of Forested Properties under Even-Aged Management," Forest Science 27, no. 2 (June 1981): 305–315.

the income approach should be considered within this context. Bare land value (BLV) is the net present value (NPV) of all revenues and costs associated with growing timber on the land in perpetuity at a specified discount rate. It can be interpreted as the maximum price that can be paid for a bare tract of land in order to earn a rate of return (ROR) equal to the discount rate used to calculate the BLV.[10]

An allocated land value (ALV) from comparable sales is derived from a disaggregation of timberland into its components: premerchantable timber, merchantable timber, and the land. The sum of the two timber values, deducted from the total sale price, equals allocated land value.

ALV = Sale Price – (Premerchantable Timber Value + Merchantable Timber Value)

In a perfect world, both BLV and ALV would be the same, but often this has not been the case in valuing large timberland tracts for timberland investment management organizations (TIMOs) and real estate investment trusts (REITs). The current study examines this land value differential (LVD) to determine what factors may account for the difference between the BLV and ALV.

For this analysis, a representative appraiser chose comparable sales from his consulting firm's database that illustrated the key difference between BLV and ALV. The comparable sales are large timberland properties with 5,000+ acres of intensively managed pine plantations in the southeastern United States, all with a highest and best use of perpetual timber production. A sensitivity analysis was then performed on the key factors (discount rate, site index, and stumpage price appreciation) affecting BLV to illustrate how each factor influences the magnitude of the land value differential. From the sensitivity analysis, a BLV was simulated that reaches the ALV level for each sale, providing insight on the individual influence of each factor that contributes to the land value differential. This method extracts the implied importance of the adjustment factors from market data, so that the implied market behavior can then be replicated in the adjustment process.

The analysis focuses on the three key variables that drive the income approach in timberland valuation; these are most likely to explain differences with market values obtained from comparable sales driven by buyers and sellers with perceptions about the same variables. Site index, in particular, drives the value obtained in the discounted cash flow process, as it is highly correlated with the inherent forest productivity of the property in terms of growing commercial timber products. Forest yield (timber product output) contributes the vast majority of value using the discounted cash flow method, and this is assumed to be a direct function of site index by foresters. Site index can even impact optimal rotation length, thus determining the timing of cash flows. It was expected that variables like site index would significantly contribute to value in both valuation approaches.

Literature Review

The income approach is commonly used in timberland valuation and offers a strong conceptual foundation for valuing land focused on timber production.[11] This approach is essential to valuing the underlying land component in the valuation of timberland, as valuing timberland exclusive of trees often poses difficulties.[12] Keep in mind BLV is the value of bare land in permanent timber production in need of immediate regeneration.[13]

Of course, the sales comparison approach is also used to appraise timberland, but it presents difficulty in locating directly comparable sales and adjusting for inherent differences in timber stands.[14] Timberland appraisers use a method that allocates values corresponding to the different

10. Steven H. Bullard and Thomas J. Straka, Basic Concepts in Forest Valuation and Investment Analysis, 3rd ed. (Jackson, MS: Forestry Suppliers, Inc., 2011).

11. Schuster and Niccolucci, "Comparative Accuracy of Six Timber Appraisal Methods"; William T. Anglyn, "Timber Assessment Procedures—A Critical Analysis," The Appraisal Journal (April 1991): 205–211; Kobriger et al., "Revisiting the Valuation of Timberland."

12. W. David Klemperer, "Segregating Land and Timber Values from Sales of Uneven-Aged Forests," The Appraisal Journal (January 1979): 16–25.

13. Klemperer, "Segregating Land and Timber Values"; Straka, "Valuation of Bare Forestland."

14. Timothy D. Newman," Appraisal of Timber: A Direct Sales Approach," The Appraisal Journal (January 1984): 17–26; Healy and Bergquist, "The Sales Comparison Approach and Timberland Valuation."

components of the property. These allocated values are estimated from the comparable sales data. This technique produces an ALV that is highly dependent upon current timber pricing and buyer motivations for that particular sale, which may or may not be in line with the assumptions used to develop a purely timber-focused BLV.[15]

Young, precommercial timber presents a situation where discounted cash flow techniques are often a preferred valuation method.[16] BLV is the standard discounted cash flow method in forestry for timberland valuation. The techniques can be traced to Martin Faustmann, a German appraiser, who developed the technique in 1849 to value bare forestland for tax purposes.[17] Appraisers who are not timber experts are somewhat reluctant to use BLV calculations, as they require professional forestry judgments regarding stumpage prices, reforestation costs, and forest yield.[18] BLV involves standard discounted cash flow calculations and uses standard income capitalization formulas.[19]

Factors that impact forestland values have been identified in the literature. Studies have found road access, topography, land productivity, and population density were positively correlated with forestland prices.[20] While physical factors, like tract size, site productivity, and timber volume, clearly impact bare forestland value, buyers' and sellers' perceptions of markets and value also play a major role.[21]

Another study found that not only does timber volume on a tract influence timberland price, but the interaction with regional timber volumes also plays a role.[22] The complexity of valuing forest tracts and separating the timber from the bare land involves many external factors far removed from the tract for small family forest owners (e.g., financing and future intentions for the property).[23] The results of these studies should not surprise appraisers; they are derived from individual and family forest owners. Many large timberland transactions involve properties previously owned by forest industry, but are now managed or owned by TIMOs and REITs.

While some of these factors would be relevant to TIMOs and REITs, their focus has been on investment return and forest productivity.[24] There has been little research on the factors that might account for differences in timberland valuation results from the sales comparison and income approaches for these types of timberland investors. Timberland investors concentrate on productive forests and, where possible, tend to harvest hardwood stands and convert them to pine stands (much like the forest industry that used to own the same land). Investment parameters often stress economies of scale, liquidity, risk diversifi-

15. Gilmore and Healy, "What Is the Dirt Worth?"

16. W. David Klemperer, "Valuing Young Timber Scheduled for Future Harvest," The Appraisal Journal (October 1987): 535–547.

17. Martin Faustmann, "Calculation of the Value which Forest Land and Immature Stands Possess for Forestry," Allgemeine Forst und Jagdzeitung (15 December 1849): 27–55. (English translation by W. Linnard in Gane.1968. Martin Faustmann and the Evolution of Discounted Cash Flow. Michael Gane, ed. Commonwealth Forestry Institute Paper 42.)

18. W. David Klemperer, Forest Resource Economics and Finance (New York: McGraw-Hill, Inc., 1996); Bullard and Straka, Basic Concepts in Forest Valuation and Investment Analysis.

19. Straka and Bullard, "Land Expectation Value Calculation in Timberland Valuation"; Jefferson H. Mayo and Thomas J. Straka, "The Holding Value Premium in Standing Timber Valuation," The Appraisal Journal (Winter 2005): 98–106.

20. Anders Roos, "The Price for Forest Land in Combined Forest Estates," Scandinavian Journal of Forest Research 10, no. 1-4 (1995): 204–208; Daowei Zhang, Li Meng, and Maksym Polyakov, "Determinants of the Prices of Bare Forestland and Precommercial Timber Stands: A Spatial Hedonic Study," Forest Science 59, no. 4 (August 2013): 400–406.

21. Thomas Aronsson and Ola Corlén, "The Determinants of Forest Land Prices: An Empirical Analysis," Canadian Journal of Forest Research 30, no. 4 (April 2000): 589–595.

22. Sofia Carlsson, Lars Lönnstedt, and Torbjörn Sundelin, "Factors Affecting Swedish Forest Property Prices," Open Journal of Forestry 4, no. 4 (July 2014): 363–378.

23. Gary A. Kennedy, Lonnie R. Vandeveer, Steven A. Henning, Huizhen Niu, and Donald L. Deckard, "Estimating Tract Value Relationships in the North Louisiana Timberland Market," Southwestern Economic Review 29 (2002): 123–134; Stephanie A. Snyder, Michael A. Kilgore, Rachel Hudson, and Jacob Donnay, "Determinants of Forest Land Prices in Northern Minnesota: A Hedonic Pricing Approach," Forest Science 53, no. 1 (February 2007): 25–36.

24. Jacek P. Siry and Frederick W. Cubbage, "A Survey of Timberland Investment Management Organizations Forestland Management in the South," (Proceedings of the 31st Annual Southern Forest Economics Workshop, Atlanta, GA, March 27–28, 2001): 153–156.

cation, and financial return.[25] Discount rate obviously plays a role in BLV calculations, but other variables known to impact timberland-investor transactions are location, highest and best use potential, and timber price expectations.[26]

Data and Methods of Analysis

The impetus for this study was the observation that typical BLV and sales comparison (ALV) approaches often produce inconsistent results when estimating the underlying land values in timberland transactions for TIMO and REIT clients. This difference in land value—the land value differential, or LVD—is an interesting phenomenon that has not been addressed in the literature. To examine this phenomenon and its possible underlying causes, appraisal data from representative timberland transactions were used to determine the adjustment factors and the magnitude of those factors that would result in a minimal LVD. The analysis focused on the two most common timberland valuation approaches, income capitalization and sales comparison, with the income approach being defined by the traditional forestry investment criterion of BLV.

By selecting seven comparable sales of large (5,000+ acres) timberland properties in the southeastern United States from a large consulting forestry company's database, it was possible to eliminate most of the highest and best use potential factors that are typically inherent to smaller-sized tracts. From the comparable sales an allocated convertible land value was extracted, derived from the appraiser's allocation process. The convertible land value for each comparable sale was categorized as "allocated land value," or ALV. As discussed above, appraisers disaggregate values to different components of a property. This commonly includes different land components (convertible, non-convertible, non-forest) in addition to the timber component. Also, inside of these comparable sales were data referring to current stumpage prices, site index, and reforestation cost inputs. These same inputs were used in the study's BLV calculations so they would align with the comparable sales data.

When deriving a typical BLV, a standard discount rate of 5.25% was used. This discount rate correlated to the rate level reflected in conversations with market participants and third-party surveys. Though it is common to build up a discount rate or to extract it from sales on other property types, it would be very difficult to do either of these due to the nature and complexity of timberland discounted cash flows and the unwillingness of most market participants to directly share their discounted cash flow input assumptions. Instead, it is most common to derive the discount rate from direct conversations with market participants and from third-party surveys of market participants.

Next, a series of discounted cash flow models were run, including the forest inputs carried over from the comparable sales data. These produced a "typical" BLV that became the baseline in the comparison. This baseline was predicated on a forest management regime (timeline of management activities, with costs and revenues) that included a commercial thinning at age 15, a second commercial thinning at age 22, and a final clear-cut harvest at age 34. Using the standard discount rate and the typical BLV forest management regime allowed for a consistent comparison between the comparable sales.

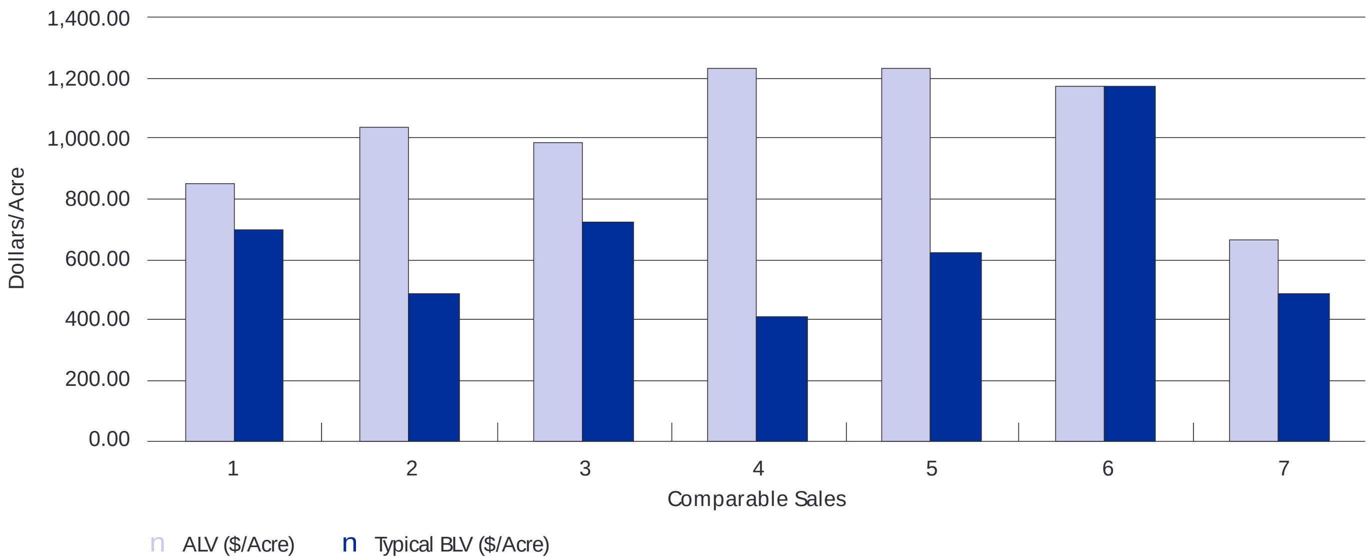
From this computation, the value differential between the ALV and typical BLV was then determined for each of the seven comparable sales (this differential is referred to here as the LVD). Exhibits 1 and 3A illustrate the comparison between a typical BLV (income approach) and ALV (sales comparison approach).

Sensitivity analysis was then used to identify the adjustment factors for each comparable sale that would create a BLV equal or near-equal to ALV, resulting in a minimal LVD. To do this, a range of BLVs was simulated for each comparable sale by adjusting the three driving variables of the BLV computation: discount rate, site index at base age 25, and stumpage price expectation or appreciation. Ranges of 2%–10%, 50–110, and 1%–4% were created for each variable, respectively. It is important to note that the study's BLV calculation is slightly different from the classical BLV, as a price appreciation factor was included

25. Daowei Zhang, Brett J. Butler, and Rao V. Nagubadi, "Institutional Timberland Ownership in the US South: Magnitude, Location, Dynamics, and Management," Journal of Forestry 110, no. 7 (October 2012): 355–361.

26. Jacob Gorman, "Institutional Timberland Investments: Asset Pricing and the Discount Rate" (PhD Diss., Auburn University, 2012).

Exhibit 1 Comparison between Typical BLV Derived from Income Approach and the ALV from Comparable Sales, Seven Representative Sales



in the model, which created a stumpage price expectation. Although BLV normally assumes constant stumpage prices, the study's modeling approach still retains the essence of the classical BLV calculation.

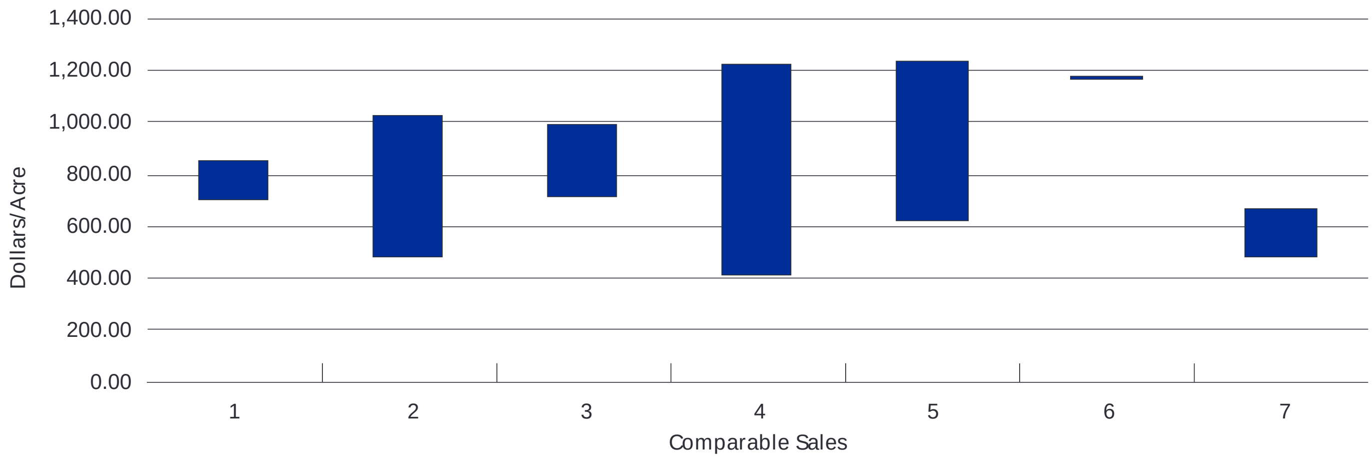
By adjusting each of these variables independently through their ranges, while holding the other two variables constant at their baseline or typical levels, it was possible to determine how sensitive the BLV was to each adjustment as it approached ALV. Furthermore, the percentage change (elasticity) of BLV to ALV was also calculated and the corresponding levels of each variable to identify how much of an adjustment was necessary. For this analysis, elasticity is defined as the percentage change in BLV divided by the percentage change in the parameter being adjusted.

Results and Discussion

Most timberland appraisers realize there are inconsistencies in the values derived for the underlying land component between the sales comparison and income approaches, but the appraisal literature provides little discussion on why these differences arise and the factors that may lead to these differences. In the current study, the difference from the two approaches was captured by plotting LVD, as shown in Exhibits 2 and 3A. In a perfect world, one would expect LVD to be near zero, as in Comparable Sale 6, where the two approaches essentially agree on value. However, real-world results are often more like those found in Comparable Sales 4 and 5, with LVDs of $821.53/acre and $608.98/acre, respectively. Consistently seeing differences in the land value, as with these sales, is what led to the current investigation of this issue. Of course, variables like road access, size/shape, or proximity to city centers affect comparable sale values, but it is important to recognize this analysis focuses solely on the input variables that drive BLV.

In the analysis, independently calculating BLV at each level within the adjusted range of each driving variable permitted simulation of a BLV that was near the ALV level. Exhibits 3B, 3C, and 3D summarize the differences between each driving variable for a typical BLV and a simulated BLV corresponding to ALV, while also indicating the resulting LVD after the adjustments were made. The ALV represents the base value, as it is the allocated land value that has already been derived by the appraiser. The BLV is the value that was derived using discounted cash flow analysis. The simulated BLV is independently calculated through the range of constants and is the value used to illustrate this comparison. To simplify and condense the results, the key findings from Comparable Sale 4 were examined. The

Exhibit 2 LVD Resulting from the Two Different Approaches to Value for Seven Representative Sales



results in Exhibits 3A to 3D illustrate the relationships between the three adjustment parameters, and show that both BLV and LVD are fairly consistent between the seven comparable sales. Comparable Sale 4, with the largest LVD, will simply produce results that are easier to discern due to the larger difference.

In Comparable Sale 4, the discount rate levels for both a typical BLV and the simulated BLV corresponding to ALV were 5.25% and 3.35%, respectively. This difference in a discount rate of 1.9% is shown in Exhibit 4. To increase BLV by $823.63/acre—resulting in a BLV comparable to ALV—the discount rate needed to be adjusted by approximately 36%. The percentage change in BLV necessary to reduce LVD to near zero was approximately 201%. Thus, elasticity for Comparable Sale 4 in terms of discount rate was -5.6.

The site index (at base age 25) for the typical BLV and simulated BLV modeled at the ALV level were 67 and 96, respectively, leaving a difference of 29, as illustrated in Exhibit 5. An adjustment of approximately 43% was needed to reduce LVD to $4.57/acre, as shown in Exhibit 3C. As might be expected, the level of productivity from a timberland tract with a site index of 96 compared to one of 67 is extremely significant; the difference in the amount of wood they might produce, and the inherent value differences, would be revealed using the income approach. To put this in perspective, a tract with a site index of 96 would produce 4.35 tons/acre more annually than a tract with a site index of 67 and be worth $816.96/acre more. Thus, elasticity for Comparable Sale 4 in terms of site index was 4.6 (percent change of $409.47 and $1,226.43 and percent change of 67 and 96).

The level of stumpage price appreciation, for both the typical BLV and a simulated BLV corresponding to ALV, were 1.00% and 3.20%, respectively, leaving a difference of 2.20%, which is illustrated in Exhibit 6. To achieve a minimal LVD at or near zero, the appropriate adjustment of 220% was made. Thus, elasticity for Comparable Sale 4 in terms of stumpage price appreciation was 0.9. This implies that stumpage prices would need to increase $39.02/ton for pine saw timber (PST), $10.39/ton for pine chip-n-saw (CNS) and $3.65/ton for pine pulpwood (PPW) in 34 years, 22 years, and 15 years, respectively, compared to the typical BLV. This was derived by capitalizing the original price for each product by its price appreciation adjustment level in Comparable Sale 4, by the allotted years of the cutting regime used in the discounted cash flow model. The original prices in Comparable Sale 4 were $25.75 (PST), $13.75 (CNS), and $8.25 (PPW). To simplify the cash flow analysis, the future stumpage prices for PST, CNS, and PPW were calculated as if the only wood being harvested in each of the cutting cycles was a constant timber product mix. In reality, it is likely there would be a variety of different sizes of wood cut during a second thinning and clear-cut. Both a second thinning and a clear-cut may produce PST, CNS, and PPW, but the final harvest clear-cut will produce much larger products. A representation of this calculation is shown in Exhibit 7.

Exhibit 3A Allocated Land Values, Bare Land Values, and Resulting Land Value Differentials for Seven Comparable Sales

Comparable Sale	Allocated Land Value ($)	Bare Land Value* ($)	Land Value Differential ($)
1	849.00	700.38	148.62
2	1,034.00	482.94	551.06
3	989.00	720.47	268.53
4	1,231.00	409.47	821.53
5	1,235.00	626.02	608.98
6	1,173.00	1,170.90	2.10
7	664.00	486.96	177.04

* Bare land value (BLV) calculated using 5.25% discount rate.

Exhibit 3B Sensitivity Analysis of Land Value Differential to Changes in Discount Rate

Comparable Sale	Allocated Land Value ($)	Bare Land Value* ($)	Simulated BLV ($)	Corresponding Discount Rate (%)	Land Value Differential ($)
1	849.00	700.38	843.73	4.94	5.27
2	1,034.00	482.94	1,032.22	3.92	1.78
3	989.00	720.47	995.05	4.50	(6.05)
4	1,231.00	409.47	1,233.10	3.35	(2.10)
5	1,235.00	626.02	1,232.85	3.88	2.15
6	1,173.00	1,170.90	1,170.90	5.25	2.10
7	664.00	486.96	666.09	4.70	(2.09)

* Bare land value (BLV) calculated using 5.25% discount rate.

Exhibit 3C Sensitivity Analysis of Land Value Differential to Changes in Site Index

Comparable Sale	Allocated Land Value ($)	Bare Land Value ($)	Site Index Base Age 25	Simulated BLV ($)	Corresponding Site Index	Land Value Differential ($)
1	849.00	700.38	70	832.58	73	16.42
2	1,034.00	482.94	67	1,056.71	85	(22.71)
3	989.00	720.47	65	997.63	73	(8.63)
4	1,231.00	409.47	67	1,226.43	96	4.57
5	1,235.00	626.02	70	1,231.91	90	3.09
6	1,173.00	1,170.90	70	1,170.90	70	2.10
7	664.00	486.96	65	683.36	71	(19.36)

Exhibit 3D Sensitivity Analysis of Land Value Differential to Changes in Stumpage Price Appreciation

Comparable Sale	Allocated Land Value ($)	Bare Land Value ($)	Product*	Market Price ($/Ton)	Price Appreciation Per Year (%)	Simulated BLV ($)	Corresponding Annual Appreciation Rate (%)	Land Value Differential ($)
			PST	29.75				
1	849.00	700.38	CNS	24.00	1.00	833.57	1.30	15.43
			PPW	18.00				
			PST	28.50				
2	1,034.00	482.94	CNS	16.00	1.00	1,038.44	2.50	(4.44)
			PPW	9.50				
			PST	26.00				
3	989.00	720.47	CNS	16.00	1.00	979.24	1.80	9.76
			PPW	14.00				
			PST	25.75				
4	1,231.00	409.47	CNS	13.75	1.00	1,220.35	3.20	10.65
			PPW	8.25				
			PST	24.00				
5	1,235.00	626.02	CNS	17.50	1.00	1,244.35	2.60	(9.35)
			PPW	9.75				
			PST	30.00				
6	1,173.00	1,170.90	CNS	26.00	1.00	1,170.91	1.00	2.09
			PPW	21.00				
			PST	30.25				
7	664.00	486.96	CNS	15.75	1.00	672.82	1.60	(8.82)
			PPW	9.50				

* PST—Pine saw timber; CNS—Pine chip-n-saw; PPW—Pine pulpwood.

Exhibit 4 Differences in Discount Rates Necessary to Reduce LVD to Zero, for Seven Representative Sales

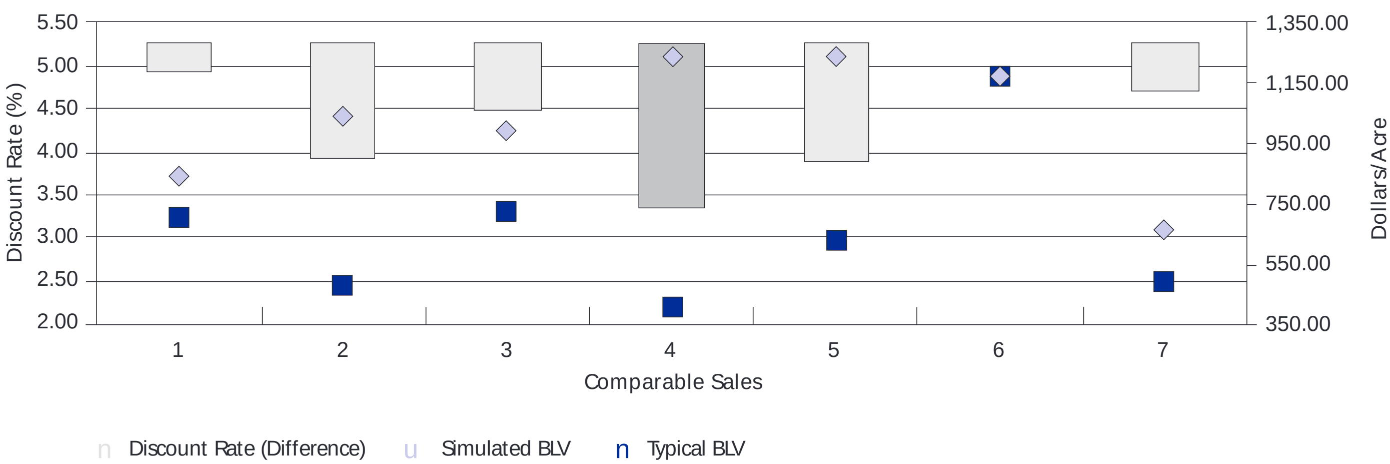


Exhibit 5 Differences in Site Index Necessary to Reduce LVD to Zero for Seven Representative Sales

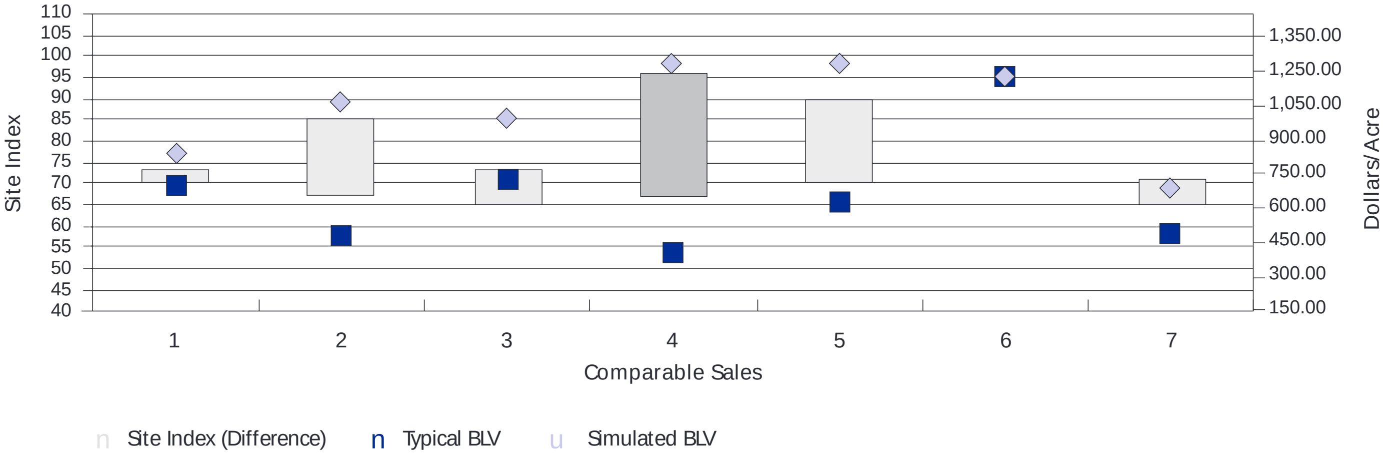


Exhibit 6 Differences in Stumpage Price Appreciation Necessary to Reduce LVD to Zero for Seven Representative Sales

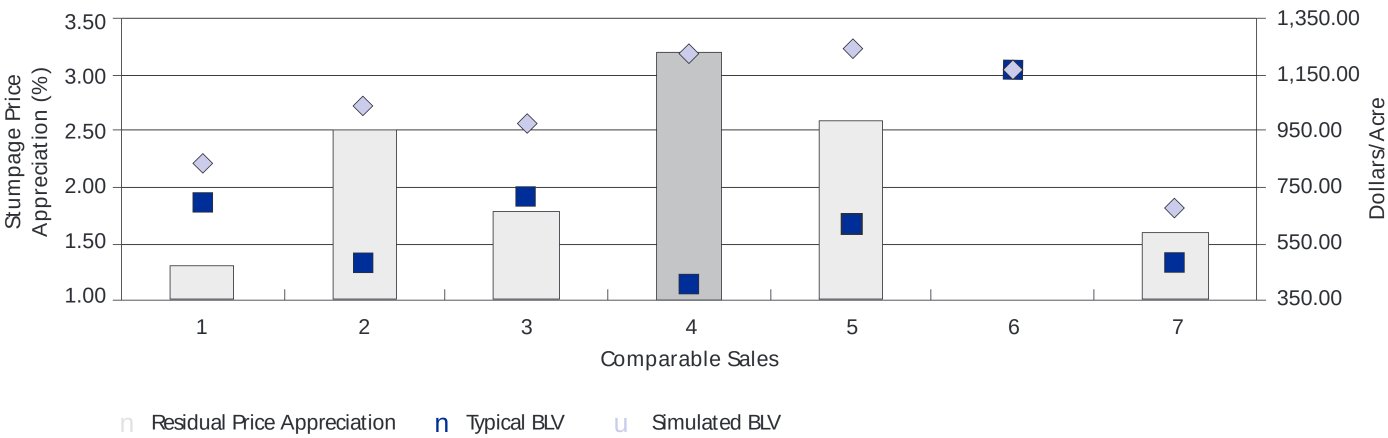
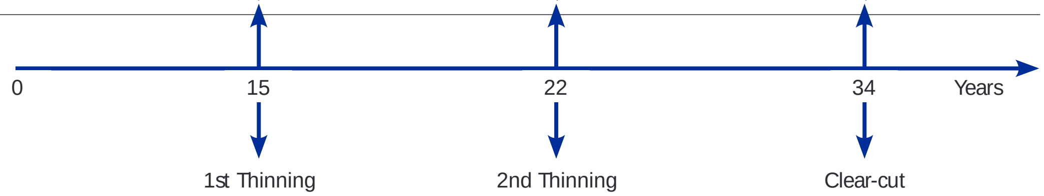


Exhibit 7 Future Stumpage Price Calculation and Timeline

Product*	Stumpage Prices	Typical BLV – (1% appreciation)	Simulated BLV at ALV Level – (3.2% appreciation)
PST	$25.75/ton	$\$25.75\ (1+0.01)^{34} =$ $36.12/ton	$\$25.75\ (1+0.032)^{34} =$ $75.14/ton
CNS	$13.75/ton	$\$13.75\ (1+0.01)^{22} =$ $17.11/ton	$\$13.75\ (1+0.032)^{22} =$ $27.50/ton
PPW	$8.25/ton	$\$8.25\ (1+0.01)^{15} =$ $9.58/ton	$\$8.25\ (1+0.032)^{15} =$ $13.23/ton
BLV	PPW = $9.58/ton	CNS = $17.11/ton	PST = $36.17/ton
Simulated BLV	PPW = $13.23/ton	CNS = $27.50/ton	PST = $75.14/ton



* PST—Pine saw timber; CNS—Pine chip-n-saw; PPW—Pine pulpwood.

Conclusion

Comparable Sale 4, using the income approach, suggests that buyers would set the discount rate to 3.35%, model the productivity of the tract at site index 96, or expect stumpage prices to appreciate by 3.20% annually (or some combination of the three) in the BLV computation in order to break even on the property based on the ALV in the sales comparison approach. The other comparable sales produced different parameter values, but the magnitude of differences between the resulting elasticities tended to be very close between the seven comparable sales. The analysis indicates that a 36% adjustment in discount rate, a 43% adjustment in site index, and a 220% adjustment to account for the approximately 200% increase in BLV would be necessary to obtain minimal LVDs. These correspond to elasticities of -5.6, 4.6, and 0.9, respectively.

The study results show that relatively small adjustments made to key variables in the income approach could influence BLV. The analysis found that BLV is most sensitive to adjustments in site index and discount rate, and less sensitive to assumptions on stumpage price appreciation. Since the site index is the basic productivity of the soil to produce timber, one would expect it to drive BLV as the "engine" that produces the timber revenue stream. Timberland appraisers would likely expect the discount rate to influence BLV in the income approach. However, the study found that site index was not only a driver of forest productivity, but also a main driver of BLV in the income approach. Stumpage price appreciation is probably the hardest assumption to make in modelling BLV and, fortunately, it has the least impact on LVD. Additional research on after-tax BLV could be applied to examine if the tax benefits that are consumed under a TIMO and REIT structure would assist in mitigating the LVD issue. Research around the impact of investment horizons and property holding periods for TIMOs and REITs on timberland values also could be investigated.

This discussion has focused on the different land values that often result when using the sales comparison and income approaches in timberland valuation. It should be emphasized that the recognized income approach in this situation is

BLV, or the value of bare timberland used for perpetual timber production. This does nothing more than assign value to the dirt supporting a typical timber operation into perpetuity. The analysis essentially compared the allocated land value from sales to a typical bare land value. This involved a comparison of the two approaches, recognizing that the income approach was a BLV—an important assumption and the regular one typical in forestry valuation. The analysis allowed for determination of the factors that typically impact the income approach and cause differences between the results in the two approaches. These findings will allow the appraiser to better understand what creates LVD and the importance of various factors in the adjustment process when valuing large timberland properties with the inherent differences described in this study.

About the Authors

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Additional Resources

Suggested by the Y. T. and Louise Lee Lum Library

American Society of Farm Managers and Rural Appraisers, Resources
http://asfmra.org/resources

American Tree Farm System, State Tree Farm Programs and Information
https://www.treefarmsystem.org/state-tree-farm-programs

Forest History Society, Library and Archives
https://foresthistory.org/research-explore/

Forest Landowners Association, Markets and Forecasts
https://www.forestlandowners.com/markets

Nareit, Timberland REITS
https://www.reit.com/what-reit/reit-sectors/timberland-reits

Purdue University, Forestry and Natural Resources
https://ag.purdue.edu/stories/category/forestry-natural-resources/

Realtors Land Institute, Basics of Timberland Investing
https://www.rliland.com/the-basics-of-timberland-investing

Sewell Company, Timberland Report
http://www.sewall.com/about/newsinfo/digital-library/newsletters.php

Southern Regional Extension Forestry, Resource Publications
https://sref.info/resources/publications/

Texas A&M Forest Service
- Texas Forest Information Portal
  http://texasforestinfo.tamu.edu/
- Selected Service Providers
  http://bit.ly/TexasForestProviders

CONTINUED >

Additional Resources (continued)

University Extension Services (representative listing)

- Colorado State University
  https://extension.colostate.edu/
- Clemson University
  https://www.clemson.edu/extension/
- Mississippi State University
  https://extension.msstate.edu/natural-resources/forestry
- North Carolina State University
  https://forestry.ces.ncsu.edu/
- Oregon State University
  http://extensionweb.forestry.oregonstate.edu/
- University of Idaho
  https://www.uidaho.edu/extension/forestry
- University of Illinois
  https://m.extension.illinois.edu/forestry/timber_harvest/timber_marketing_and_sales.cfm
- University of Kentucky
  https://forestry.ca.uky.edu/extension-home
- University of Minnesota
  https://extension.umn.edu/forestry/agroforestry
- University of Tennessee-Knoxville
  https://trace.tennessee.edu/utk_agexfores/

US Department of Agriculture, US Forest Service

- Landowner Resources
  https://www.fs.fed.us/managing-land/private-land
- North Central Region, Web-Based Forest Management Guides
  https://www.nrs.fs.fed.us/fmg/nfmg/fm101/silv/p2_treatment.html
- Southern Research Station, Timber Price Information
  http://www.srs.fs.usda.gov/econ/timberprices/data.html