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TIMBERLAND RETURN DRIVERS:

A FRESH LOOK USING EMPIRICAL DATA

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Introduction

There is widespread consensus that biological growth accounts for most of a timberland investment's return

One of the first things investors learn about the timberland asset class is that it offers three primary sources of investment return: (1) biological growth; (2) timber price appreciation; and, (3) land price appreciation. If we set aside alternative and ancillary sources of income, these are the core drivers of performance within an institutional timberland portfolio today.

Interestingly, there is little debate among experts operating within the sector about the relative importance of these return divers. Furthermore, there is widespread consensus that biological growth accounts for most of a timberland investment's return; that timber price growth is the second most important factor in asset performance; and, that land value increases are responsible for a relatively modest percentage of total return. The foundation for this thesis was a seminal research paper published in 1998 by Jon Caulfield entitled, "Timberland Return Drivers and Investing Styles for an Asset That Has Come of Age." This article, which was published in the journal, Real Estate Finance, modeled a hypothetical southern pine plantation. According to the author, 60.5 percent of the asset's total return was attributable to biological growth; 33.3 percent was attributable to rising timber markets; and, 6.2 percent was derived from adjustments in land values (Figure 1).

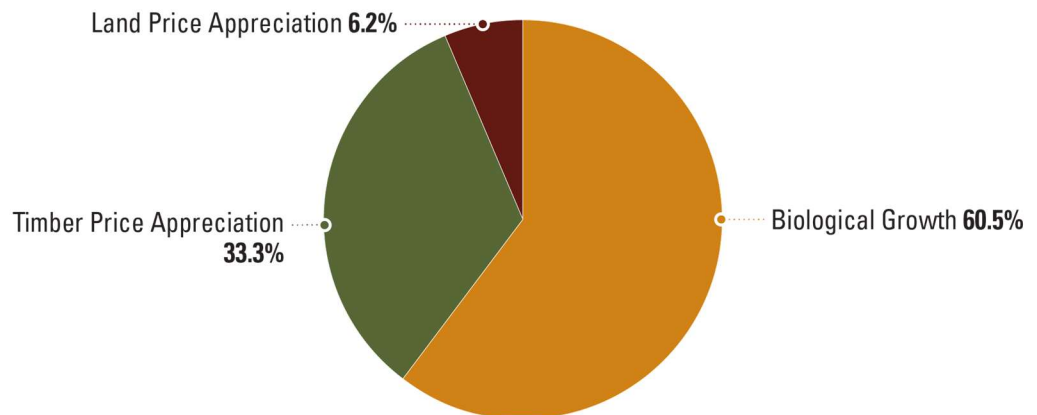## Contributions of Timberland Return as Calculated by Caulfield, 1998

Figure 1. The contributions of return for a timberland investment as modeled by Caulfield, 1998. The results were drawn from a hypothetical 10-year-old southern pine plantation that was held for 15 years.

In subsequent years, the results of Caulfield's work were largely adopted and reaffirmed by the timberland investment community and many asset class-related marketing and research materials still in circulation today align closely with his analysis (see Table 1).

Table 1. Sample of expected return attributions of timberland investments as presented in marketing materials of various timberland investment management organizations (TIMOs).

Contribution of Timberland Investment Return

Source of Marketing Material	Biological Growth	Timber Price Appreciation	Land Value Appreciation	Other /Ancillary Income
Atlanta, GA based TIMO	57%	25%	17%	
Europe-Based TIMO	50%	20%	10%	20%
Brazil-Based TIMO	65%-75%	25%-35%	2%-5%	

The question that should be of most interest to timberland investors today, however, is whether these long and widely-held return assumptions are actually reflected in the realized returns of timberland investments over time. This paper tackles that question using an empirical approach. Historical data derived from the National Council of Real Estate Investment Fiduciaries (NCREIF) Timberland Property Index was used to separate the components of return produced by biological growth, timber prices and land prices. This de-construction of return drivers enables us to evaluate the degree to which reality conforms with accepted theory.

Deriving Return Attribution from NCREIF Data

An ideal approach for analyzing the asset class' relative return drivers would entail aggregating the performance metrics generated by a large number of timberland portfolios that have been professionally managed by timberland investment management organizations (TIMOs). Unfortunately, this kind of information is unavailable so the best alternative is to use the NCREIF Timberland Property Index.

TIMOs that are contributing members of NCREIF provide the organization with key investment metrics from the timberland properties that they manage on behalf of their clients. These data, which are submitted both quarterly and annually, include total returns, EBITDDA returns (i.e., income return), and appreciation returns (i.e., capital gains). Unlocking the return attribution characteristics of the asset class entails conducting regression analyses of timberland returns against established and reliable market metrics, such as timber prices.

Regression analysis entails first obtaining an r-squared (R^2) value, which is a measure of how well independent variables (e.g., timber prices) explain the value of a dependent variable (e.g., timberland returns). An r-square value can run from 0 to 1. In the case of our analysis, an r-square value of zero (0) would mean that regardless of how timber prices changed, they would have no effect on timberland returns in any given year. An r-square value of 0.5, however, would mean that half of the return that the asset class produced in that year could be explained by changing timber prices. This would mean that one could safely conclude the remaining half of those returns could be attributable to some combination of other factors, including biological growth or changes in underlying land values.

Choice of Study Period and Geography

For purposes of this white paper, our analysis concentrated on annual timberland returns generated over a 25-year period from 1991 through 2015. The NCREIF Timberland Property Index actually tracks returns back to 1987, but the sample size of the data that is available prior to 1991 falls well below $1 billion in net asset value (NAV), which makes that component of the total data set too small to be representative of the asset class.

Over our 25-year study period, we aggregated the quarterly NCREIF returns into annual returns. We chose annual returns because full-property valuations for timberland are typically performed only once a year. Given the 1991-to-2015 span, the resulting 25 data points (or "observations" in statistics parlance) were deemed sufficient to perform regressions capable of producing statistically meaningful results.

With respect to geographic focus, we chose to concentrate our analysis on the two regions of the United States that are best represented in the NCREIF Timberland Property Index: the U.S. South and U.S. Pacific Northwest. Historical timber market pricing data for these two regions is reliable and readily available, but the South and Pacific Northwest have very different commercial tree species, wood product specifications, and log market dynamics so we chose to segregate our analyses of the two regions. It is important to note that the NCREIF Timberland Property Index also includes performance metrics for the U.S. Northeast and U.S. Lake States. However, timber pricing data for these two regions is lacking so they were excluded from our work.

Results

There is an inherent level of imprecision associated with relying on linear regression to calculate the return attribution of timberland investments. All statistical methods suffer from this limitation so the results shown below should be considered approximate rather than precise determinations of the relative impacts of the

studied return drivers. With that understanding, the pie charts in Figures 2a and 2b below show the results of our analysis – attributions of total timberland investment returns in the U.S. Pacific Northwest and U.S. South during the period from 1991 to 2015

Contributions of Timberland Returns in the U.S. Pacific Northwest (1991–2015)

Land Price Appreciation **25.2%**

Timber Price Appreciation **44.7%**

Biological Growth **30.1%**

Contributions of Timberland Returns in the U.S.South (1991–2015)

Timber Price Appreciation **39.6%**

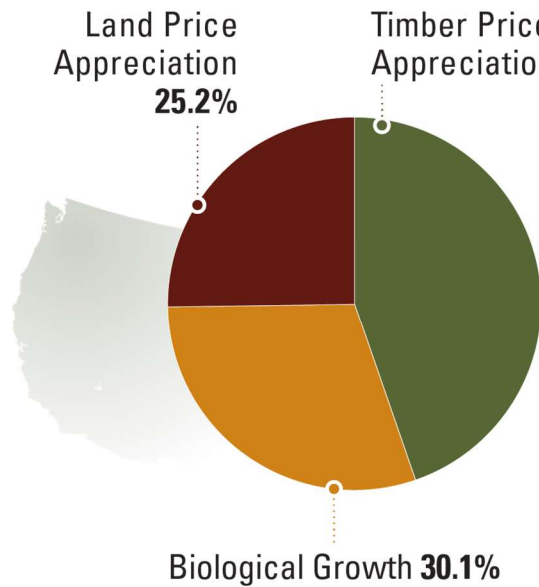Land Price Appreciation **40.7%**

Biological Growth **19.7%**

Figure 2a. The calculated share of the three main drivers of timberland investment returns for the U.S. Pacific Northwest, derived from NCREIF Timberland Property Index performance data from 1991 through 2015.
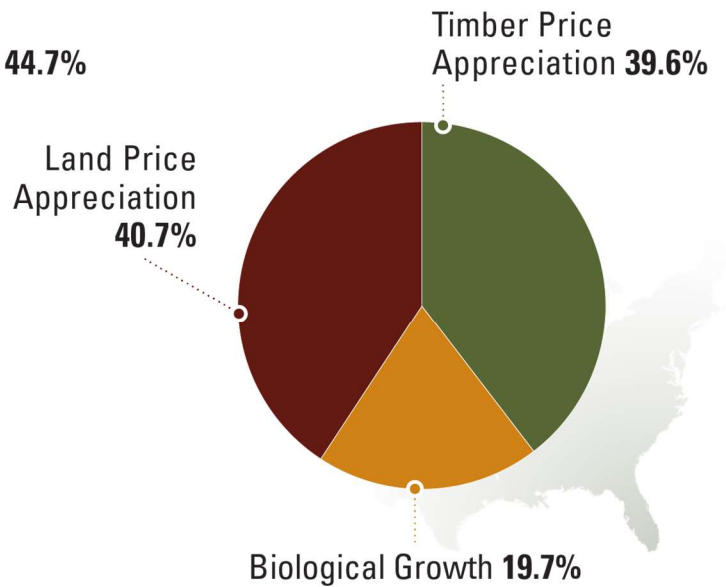
Figure 2b. The calculated share of the three main drivers of timberland investment returns for the U.S. South, derived from NCREIF Timberland Property Index performance data from 1991 through 2015.

Discussion of Findings

Two features stand out from the results of our analysis. First, it is clear in Figures 2a and 2b that during the study period biological growth actually contributed a much smaller percentage of the asset class's total return than may have been commonly assumed. Instead of accounting for most of the performance, biological growth actually contributed less than one-third of total U.S. timberland investment performance during those 25 years. The second notable feature is that there was significant regional variation. In the U.S. South, land price appreciation was the leading source of return between 1991 and 2015 (Figure 2b). In contrast, timber price appreciation drove timberland investment returns in the Pacific Northwest to a greater degree than was the case in the U.S. South (Figure 2a).

During the study period biological growth actually contributed a much smaller percentage of the asset class's total return than may have been commonly assumed

Both of these differences can be explained, in large part, by the prevailing conditions under which investors placed capital and held assets in the timberland sector from the early 1990s to the present. Trees in the two regions did not grow more slowly than expected during that span of time. In fact, in the last 25 years, advances in forest science and biometrics further validated timber growth rates in both regions. What was different was the behavior of regional timber and land markets, which performed in ways that Caulfield and others may not have expected because of evolving macro-economic trends.

Land Appreciation Drove Returns in the South

In the case of the U.S. South, according to NCREIF (Figure 3), timberland values, on average, rose from $535 an acre at the end of 1990 to $1,781 an acre at the end of 2015, a 330 percent gain. To put it into perspective, over that same 25-year period, the global price of corn rose only 60 percent, copper 87 percent, and crude oil (West Texas Intermediate) 36 percent. During that time, timber prices in the region were relatively unchanged. In 1991, the South-wide average price of pine sawtimber stood at $19.33 a ton. By the end of 2015, 25 years later, the price of sawtimber was only $24.94 a ton. In other words, most of the appreciation in timberland values in the South did not come from timber price increases but from increases in underlying land values.

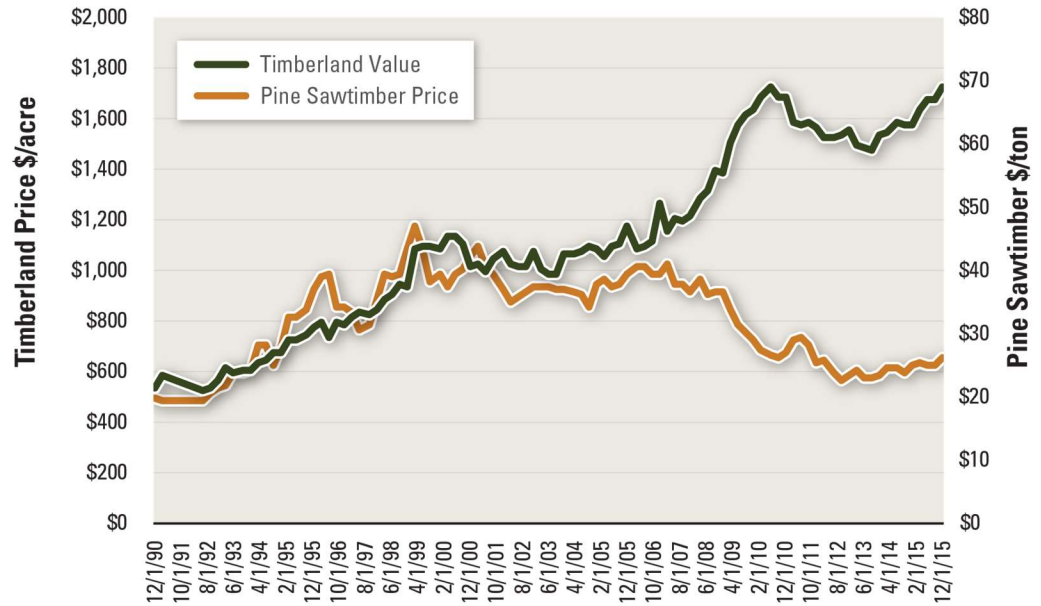## Average Price of Timberland and Pine Sawtimber in the U.S. South, 1991–2015

Figure 3. Market value of timberland and southern pine sawtimber in the U.S. South as tracked NCREIF Timberland Property Index for the former and Timber Mart-South for the latter. All prices are nominal.

There are a number of factors that help explain why southern forestland experienced strong price appreciation. First, southern pine plantations have become more productive, having benefited from significant advances in forest technology, silviculture, and tree genetics. Land is more valuable when it can grow a commercial crop of timber more quickly and produce higher quality trees. A second factor is the fall of the discount rate used to value timberland. Over the past three decades, southern timberland markets have matured and become more transparent. To illustrate this point, in the year 2000, $680 million of large timberland properties changed hands in the South. By 2015, total timberland transactions reached $1.7 billion. This market maturity has helped reduce the risk premium investors demand to place capital in the region. A third, but equally important, factor is the demographic and economic growth of the South, which has stimulated and sustained land use changes across much of the regional landscape, especially in the South's more rural areas. During the last 25 years, timberland assets located near expanding metropolitan centers have dramatically increased in value because they have been in greater demand for development, conservation, public recreation and other higher and betters uses (HBU).

Unlike in the South, timber price acceleration was the leading source of returns in the Northwest

Timber Prices Drove Returns in the Pacific Northwest

Like the South, the Pacific Northwest also enjoyed strong timberland appreciation during the last 25 years. In fact, land appreciation accounted for one-fourth of the total return generated in the region. However, unlike in the South, timber price acceleration was the leading source of returns in the Northwest. This was not surprising because, historically, the value of standing timber on a given acre of timberland in the Pacific Northwest normally has been two to three times higher than in the South. This is because trees in commercial forests in the Pacific Northwest commonly grow to much larger sizes – in both height and diameter – than in the South. This leads to higher per-acre land values. Furthermore, timber markets in the West enjoyed stronger market conditions during parts of our study period. For instance, during the most recent cycle, and specifically following the 2008 recession, timber prices in the Pacific Northwest increased dramatically in response to strong export demand from China (Figure 4). By comparison, southern softwood sawtimber markets experienced flat demand and pricing over that same period. This was due to the fact that the South, unlike the Pacific Northwest, lacks easy access to Asian export markets like China. The South's wood demand is largely derived from domestic markets, which suffered from a weak U.S. housing market following the recession.

Comparative Softwood Sawtimber Prices
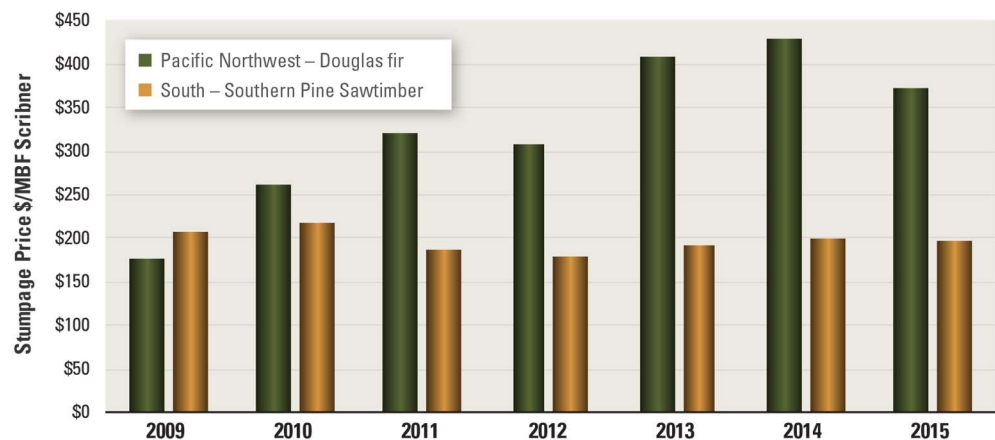in the Pacific Northwest and South

Figure 4. Average stumpage prices for Douglas fir sawtimber grown in the Pacific Northwest and southern pine sawtimber grown in the South from 2009 to 2015. Source: RISI

For timberland investors, these factors bring to mind the old investment adage, "past performance does not assure future results." To be more specific, in the context of

our analysis, the macro-economic and market trends that caused land values and timber prices to drive timberland investment performance in the U.S. South and U.S. Pacific Northwest, respectively, in recent years may not continue to influence the performance of these regional markets to the same degree in the future. For instance, forest industry research groups like RISI, Forisk and Forest Economic Advisors believe that the 47 percent discount rate that southern pine sawtimber enjoyed in 2015 against Pacific Northwest Douglas fir is unsustainable. Over the next several years, as the U.S. housing market continues to recover, these market analysts expect the ongoing influx of new sawmill capacity in the South will cause southern pine sawtimber prices to increase at a faster rate than will Douglas fir sawtimber prices in the Pacific Northwest. If this assessment proves correct, investors can expect that greater percentages of the total returns generated by their southern timberland assets will be attributable to price appreciation than will be the case for timberland assets they may hold in the Pacific Northwest. This would, in effect, represent a reversal of the trend that has been recently reflected in the NCREIF data.

It is important to note that caution must be employed when attempting to extrapolate the factors and trends that are driving, or that are expected to drive, U.S. timberland performance relative to the performance of other global timberland investment markets. Global markets exhibit very different return attribution profiles because of the differing species compositions of their forests and because of the unique characteristics of the markets they serve. Having said that, however, there are two, important, universal conclusions that can be drawn from the results of our empirical study of U.S. timberland returns:

1. Contrary to prevailing assumptions, market factors can have a greater impact than biological timber production potential on the financial performance of a timberland investment. Instead of providing 60 percent or more of its total return, biological growth may contribute much less of a timberland investment's total performance. In fact, in certain cases, biological growth may contribute a lower percentage of an investment's return than either or both timber price and land value appreciation.

2. The decision of where to invest, and specifically in what geographies and what markets, can have a measurable effect on how timber prices, land prices and biological growth factors influence the total performance of a timberland investment portfolio.

Conclusions and Recommendations

Our analysis and findings should not be interpreted as a refutation of Jon Caulfield's earlier work. The return attribution models that he and other researchers have used through the years have been based on very specific assumptions. Our point is that such assumptions may not always reflect the actual performance and real world

behavior of timberland investment markets and that this can influence the results that ultimately are produced.

To that point, one key conclusion of our analysis is that because of the diverse characteristics of timberland investments, one should not blindly accept the notion that a forest's biological growth potential will be its primary return driver. An over-reliance on this widely accepted paradigm is, in fact, reflective of a passive approach to timberland investment and portfolio construction. This is because it implies that other critical and proven factors of timberland investment success, such as manager selection, investment strategy, portfolio diversification and regional market exposure, are of relatively lesser importance. In fact, the findings in this white paper strongly suggest otherwise. The divergent return attribution profiles of the U.S. Pacific Northwest and the U.S. South clearly indicate that the decision to seek exposure within, or to avoid, certain geographies and markets, can have a long-term effect on the performance of an institutional timberland portfolio.

Because of the diverse characteristics of timberland investments, one should not blindly accept the notion that a forest's biological growth potential will be its primary return driver

Based on this assessment, TIR recommends that investors employ a proactive approach to developing and managing their timberland portfolios, which means embracing the following principles:

- **Never Assume a Stable Market Environment:** A timberland investment will rarely achieve "average" or "typical" performance as it is defined in the context of an investment pro forma. Consequently, it is important for investors to understand and anticipate macro-economic trends as well as regional market developments so they can adjust their investment strategies accordingly. For instance, timberland assets that are located in areas that have strong demographic growth potential might expect changing land-use dynamics to have an impact on future forestland values. On a macro level, shifts in interest rates can impact the discount rates used in the timberland market, causing forest asset values to rise or fall independent of biological growth rates or timber prices.

- **Diversification is Important:** Biology is largely predictable. There are decades of forest science behind most of the assumptions TIMOs make about the timber productivity potential of an asset. Timber markets, however, are far less certain and predictable and, as our attribution analysis demonstrated, their behavior can have a dramatic and significant impact on timberland returns and their composition. Investors should manage their market-related risk exposure within a timberland portfolio by diversifying their holdings by geography, forest maturity, product output characteristics, and vintage year.

- **Manager Selection is Important:** Most competent timberland investment managers know how to grow trees. However, if biological tree growth was

the primary or most important driver of timberland investment performance there would be little difference between the returns TIMOs have generated – and that is simply not the case. According to NCREIF, the divergence in performance between the top quartile (75th percentile) and bottom quartile (25th percentile) of TIMOs exceeds 400 basis points of total return over five years and 500 basis points over 10 years (as of Q1 of 2016). In other words, TIMOs are not equally adept at understanding, anticipating and exploiting market inefficiencies in the timberland investment sector. Therefore, selecting the right manager for your timberland portfolio is a key consideration if your objective is generating superior risk-adjusted returns.

Appendix: Methodology

1. **Organize Timberland Return Data:**
   Create annualized returns from NCREIF Timberland Property Index for (a) total return; (b) EBITDDDA Return (i.e., income return); and (c) Appreciation Return (i.e., capital gains). The NCREIF Returns are segregated into two regions: the Pacific Northwest and the South. Select values from the 25-year period spanning from 1991 through 2015.

2. **Obtain Contribution of Timber Prices to Total Return through Regression:**
   Perform a regression of NCREIF total return against the annual appreciation rates of timber prices. The regression provides an adjusted r-square, which shows how much of the total return is explained by timber prices. The remaining unexplained return is biological growth and land prices. (This assumes that ancillary income is small enough to ignore.)

   - Timber prices for the South are a weighted average of the leading commercial timber products in the region: southern pine pulpwood (30 percent weighting), southern pine chip-n- saw (30 percent weighting), and southern pine sawtimber (40 percent weighting). Price statistics were sourced from Timber Mart-South

   - Timber prices for the Pacific Northwest are a straight average of the leading commercial timber products in the region: Douglas fir, hemlock, true firs, and ponderosa pine. Price statistics were sourced from RISI.

3. **Obtain the Contribution of Timber Prices to Appreciation Return:**
   Perform a regression of NCREIF appreciation return against the annual appreciation rates of timber prices. The regression provides an adjusted r-square, which shows how much of the total return is explained by timber prices. The remaining unexplained return is biological growth and land prices. (This assumes that ancillary income is small enough to ignore.)

4. **Find the Impact of Timber Prices on Income Return:**
   We have the contribution of timber prices (a) to total return, and (b) to attribution return. We can therefore infer the contribution of timber prices to income return by subtracting the total return share from the attribution return share.

5. **Find the Contribution of Biological Growth on Return:**
   Biological growth can add value by (a) adding to annual timberland income through harvest, or (b) adding to annual timberland appreciation by making the standing timber on the land more valuable. We can estimate the latter from the annual changes in operative timber inventory over the 1991-2015 period. These values were obtained from RISI. As a result, biological growth's contribution to income return is the remaining NCREIF income return after you subtract out the contribution of timber prices (from step #4).

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6. **Calculate the Contribution of Land Prices:**
At this point, we have the contribution of biological growth and timber prices. The contribution of land prices to total return is calculated simply by subtracting the contribution of biological growth and of timber prices to NCREIF total return. We now have all three major attributions of timberland returns for the South and the Pacific Northwest.

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