Hancock
Timberland Investor

Hancock Timber Resource Group®

First Quarter 2001

Modeling Future Price Uncertainty

Fluctuations in timber prices are a key feature of any timberland investment. First and foremost, they are a significant source of risk. For example, as we described in our 4Q1999 Timberland Investor, fluctuations in pine sawtimber stumpage prices in the U.S. South have been responsible for about two-thirds of the variability in regional timberland values.

But timber price fluctuations are also a source of value. The option value of market timing timber harvests, for example, is related directly to the magnitude of predictable variation in timber prices *(Plantinga,1998)*.

It is a relatively simple matter to measure the variability of historical timber prices over short periods (months, quarters, or even years), and then use these historical observations to develop expectations of how timber prices will fluctuate over similar periods in the future.

Timberland investors, however, are often more concerned with and affected by timber price variability over longer periods. Most closed end timberland investment funds, for example, are likely to hold timberland properties for approximately ten years. Investors in these funds are most concerned with how timber prices are likely to fluctuate over a ten-year period, and the implication of those timber price fluctuations for the performance of their fund's timberland properties.

It is much more difficult to measure the variability of historical timber prices over longer periods. For one thing, it may require a longer series of historical data than is currently available.

Instead, measures of short-term volatility are typically translated into estimates of historical long-term fluctuations. The translation from short to long term, however, depends greatly on the 'stochastic process' that is assumed to govern timber price movements. In other words, these estimates depend on whether short-term price fluctuations are assumed to represent permanent (or partially permanent) shifts in a long-term price trend, or alternatively, temporary departures from a stable long-term price path. Both sorts of assumptions are common among timberland investors.

In this article we describe two very different stochastic processes. One, called a random walk, assumes that 100 percent of any short-term timber price fluctuation represents a permanent shift in the long-term expected timber price path. The other, called mean reversion, assumes that the long-term expected timber price path is stable. We demonstrate how these two alternatives translate the same expectation of annual timber price variability into profoundly different expectations of variability over ten years. Finally, we illustrate the implications of these different expectations of long-term timber price volatility for the investment performance of a timberland property over a ten-year holding period.

Random Walks and Mean Reversion

Just as we do not know mean levels or volatilities of future timber prices, we also do not know the underlying stochastic process that determines future prices. The academic literature proffers two main approaches, mean reversion and the random walk *(Brazee and Mendelson, 1988, Haight and Holmes, 1991, Hultkrantz, 1993, Washburn and Binkley, 1990, Yin and Newman, 1996).*

Simply stated, nonstationary processes or the random walk for time series data imply that all information used to forecast a future price is housed in the current price. In other words, there is nothing to gain from analyzing past prices, for they do not help predict future prices.

Stationary processes or mean reversion, on the other hand, produce future timber price paths that fluctuate around the mean of the historical series. If a future price departs from the mean, movement in the opposite direction in a subsequent period corrects it. One could argue then, that financial gains could be realized by exploiting the underlying stochastic process, for past prices can be used to predict future prices *(Brazee and Mendelsohn 1988, Lohmander 1987).*

We use Monte Carlo simulation to illustrate the variability of southern pine sawtimber stumpage price paths under a random walk and mean reversion. In each case, we assume an expected price of $48.00 per ton with an expected annual standard deviation of 16.0 percent.

At year ten, the variability around the expected price differs widely depending on the underlying price process.

Figure A charts the simulated price paths under a random walk process. At year ten, the median price is $48.00, yet the mean price generated is $54.98, with a standard deviation of $30.43.

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Modeling Future Price Uncertainty *continued*

Under a mean reversion process, the variation around the expected price decreases dramatically. At year ten, the median price is again $48.00, yet the mean is calculated at $48.79 with a $8.02 standard deviation.

Consequences for the Anticipated Risk of a Long-term Timberland Investment

How is the return of a timberland investment altered by the underlying price process assumption? Applying these simulated price paths to a model timberland investment provides interesting results.

Our model forest consists of a fully regulated southern pine plantation in the South; implying that equal volumes of timber are harvested each year. We use *Timber Mart-South*'s Alabama statewide average prices, adjusted for inflation, as the current and historical timber price series. Our expectations of future timber prices used in the model assume zero real price appreciation.

We simulate future timber prices under both underlying price processes (the random walk and mean reversion) and evaluate the financial performance under each.

The result shows that the uncertainty in future prices greatly affects the variability of the expected return over a ten-year period.

Figure C displays the mean, median and standard deviation of real returns over a ten-year period following 50,000 computer simulations under both price processes.

If a random walk is the underlying process governing future timber prices, the standard deviation of the annualized ten-year return is 5.1 percent.

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Figure A. Simulated Pine Sawtimber Prices under a Random Walk Process

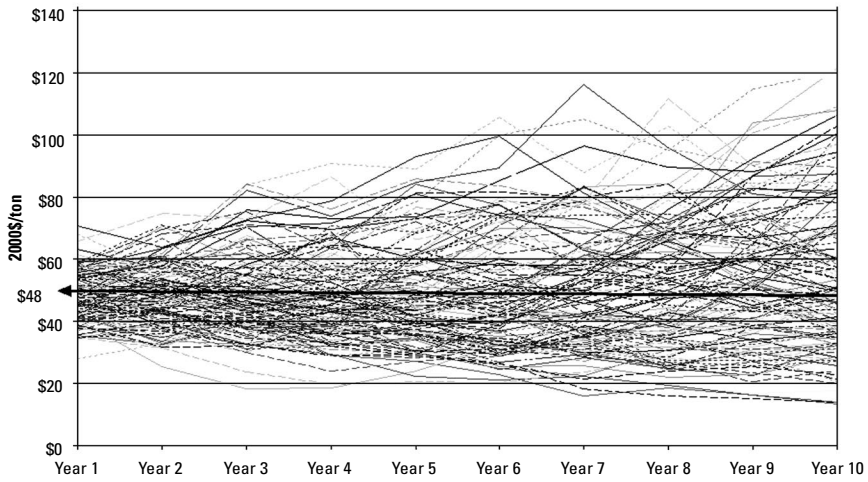

Figure B. Simulated Pine Sawtimber Prices under a Mean Reversion Process

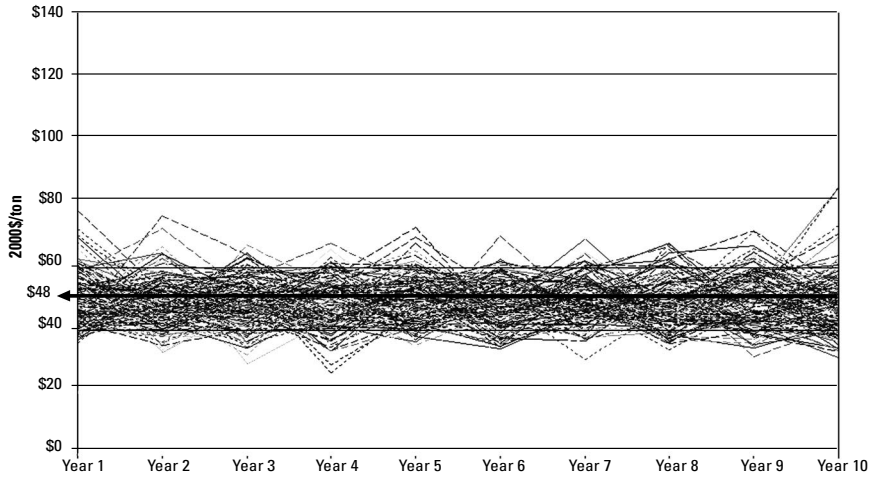

Figure C. Simulated Annual Return

	RANDOM WALK			MEAN REVERSION		
	Mean	Median	Standard Deviation	Mean	Median	Standard Deviation
Year 10	8.3%	7.8%	5.1%	7.8%	7.8%	0.8%

Quarterly Average Regional Composite Prices: Softwood Sawtimber Stumpage

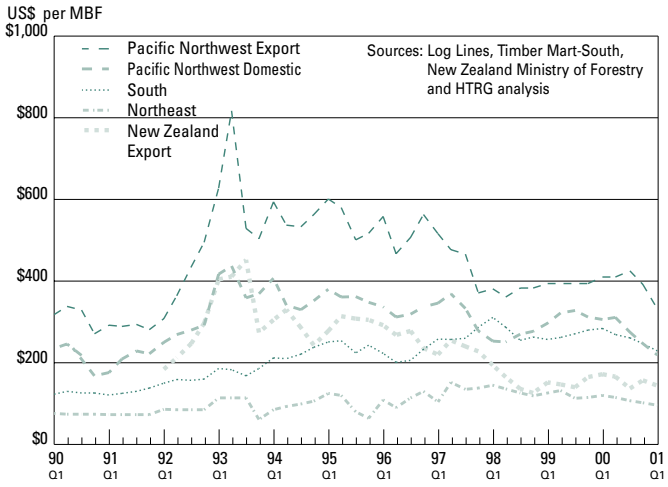

Figure 1. Regional Softwood Sawtimber Stumpage Prices

Softwood stumpage prices continued to slide in all regions first quarter, for both domestic and export markets. The Pacific Northwest was hit particularly hard, with stumpage prices for domestic grades dropping below southern pine stumpage – a shift not seen since early 1998.

Quarterly Average Regional Composite Prices: Softwood Pulpwood Stumpage

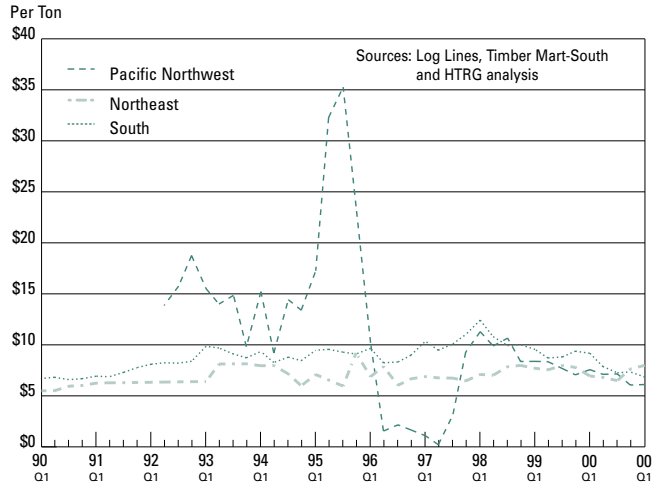

Figure 2. Regional Softwood Pulpwood Stumpage Prices

Regional prices for pulpwood continued to fair poorly. In the South, persistent dry weather and continued salvage efforts from last year's beetle problems combined with slack pulp and paper demand pulling first quarter prices down to an inflation-adjusted low for the decade.

Regional Timberland Values

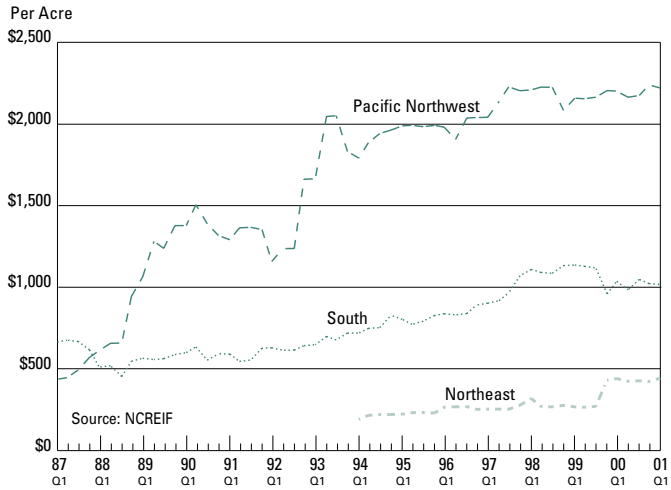

Figure 3. Timberland Prices

As timberland appraisals most often occur in the second and fourth quarters of the year, first quarter timberland values should be used with some caution. With this in mind, first quarter numbers show the anticipated downturn in Pacific Northwest timberland values beginning to materialize. After several quarters of appreciation in timberland values despite continued downward pressure in stumpage markets, values finally shifted down by $20 per acre on average. Further pressure on the region is expected as timberland values adjust to lower-valued stumpage.

Timberland Enterprise Value per Southern Equivalent Acre

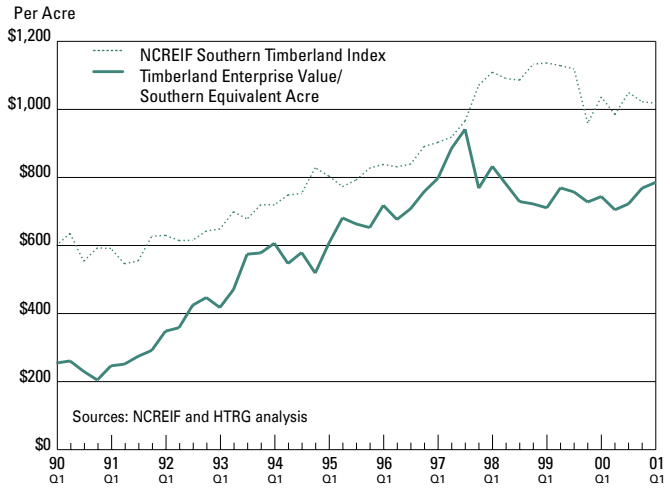

Figure 4. Public Market Timberland Value

Recent gains in lumber markets translated to gains in public timberland values, as the sample of companies in the Timberland Enterprise Value per Southern Equivalent Acre Index is heavily weighted toward wood products producers. Private timberland values moved sideways first quarter.

EBITDDA Multiples for Privately Traded Timberland

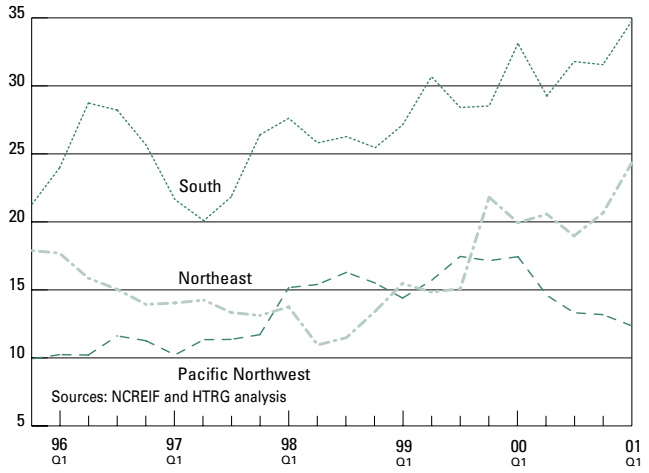

Figure 5. Timberland Pricing Multiples

The first quarter pricing multiple in the South rose as stumpage prices continued to fall at a greater speed than timberland values. The 'pricey-ness' may be falling out of Pacific Northwest timberland as values start to reflect the downfall in stumpage markets.

Timberland Investment Performance

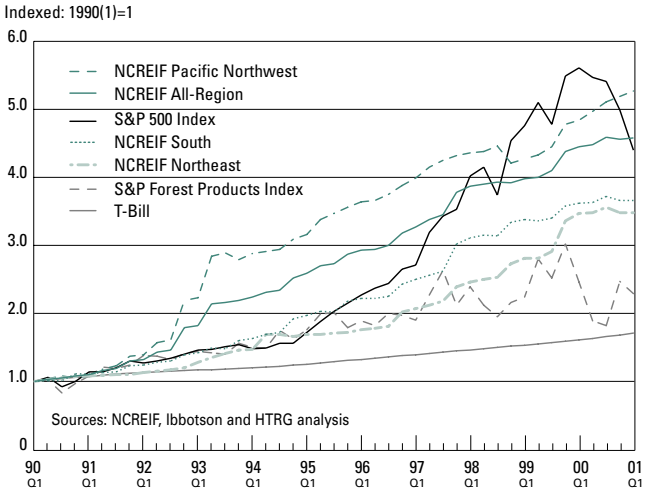

Figure 6. Timberland Returns (1990-2001)

Private timberland returns moved sideways in most regional markets first quarter, with positive income returns in the Pacific Northwest driving the All-Region total return up twenty basis points over last quarter. In contrast, public markets, as measured by the S&P Forest Products Index, lost half of last quarter's gain.

Timberland Investment Performance

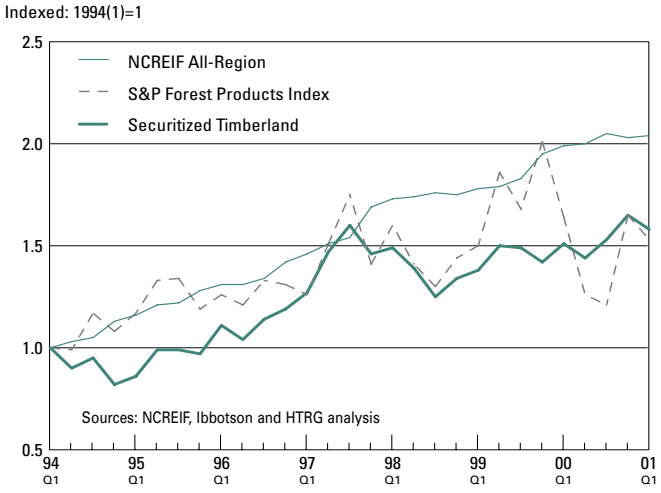

Figure 7. Timberland Returns (1994-2001)

As private markets moved steadily forward, public markets slipped first quarter, loosing a portion of the gains realized in the latter half of last year.

Securitized Timberland Performance

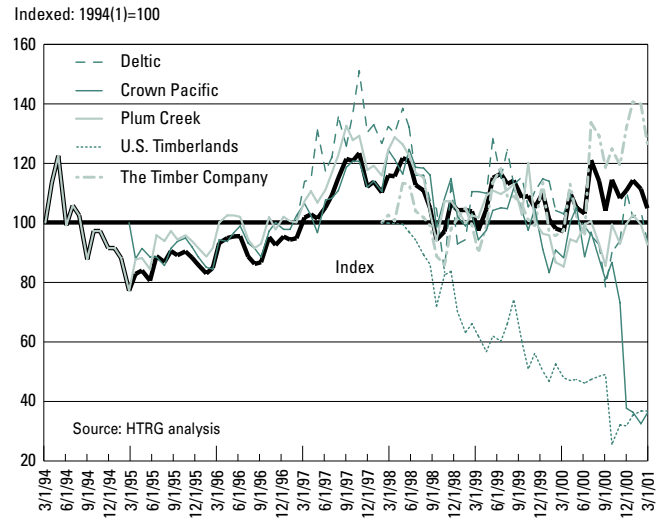

Figure 8. Hancock Securitized Timberland Index

Weak timber markets weighed heavily on several companies' stock prices first quarter. U.S. Timberlands, continuing its indefinite suspension of quarterly distributions to shareholders, reported an 80 percent decline in cash flow first quarter. Crown Pacific, also suspending quarterly distributions, continues to defer harvests from fee lands, resulting in timberland revenues down 35 percent over last quarter. Plum Creek and Deltic on the other hand, offset declines in timber markets by the sale of non-strategic timberlands first quarter – raising stock prices. The combined result was a slight drop in the Securitized Timber Index first quarter as compared to last quarter.

Modeling Future Price Uncertainty *continued from page 2*

If on the other hand, timber prices follow mean reversion, the standard deviation is only 0.8 percent.

Conclusion:

Timberland investment analysts make alternative assumptions about how short-term timber price volatility translates into longer-term volatility. This can lead to profoundly different conclusions about the implication of timber price fluctuations for the value and performance of timberland investments.

The challenge of correctly modeling the underlying process that governs future timber price movements complicates the inherently uncertain task of long-term price forecasting.

We leave the identification of the 'right' assumption for another day.

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This piece is taken from a larger report entitled *Stochastic Simulation in Timberland Investment Analysis.* Let us know if you would like a copy.

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NOTES:

Figure 1. The composite price for southern sawtimber is based on quarterly average Timber Mart-South published prices for pine sawtimber and chip-n-saw stumpage. Pacific Northwest prices are derived from quarterly average Log Lines published prices for whitewoods and Douglas-fir with internal analysis of logging costs for stumpage calculations. New Zealand export prices are based on New Zealand Ministry of Forestry quarterly average published prices for Radiata unpruned A, J and K sort export logs with internal analysis of logging costs for stumpage calculations. Northeast sawtimber prices are calculated from internal analysis.

Figure 2. Pulpwood composite prices are derived from quarterly average Timber Mart-South published prices for southern pine pulp wood stumpage, Log Lines published whitewood and Douglas-fir pulp logs with internal analysis of logging costs for the Pacific Northwest, and HTRG analysis of Spruce/Fir pulpwood in the Northeast.

Figure 3. Regional NCREIF timberland market value per acre is derived by dividing the total regional market value at quarter end by the number of acres reported in that region. Due to the small sample of property in the Pacific Northwest in 1987 Q1 and 1987 Q2, these values were back cast from 1987 Q3 with quarter-end appreciation returns. Market values for Northeast timberland were re-estimated for the period 1998Q4 through 1999Q3 to adjust for what we believe to be an anomalous property included in the NCREIF database during those quarters.

Figure 4. Timberland Enterprise Value per southern Equivalent Acre (TEV/SEA) for five timber-intensive publicly traded companies compared to southern timberland values per acre calculated from the NCREIF database. TEV is a quarterly estimate based on total enterprise value (total market equity + book value debt) less estimated value of processing facilities, other non-timber assets and non-enterprise working capital. SEV uses regional NCREIF $/acre values to translate a company's timberland holdings in various regions to the area of southern timberland that would have an equivalent market value.

Figure 5. EBITDDA multiples are calculated using NCREIF timberland value per acre at quarter end divided by a trailing four-quarter average NCREIF net income per acre.

Figure 6. Total quarter-end returns to timberland based on the NCREIF database. Northeast returns prior to 1994 are based on the John Hancock Timber Index. Additional adjustments were made to return calculations in the Northeast for the period 1998 Q4 through 1999Q3 to adjust for what we believe to be an anomalous property included in the NCREIF database during those quarters. This re-calculation in the Northeast results in a re-calculated All-Region NCREIF return series during the same period. Ibbotson Assoc. database was used for S&P 500, U.S. T-Bill and S&P Forest Products quarter-end returns (dividends reinvested).

Figure 7. Total quarter-end returns to securitized timberland based on internal analysis. The Securitized Timberland Index includes Plum Creek (PCL), Crown Pacific (CRO), U.S. Timberlands (TIMBZ), Deltic (DEL) and The Timber Company (TGP) (dividends reinvested).

Figure 8. The HSTI uses a base-weighted aggregate methodology (similar to that used to construct the S&P 500) to calculate a market capitalization-weighted value for five publicly traded timber-intensive forest products companies. Base weights were readjusted for the emergence of new companies or at the beginning of each year. Dividends are not reinvested.

References to expected investment performance in this newsletter are based on historical information and are not to be interpreted as guarantees of future results.