



Industry news

Ice Storm Fallout: Possibility of Dangerous Insects, Maine Entomologist Says (Jan 8th)

Insect experts are warning landowners whose trees have been damaged in this winter's ice storms to keep an eye out for the spread of wood-destroying bugs such as the Asian Longhorn Beetle.

— *Kennebec Journal*

Board of Environmental Protection Unanimously Approves New Maine Mining Rules (Jan 10th)

A 5-0 vote among the board offers a recommendation to the state legislature, but sparks opposition from environmentalists who argue the regulations do not go far enough.

— *Bangor Daily News*

Incentives Could Attract Pellet Producer to Adirondacks, Officials Say (Jan 10th)

A newly proposed program to provide financing and technical assistance for oil-to-wood home heating system conversions in New York has spurred interest from regional pellet producers.

— *Glens Falls Post Star*

Older Trees Are Growing Faster, Storing More Carbon as They Age (Jan 15th)

Several new studies demonstrate that most tree species become better carbon sinks as they mature - in contrast to the conventionally-accepted viewpoint that the opposite was true.

— *Science Daily*

Industry Overview

Forestland Operations

Well, as it turns out, the groundhog was right: we have certainly had an extended winter. After quite a few years of grouching about short winters and poor logging conditions in the early spring, it would seem we finally have no real excuse. Comparatively this has been one of the longest periods of snow and cold in recent memory. Caribou, Maine recorded 14 nights of sub-zero temperatures in March, a new record. One of our foresters told me that in some places where there is normally about 8 inches of snow this time of year, we'd find 32 inches this year.

The cold weather has had a big impact on forestry and harvest operations. Last year at this time, our harvesting equipment had already been parked for three weeks because we felt the ground was too soft to harvest without risking damage to the forest. This year, we're just starting to wind down the first week in April. Three weeks may not sound like a lot of time, but it can make all the difference in terms of the production and consumption of timber. The extended winter has been a particularly pleasant surprise to both loggers and mills considering that we saw an unusually slow start to the regional wood flow this year.



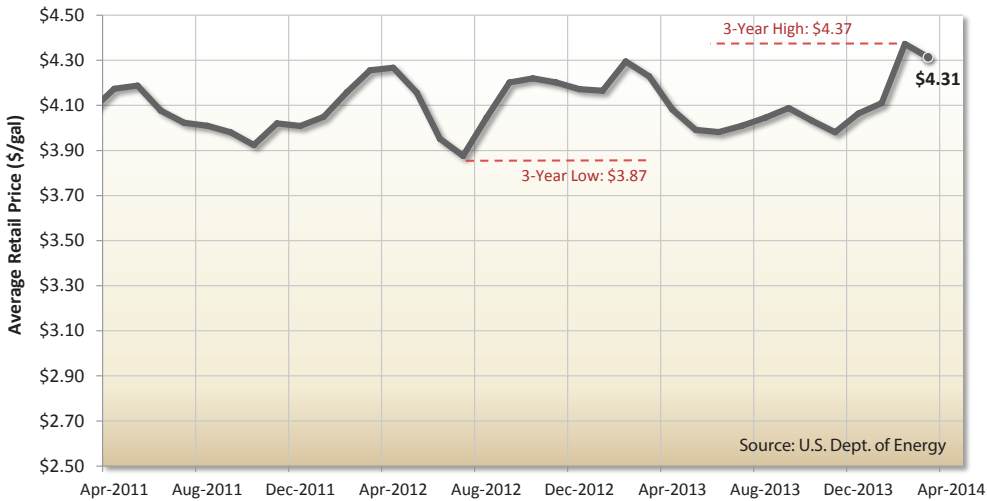
A winter haul road is opened up in early March to prepare for some trucking.

At this point, nearly everyone in the Northeast is in good shape trucking wood; in some cases we have resorted to pile downs where local conditions warrant and where we can still get to the timber once the inevitable spring thaw occurs. If the colder nights continue, we should get a few more weeks in before that happens.

The price of diesel fuel – a large component of logging costs, and therefore the net returns realized for landowners – remains relatively unchanged over the quarter (see chart below).

We did temporarily hit a new 3-year high for diesel fuel prices in New England. Diesel is a very similar product to typical home heating oil, and as a result there is always some seasonality in the prevailing market prices, but the unusually long and cold winter has brought us to another peak.

NUMBER 2 DIESEL FUEL PRICES - NEW ENGLAND
3 YEAR HISTORICAL MONTHLY AVERAGES



Our fuel premium – the price paid to loggers over and above normal contracted timber harvesting rates – was also increased in mid-February due to certain fuel index benchmarks being reached. Other than this automatic inflator, there have not been, nor do we expect there to be in the short term, any substantive changes to our overall logging rates.

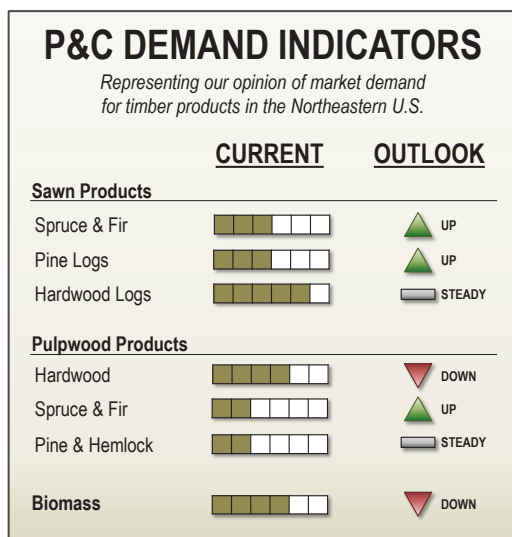
Logging capacity, however, is a growing problem and we remain concerned about the apparent lack of reinvestment in equipment as well as scarcity of new entrants in the business of logging. Case in point: we had an unusually high number of contractors experiencing mechanical breakdowns this winter. Considering the winter is where we move a large percentage of the year’s timber volume, the associated downtime was painful for loggers and landowners alike. It’s a tough business with thin margins – in many ways a “lifestyle” occupation. We’re starting to hear about more mills that are considering financing their own dedicated logging crews to ensure they have the capacity they require.

Forest Product Markets

The extended winter has left most of our timber markets flush with raw materials in the latter half of the first quarter. At this point, most mills are well-prepared for spring mud season and have started to appropriately curtail their wood buying.

Sawn Products

Considering the U.S. housing and construction markets are the largest consumers of most sawtimber products, we tend to follow housing indexes as indicators of demand. One of the most useful of these tracks the confidence that homebuilders have in their construction pipeline. Below is a chart showing a 3-year trend of this index. Regular readers of this newsletter will recognize that the pattern for homebuilder confidence almost mirrors the trend seen in the spruce/fir pricing indices published by Random Lengths.



East Millinocket Mill Halts Paper Production for a Few Months (Jan 24th)

The high costs of natural gas, electricity, and timber, as well as falling paper prices, are blamed for causing a temporary shutdown at the mill. The company has fallen behind on its payments, and is using the shutdown to re-engineer its business plan.

— *Portland Press Herald*

Northeast Mills Face Challenges (Jan 31st)

Rising energy costs and a comparatively high price of fiber cause regionally disparate cost structures for mills in the Northeast vs. the rest of the country.

— *Forest2Market Blog*

Wood Fiber Costs For Hardwood Pulp Producers Have Fallen 17% In Two Years (Feb 2nd)

Despite the rising costs in other raw materials used by pulp manufacturers, the cost of purchasing hardwood fiber has fallen in the major pulp-producing regions.

— *Forest Business Network*

Freed From Clearcut Restrictions, Maine’s Largest Landowner Says It’s Doing Better Forestry (Feb 7th)

After enrolling its lands into a voluntary management oversight program and excepting it from clear-cutting regulations, J.D. Irving believes that it is practicing better, more sustainable forest management.

— *Bangor Daily News*

Maine’s Sole Tissue Producer Faces Threats from Abroad and Closer to Home (Feb 10th)

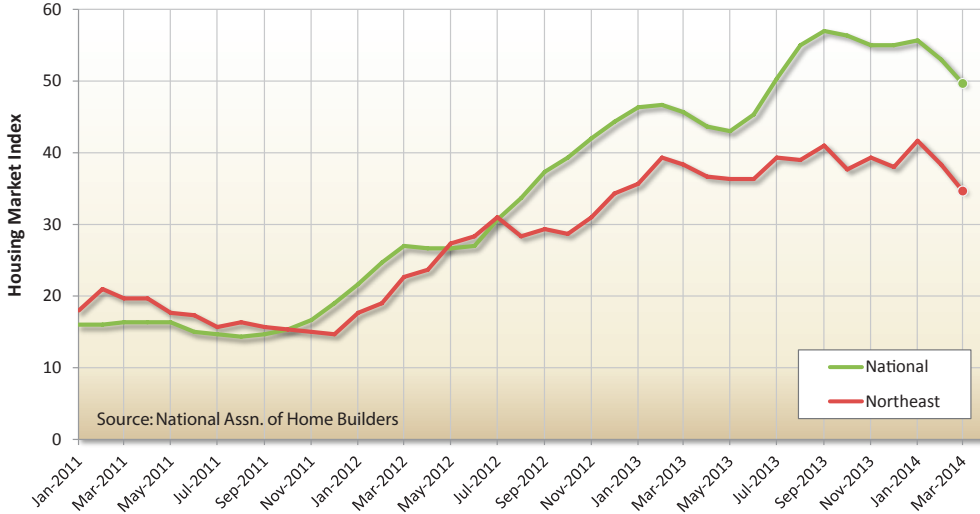
Demand for tissue products has been increasing steadily, renewing interest in the product and increasing competitive pressures for a regional manufacturer.

— *Bangor Daily News*

Increasingly positive long-term trends in the overall economy have spurred continued optimism among sawtimber buyers. We reported in a past newsletter about one analyst back in 2010 who expected dimensional lumber markets to return to normal by 2015. Depending on how you define “normal”, he may not have been far from the mark. While housing starts have a long way to go, and there will be without a doubt more bumps along the way, we’re encouraged by what we see.

HOME BUILDER CONFIDENCE INDEX

NAHB/WELLS FARGO HOUSING MARKET INDEX - 3 - MONTH MOVING AVERAGE

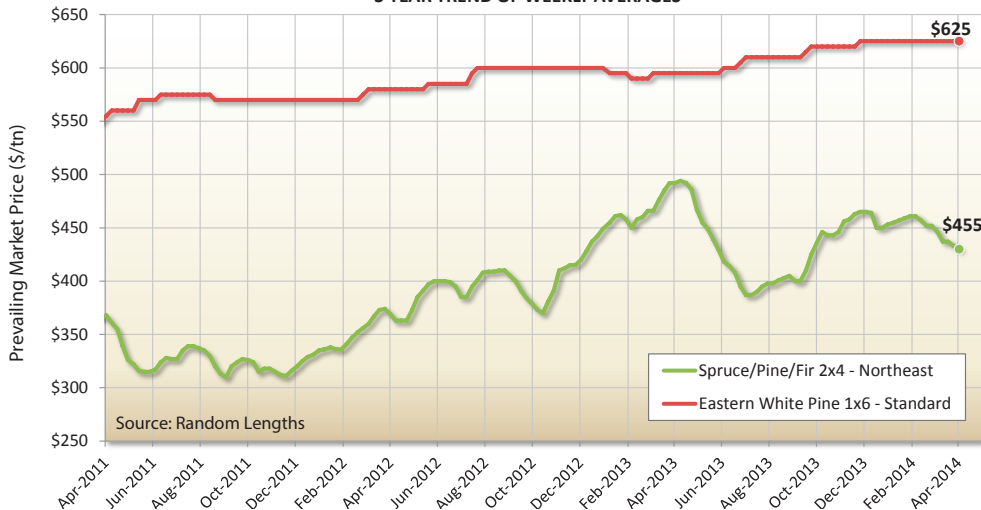


Softwood

Demand for spruce and fir sawstock started out very strong this quarter, but waned later on as mill inventories filled with winter volume. At the beginning of the winter season, we saw abnormally high demand compared to last year for the product, driven in large part, we believe, by the higher price of finished dimensional lumber. Last year when mills were in the planning process and allocating budget for their winter volume purchases, pricing was in the doldrums – and many were caught off guard by a sudden uptick during the first quarter. This year, however, prices were quite a bit higher and sawmills appear to have planned their winter well. With lumber prices where they are currently, mills in our operating regions have been generally both profitable and productive.

PRICE TRENDS IN SOFTWOOD LUMBER

3 YEAR TREND OF WEEKLY AVERAGES



Landowners Cash In On Timber They Don't Cut (Feb 16th)

Funds provided by the sale of carbon offsets are providing an incentive for certain conservation-minded landowners to leave more trees standing in the forest.

— Morning Sentinel

\$18M for Spruce Budworm Early Infestation Initiative (Feb 20th)

The Canadian government has pledged to provide funding support to help stop the spread of an insect that has already caused significant defoliation in parts of New Brunswick and Quebec.

— FarmFocus

Forest Industry Contributes \$33B to Economy in Four Northeastern States (Feb 25th)

Recent reports highlight the important economic role of forest products and forest-based recreation in four largely rural states: Maine, New Hampshire, Vermont and New York.

— Conway Daily Sun

Cate Street Changes 'whole nature' of Millinocket Pellet Plant Proposal (Mar 6th)

A change of direction in the pellet milling technology slated for the yet-to-be-built Thermogen pellet plant could mean more costs for the company - but ultimately higher production levels and more jobs for the state.

— Bangor Daily News

Maine Mill to Invest \$120M, Add 80 Jobs (Mar 13th)

Maine's struggling paper industry got a boost Wednesday when the parent company of Woodland Pulp in Baileyville said it will invest about \$120 million to install two tissue machines.

— Portland Press Herald



In the latter half of the first quarter, after 3-4 weeks of unexpected deliveries to mills, the foot came off the gas, and quickly. Wood buyers quickly changed from buying whatever they could to carefully managing the wood deliveries from their suppliers. At this point, the extended winter has left most mills in a comfortable position with their raw material inventories, and as a result we are seeing less-than-normal demand for the spruce and fir sawtimber. Landowners next quarter should expect seasonally normal weakened demand for spruce/fir high-grade markets.

However, mill production is still quite high, and once the roads open up again to hauling and the sun is shining, mill inventories will have been depleted and we expect to see demand start to tick back up.

In recent weeks, dimensional lumber price indices have started to pull back. We believe this will prove to be a short term and seasonal effect, not the beginning of a significant downturn.

Pine sawtimber markets have been on a steady progressive climb. Coming into the quarter, all signs were pointing to a strong demand outlook, and that's exactly what we saw. Most mills were fairly nervous at the beginning of the winter season and bought heavily. Their finished product markets are much better than they were a year ago – a stark contrast considering that some mills were at that time questioning whether or not they should be running at all. We responded to this demand by specifically targeting pine when it made sense. This time of year it's important to keep one foot on the throttle and one foot on the brake – and with pine this year, we found ourselves feathering the throttle more than the brake.

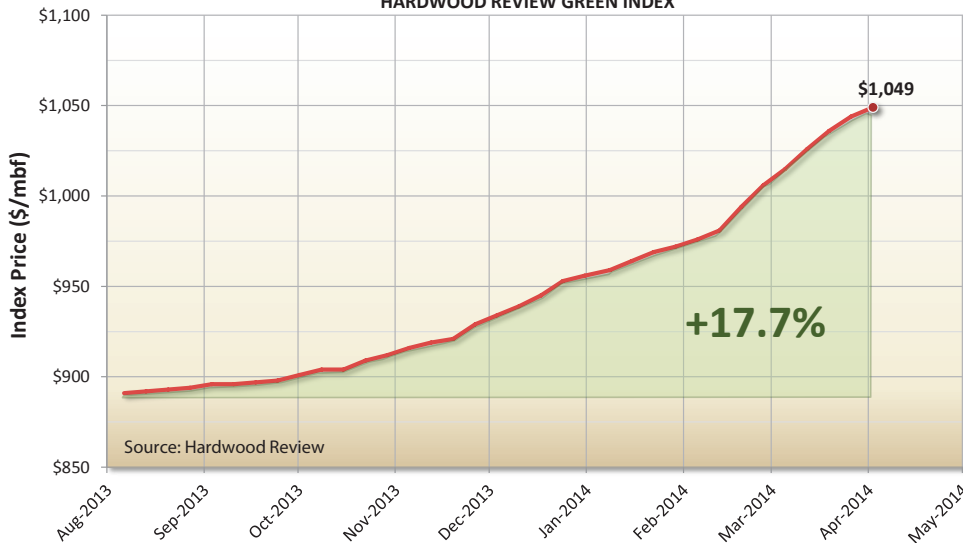
Although the level of demand surpassed our expectations, mills will be under pressure to keep inventories of pine fresh and lean coming into springtime. Pine sawtimber has the shortest shelf-life of any of the products we deliver and mills don't want to be holding a big inventory in June. At this point, they are buying only what they need and we expect demand to be flat going through the summer. Therefore, most of our pine will stay standing on the stump until the spoiling season is over.

Hardwood

Demand for hardwood grade logs was strong to begin the quarter, and got even stronger as we headed toward the finish line. We expect to see this to increase even more in the short term.

RECENT PRICES IN HARDWOOD LUMBER

HARDWOOD REVIEW GREEN INDEX



February Saw the Third Straight Decline in Housing Starts (Mar / Apr)

Winter groundbreaking on new homes slipped by 0.2 percent in February on a seasonally adjusted basis, and failed to meet analyst expectations, causing some concern among builders. Improvement is expected as the weather improves.

— Northern Logger

Freesheet Market Looks Up as Major Capacity Shuts Tighten Supply (Mar / Apr)

After some recent significant downscaling of production capacity across the U.S. uncoated freesheet market, the stage is set for a rebound in pricing that will help boost margins in an industry that really needs it.

— PaperAge Magazine

Corinth Pellets to Undergo \$7M Upgrade, Add 18 Jobs (Mar 19th)

State tax incentives and investment capital are working together to help expand production capacity at a local pellet manufacturing facility.

— Bangor Daily News

Big Hole in the Bear-Bait Debate (Mar 23rd)

The statewide referendum over bear hunting is a lot more complicated, and involve a lot more stakeholders, than most people realize.

— Kennebec Journal

New Markets For Timber Benefit Industry (Mar 23rd)

Changes in reforestation techniques and the development of new technologies in timber processing has boosted both the growth rate of trees and the manufacturing yield of timber into forest products.

— Associated Press

All regional hardwood mills are where they were last quarter or better, fueled largely by unabated end-user demand in clear flooring grade products.

It used to be that flooring products were simply considered a by-product of the hardwood grade market. Well, no more. Leading the charge is hard maple, which has been travelling in record high price territory.

This has been having a pull-along effect on other hardwoods, notably soft maple. Mills that buy mixed loads of hardwood are paying more simply to get the maple into their yard. This is in some ways an artificial demand. That said, we have seen some welcome “natural” demand increases for darker woods, such as yellow birch and oak. All this demand has had a substantial effect on raw material prices and the net returns seen by our landowners.

Even with the economy improving, we’re concerned this demand is due for a correction, or at least a tapering off. More than likely, the hardwood grade market will do what the dimensional lumber market did last year – find a new equilibrium at higher price levels. There are several instances of the hardwood industry being in the early stages of adding capacity– a welcome development.

All this demand for grade logs has also influenced the demand for boltwood – smaller-diameter logs that go into specialty markets such as tool handles and golf tees. Our standard for grade logs is a 10” diameter, while boltwood is in the 7”-9” range. We’ve started to see some grade mills begin to accept this smaller diameter wood to fill demand, despite it being less efficient to saw into the type of products they produce. For the landowner, this is good news – historically some of this smaller diameter wood might have gone to lower-priced pulp markets, but the recent pricing has changed the way we merchandize the wood that we do cut.

Demand for veneer products has seen very little change over the last 12 months. So far the hard maple craze has been slow to be recognized in veneer grades, but we expect it will catch up eventually. Strangely, in some cases, the higher grade sawlogs are exceeding the value of the lower quality veneers. We’re in the business of maximizing value, so this keeps us on our toes – we’re constantly evaluating the best market for any given stem on a job-by-job basis.

Pulpwood Products

The northeastern pulpwood markets have been no stranger to absorbing sudden market shocks, but recently those shocks seem to be coming fast and furiously. The good news is that the market has developed an ability to react quickly and buffer the shocks. The mill shutdown at Great Northern, while certainly receiving the most public attention, has been largely unnoticed as other facilities have picked up most of the slack. The explosion at Lincoln Pulp & Tissue similarly represented a huge setback in that region, but the wood consumption has been surprisingly unaffected. Most recently, the chip facility that feeds the Woodland Pulp mill was knocked out of service by a fire. While they’ve been able to find alternatives quickly and in a stop-gap fashion, they’ll shortly be looking to rebuild.

Softwood

Both demand and price of softwood pulpwood has been flat through the quarter, and inventories in most of the traditional softwood pulp markets – those that are running anyway – are very high coming into spring.

Great Northern continues to be idled, and despite having an announced re-start date of May 1st, we remain quite skeptical of them being able to meet this deadline.



Environmentalists, Energy Firms Spar Over LePage’s Bill to Increase Timber Harvest (Mar 25th)

A plan to increase the state’s timber harvest to help fund Maine’s energy efficiency rebate program has renewed debate over the mission and purpose of public lands.

— Bangor Daily News

LePage’s Anti-Park Bill Draws Lots of Support During First Hearing (Mar 25th)

A bill which would enact legislative hurdles for transferring land to federal control has been the subject of debate among landowners, sportsmen, and supporters of a national park.

— Bangor Daily News

Using More Wood for Construction Can Slash Global Reliance on Fossil Fuels (Mar 31st)

A Yale study has found that using more wood and less steel and concrete in building and bridge construction would substantially reduce global carbon dioxide emissions and fossil fuel consumption.

— Science Daily

Weaker Canadian Dollar a Windfall for Forestry Sector (Mar 31st)

The Canadian dollar’s recent drop is creating some winners and some losers. Canada’s forestry sector will be one of the biggest winners, according to bond-rating firm Moody’s Investors Service.

— Science Daily

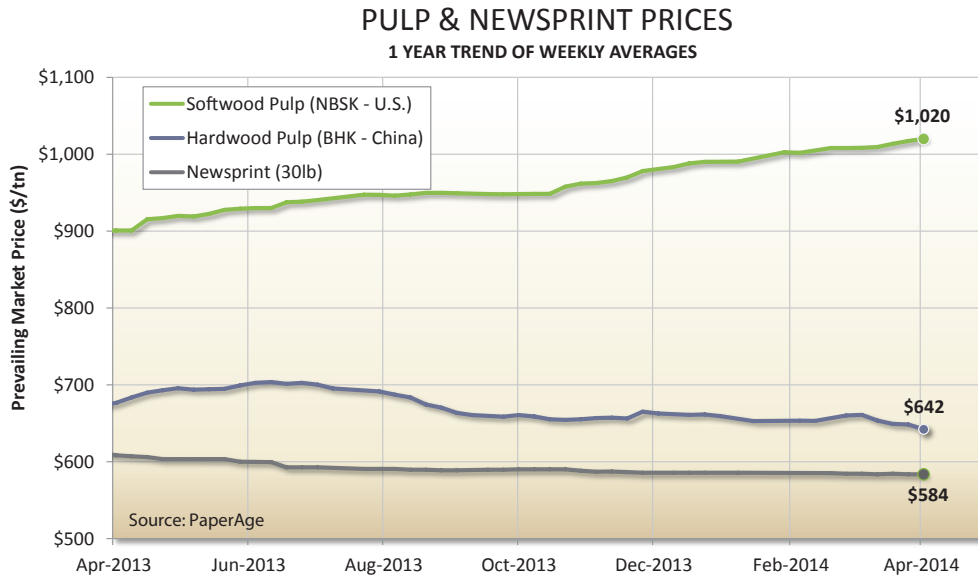
World Sawlog Prices Soar (Apr)

Tightened supply is credited for improving lumber prices during the fourth quarter of 2013 in a number of key markets, including North America and Europe. The trend is expected to continue.

— Northern Logger



Interestingly, while the typical consumers of softwood pulpwood have slacked off in their production, some of the non-traditional users have picked it up. Notably, several hardwood pulpwood consumers have begun adding softwood runs to their mix of production. A few of them have a proven ability to switch back and forth between the two pulping processes fairly efficiently. Given where softwood kraft prices are globally, we may see a growing bias toward softwood kraft production.



While this product substitution between hardwood and softwood has been encouraging, we feel it is just one side of a double edged sword – if mills are producing softwood, that means they are not producing hardwood. Either way, pulping capacity overall in the region has been falling for a few years, but some mills have made reinvestment commitments which boost regional capacity.

Hardwood Pulpwood

Hardwood chip plant inventories are abnormally low for this time of year. We would normally expect to see inventories bulging, but weather has had a large impact on supply of hardwood pulpwood. The cold weather this winter enabled loggers and land managers to get into areas of marginal soils – typical softwood ground – more than usual, and that has, to some degree, affected the mix of wood that has been available in the markets. As a result we’ve seen a higher percentage of softwood cut this year.

This winter has been so long and cold that there is a shortage of dry firewood available in the marketplace. We’ve seen some requests for firewood that have us digging through our hardwood pulp piles to find pure loads of ash, which has a very low moisture content and burns quite well. While this is a spot market effect, it’s had a good impact on landowner returns.

Demand for poplar groundwood, which has been marked by high demand in recent years, has waned. For the first time in recent years, our regional mills seem satisfied where they are at for now coming into spring. We do expect this to be a temporary seasonal anomaly.

Biomass

Considering that late November and early December were relatively wet, there was little biomass inventory coming into the first quarter. Pricing in biomass has been noticeably trending upward, and that has led to a few biomass thinning operations that have proven to be both economically viable and silviculturally beneficial. This creates a net positive return for the landowner in immediate cash flow, but also improves the remaining growing condition of the forest. I wish I could report that this is heralding a new era for biomass, our lowest-value product, but it is instead the convergence of better market prices, good seasonal operating conditions, and short distance to the mills. While it is a useful tool for the landowner, the current value of biomass means these types of operations are only possible in the wintertime and in certain locations.

Benjamin D. Carlisle
PRESIDENT



Timber Inventory Uncertainty: Impact on Property Valuation

The value of a forest property is obviously heavily dependent on the volume and value of the property's standing timber. Most people familiar with the timberland space understand that timber inventory estimates have a certain amount of uncertainty associated with them. But appraisals are often read by non-technical users who assume that the reported timber volumes are empirical facts. Even seasoned users who know better often accept inventory estimates without question because, although imperfect, "they're the best numbers we have". These same seasoned users also may not understand completely the various sources of timber inventory uncertainty, or to what extent that uncertainty impacts property value estimates. The following is meant to provide a more complete understanding of how timber inventory estimates are made, why they are uncertain, and how that uncertainty affects property valuations.

The Inventory Process

Although timber inventory processes can vary a great deal, the "stratified random sample" is a common approach. The essential elements of this process are:

- The property is mapped to determine its total acreage and the acreage of each of several "strata". Strata are normally defined by timber types, e.g. spruce/fir sawtimber, northern hardwood poletimber, etc. Defining timber type attributes can include dominant species, tree size class, stand density, physiography, etc.
- A sampling design is developed, detailing the size of sample plots, the field measurements to be made, measurement techniques, coding, etc.
- An estimate is made of the total number of sample plots required, and the number of plots to be allocated to each stratum. The objective in this exercise is to minimize the "sampling error", to be discussed below. If the purpose of the inventory is to value the property, the objective might be to minimize the sampling error on the highest valued products, which might result in disproportionately more sample plots being allocated to sawtimber strata.
- The target plots are laid out on the map. While this is treated as a random sample, for operational efficiency the plots are often laid out in a systematic fashion, i.e. on a grid.
- Armed with the GPS coordinates of each plot, timber cruisers navigate to each plot and make the prescribed measurements. Although timber volume is ultimately the variable of interest, it cannot be measured directly. Rather, tree diameters and heights are measured to indicate the fundamental geometry of the tree, which will ultimately be converted to a volume estimate. It is typical to measure or estimate multiple diameters and heights for a sample tree in order to identify the different timber products (sawlogs, pulp sticks, etc.) the tree could produce.
- Aside from the individual tree measurements, variables such as site quality, stand age, regeneration conditions, etc. are typically measured or observed before the cruisers move on to the next plot.
- The field measurements are converted to product volumes for each tree, which are then expanded to per acre, per stratum, and per property total volumes. The conversion to product volumes depends on a volume model that can take many forms, such as volume tables, geometric functions, regression formulas, etc. The volume model should have been specified in the sampling design so as to assure that conforming tree measurements would be made. The expansion of individual tree volumes to the property as a whole depends on the acreage estimates for the sample strata.

Sources of Uncertainty

Many complicating details have been left out of this description. Suffice it to say that any process with this many moving parts will produce estimates that are not 100% accurate. The three general classes of error in a forest inventory include: sampling error, measurement error, and prediction error.

Unfortunately only one of these sources of error is readily measurable and commonly reported: the sampling error. As a statistical process, the inventory produces estimates of sample means, and each mean has an associated standard deviation from which the sampling error can be computed. The sampling error has two components: a confidence interval and a probability. The sampling error is often expressed as a percentage around the mean (confidence interval) at a given probability, e.g. "the average volume is 20 cords per acre + 10% at the 90% probability level."



Translated: if the forest were repeatedly sampled, the resulting mean volume would be between 18 and 22 cords per acre 9 times out of ten.

Note that the sampling error is random, dependent on the natural variation within the forest population, as well as the size of the sample. The other sources of error can be more problematic in that they can systematically introduce a bias to the inventory estimates.

Measurement error results when the measured and reported value (e.g. diameter) differs from the true value. Measurement error that results from a poorly calibrated instrument or a consistently incorrect application of procedures (e.g. always measuring diameter too high on the tree) will result in bias. It is the belief (or hope!) of many foresters that other measurement errors are random and therefore offset one another. Measurement error is difficult to identify and correct; most often inventory audits as a form of quality control are employed.

Prediction error is probably the least recognized and most insidious form of error. In my experience this is often the cause of wide discrepancies that are sometimes observed between two independent inventories of the same property. Prediction error originates in the volume models that are used to convert tree measurements to volume estimates and in the growth models that are used to update an older inventory.

It should first be recognized that the models themselves are usually constructed using sample data and so are subject to the normal sampling and measurement errors. Then statistical techniques, such as regression analysis, might be applied that produces further random error. So the model as constructed contains inherent uncertainty that contributes to prediction error.

The inherent uncertainty in the model is amplified if the population on which the model is based differs from the population currently being sampled. Tree geometry varies by site quality, age, stand density, species, topography, etc. A volume model that is not multi-variate will predict the volume of the average tree over a wide region, which may not fit the specific forest being inventoried.

Volume models require precisely defined inputs, e.g. “height to a 3.5 inch diameter inside bark”. Prediction error can be generated when the model receives input other than that for which it is calibrated, e.g. “height to a 4 inch diameter outside bark”, resulting in erroneous volume estimates. This sort of mix-up often occurs as a result of measurement error, when the cruiser measures trees according to market specs rather than the intended specs of the volume model. Of course this mismatch between inventory specs and market specs raises other issues in the context of valuation, which will be discussed below.

Often a current inventory is not available – the most recent fieldwork may have been conducted a year ago, or as many as 10 years ago. In that case the old field-generated inventory must be updated for growth and harvest that took place during the interim period. The growth model suffers all of the same prediction error problems as the volume model, but with the growth model these errors get compounded each year of the projection period. Harvest volumes used to update inventories are not sample-based and are not modeled – they are usually a 100% enumeration of the volumes that were removed. They are subject to measurement error (e.g. bad mill scale) and again the market specs for products may not be the same as the inventory specs, causing an “apples and oranges” problem when adding growth and subtracting harvest.

Uses of the Inventory Appraisal

Now that the reader has been persuaded to forever look at inventory estimates with a jaundiced eye, the bad news – the appraiser is often handed an inventory that suffers to varying degrees from all of these levels of uncertainty. How does that uncertainty work its way into the estimate of total property value?

One of the fundamental tasks in timberland appraisal is calculation of the property’s Gross Timber Value (GTV, also referred to as Timber Capital Value). GTV is simply the retail value of the property’s current standing timber. It is estimated by multiplying current inventory estimates by current market stumpage prices. Care must be taken that the prices and inventory volumes are on the same volumetric basis. For example, in the Lake States, pulpwood is commonly sold by the “100-inch cord” which is approximately 4% more volume than a standard cord. In the case where the inventory is reported in standard cords, either the inventory or the prices should be adjusted downward before calculating GTV.



Given the uncertainty surrounding inventory estimates, and the further difficulty of estimating market stumpage prices for a variety of products, even under the best conditions GTV estimates should be considered to have an “uncertainty range¹” of at least $\pm 10\text{-}20\%$.

GTV plays a role in all three of the standard appraisal approaches used in valuing timberland: cost, comparable sales, and income. Each approach produces an indicated value and the appraiser reconciles these values to develop a final estimate of market value.

In the cost approach, total property value is indicated directly as a multiple of GTV. For example, in the Lake States, investment grade properties often sell in the range of 60-80% of their GTV. Assuming a GTV uncertainty range of $\pm 15\%$ and a timber value multiplier (TVM)² of 70%, the property value indicated by the cost approach has an uncertainty range of approximately $\pm 10\%$ (.15 X .70).

In the comparable sales approach, the subject property is compared to other sold properties for a variety of attributes, one of which is timber value indicated by GTV. If the subject property contains greater (less) timber value than a comparable sale, then the comparable’s price is adjusted upward (downward). One formulation of the adjustment amount is [(subject GTV/acre – comparable GTV/Acre) X TVM]. If it is assumed that (1) the comparable GTV is its “true” value, and (2) there are no other adjustments to be made, then it can be shown that the uncertainty range of the indicated subject property value is the same as the uncertainty range around the GTV estimate, i.e. $\pm 10\text{-}20\%$. If the assumption regarding the comparable GTV is relaxed, the uncertainty range around the indicated value could be much wider.

The income approach is based on a discounted cash flow model where cash flows are projected for a finite period (typically 10-30 years), and a reversion value is estimated in the final year of the projection. The reversion value and all of the annual cash flows are discounted to the present at a risk-adjusted discount rate³ for timberland. Importantly, the reversion value is often estimated using a cost approach which depends directly on the final year estimate of GTV.

Typically the largest cash flow stream in a timberland DCF is the timber harvest revenue. Timber inventory, growth and harvest are projected throughout the period using some form of model that is subject to prediction error. A simple DCF model illustrates the impact on net present value of uncertainty in the inventory and growth estimates. Here are the features of our model:

- 15 year projection
- 5% discount rate
- constant real prices
- uncertainty range on initial inventory of +15%
- annual growth equal to 3% of inventory, with a uncertainty range of $\pm 15\%$ (2.55% - 3.45%)
- harvest equal to 90% of growth
- annual expenses starting at 25% of stumpage and remaining fixed throughout the projection
- a Timber Value Multiplier of 70% on the reversion value

This simple model results in an approximate $\pm 20\%$ uncertainty range around the indicated property value from the income approach. The interval widens as the uncertainty around the initial inventory and growth estimates increases, but it changes little in response to changes in the discount rate, harvest rate, expense rate or Timber Value Multiplier.

In summary, the typical error levels present in timber inventory and growth estimates can by themselves lead to a measurable uncertainty in appraised property values. Some simple valuation model exercises using realistic assumptions resulted in the following approximate uncertainty ranges on indicated property values by the three standard appraisal approaches:

Cost:	$\pm 10\%$
Comparable Sales:	$\pm 15\%$
Income:	$\pm 20\%$

The income approach generates the highest uncertainty because of the “magic of compounding”. The cost approach generates the least uncertainty because only a portion of the inventory value predicts property value.

Conclusions

Most users of timberland appraisals understand that they are complicated analyses that depend on many market factors, assumptions and appraiser judgment. Many think that the timber inventory is a firm bedrock that provides some comfort in the face of all of those uncertain market elements. To the contrary, we have shown that even “good” inventories by themselves create significant uncertainty in the final appraised values.

This is not to suggest that timberland appraisals are worthless or should be abandoned. They are after all based on “the best information available” in most instances. But we offer these suggestions and best practices for appraisers and appraisal users:

- The timberland appraiser should have some field inventory experience, but more importantly should have or be able to draw upon the expertise required to “look under the hood” of inventory estimates. Often, some of the problems with inventory estimates can be corrected by re-processing field data, but this is not a minor undertaking.
- A timberland appraisal report should, at a minimum, summarize the source of the inventory estimates and provide some opinion on their adequacy. If the inventory sampling errors are available, they should be reported.
- In almost every appraisal, the assumed accuracy of the inventory should be stated as an Extraordinary Assumption⁴.
- The quality of the forest inventory should be a consideration in selection of the discount rate for the income approach. Cash flows that are dependent on a more uncertain inventory should be discounted more steeply. Note that this will not narrow the uncertainty range on a percentage basis, but by lowering the net present value it will narrow the absolute uncertainty range.
- Upon engagement, appraisers should reserve the right to withdraw from an assignment if the condition of the inventory is such that it could lead to a misleading estimate of property value.
- Appraisal clients must understand the nature and impact of inventory uncertainty. Many readers of an appraisal would be surprised to learn that simply because of inventory uncertainty the appraised value could have a 10-20% uncertainty range.
- Institutional investors, lenders, and asset managers should have clear guidelines regarding the minimum inventory requirements for valuation.
- The value uncertainty should be explicitly considered in deciding whether the cost of a fresh inventory is justified during acquisition due diligence.
- Given the unavoidable uncertainty in timberland appraisals, appraisal clients should consider whether the appraised value ought to be stated as a range rather than a point estimate. A follow-on to this would be reconsideration of acquisition and lending guidelines that are appraisal-driven. Perhaps a concept such as “Reliable Minimum Estimate” as used in statistics could be adopted for valuation.

Sam Radcliffe
VICE PRESIDENT

¹ As used here, the term “uncertainty range” is analogous to a statistical confidence interval, but it includes not only the sampling error but also the estimated impact of other error types.

² The Timber Value Multiplier was described in our 2010 Q2 newsletter. Please contact sjradcliffe@prentissandcarlisle.com for a copy.

³ The timberland discount rate was discussed in our 2013 Q2 newsletter, available at http://www.prentissandcarlisle.com/assets/PCnswltr_2QTR-13.pdf

⁴ From USPAP: Extraordinary Assumption: an assumption, directly related to a specific assignment, as of the effective date of the assignment results, which, if found to be false, could alter the appraiser’s opinions or conclusions.

Comment: Extraordinary assumptions presume as fact otherwise uncertain information about physical, legal, or economic characteristics of the subject property; or about conditions external to the property, such as market conditions or trends; or about the integrity of data used in an analysis.

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