

MARKET POTENTIAL FOR YELLOW POPLAR TIES: PART I

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*Editor's Note: The full title of this research article is "An Assessment of the Market Potential for Yellow Poplar Railroad Ties Based on Historical Price Trends and Standing Timber Volume." Authors Gazal, Hassler and McNeel represent the West Virginia University Appalachian Hardwood Center, where McNeel serves as director. The below article represents the first of a two-part series. Part II will appear in the next edition of *Crossties* and include further discussion and conclusions of this study that focuses on a historical time series comparison of yellow poplar lumber prices with lumber prices of other routinely marketed hardwood species, cants and tie prices over two NHLA grades.*

INTRODUCTION

Service tests of ties subjected to newer borate-focused treating processes suggest that yellow poplar can attain comparable serviceability to ties produced from other well-accepted hardwood species. Given that yellow poplar could be a suitable species for ties, this analysis is focused on the procurement potential for yellow poplar ties with respect to product pricing and timber availability.

To address the market potential for yellow poplar railroad ties, this study focuses on a historical time series comparison of yellow poplar lumber prices with lumber prices of other routinely marketed hardwood species, cants and tie prices over two NHLA (National Hardwood Lumber

Association) grades, No. 2A Common and No. 1 Common. All product pricing data was provided through the *Hardwood Market Report* (HMR). Lumber price comparisons include yellow poplar, red oak, white oak and soft maple. Cant and tie prices are based on the pricing of mixed hardwood cants and mixed hardwood railroad ties, as reported by HMR. The historical time series spans from the first quarter of 2001 through the first quarter of 2022.

The timber availability analysis is based on USDA Forest Service-Forest Inventory Analysis data for West Virginia. This data is updated on a regular basis by the USDA Forest Service for each state. This analysis focused on growing stock volumes and harvests in West Virginia, since that state represents a significant portion of the hardwood timber supply available to the hardwood industry.

For comparison purposes, the analysis includes total growing stock volume, net growth and growth drain ratios for the four species under consideration. Competition for yellow poplar is very robust and includes lumber (both domestic and export markets), pallet cants and pallet lumber, pulpwood for OSB and paper production, peeler logs for engineered wood products, and rustic fence rails.

METHODS & DATA

Quarterly nominal prices, (i.e., second week of each month of January, April, July and October) were obtained through HMR for

the period from 2001 to the first quarter of 2022 for key Appalachian hardwoods, including red oak, white oak, soft maple and yellow poplar lumber in grades 1C and 2A and analyzed to identify trends and cyclical behavior over time. Additionally, quarterly prices for cants and ties of mixed species from the Appalachian region were included in the analysis.

HMR reports all product prices in U.S. dollars per thousand board feet (MBF) except for ties. Tie prices are reported in HMR using a price range and so the average of the quarterly price range for ties was calculated and used in this study. Finally, prices for ties represented a tie product with dimensions of 7 inches by 9 inches by 8.5 feet. To allow for direct comparisons to the other products evaluated in this study, tie prices were converted to U.S. dollars per thousand board feet.

Nominal prices were transformed to 2001 U.S. dollars (real) using the producer price index for industrial commodities as reported by the Bureau of Labor Statistics. Price data were plotted in MS Excel to evaluate trends and forecast prices over a five-year period. Specific trends in the data were evaluated using regression analysis. Correlation analysis was used to identify any correlation between individual price curves.

Standing timber and harvest volumes for red oak, white oak, soft maple, and yellow poplar in West Virginia were also evaluated. Specifically, growing stock volume of sawtimber trees, average annual net growth volume, average annual sawtimber removals, and net of growth and removals were reported for the period 2008-2018 (growing stock volume was reported for 2004-2019). All volumes were reported in thousands of board feet.

RESULTS

Grade 2A, Cants and Tie Prices

Figures 1 (nominal) and 2 (real) show the historical prices as well as projected prices for red oak, white oak, soft maple, and yellow poplar grade 2A lumber as well as prices for cants and ties. Nominal prices are reported to provide a picture of price levels at a given point in time. Including inflation will show an upward trend in prices over time since prices generally increase over time due to inflation. This upward trend is ►

confirmed by the analysis of the trendlines, which indicate a positive slope for each species/product evaluated (Figure 2).

Red oak, white oak and yellow poplar prices reached the highest levels in nominal terms in the fourth quarter of 2021 at \$970/MBF, \$975/MBF and \$650/MBF, respectively. Soft maple reached its peak in the first quarter of 2022 at \$645/MBF. Cants and ties reached the highest levels in prices in the first quarter of 2022 at \$700/MBF and \$907/MBF, respectively. Red oak prices reached the lowest levels in nominal terms in the second and third quarter of 2009 and the third quarter of 2020 at \$400/MBF. The lowest prices for white oak were recorded in the second and third quarters of 2009 at \$325/MBF. Soft maple prices reached the lowest level in the third quarter of 2002 to the first quarter of 2003 at \$270/MBF. Both mixed cants and ties reached their lowest levels between 2001-2002 at \$255/MBF and \$348/MBF, respectively.

Real prices (in 2001 U.S. dollar) are reported to produce a clear economic picture of the real price trends between 2001 and the first quarter of 2022. This helps

determine if the trend of prices over time actually increases or decreases by removing the effect of inflation. In other words, if an upward trend is still observed, something other than inflation may be causing that shift.

Regarding price fluctuations (using nominal prices) between 2001 and the first quarter of 2022, yellow poplar lumber, cants and ties showed a more stable trend in prices when compared with red oak, white oak and soft maple. Both red oak and white oak exhibited more fluctuation in prices over time. In addition, red oak and white oak lumber also showed higher prices historically when compared against the other species and products. Yellow poplar showed historically lower prices in comparison to all other analyzed species and products, followed closely by cants. In fact, both yellow poplar lumber and cants exhibited remarkably similar price patterns between 2001 and the first quarter of 2022. These patterns held for both nominal and real prices.

In terms of correlation between each price curve, red oak and white oak lumber

prices are highly correlated (nominal: Correlation coefficient = 0.73-0.76). That is, just like white oak lumber and ties, yellow poplar lumber prices are highly related to cant prices.

In terms of the general trend in prices in real terms (upward vs. downward), red oak lumber trends downward in price while cants and ties show a significant upward trend. For example, on average, red oak lumber prices decrease \$1.70/MBF per quarter while cants and ties increase about \$0.54/MBF and \$1.32/MBF, respectively. White oak and soft maple exhibit a slightly upward trend, but that trend is not statistically significant. Yellow poplar lumber exhibits a statistically significant downward trend throughout the analysis period, decreasing on average \$0.35/MBF per quarter in real terms.

Based on historical data, a five-year projection of red oak, soft maple and yellow poplar 2A lumber prices after the first quarter of 2022 predicts that prices will continue to decline at a slower pace. Prices for cants, ties and white oak lumber are projected to continue to increase for the next five years, but also at a slower pace.

Grade 1C, Cants and Ties Prices

Figures 3 (nominal) and 4 (real) illustrate the historical prices as well as projected prices for red oak, white oak, soft maple and yellow poplar grade 1C lumber, as well as prices for cants and ties. As expected, prices showed an increasing trend over time in nominal terms for all species and products as shown by the positive slopes of the trend lines. Red oak, white oak and soft maple lumber reached the lowest levels in prices in nominal terms in the second and third quarters of 2009 at \$500/MBF, \$450/MBF and \$525/MBF, respectively. Yellow poplar lumber prices reached the lowest level in the second quarter of 2008 at \$330/MBF. Nominal prices for red oak and yellow poplar lumber reached their highest level in the fourth quarter of 2021 at \$1,015/MBF and \$855/MBF, respectively. The highest nominal prices for white oak and soft maple lumber occurred in the first quarter of 2022 at \$1,555/MBF, respectively.

Just like the 2A yellow poplar lumber, 1C yellow poplar exhibited a more stable price trend (using nominal prices) between

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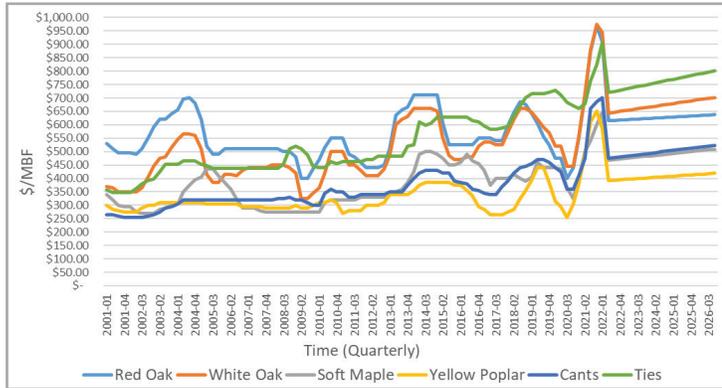
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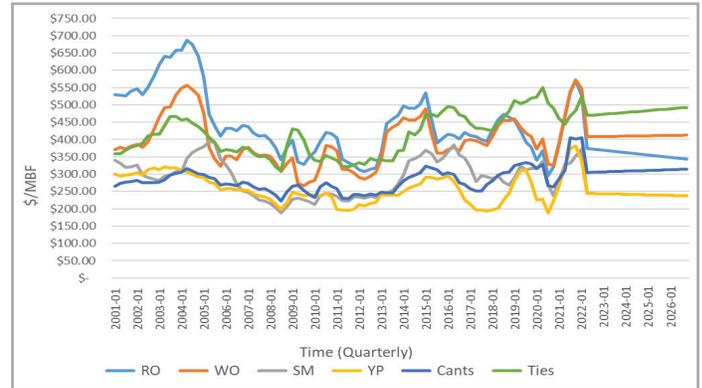
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Figure 1



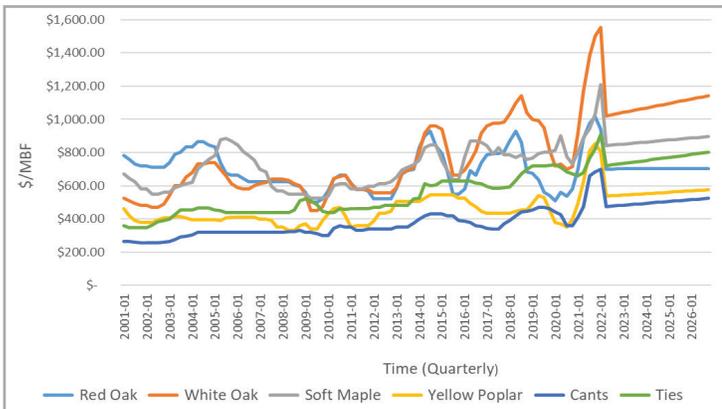
Historical and projected nominal prices for selected grade 2A lumber in the Appalachian region.

Figure 2



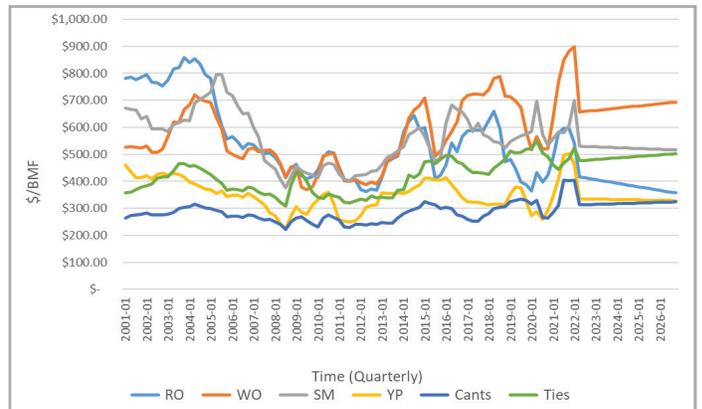
Historical and projected real prices for selected grade 2A lumber species in the Appalachian region (prices in 2001 U.S. dollars).

Figure 3



Historical and projected nominal prices for selected grade 1C lumber species and products in the Appalachian region.

Figure 4



Historical and projected real prices for selected grade 1C lumber species and products in the Appalachian region (prices in 2001 U.S. dollars).

2001 and the first quarter of 2022, similar to mixed cants and ties, while red oak and white oak lumber showed more fluctuation in prices. In terms of price levels over time, white oak lumber prices are generally higher followed by red oak and soft maple. Yellow poplar lumber was slightly more expensive than cants but showed the second-least-expensive prices over time. All these trends held true for both nominal and real prices.

Correlation analysis suggests that white oak lumber, yellow poplar lumber and ties are highly correlated to cants in nominal terms (Correlation coefficient = 0.85-0.89). In real terms, only white oak and ties are strongly correlated to cants (Correlation coefficient = 0.76). The rest of the species are weakly correlated.

In terms of the general trend in prices in real terms (upward vs. downward), red oak and soft maple lumber trended downwards. That is, on average, red oak prices were decreasing \$3.30/MBF per quarter while soft maple prices were decreasing \$0.75/

MBF per quarter. Yellow poplar also trended downward but not at a statistically significant rate. White oak on the other hand trended upward just like mixed cants and ties. White oak prices were increasing \$2/MBF per quarter on average.

Based on historical data, the five-year projection for red oak, soft maple and yellow poplar 1C prices after the first quarter of 2022 suggests that prices will continue to decline but at a slower pace. Prices for white oak lumber, on the other hand, are projected to continue increasing over the next five years at a rate similar to ties and mixed cants.

General Swing Points in Prices (Nominal & Real)

The low and high points of prices for the species/products evaluated are consistent with the general price behavior of lumber in the United States from 2001 to 2022. In terms of swing points in the time series price data evaluated, prices started

to peak around 2004 as growth in home construction and increases in the amount of hardwood kitchen cabinets, wood flooring and millwork continued from the 1990s, resulting in increased hardwood lumber consumption (Luppold et al., 2014). Exports of hardwood lumber also increased during that period.

A decreasing pattern in prices between 2004 and 2009 and continuing in 2012 was observed for all species and products. According to Luppold et al. (2014), the decline in lumber prices in general between 2004 and 2009 was due to the decline in domestic and international demand for lumber used in appearance applications, while the decline in 2009 and 2012 can be attributed to the liquidation of lumber inventories by primary and secondary manufacturers that were put out of business due to poor market conditions (e.g., housing market collapse).

Prices started to increase in 2012 as the housing market started to recover and

peaked again in 2014-2015 as the housing market started to become solid again. Declining prices were observed again in 2017-2018, probably a result of the large declines in exports to China due to tariffs (USDA FAS, 2020). A steep decline in prices for all species and products evaluated occurred again starting in the second quarter of 2020 to the fourth quarter of 2020, generally attributable to the COVID-19 pandemic and spurred on by government measures that slowed down business activities throughout the country, including the forest products industry.

However, prices rebounded in the fourth quarter of 2021, and rose to a level comparable to prices reached in 2003-2004 (in real terms). A surge in the demand for lumber and other wood products from rising housing demand and historically low interest rates, combined with a precipitous decrease in lumber inventory produced significant spikes in hardwood lumber prices throughout 2021, which have continued past the first quarter of 2022.

Other factors that contributed to the rising prices during this period include labor shortages during the pandemic that led to increased labor costs and a severe trucking shortage (caused primarily by a shortage of qualified drivers) that caused an increase in freight costs (Zhang and Stottlemeyer, 2021), both of which are continuing today. The high demand shows signs of cooling, as observed in the first quarter of 2022 prices, which shows some decline. This is true for all species and products evaluated in this study.

Volume Trends for Red Oak, White Oak, Soft Maple and Yellow Poplar in West Virginia

The total growing stock volume of sawtimber trees from 2004-2019 for the different species evaluated in this study is presented in Figure 5. Growing stock volume is generally trending upward for all the species. Red oak and yellow poplar showed the highest levels of growing stock volume during the period evaluated, while

soft maple showed the lowest level of growing stock volume in West Virginia.

Average annual net growth for the different species is provided in Figure 6. Red oak and yellow poplar both trended downward, while soft maple and white oak were trending higher. Red oak and yellow poplar had the highest net growth while soft maple had the lowest. For removals (Figure 7), yellow poplar had the highest removal volume until 2015. After 2015, red oak had the highest removals. Removals for red oak and yellow poplar trended downward after 2018. Both soft maple and white oak have more stable removal volumes during the period of analysis, with soft maple having the lowest removal volume followed by white oak.

Net growth, adjusted for removals, is presented in Figure 8. There are more fluctuations in the net of growth and removals for yellow poplar, when compared to the other three species. However, yellow poplar growth has generally trended higher since about 2010.



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