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Wood Supply Chain Component Costs Analysis: A Comparison of Wisconsin and U.S. Regional Costs (SLS#4458)

Client:

National Council for Air and Stream Improvements, Inc.

Prepared for:

Great Lakes Timber Professionals Association

Wisconsin County Forests Association

Prepared by:

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Forest2Market, Inc.
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Effective Date: November 30, 2014

Wisconsin Forest Practices Study

Factors Influencing Wisconsin's Forest-Based Manufacturing Competitiveness

Summary of Facts and Conclusions

Project	Wood Supply Chain Component Costs Analysis; A Comparison of Wisconsin and U.S. Regional Costs
Prepared for	Great Lakes Timber Professionals Association Wisconsin County Forests Association
Client	National Council for Air and Stream Improvement, Inc. P.O. Box 13318 Research Triangle Park, North Carolina 27709-3318
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Effective Date	November 30, 2014
Project Objective	Complete an assessment of wood fiber supply chain costs in Wisconsin, including a comparison to other U.S. regions, in order to address the question of how Wisconsin can continue to provide sustainably-grown wood fiber to support a competitive wood-using industry and attract investment in primary forest-based manufacturing.

Results	<p>Wisconsin's total delivered fiber cost for pulpwood compared to the U.S. Northeast region shows lower aspen and mixed hardwood costs and higher conifer costs. Both northern regions incur higher delivered costs compared to the U.S. South and Pacific Northwest. Analysis of individual supply chain costs indicate that Wisconsin's costs vary when compared to other regions and species groups, with higher conifer stumpage and lower aspen and hardwood stumpage. Harvesting costs likewise vary, generally being lower than the Northeast and higher than the South. Wisconsin-delivered fiber costs typically include higher freight and "other" costs (handling, procurement, etc.) in most instances. The results of this study reflect a snapshot in time, as the data set included a summary of only four quarters (Q3, 2013 through Q2, 2014).</p>
Conclusions	<p>Wisconsin and the U.S. Northeast will be at a competitive disadvantage when total delivered pulpwood fiber costs are compared to the South, due largely to differences in seasonal weather-related impacts on operability, such as prolonged spring breakup periods, along with other unique forest and operational characteristics. Wisconsin also has challenges inherent in the industry that appear to increase freight and "other" costs. Lowering costs or, minimally, being mindful of issues that increase these costs, such as restrictions limiting activity to winter months, will be a factor in maintaining Wisconsin's position in the U.S and global timber industry.</p>

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1. Project Overview

1.1 Investigators

This research investigation is a collaborative effort including team members from Steigerwaldt (Steigerwaldt Land Services Inc.; SLS) and Forest2Market (F2M). The primary investigator for the project is Forrest M. Gibeault (SLS), along with the project partner from F2M, Peter J. Coutu. Contact information for the investigators is below.

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1.2 WFPS Overview

The Wisconsin Forest Practices Study (WFPS), pursuant to s.26.105(1), Wis. Stats., was made possible by means of a grant awarded by the Wisconsin Department of Natural Resources (WDNR) to the Great Lakes Timber Professionals Association (GLTPA) and the Wisconsin County Forests Association (WCFA). The broad objective of the WFPS is to obtain research results that will help guide decisions and policy development for investment in forest-based manufacturing industries in Wisconsin, while ensuring that social and ecological benefits provided by Wisconsin's forests remain viable for future generations.

GLTPA and WCFA have selected the National Council for Air and Stream Improvement (NCASI) to serve as research coordinator for this study. NCASI is an independent, non-profit 501(c)(6) research institute formed in 1943 focusing on environmental and sustainability topics relevant to forest management and the manufacturing of forest products.

Essentially, the question posed is: How does Wisconsin continue to provide sustainably-grown wood fiber to support competitive wood-using industries in the future? The WFPS study included three general topic areas of research. This research addresses the topic of: What forestry-related factors are expected to enhance or reduce the competitiveness of forest-based manufacturing in Wisconsin?

The specific objective for this topic is further identified as follows:

- Complete an assessment of forestry-related factors that are likely to enhance or impede Wisconsin's ability to attract investment in primary forest-based manufacturing facilities.

1.3 Objective and Outcomes

The focus of this research centers on the evaluation of the costs of each link in Wisconsin's wood fiber supply chain and a comparison of these costs to other regions in the United States. Included will be an assessment of cost factors as to why they may exist and commentary on options to address competitiveness with other U.S. forest industry regions with regard to delivered fiber cost.

1.4 Region Introduction

Four regions within the U.S. are included in the analysis. In addition, commentary is provided on timber availability and supply chain considerations for the eastern Canadian provinces. Detailed comparative analysis is based on the following U.S. regions - the Northeast, Lake States, Pacific Northwest, and the South (regions depicted in Figure #1).

Figure#1 – Reporting Regions



* Lake States region adjusted to represent the Wisconsin market

F2M provided quarterly data summarized by region and species/product group. For the purpose of this report, the Lake States data, which includes a data set sourced primarily in northeastern Minnesota (MN), Wisconsin (WI), and the western Upper Peninsula (UP) of Michigan (MI), will be considered the Wisconsin baseline. Many Wisconsin mills procure timber across state lines and, conversely, timber harvested within Wisconsin is shipped and sold to mills in Minnesota and Michigan. Therefore, the supply chain components of the Lake States region include costs that originate from both inside and outside of Wisconsin. An evaluation performed by F2M suggests that 79 percent of loads originating from Wisconsin forests are shipped to mills within the state lines. Yet, about 21 percent of the aspen pulpwood loads in F2M's database are shipped to out-of-state mills. As a result, the significant border mills located in Minnesota and Michigan are important to the Wisconsin marketplace.

The data set used in this report will include all F2M reporting mills within Wisconsin, as well as border mills that procure material from Wisconsin forests. This representation of the Wisconsin marketplace will be referenced as the Lake States region throughout this report.

1.5 Detailed Regional Overview

Total delivered wood fiber cost is dependent upon many factors, as the forest industries of each region have characteristics that directly impact the supply chain components. Factors such as harvest methodology, logging contractor population and business size, transportation details, and seasonality are examples of the characteristics this study evaluated. An overview of these items by reporting region is provided in the following subsections.

1.5.1 Lake States (Wisconsin) Market Summary

Wood fiber is procured from a variety of owners in the Lake States region, but the majority of the material originates from small private landowners, followed by public sources such as county and state forests and larger tracks under private ownership. Data from 2011 suggests that about 60 percent of the harvest volume in Wisconsin originated from family or single, small private ownership, while 8 percent is from forest industry lands, 30 percent from public lands, and 2 percent from Native American ownership (Stoltzman, WDNR). Compared to other regions, the Lake States has many smaller sized, cut-to-length contractors, which generally produce, on average, two to five loads per day. Research completed by RISI suggests that logging crews using a mixture of harvesting techniques in the North Central U.S. average about four to five loads per day (RISI, Barynin 2013). North Central U.S. logging contractors purchased the majority of their timber on the open market (80 percent), which is unique when compared to the other reporting regions (Baker et al. 2013). Research completed for the Wood Supply Research Institute found that the majority of contractors in the Northeast and West regions worked on a contract basis for larger companies, while about one-half of the contractors in the South purchased timber (Baker et al. 2013).

The forest economy in the Lake States is dominated by hardwood logs and round pulpwood. Harvesting is generally based on lower production levels due to growing and maintaining high-quality hardwood stands. Timber Products Output (TPO) data from 2008 reports that 30 percent of the annual harvest volume is comprised of sawlog products, while about 60 percent is considered pulpwood (Stoltzman, WDNR). Additionally, trucking costs in the Lake States are quite high and, according to F2M data, the average trucking costs are approximately \$0.19 per ton per mile. The transportation of pulpwood by rail is also somewhat unique in the Lakes States region.

This region also has the highest percentage of hardwood when looking at the species mix harvested, which correlates to the predominance of uneven-aged management and hardwood single tree and group selection thinning when compared to all other regions. A major consideration in the Lake States region is logging seasonality; extreme variation in deliveries from winter to spring and, to a lesser extent, from fall to summer, occurs in most locations.

1.5.2 Northeast U.S. Market Summary

This region's timber supply is reliant upon large private owners to a great extent and, as such, this ownership base can influence fiber pricing. Harvest operations are focused on whole-tree harvesting in much of this region, and the average logging contractor is considered mid-sized. According to industry contacts, most contractors produce an average of five to ten loads per day (F2M). Whole-tree operations in the Northeast average about seven loads per day (RISI, Barynin 2013). Transportation costs are also high in this region and are comparable to, or slightly lower than, the Lake States (F2M reports about \$0.18 per ton per mile). Species mix is similar to that of Wisconsin, but the component of softwood and hardwood is more evenly split in this region, as each contributes about 50 percent of the volume produced in the Northeast. This region is more geared toward even-aged management, especially in the northern portion. However, harvesting methods transition towards uneven-aged management and production levels generally decrease proceeding south and west from Maine into central New York, Vermont, and New Hampshire.

Softwood and hardwood logs and round pulpwood material are the main products. Primary and secondary chips are also an important product mix in some locations.

1.5.3 South U.S. Market Summary

The South is generally reliant on private forestland owners for stumpage. Harvesting in this region is almost entirely whole-tree with fewer and larger contractors when compared to the northern regions. Trucking costs are likely the lowest across the country and are generally under \$0.16 per ton per mile. Softwood species make up the bulk of the production volume, and most forest acreage is managed on an even-aged basis. The forest economy in this region is not as impacted by seasonal weather. The primary wood fiber products are softwood logs and pulpwood, and harvesting is quite mechanized and production based. The average logging crew in the South, according to regional research, averages about 11 loads per day (RISI, Barynin 2013).

1.5.4 Pacific Northwest U.S. Market Summary

This region produces timber from large private and public ownership. Harvesting is whole-tree and generally performed by medium to large-sized logging contractors. The species mix in the Pacific Northwest is largely softwood, with hardwood production limited to a few regions. Forest management techniques are typically even-aged, and operations are generally production based. Freight costs in this region are quite high and are estimated at \$0.20 per ton per mile (F2M). Harvest production in this region is similar to the South, as research suggests daily production averages about 11 to 12 loads per day.

1.5.5 Summary of Regional Characteristics

Differences in regional characteristics of the four study regions may affect components of the supply chain. The notable characteristics are as follows:

- Transportation costs are comparatively high in the Lake States and Northeast regions, when compared to the South.
- The South region is characterized by high production and little seasonal variability in wood supply .
- Daily production levels are highest in the South and Pacific Northwest.
- The Northeast region is variable in production levels, but the bulk of the volume harvested originates from whole-tree operations.

1.6 Canadian Markets

The forest products industry in eastern Canada is a regional market of interest outside of the U.S. Due to the region's proximity to Wisconsin and the similarity of wood species and products produced here, an evaluation of this market may provide additional insight to supplement this study. F2M does not benchmark products from the eastern Canadian region; therefore, comparative data is not available for the supply chain analysis and comparison. For this report, we communicated with industry contacts who had expertise with regards to the wood fiber market drivers and possible implications related to cost components. A narrative summary of this communication is included as part of the discussion of the results in Section 3.4.

2. Methods

2.1 Supply Chain Cost Data

This work utilized delivered fiber supply costs data collected and compiled by F2M. F2M maintains a complete and highly accurate delivered price database that is one of the most extensive and credible wood product benchmarks in the industry. The F2M data is based on actual delivered raw material costs and component costs through the supply chain.

Additional detail regarding the data utilized for the study and the analysis procedure is outlined in the following sections.

2.1.1 Data Source

The source data originates from mills and wood producers that subscribe to F2M transaction-based market price and trend reports and analytics products. Delivered wood data provided to F2M is sourced directly from subscriber wood settlement systems. In most cases, cost components are reported for individual loads. In instances of unreported costs, F2M has developed methodology to assign costs from market averages within the benchmark regions (see section 1.5 for more information). The data sourced through F2M is reported by quarter (weighted averaged data) for 2013 and the first and second quarters of 2014.

2.1.2 Supply Chain Component Descriptions

Supply chain component data is derived from wood settlement statements collected and housed within the F2M database. These costs sum to the total delivered cost, including all costs a mill or wood dealer incurred in the process of acquiring the material. It is the sum of costs categorized as *Other*, *Harvesting*, *Freight*, *Margin*, and *Stumpage*. These component categories are described in more detail below.

- *Stumpage* – The stumpage cost component is known on mill purchased deliveries. In many cases, however, where a supplier has purchased the stumpage, this component is not tied to a specific load. F2M tracks and collects stumpage data from a variety of sources within each region and uses this data to add the stumpage cost into the delivered load total. The stumpage price is the weighted average of compiled sale data within a given procurement radius. The Stumpage component is defined as the amount paid to the landowner for standing timber.
- *Harvesting* – This cost is known on loads where the mill pays harvesting directly, or it is derived from data provided by a wood supplier. Harvesting costs are also aggregated and applied to loads where harvest costs are unknown. Harvesting costs include cut, skid, and all costs associated with producing wood to a landing. Loading trucks is also included in harvesting for most locations operating in tree-length markets.
- *Freight* – The freight cost is a known value for loads where the mill pays freight directly. Freight rates (\$/ton/mile) are calculated and applied in instances where freight is unknown, using the weighted average based on load miles. Freight generally includes all loading and shipping costs to the mill location. In Wisconsin, freight includes loading (due to cut-to-length logging and production of 100-inch material), as most trucks include loaders. In other regions, the loading cost is generally included in the harvesting component.
- *Other* – This cost component is generally not contained in a company's wood accounting system. The cost is typically provided to F2M on a total basis for a total purchase amount and then converted to a per ton basis appropriately. This cost component includes procurement expenses, wood yard expense, wood yard freight and transfer expense, and other adjustments.
- *Margin* – This component is calculated as the total cost less Harvesting, Freight, and Stumpage (excluding the Other cost component). Margin is defined as the dealer's net after paying cut, skid, load, and haul. Essentially, it is what the supplier and/or the mill has left after all expenses have been paid.

2.1.3 Species Groups and Products

This study will evaluate three general species groups: aspen, hardwood, and conifer, with the focus limited to pulpwood fiber. The sawtimber product group is not included in this study, as measurement, product, and sale specifications vary considerably. Sawlog and bolt product specifications are ever changing and

quite different from region to region. Log scale measurement units and methodology are also inconsistent and often dictated by the harvest operations and the infrastructure in a specific region. Given these considerations, the sawtimber product group is too variable for use in a broad comparative analysis. Details regarding the various regions will be discussed in the following sections.

2.2 Time Period Evaluation

The quarterly data was queried from the F2M database for all of 2013 and the first half of 2014 (Q1 and Q2, 2014). Data is aggregated by quarter and otherwise combined for this report to protect subscriber anonymity.

The six quarter data set is available for all regions and species, except for the Northeast region, in which only Q3 and Q4, 2013, and Q1 and Q2, 2014, are summarized. The Northeast region is new to the F2M database and, as a result, has a more limited data set available for study.

Evaluation of the quarterly data included two separate tests researching how best to aggregate the F2M quarterly data. These tests are presented in the next section. Due to the limited extent of the quarterly data evaluated for this study, statistical tests were not completed as part of our analysis.

2.2.1 Data Period Testing

As outlined above, we performed two tests to evaluate potential presence of quarterly anomalies, cyclic events, or extraordinary occurrences. In the first test, we estimated percent change of each quarter compared to the average of the six quarters provided by F2M (four quarters in the case of the Northeast region), by region and species group. This test evaluated variation in prices among seasons and differences in prices from 2013 to 2014.

As an example, the total delivered weighted average price for aspen in the Lake States region in Q1, 2013, was \$40.87 per ton, while the average of all six quarters was \$42.91 per ton. The percent change for this quarter was calculated as follows:

$$\text{Percent Change: } (\$40.87 - \$42.91)/\$40.87 = -0.0499 \text{ or } -4.99\%$$

A second analysis tested the deviation of the average of the last four quarters (Q3 and Q4, 2013, and Q1 and Q2, 2014). Since seasonal differences in the delivered pricing were expected, this test evaluated the change in pricing over a one year period, using the most recent quarters available to represent the seasonal changes that would occur in a calendar year. The difference was evaluated as a change from the average and was presented as a positive number for purposes of this evaluation.

An example of this test is:

$$\begin{aligned} &\text{Aspen: Lake States Region (Total Delivered Price)} \\ &\text{Average of last four quarters} = \$43.83 \text{ per ton} \\ &\text{Q3, 2013 value} = \$41.68 \text{ per ton} \\ &\text{Deviation from Average: } \$41.68 - \$43.83 = -\$2.15 \text{ per ton (Evaluated as a positive number for analysis)} \end{aligned}$$

The results of both tests are provided in section 3.0.

2.2.2 Data Period Findings

In the percent change test, total delivered price for the aspen group in the Northeast region differed among quarters by as much as -5.64 percent to 4.55 percent relative to the average delivered cost for the entire dataset. Lake States data suggested more consistency for aspen price from Q1, 2013, through Q1, 2014; however, the percent change from the average for Q2, 2014, increased to 12.2 percent. This

represents the greatest percent change relative to the dataset average for all regions and species groups evaluated. Analysis of the hardwood group found similar results to that of the aspen group in the Lake States and the Northeast regions. Although both the Northeast and Lake States regions saw an increase in pricing for Q2, 2014, the increase in the Lake States was relatively large and coincided with a notable market event. Demand and pricing increased in the summer of 2014, following a long period of high precipitation dating back to the fall of 2013 (Exhibit #1, raw data from the percent change and deviation from average tests).

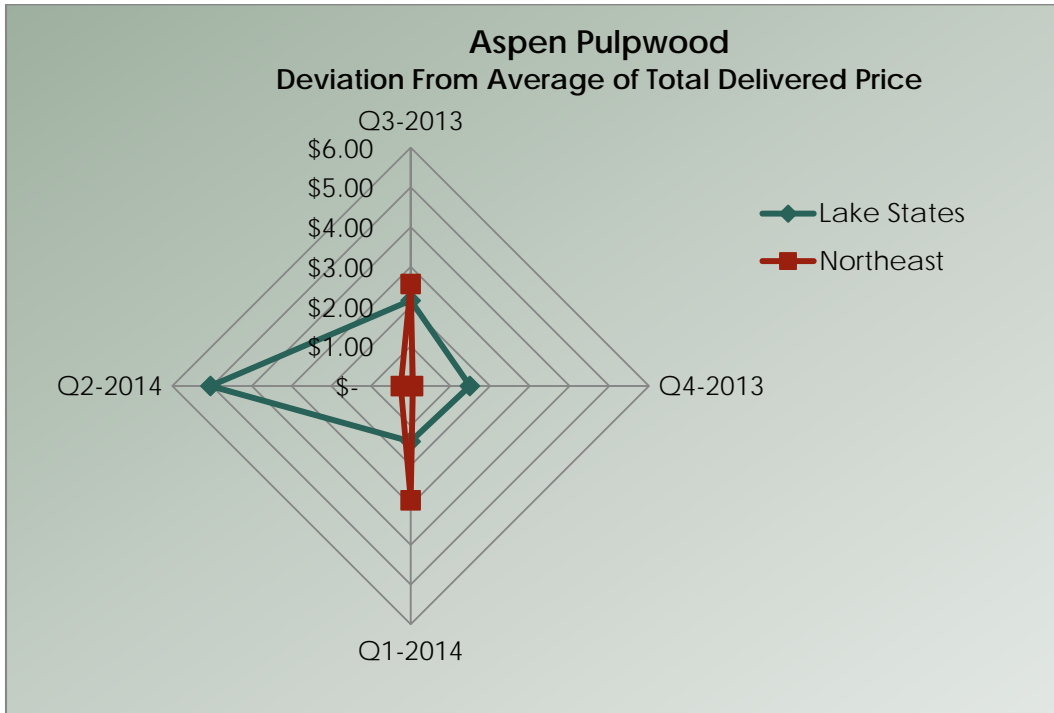
Percent change in pricing for the hardwood group varied considerably among quarters in the South, with an increase in average pricing occurring in the first half of 2014. Total delivered price for the hardwood group varied among quarters in the Pacific Northwest, but pricing increased to the highest point during Q2, 2014, to \$41.79 per ton (see Table #1). Based on the data series evaluated for this report, results for the aspen and hardwood groups suggested that an increase in pricing occurred during Q1 and/or Q2 of 2014 for all regions.

Percent change results within the conifer group (Lake States region) were similar to that of the other species. The Northeast region exhibited trends similar to the hardwood group, with a decline in pricing in Q1, 2014. The South reported an increase in pricing in 2014, with total delivered price increasing 2.25 percent from Q4, 2013, to Q1, 2014. Delivered pricing increased in early 2014 in the Northwest as well. In the Pacific Northwest, total delivered price increased by 6.41 percent from Q4, 2013, to Q1, 2014. The results of the percent change analysis are provided in Exhibit #1.

The results of the second test, evaluating the deviation from average, are discussed in the following paragraphs.

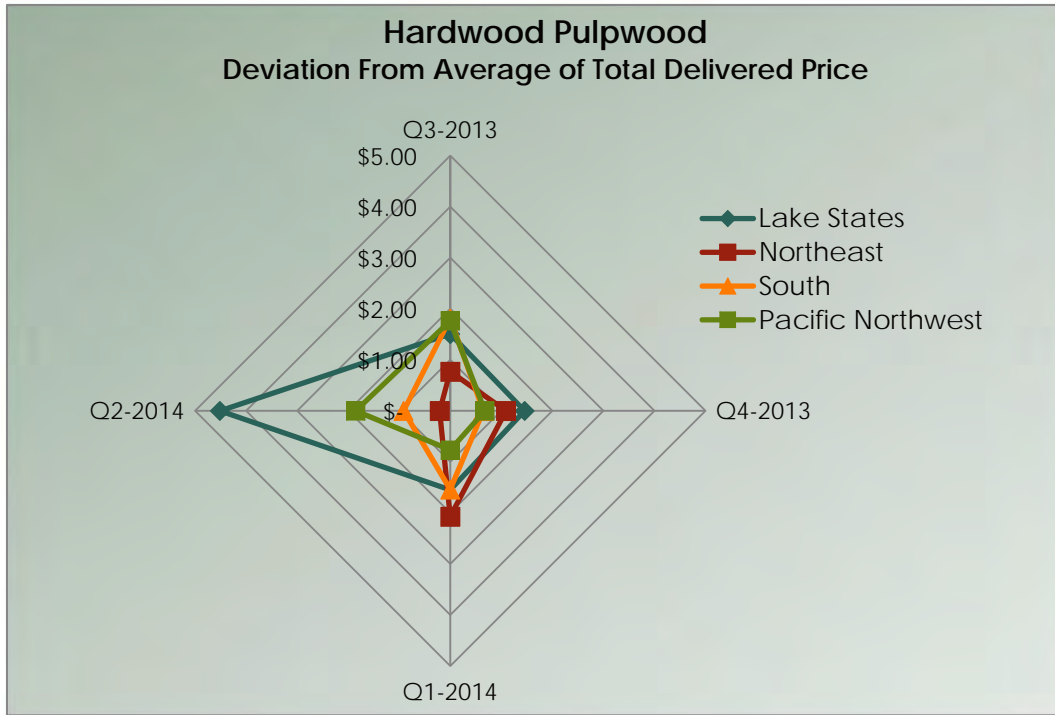
In an effort to better understand variability of data for the most recent quarters, we plotted deviation from the average in Q3, 2013, Q4, 2013, Q1, 2014, and Q2, 2014 (Figure #2). Seasonal price fluctuation was evident in regions that produce aspen, as seasonal changes in temperature and precipitation are quite common in this portion of the country. As suggested earlier in this section, the volatility observed in the Lake States is typically related to weather-related events that constrain the supply chain. Delivered price variability, due to seasonality, is common in the Lake States and, to a lesser extent, in the Northeast.

Figure #2 – Aspen Validation for Recent Quarters



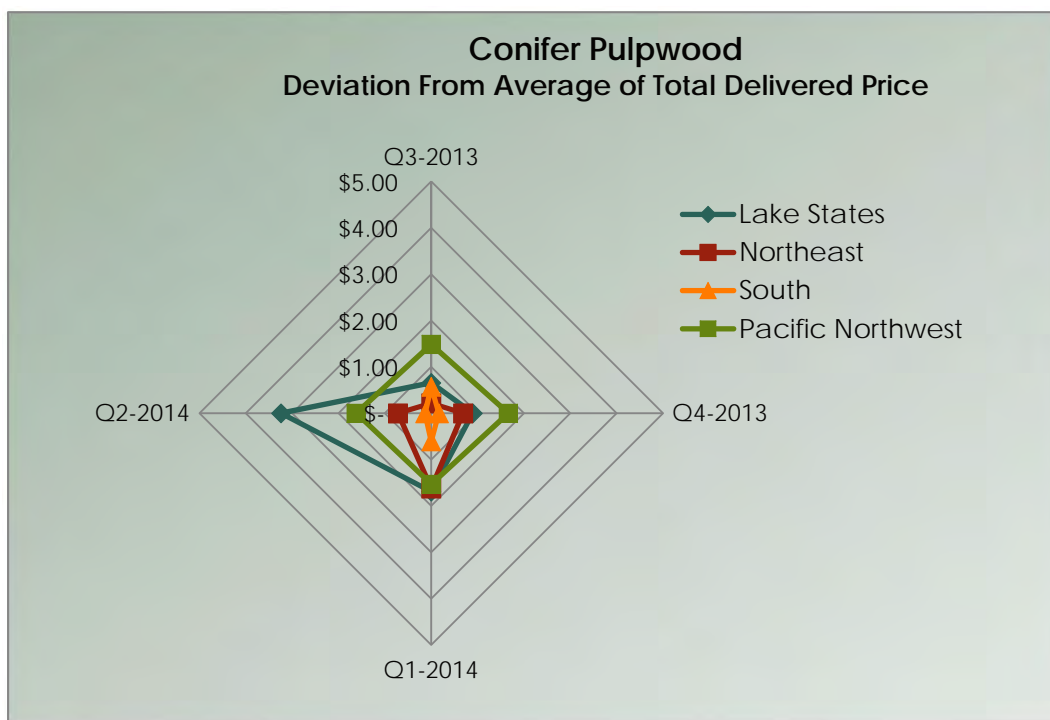
For the hardwood group, the Lake States region again experienced a higher level of deviation from the average in Q2, 2014, while the Northeast region showed a price change earlier in the year (occurring in Q1, 2014). For the most part, prices in the South and the Pacific Northwest regions varied little by quarter. Yet, prices in the Pacific Northwest moved substantially in Q2, 2014, when compared to the other three quarters. Our results for the hardwood group correlate well with information provided by our industry contacts who suggested that the South generally has a more even flow of material throughout the year, even throughout the wet winter period (Figure #3)

Figure #3 – Hardwood Validation for Recent Quarters



The conifer group had the most consistent pricing, as the deviation from average was smaller than for other groups (Figure #4). As with the other species groups analyzed, the Lake States region experienced greater deviation from the average in Q2, 2014. Other variability worth noting includes the Q1, 2014, price increase for the Northeast region (Figure #4).

Figure #4 – Conifer Validation for Recent Quarters



A table presenting raw data from the deviation analysis is provided in Exhibit #1.

These analyses suggest that seasonal variability is common in the Lake States and Northeast, and when compared to all four regions, variability for these northern regions was considerable for all species groups analyzed. Due to this variability, we evaluated the F2M delivered cost data as an aggregate that included the four most recent quarters. A regional comparison would be difficult without aggregating the data, as the known data variability would likely result in misrepresentation of regions and the resulting conclusions. Thus, the average of Q3, 2013, Q4, 2013, Q1, 2014, and Q2, 2014 served as the baseline data set in this study. Results of our evaluation are provided in the following sections.

Since the Lake States region exhibited a substantial price increase in Q2, 2014, we evaluated the impact this quarter had, given the fact that the analysis used this data point as part of the final aggregated data set. When we excluded the Q2, 2014 data from the Lake States region and averaged only Q3, 2013, Q4, 2013, and Q1, 2014, the average total delivered price decreased by 2.4 to 4.0 percent across the species groups. Yet, when Q2, 2014 was excluded from all other regions and species groups, the average total delivered price decreased by only 0.12 to 1.58 percent. Therefore, the inclusion of the Q2, 2014, data in our final study aggregation appeared to have a slight impact on all species groups and regions, with the quarter having more of an impact in the Lake States.

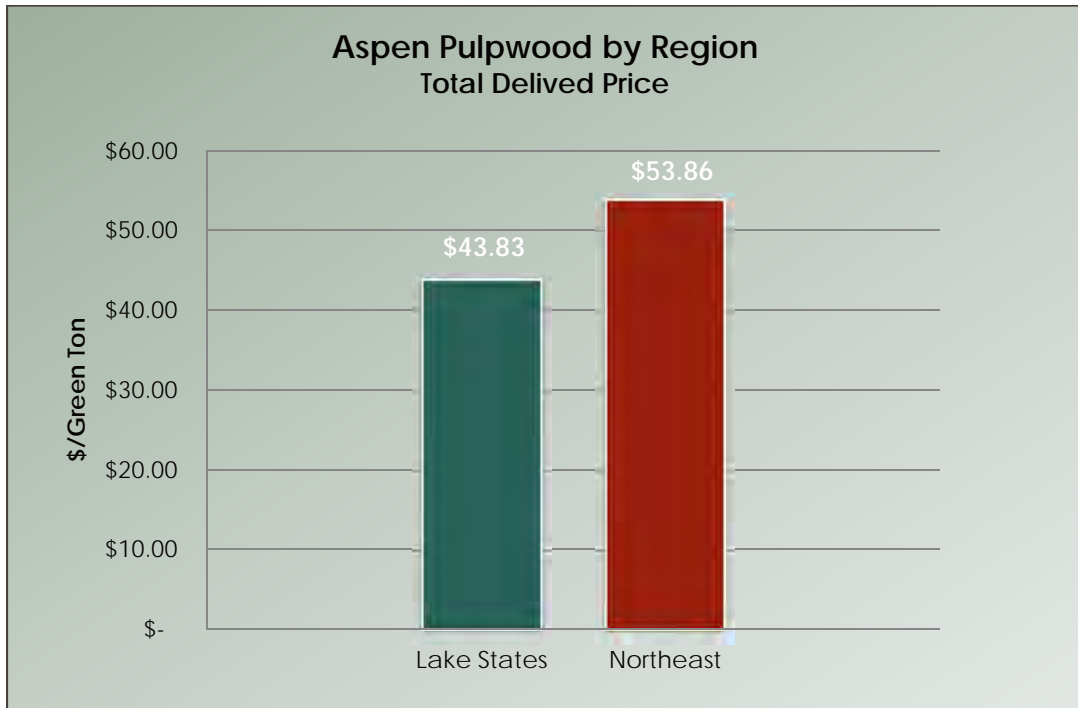
3. Results

3.1 Total Delivered Price Comparisons

Quarterly data is summarized by total delivered price and species group in this section. Pricing is displayed in a series of figures, with the raw data presented in Exhibit #2.

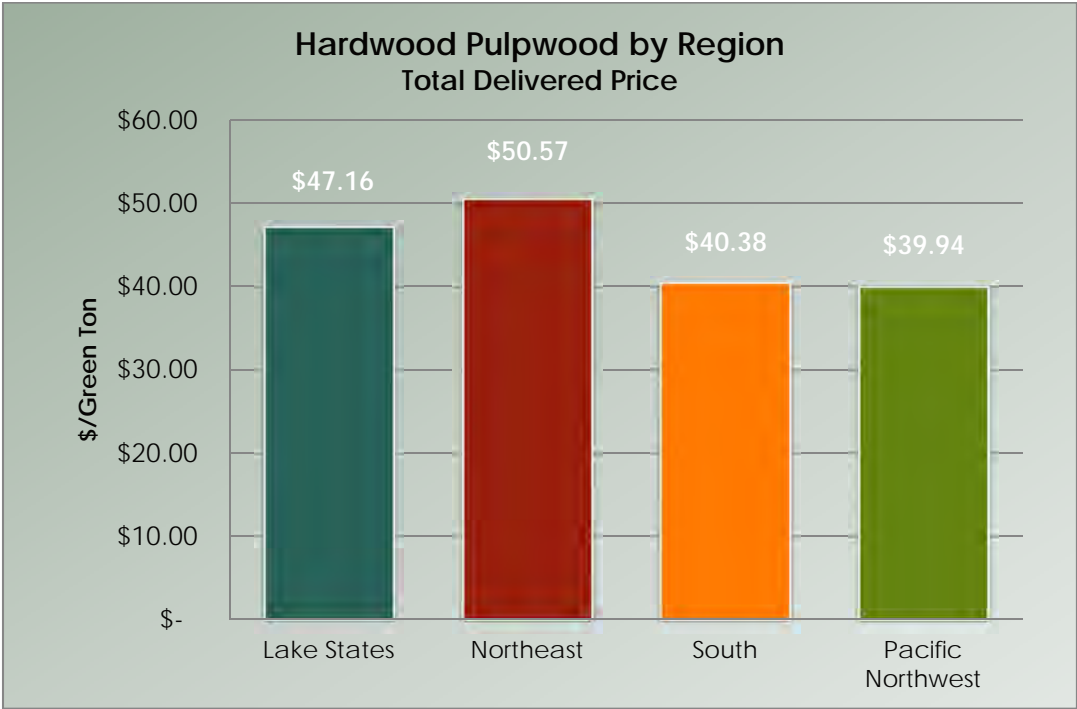
Total delivered pricing for the aspen product group in the Northeast exceeded price in the Lake States. Total delivered pricing for the aspen product was 19 percent higher in the Northeast region over the quarters analyzed (Figure #5).

Figure #5 – Total Delivered Pricing for the Aspen Group



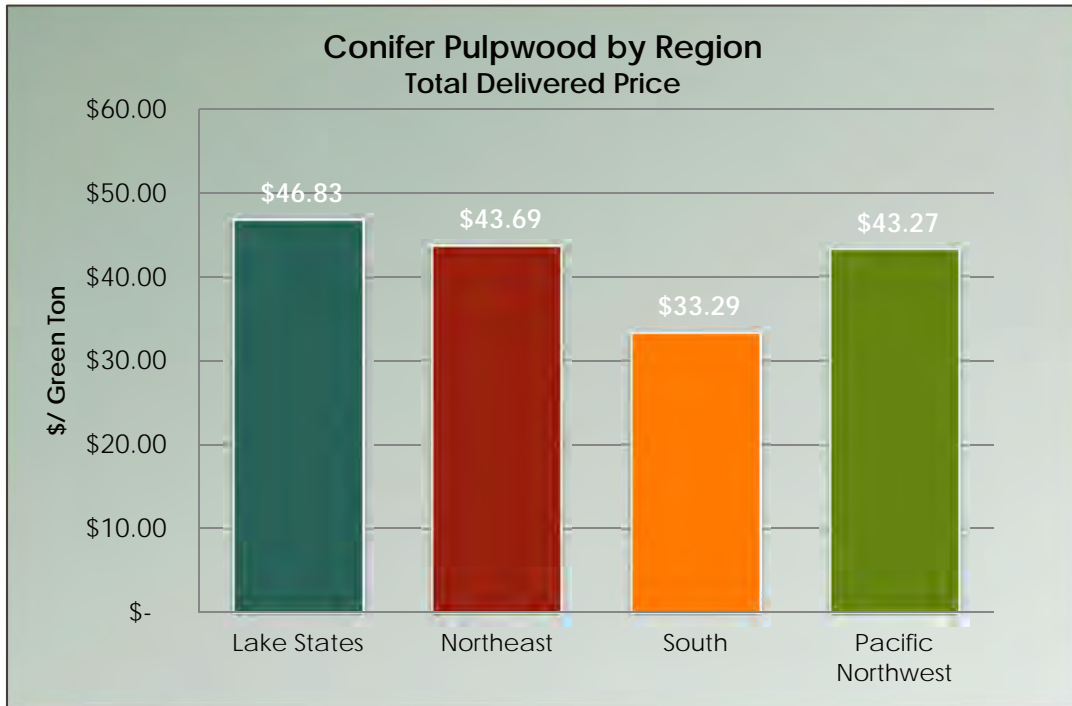
Total delivered pricing for the hardwood group is displayed in Figure #6 below. Hardwood pulpwood pricing for the South and Pacific Northwest was approximately \$40.00 per ton, and about \$50.00 per ton for the Lakes States and Northeast. The Lakes States had the second highest average pricing. As analyzed in Section 2.2, the Lakes States and Northeast exhibited the most variability from quarter to quarter, with the most occurring in the Lake States. Seasonal constraints on raw material availability are likely impacting pricing in these northern markets. The data analyzed for this report supports this hypothesis, as price increases were noted in Q2, 2014, corresponding with additional costs associated with seasonal market events, such as lower production levels and additional material transportation costs (Figure #6).

Figure #6 – Total Delivered Pricing for the Hardwood Group



Conifer pulpwood was more variable between regions than that of hardwood pulpwood. The highest average delivered price for this species group was in the Lake States region, which had a total price of \$46.83 per ton. The South had the lowest average price at \$33.29 per ton. The difference between the min and max for conifer pulpwood was \$13.54 per ton, which was the largest divergence between regions for any given species grouping we evaluated. These regions represent both ends of the spectrum for harvest methodology, seasonal constraints, and forest economic characteristics. In the South, there is little seasonal fluctuation in roundwood production, a majority of the market share is comprised of softwood, and harvesting is largely whole-tree and production based (Figure #7).

Figure #7 – Total Delivered Pricing for the Conifer Group



3.2 Supply Chain Regional Analysis

Costs associated with the supply chain components described previously in the report are exhibited in the following figures. Each species group is presented in a separate figure that presents the cost (\$) of each component and the total delivered value (sum of the component costs) for each region. This study measured variance within each supply chain component between species groups. Variance is defined as the measure of how spread out or variable the sample statistics are within each supply chain component grouping as provided by F2M. The following formula was applied to these groupings to derive the variance metric:

$$\frac{\sum(x-\bar{x})^2}{(n-1)}, \text{ where } \bar{x} \text{ is the sample mean average, and } n \text{ is the sample size}$$

Variance summary statistics are provided in Exhibit #3.

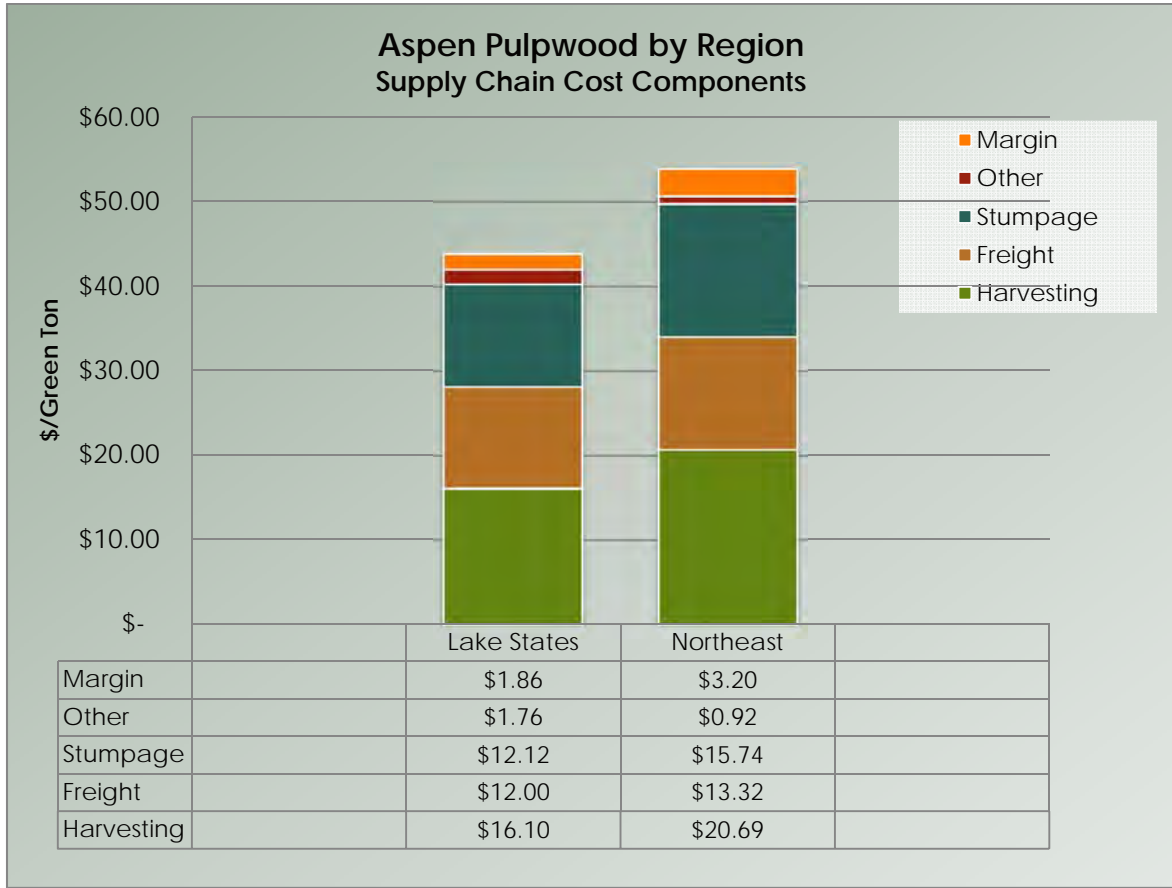
More detailed analysis of each component is provided in the following sections. The supply chain components are presented as a percentage of the total delivered cost in Table #1.

Table #1 – Cost Components as a Percent of Total Delivered

Supply Chain Cost Component (%)							
Aspen Pulpwood							
Region	Total Delivered	Other	Harvesting	Freight	Margin	Stumpage	
Lake States	\$ 43.83	4%	37%	27%	4%	28%	
Northeast	\$ 53.86	2%	38%	25%	6%	29%	
Hardwood Pulpwood							
Region	Total Delivered	Other	Harvesting	Freight	Margin	Stumpage	
Lake States	\$ 47.16	13%	34%	26%	4%	23%	
Northeast	\$ 50.57	4%	41%	25%	4%	27%	
South	\$ 40.38	5%	31%	25%	12%	28%	
Pacific Northwest	\$ 39.94	26%	47%	21%	3%	3%	
Conifer Pulpwood							
Region	Total Delivered	Other	Harvesting	Freight	Margin	Stumpage	
Lake States	\$ 46.83	10%	35%	27%	5%	23%	
Northeast	\$ 43.69	3%	48%	30%	4%	15%	
South	\$ 33.29	2%	36%	25%	5%	32%	
Pacific Northwest	\$ 43.27	24%	39%	22%	4%	11%	

The cost components within the regions that produce aspen pulpwood had a low level of variation when evaluated as a percent of total delivered price. All of the component costs varied by no more than two percent between the Lake States and Northeast regions for the aspen species group (Table #1 Aspen component prices are presented in Figure #8).

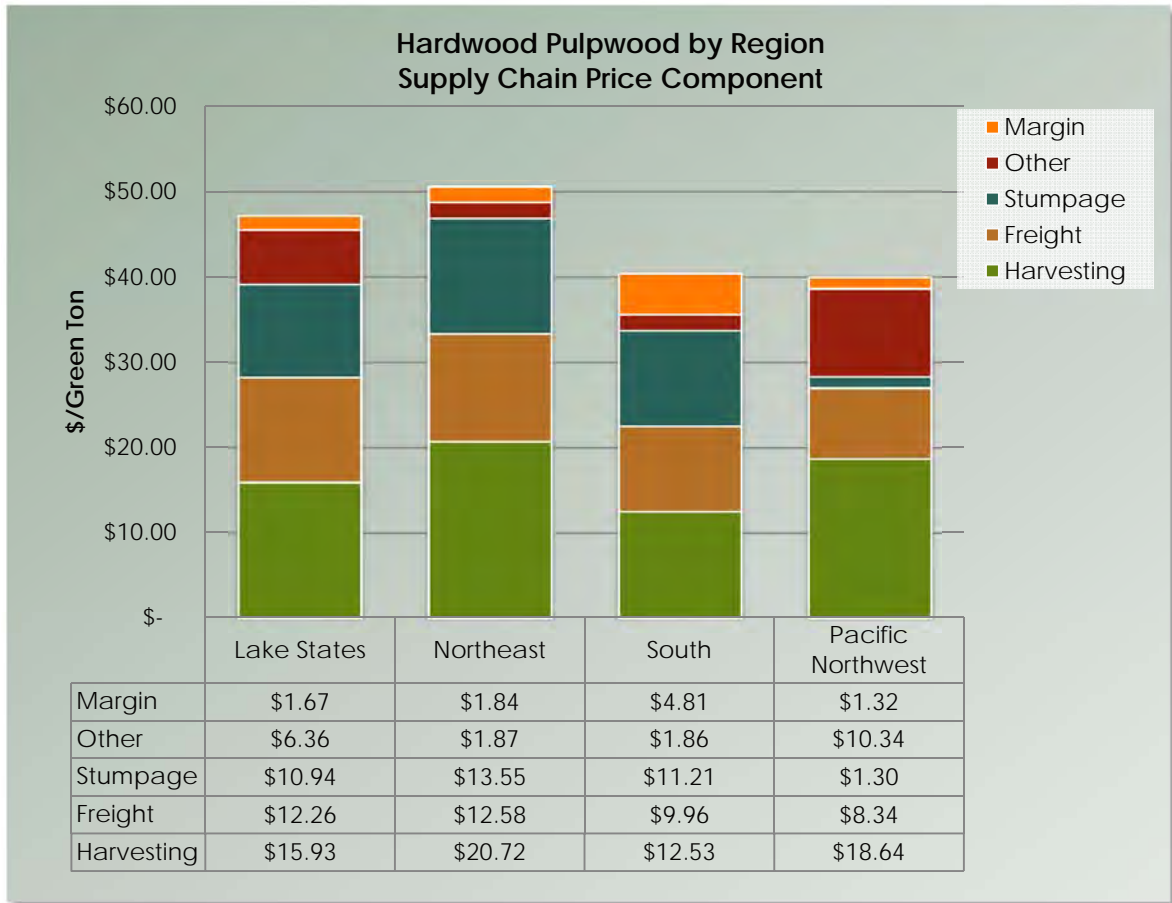
Figure #8 – Aspen Pulpwood Cost Component Summary



The cost of Freight and Other for aspen pulpwood varied least among cost components in aspen producing regions. The highest variance occurred in the Harvesting and Stumpage categories, with a change of more than 20 percent for both. Our study found the Lake States region had a higher cost for the Other category than the Northeast region (Figure #8 and Exhibit #3 provide an estimate of variance by region and species group).

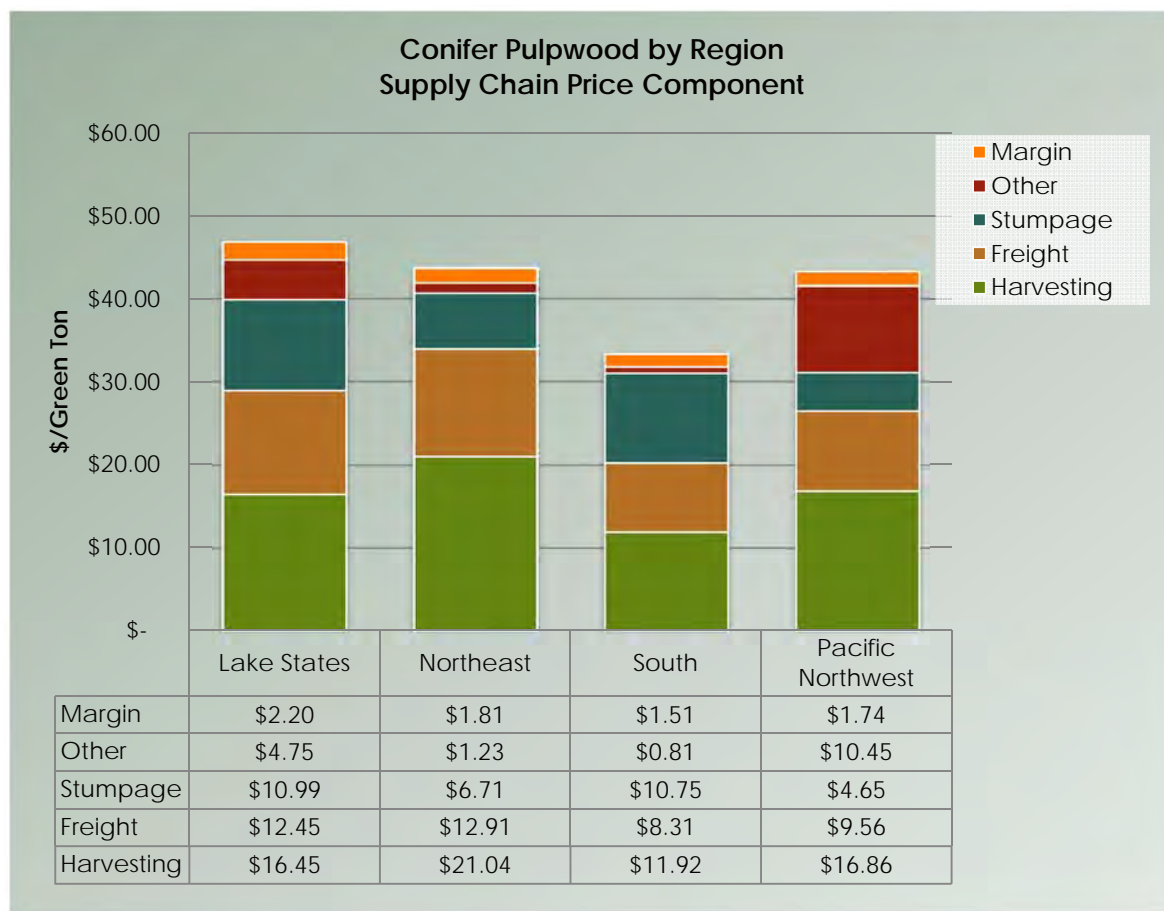
The costs of the supply chain components for the hardwood pulpwood group is displayed in Figure #9. Cost components for this group varied more between regions than aspen pulpwood (Exhibit #3, variance metrics). The difference in cost between the minimum and maximum values for Stumpage was 90 percent, with the Northeast average at \$13.55 per ton (27 percent of total delivered value) in comparison to \$1.30 per ton (three percent of total delivered value) in the Pacific Northwest (Figure #9). The Other category had the second most variance, where the min and max values varied by over 80 percent. The Other grouping includes costs that are specific to a region’s wood transportation system, as well as handling and processing costs. Additional details on the factors that affect hardwood pulpwood costs are discussed later in this section (Figure #9 and Table #1).

Figure # 9 – Hardwood Pulpwood Cost Component Summary



Conifer pulpwood cost components are provided in Figure #10. The Lake States region had the highest costs for both the Stumpage and Margin components. The greatest range in cost among the supply chain components occurred in the Other category, which ranged from \$0.81 to \$10.45 per ton, representing a difference of over 90 percent. The Harvesting category also exhibited a high rate of variance, with the minimum and maximum values showing a 43 percent difference.

Figure # 10 – Conifer Pulpwood Cost Component Summary



The following sections will continue summarizing results of the supply chain costs evaluation, with each cost component being analyzed in more detail.

3.2.1 Stumpage

The Stumpage component of the supply chain was one of the most variable cost components analyzed; with hardwood pulpwood exhibiting the most variance across the regions. Stumpage pricing is derived for each mill predominantly from documented timber sale results and is tied to the mill's procurement zone.

When compared to other regions, Lake States stumpage rates ranked second highest for aspen pulpwood, third highest for hardwood pulpwood, and was the highest region for conifer pulpwood. The Lake States Stumpage cost approximated that of the Southern region for conifer pulpwood, differing only by \$0.24 per ton. However, the Lake States conifer pulpwood total delivered price was \$13.54 per ton, higher than the South. Among the three species groups, aspen stumpage had the lowest measure of variance (variance = 6.55; Exhibit #3).

The Lake States data suggested that it may have more competitive stumpage pricing for hardwood pulpwood, as it had lower stumpage than both the Northeast and South regions. As a percent of total delivered cost, the stumpage component was also lower in the Lake States than other respective eastern U.S. regions (Northeast and South). Yet, the Lake States had the second highest total delivered price for this species group.

3.2.2 Harvesting

The cost of harvesting in the Lake States was comparable to many of the other regions studied. The Lake States region had the lowest harvesting cost for aspen pulpwood and ranked third for hardwood and conifer pulpwood. The data suggests that the Lake States is quite competitive at the national level for cost to produce timber at the landing.

Baker et al. (2013) suggests that the average logging contractor in the Lake States harvests about 1,800 tons per week, which is less than one-half that produced by a similar sized contractor in the South and the Northeast. Yet, our study revealed that the Lake States has higher production per woodworker than the West or Northeast (Baker et al. 2013).

Cut-to-length harvesting is the most common method of producing aspen, hardwood, and most conifer species in the Lake States. As a primary harvesting method, cut-to-length systems are fairly unique to the Lake States region. The dominance of this system, as well as the high percentage of forests being managed using uneven-aged techniques, is likely one of the reasons that the Lake States lags behind other regions in average production (Baker et al. 2013). A separate study completed for the Wood Supply Research Institute, found the fewest number of logging weeks per year in the Lake States and Northeast, especially for cut-to-length and cable skidder operations (RISI, Barynin 2013).

3.2.3 Freight

As outlined in section 3.1 of the report, the Lake States region has some of the highest trucking costs in the country, exceeded only by the Pacific Northwest. Conversations with industry experts suggest that trucking costs are about \$0.19 per ton per mile in the Lake States, followed by the Northeast (\$0.18 per ton per mile), and the South (\$0.16 per ton per mile)(F2M).

When evaluating the F2M results, it should be noted that in most regions truck loading is part of harvesting cost, especially where whole-tree harvesting is the common technique and trailers are without loaders. A large percentage of haul trucks in the Lake States include loaders, which add to the hauling costs. Total freight costs are highest in the Northeast, with the Lake States ranked as a close second. The freight cost component is similar for these two regions, with the largest gap occurring for aspen pulpwood, for which the Northeast's freight cost is \$1.32 per ton higher. In general, regions with harvesting operations and industry infrastructure that facilitate haul trucks without on-board loaders result in the loading costs being accounted for in the Harvesting cost component.

Total freight costs in the South and Pacific Northwest were substantially lower than the Lake States, with hardwood pulpwood freight \$2.30 per ton lower in the South and \$3.92 per ton lower in the Pacific Northwest. A regional analysis completed by RISI found that over 90 percent of annual production in the South originates from crews using tree-length harvest methods (RISI, Barynin 2013). The cost of loading trucks on these jobs would have been included in the harvesting portion of the F2M supply chain data (F2M).

The average haul distance reported by F2M represents the weighted average from all loads within the selected data set (reported by product, region, and quarter). Table #2 provides average haul distances from the most recent quarters (Q3, 2013, Q4, 2013, Q1, 2014, and Q2, 2014).

Table #2 – F2M Derived Average Haul Distance by Region and Product Grouping

Region	Average Haul Distance		
	Conifer	Hardwood	Aspen
Lake States	106	114	72
Northeast	78	84	76
South	54	66	-
Pacific Northwest	48	41	-

The regional cost analysis survey developed in cooperation with the Wood Supply Research Institute found that the respondents' average load traveled 75 miles to a mill in the Lake States and Northeast regions (Baker et al. 2013). This haul distance is similar to haul distances in these regions derived from F2M data and suggest that the regions used in each analysis are similar in terms of contractor characteristics and general location. Haul distances derived from F2M for the Lake States region are about 30 percent higher on average for conifer and hardwood pulpwood than haul distances presented by Baker et al. (2013); however, both sources identify the Lake States as region with some of the longest haul distances.

3.2.4 Margin

The margin for the average load was quite variable for the aspen and hardwood pulpwood product groupings. The Lake States region has one of the lowest margin costs for these product categories, with the margin just over one-half of the Northeast cost for aspen pulpwood. Conversely, the Lake States had the highest margin for conifer pulpwood at \$2.20 per ton, which is about \$0.69 per ton, or 31 percent, more than the South. As described earlier in the report, this is a calculated cost and is considered the net after paying cut, skid, load, and haul costs (excluding the Other cost component).

3.2.5 Other

This cost component figure was highly variable between regions. The Other category includes costs associated with procurement, wood yard expense, and wood transfer, so variation between reporting mills for this supply chain component is expected. The Pacific Northwest and the Lake States regions had the highest costs for this component (Exhibit #3), but costs in these regions are tied to markedly different production processes.

In the Lake States, a major component of the Other category is linked to the transfer of wood during seasons of wood supply shortages and includes general costs associated with wood yard operations. Wood yard transfers and direct yard costs are believed to be high in the Lake States due to shortwood handling and the stock piling of raw material to hedge against potential seasonal supply constraints. These costs are common to the Wisconsin/Lake States region and, to a lesser extent, the Northeast region, as well as to select areas utilizing the cut-to-length harvest model. Shortwood handling adds considerable cost to the Lake States region, and the Other category contributed over 10 percent of the total delivered cost for both hardwood and conifer pulpwood.

The primary cost that contributes to the Other cost component in the Pacific Northwest is the transfer of chips. Pulpwood material in the Pacific Northwest is mostly sourced from sawmills in the form of residue chips. Therefore, pulpwood is mostly topwood volume in the form of chips. The handling and re-hauling of this material from sawmill to the pulpmill adds significant cost to pulpwood in this region.

3.3 Wisconsin Fiber Cost Summary and Comparison Analysis

Our evaluation of the load data selected to represent the Wisconsin marketplace identified many competitive advantages associated with this region. When compared to the Northeast region, mills/suppliers included in the Wisconsin data set reported lower total delivered costs for both hardwood and aspen pulpwood. In the Wisconsin data set, Stumpage, Harvesting, and Margins occupied a smaller percentage of the total delivered cost for aspen pulpwood in comparison to the Northeast region. Results for hardwood pulpwood product were similar. However, the advantages begin to shift toward the Northeast region when comparing conifer pulpwood. The Stumpage, Margin, and Other component costs are higher in the Lake States for conifer pulpwood deliveries. Overall, Wisconsin data indicates more efficiencies in the Harvesting cost component than any other supply chain cost when compared to the Northeast region.

It is difficult to identify specific costs that may lead to the higher reported Harvest costs in the Northeast region, but some of the contributing factors may stem from this region's varied wood products industry. The Northeast study region includes mills from central New York eastward, including Vermont, New Hampshire, and north through the entire state of Maine. This region's landowner base and harvesting methods differ from north to south. Most of the state of Maine and the northern portions of the other states in this region are in an area of higher production levels with generally larger landowners. The northern extents of the region are defined by larger crews, producing timber using buncher and whole-tree operations. Many logging firms work under harvest contracts on large ownerships in the northern tier of the Northeast region as well. In contrast, the southern extent of the region is made up of smaller crews/firms, which in many cases are merchandising by hand and focusing on tree segment and grade optimization (similar to Wisconsin). Higher quality timber in the southern tier generally results in lower production. Data from areas of lower production, which is most common in the southern tier of the Northeast region, may be one of the factors contributing to higher Harvest costs for this region. However, a major difference between Wisconsin and the Northeast region is haul truck configuration, and the fact that the loading costs are part of Harvesting in the Northeast and part of the Freight cost in Wisconsin. As stated earlier in the report, most log trucks in Wisconsin have loaders; therefore, trucking costs are increased by both the time and expense required to load roundwood (a cost that must be incurred by the trucker in most cases) at the landing site. Accounting for loading in the same supply chain link would theoretically increase harvesting cost and lower freight cost in the Lake States and, to a lesser extent, in the Northeast.

While the cost of Harvesting is lower in the Lake States when compared to the Northeast, the Other and Stumpage cost components for conifer pulpwood are higher - 74 and 39 percent, respectively. The previous sections document wood transfer costs included in the Other category. Stumpage also plays a role in the Lakes States higher delivered conifer cost. Similar to wood transfer costs, higher conifer pulpwood stumpage in the Lake States may be connected to seasonal logging constraints. In some cases red pine stumpage is purchased to ensure that logging crews have harvestable ground during periods of wet soil conditions (generally in the fall and spring months). As a result, conifer stumpage could be above general market values, since contractors appear willing to pay more for stumpage that is accessible throughout the year. Product competition, especially for red pine, could also be affecting conifer stumpage in the Lake States. As Wisconsin's pine plantations mature, pulpwood markets have to compete with mills manufacturing sawn and pole products.

Although the South and Pacific Northwest regions are less comparable to the Lake States than the Northeast, the supply chain component costs for these regions suggest areas of competitive disadvantage at a national level. Two cost components that highlight areas of disadvantage are the Freight and Other categories. The actual component cost and percent of total delivered for these categories are higher in the Lake States than in the South. As identified previously in the report, costs in the Other category are quite high in Wisconsin due in part to harvesting methods and industry infrastructure. Other costs are much lower in the South due to efficiencies in the infrastructure and the prevalence of whole-tree harvesting.

Freight costs are 19 percent lower for hardwood pulpwood and almost 33 percent lower for conifer pulpwood in the South region relative to the Lake States. Truck loading likely makes up some of the divergence between Wisconsin and the South. Freight costs in Wisconsin are also pressed higher by the fact that less raw material can be moved over the road, due to the burden of the on-board loader.

Our review of the project results found that Wisconsin's Harvesting costs are reasonably competitive on the national level. When evaluating the harvesting costs as a percentage of the total delivered prices, the only region that had a more favorable ratio was the South, but only for hardwood pulpwood. Since this species group is managed quite differently within these two regions, the results of our study suggest that harvesting efficiencies within the current industry structure may not result in great cost savings. Production whole-tree harvesting, as is common in the hardwood type in the South, is not likely a method of harvest to be adopted in Wisconsin's quality hardwood stands.

Areas identified for further investigation include the supply chain component costs of Other, Freight, and Stumpage. The Wisconsin data set results found the Other cost component to be nearly double that of the South and Northeast regions in most cases, and in excess of five times the cost of conifer pulpwood in the South region. The Other cost component accounts for 4 to 13 percent of the total delivered cost in Wisconsin, exceeded only by the Pacific Northwest for hardwood and conifer pulpwood. This cost component is largely tied to industry structure in the Lake States; however, efficiencies in the category may create notable cost savings over time.

This study identified Freight as an area where regional industry infrastructure results in costs being moved between supply chain components. Freight costs are highest in Wisconsin and the Northeast, with the lowest average rate being reported in the South at \$8.31 per green ton for conifer pulpwood. Additional discussion on this cost component is provided in the following sections.

Lake States stumpage rates were not identified as being unusually high or notably divergent from the other regions evaluated. Wisconsin did have the highest stumpage cost of conifer pulpwood, but this component averaged only \$0.24 higher than the South for this product (Figure #10). This cost is driven by many economic factors and is generally an area that is difficult to find room for cost savings, especially in regions with competitive and healthy wood product industries.

3.4 Canadian Markets

The forest industry in eastern Canada has long been dependent on the U.S. market for the sale of finished goods. While eastern Canada has a large forest resource, mills that are close to the Northeast U.S. region, particularly Maine, receive a large proportion of their raw material supply from U.S. landowners. In fact, there has been a strong relationship between sawmills on the border of Quebec and Maine and pulp mills in central Maine. When pulp/paper mills were integrated with forest products companies, their land base in Maine supplied logs to the sawmills in Canada, and they also purchased residual chips from Canadian sawmills. Even though pulp/paper companies no longer own the land base, this supply chain continues with TIMOs and REITs supplying the logs.

A large proportion of the land base in Canada is owned as "Crown Land" (about 90 percent of the Canadian land base), and the use of natural resources is a main revenue stream for many provinces. The Canadian provinces allocate portions of the resource as fiber supply for companies willing to build mills. Historically, provinces "allocate" a forest resource area to supply a given mill with timber and set stumpage rates based on a formula. The mill is responsible for the sustainable management of the land base allocated to them. This type of raw material supply is sometimes called Forest Tenure, since the mill agrees to long-term management of the resource. In some cases, there may only be one mill operating in a given general market/procurement area.

In more recent years, and where more competitive industry has developed, this method is beginning to employ more open market bidding for stumpage. In some cases, these sales are now being used for

pricing forest tenure wood. Quebec is generally leading this change, though New Brunswick and Ontario are also moving toward this structure. The amount of the resource open for bidding varies by province.

Private forestland in Canada operates under a different standard than in the U.S. Timber from private land bases is generally sold through marketing boards, which are somewhat analogous to cooperatives in the U.S. Small private landowners sell timber through marketing boards that essentially market their timber to the forest industry. About five marketing boards are run in each of the eastern provinces. The concept of these boards is that their size allows individual landowners better access to the market and, at the same time, allows the mill to work with fewer suppliers for supply chain efficiency. The marketing boards might also be likened to the “dealer network” in the southeastern U.S. with a higher degree of government regulation.

Harvesting operations are generally dominated by whole-tree methods and, in most cases, operations are completed by smaller-sized contractors. These contractors are similar to those in the Lake States and are reported as having similar production levels. Seasonal harvesting limitations are similar to that observed in Wisconsin, but price fluctuation seems to be less pronounced. Species mix and harvesting is most similar to Northeast U.S., with a forest economy based on softwood logs and in-woods chips (F2M).

4. Summary

4.1 Project Overview

This study evaluated the topic question of: What forestry-related factors are expected to enhance or reduce the competitiveness of forest-based manufacturing in Wisconsin? The primary project objective focused on evaluating the supply chain costs in Wisconsin as compared to other significant wood baskets in the U.S. The aggregated delivered load data provided by F2M allowed for a comparison that represented a snapshot in time. This study investigated the wood product markets effective the second half of 2013 through the first half of 2014. Continued evaluation of the F2M data, provided that it is summarized in a similar manner going forward, would provide a more conclusive and statistically significant data set in the future. However, our results are consistent with commonly reported observations by industry contacts and those who provided information during our research efforts. We caution that our results represent averages over numerous reporting mills and wood suppliers over broad regions and may not capture or recognize smaller scale individual market or mill situations.

4.2 Conclusions

Results of our analyses of the quarterly data provided by F2M indicated that an aggregation of the data should be used as the baseline for regional comparison. Because the Northeast region is new to the F2M benchmarking services, data for this region only dated back to the third quarter of 2013. The total delivered and supply chain component costs were averaged across four quarters (refer to Section 2.2), and we utilized the F2M weighted average data. As a result, the conclusions of this study are based on a snapshot in time.

The various analyses and regional comparisons resulted in the following supply chain cost inferences.

Total delivered price summation:

- Wisconsin total delivered aspen pulpwood cost is over \$10.00 per ton lower than the Northeast region (the South and Pacific Northwest do not produce aspen pulpwood).
- Wisconsin has the second highest total delivered cost for hardwood pulpwood.
- Total delivered price for conifer pulpwood is highest in Wisconsin.

Supply chain cost inferences:

- A low level of variation occurs within regions that produce aspen when the cost components are evaluated as a percent of total delivered price.
- The Stumpage and Other categories have highest levels of variance between regions.
- Wisconsin has the second highest cost for the Freight component for all of the products analyzed.
- The Wisconsin data consistently exhibits some of the highest Other costs across the product groups.
- Freight costs in Wisconsin are considered the highest as a percent of the total delivered costs for all products analyzed.
- Wisconsin has the highest conifer pulpwood cost across all regions.
- Wisconsin Harvesting costs are competitive when compared to the other regions, as this cost is \$4.59 to \$4.79 per ton lower than the Northeast, and only \$3.40 to \$4.53 per ton higher than the South.

Other and Freight costs are components of the supply chain where opportunity may exist to capture cost savings through streamlining and efficiencies (see Section 3.3). The costs included in the Freight component are documented throughout the report. Freight costs are a considerable component of the total delivered cost in the Lake States, as evidenced by the fact that these costs account for 26 to 27 percent of the total delivered cost for the products analyzed. This cost is also quite high in the Northeast region, as Freight costs account for 25 to 30 percent of the total delivered price across the species groups. Generally, the Lake States and Northeast Freight costs are \$2.00 to \$4.00 or more per ton than in other regions. Overall, there was little variation in Freight costs across regions within product groups, and Freight had lower variance than some of the other component costs (Harvesting, Other, and Stumpage show high variance). Yet, Freight is a cost that is tied to many other costs in the Lake States region.

Efficiencies in Freight and Other costs are not easy to address, as portions of these costs are influenced by seasonal climatic conditions and forest industry infrastructure. The adoption of whole-tree harvesting and investment in changes to all supply chain components to facilitate change would be difficult, but could lower costs in Freight (although some costs would be moved to other categories, such as loading to Harvesting) and the Other cost component. The Other costs could be lowered near levels observed in the Northeast and South region if double handling of wood is reduced, haul trucks were reconfigured without loaders, and mills (including new industry) could accept tree-length segments. These changes would be quite significant due to the current investment in these infrastructure components. Although these supply chain cost components come to the surface as potential areas of opportunity when evaluating the F2M data, the foundational changes necessary to support logistical efficiencies may be considered implausible due to the capital costs required to change the infrastructure.

Reasonable efforts to facilitate delivering wood directly from the landing to the mill could minimize a portion of the costs included in the Other category. Different truck configurations might minimize empty backhaul situations, as is common in the Northeast, with roundwood going into Canada and finished product coming back to the U.S.

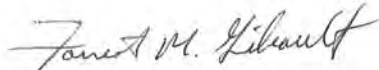
Stumpage costs in Wisconsin are generally lower than the other regions, except for conifer pulpwood, in which Wisconsin had the highest Stumpage cost. The dynamics contributing to high conifer pulpwood stumpage in Wisconsin are likely resulting from several regional market and operational characteristics. Shortwood infrastructure and contractors seeking pine plantation harvests operable nearly year-round could be some of the factors relating to this notably high cost component.

It should be noted that the Lake States region has some of the highest haul distances in the nation. Therefore, strategic placement of new industry could reduce Freight and Other costs from the start. The average haul distance in the Lake States region provides evidence that the average mill in this region is not well placed, especially when compared to the South and Pacific Northwest.

The Lake States, including Wisconsin, appear to have a slight overall delivered cost advantage over the Northeast, the region most similar in forest cover, seasonality issues, and harvest operations. Both the Lake States and the Northeast would appear at a competitive disadvantage when compared to the South. This disadvantage will be difficult to overcome given differences in weather and forest and operational characteristics.

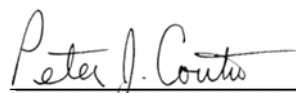
Submitted by:

STEIGERWALDT LAND SERVICES, INC.



Forrest Gibeault, ACF
Analysis and Investments Operations Director

FOREST2MARKET, INC.

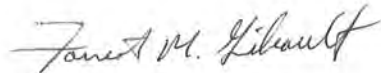


Peter J. Coutu
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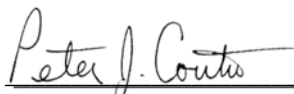
STATEMENT OF LIMITING CONDITIONS

We certify that, to the best of our knowledge and belief:

- a. The statements of fact contained in this report are true and correct.
- b. The reported analyses, opinions, and conclusions are limited only by the reported assumptions and limiting conditions, and are our personal, impartial, and unbiased professional analyses, opinions, and conclusions.
- c. The F2M data was aggregated to allow for confidentiality, and the data set provided for the study only allowed for inference at the regional levels reported.
- d. We have no present or prospective interest in the subject of this report, and no personal interest with respect to the parties involved.
- e. We have no bias with respect to the subject of this report or to the parties involved with this assignment.
- f. Our engagement in this assignment was not contingent upon developing or reporting predetermined results.
- g. Our compensation for completing this assignment is not contingent upon the development or reporting of predetermined results or directions that favors the cause of the client, the attainment of a stipulated result, or the occurrence of a subsequent event directly related to the intended use of this report.

STEIGERWALDT LAND SERVICES, INC.

Forrest Gibeault, ACF
Analysis and Investments Operations Director

FOREST2MARKET, INC.

Peter J. Coutu
Sales Director – North America

Exhibit 1

Data Validity Results

Exhibit #1 - Data Validity Results

Percent Change Analysis													
		Q1 2013		Q2 2013		Q3 2013		Q4 2013		Q1 2014		Q2 2014	
Region	Species	Total Delivered Price	% Change	Total Delivered Price	% Change	Total Delivered Price	% Change	Total Delivered Price	% Change	Total Delivered Price	% Change	Total Delivered Price	% Change
Lake States	Aspen	\$ 40.87	-4.99%	\$ 41.25	-4.02%	\$ 41.68	-2.95%	\$ 42.34	-1.34%	\$ 42.44	-1.11%	\$ 48.87	12.20%
	Hardwood	\$ 43.74	-6.35%	\$ 46.69	0.38%	\$ 45.66	-1.88%	\$ 45.71	-1.77%	\$ 45.62	-1.97%	\$ 51.68	9.99%
	Conifer	\$ 47.02	0.07%	\$ 47.59	1.25%	\$ 46.18	-1.76%	\$ 45.94	-2.29%	\$ 45.14	-4.09%	\$ 50.07	6.16%
Northeast	Aspen					\$ 56.43	4.55%	\$ 53.92	0.11%	\$ 50.99	-5.64%	\$ 54.11	0.46%
	Hardwood					\$ 51.34	1.50%	\$ 51.66	2.11%	\$ 48.50	-4.27%	\$ 50.77	0.41%
	Conifer					\$ 43.91	0.49%	\$ 44.38	1.54%	\$ 42.07	-3.85%	\$ 44.41	1.62%
South	Hardwood	\$ 38.32	-3.18%	\$ 37.40	-5.72%	\$ 38.57	-2.52%	\$ 39.73	0.48%	\$ 41.92	5.68%	\$ 41.29	4.25%
	Conifer	\$ 32.48	-1.35%	\$ 31.85	-3.35%	\$ 32.72	-0.60%	\$ 33.13	0.64%	\$ 33.90	2.89%	\$ 33.42	1.52%
Pacific Northwest	Hardwood	\$ 40.39	1.10%	\$ 39.52	-1.07%	\$ 38.18	-4.64%	\$ 40.62	1.66%	\$ 39.17	-1.97%	\$ 41.79	4.42%
	Conifer	\$ 44.37	2.61%	\$ 41.81	-3.34%	\$ 41.78	-3.42%	\$ 41.61	-3.86%	\$ 44.80	3.55%	\$ 44.89	3.74%

Deviation from Average Analysis									
		Q3 2013		Q4 2013		Q1 2014		Q2 2014	
Region	Species	Average Total Delivered Price	Deviation From Avg.	Total Delivered Price	Deviation From Avg.	Total Delivered Price	Deviation From Avg.	Total Delivered Price	Deviation From Avg.
Lake States	Hardwood	\$ 45.66	1.51	\$ 45.71	1.46	\$ 45.62	1.55	\$ 51.68	4.51
	Conifer	\$ 46.18	0.66	\$ 45.94	0.90	\$ 45.14	1.69	\$ 50.07	3.24
	Aspen	\$ 41.68	2.15	\$ 42.34	1.49	\$ 42.44	1.40	\$ 48.87	5.04
Northeast	Hardwood	\$ 51.34	0.77	\$ 51.66	1.09	\$ 48.50	2.07	\$ 50.77	0.21
	Conifer	\$ 43.91	0.22	\$ 44.38	0.68	\$ 42.07	1.62	\$ 44.41	0.72
	Aspen	\$ 56.43	2.57	\$ 53.92	0.06	\$ 50.99	2.87	\$ 54.11	0.25
South	Hardwood	\$ 38.57	1.81	\$ 39.73	0.65	\$ 41.92	1.54	\$ 41.29	0.92
	Conifer	\$ 32.72	0.57	\$ 33.13	0.17	\$ 33.90	0.61	\$ 33.42	0.13
Pacific Northwest	Hardwood	\$ 38.18	1.77	\$ 40.62	0.68	\$ 39.17	0.77	\$ 41.79	1.85
	Conifer	\$ 41.78	1.49	\$ 41.61	1.66	\$ 44.80	1.53	\$ 44.89	1.62

Exhibit 2

Total Delivered Price Summary



Exhibit #2 – Total Delivered Price Summary

Total Delivered Price	
Aspen Pulpwood	
Region	Total Delivered
Lake States	\$ 43.83
Northeast	\$ 53.86

Hardwood Pulpwood	
Region	Total Delivered
Lake States	\$ 47.16
Northeast	\$ 50.57
South	\$ 40.38
Pacific Northwest	\$ 39.94

Conifer Pulpwood	
Region	Total Delivered
Lake States	\$ 46.83
Northeast	\$ 43.69
South	\$ 33.29
Pacific Northwest	\$ 43.27

*Averages of the four most recent quarters
(Q3, 2013, Q4, 2013, Q1, 2014, and Q2, 2014)

Exhibit 3

Supply Chain Summary Tables



Exhibit #3 – Supply Chain Summary Tables

Supply Chain Price Component (\$/green ton)						
Conifer - Region						
Region	Total Delivered	Other	Harvesting	Freight	Margin	Stumpage
Lake States	\$ 46.83	\$ 4.75	\$ 16.45	\$ 12.45	\$ 2.20	\$ 10.99
Northeast	\$ 43.69	\$ 1.23	\$ 21.04	\$ 12.91	\$ 1.81	\$ 6.71
South	\$ 33.29	\$ 0.81	\$ 11.92	\$ 8.31	\$ 1.51	\$ 10.75
Pacific Northwest	\$ 43.27	\$ 10.45	\$ 16.86	\$ 9.56	\$ 1.74	\$ 4.65
Variance*	34.477	19.898	13.881	4.974	0.081	9.678

Hardwood Pulpwood - Region						
Region	Total Delivered	Other	Harvesting	Freight	Margin	Stumpage
Lake States	\$ 47.16	\$ 6.36	\$ 15.93	\$ 12.26	\$ 1.67	\$ 10.94
Northeast	\$ 50.57	\$ 1.87	\$ 20.72	\$ 12.58	\$ 1.84	\$ 13.55
South	\$ 40.38	\$ 1.86	\$ 12.53	\$ 9.96	\$ 4.81	\$ 11.21
Pacific Northwest	\$ 39.94	\$ 10.34	\$ 18.64	\$ 8.34	\$ 1.32	\$ 1.30
Variance*	27.223	16.667	12.553	4.027	2.601	29.488

Aspen Pulpwood - Region						
Region	Total Delivered	Other	Harvesting	Freight	Margin	Stumpage
Lake States	\$ 43.83	\$ 1.76	\$ 16.10	\$ 12.00	\$ 1.86	\$ 12.12
Northeast	\$ 53.86	\$ 0.92	\$ 20.69	\$ 13.32	\$ 3.20	\$ 15.74
Variance*	50.295	0.348	10.529	0.876	0.886	6.550

* Variance measured across the average regional cost by supply chain component. This measure of variance assumes that the arguments are a sample of the population. The formula used is as follows:

$$\frac{\sum (x - \bar{x})^2}{(n-1)}$$

, where \bar{x} is the sample mean average, and n is the sample size

(A higher variance value equates to more variance)

Exhibit 4

References



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Exhibit 5

Author Biographies



Steigerwaldt Land Services, Inc.

Steigerwaldt Land Services (SLS) is a Wisconsin based forestry and real estate consulting company in operation since 1957, with offices in Tomahawk and Hayward, Wisconsin. SLS employs a staff of 36 including foresters, real estate specialists, appraisers and brokers, GIS specialists, right-of-way acquisition specialists, and a land surveyor. This staff has extensive experience in all facets of the timber industry, including in-depth and on-the-ground experience with Wisconsin forest policy, regulations, and day-to-day field operations on timberland ownerships ranging from small non-industrial private family forestlands to lands owned by large timberland investment entities. Over the last two years, SLS has administered the sale and harvest of approximately 179,000 cords of timber on private Wisconsin forestlands through stumpage sales and direct delivery contracts.

As consultants, our range of services extends beyond Wisconsin to projects across the United States including a variety of assignments centered on valuation and forestland resource analysis. Examples of analysis projects include numerous biomass related resource analyses in the Lake States and Central US, a Lake States softwood resource study centered on timber availability and ownership, markets and mill competition, various mill and resource capacity studies, and a Wisconsin watershed level forest resource analysis including detailed forest, ownership, and timber market study components. SLS routinely works with partner firms in our assortment of projects either as lead or as a collaborator.

The Steigerwaldt team will be led by the following individual:

Forrest M. Gibeault, ACF

Analysis and Investment

Operations Director

Masters in Forestry, MI Tech University

10 years of experience in forest resource analysis

Forest2Market

Forest2Market provides market pricing data as well as wood and fiber supply chain expertise to customers in the forest, wood and paper products, recycled paper and packaging, and bioenergy industries. Founded in 2000, our product suite includes price reports for stumpage and lumber, price forecasts for stumpage, wood basin supply and demand assessments, and benchmarking services for delivered wood raw materials and lumber traders. Headquartered in Charlotte, North Carolina, the company also has offices in Eugene, Oregon, Appleton, Wisconsin, and Curitiba – Parana, Brazil.

The Forest2Market team will be led by the following two key individuals:

Peter J. Coutu

Director of Sales – North America

Masters in Forest Management, Michigan State University
Bachelors in Forest Management, University of Maine
24 years of experience in the Forest Products Industry

Daniel Stuber

VP of Data Operations

M.F.R. in Forest Resources, University of Georgia
Bachelors in Forest Resources, University of Georgia
15+ years of experience in Forest Products Industry
and Data Management