ROUNDWOOD MARKETS AND UTILIZATION IN WEST VIRGINIA AND OHIO

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Abstract.—West Virginia and Ohio have similar forest resources and extensive forest-based economies. Roundwood is harvested throughout this central Appalachian region and supports a diverse primary and secondary forest products sector. The objective of this research was to investigate the utilization of the forest resource harvested in West Virginia and Ohio. Utilization and market data were collected on 30 active timber harvests in 2008 in West Virginia and 9 active harvests in 2009 in Ohio. Results indicated that the average number of roundwood markets to which loggers transported materials from these 39 harvest sites was 2.4. The main markets supplied were saw logs and softwood pulp in West Virginia and saw logs in Ohio. The overall average utilization achieved at these 39 sites was 82 percent. The utilization rate averaged 80 percent for logging operations with only one or two markets and 85 percent for operations hauling products to three or more markets. The highest utilization rates were measured for pine and yellow-poplar while the lowest rates were for cherry and lower-density hardwood species. Differences exist in the characteristics of roundwood markets utilized by logging operators in Ohio and West Virginia. These results demonstrate the impact that the number and nature of markets have on log utilization at harvest sites.

INTRODUCTION

Two utilization factors are used in translating Timber Products Output (TPO) data collected in surveys of primary wood processors—a logging utilization factor, which is the subject of this study, and a milling utilization factor. The logging utilization factor provides information on the volume of residual material left in the woods compared to the volume of roundwood produced for different primary processing markets. The milling utilization factor provides information on the volume of bark, coarse residues, and fine residues produced in primary processing operations for different primary processing sectors. Throughout the region encompassed by the U.S. Forest Service Northern Research Station, these utilization factors are outdated.

For the 13 northeastern states from Maine to West Virginia and Ohio, a single set of factors has been in use, despite wide variation in forests, species, and markets. The hardwood and softwood utilization factors currently used for the region are 29.5 percent and 26.3 percent, respectively (Smith and others 2001). In many southern states, the U.S. Forest Service Southern Research Station has been updating utilization factors on a routine basis. Utilization rates have been recently completed in Virginia, Florida, and North Carolina (among others) in the last decade (Bentley and Johnson 2008, 2009a, 2009b).

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There is good reason to believe that the factors developed in past decades are no longer applicable. Logging utilization has been impacted in many regions by the development and expansion (and subsequent contraction) of the oriented strandboard (OSB) industry. Recent closings of paper mills also have impacted markets for roundwood. Rapidly increasing energy costs create new markets for top and stemwood in some regions. The economic feasibility of hauling logs to various markets is strongly influenced by prices paid for roundwood in these markets. Roundwood prices have risen in most of these markets over the last two decades but have fallen off since 2007.

The logging utilization factor is applied to the roundwood consumption volumes provided by TPO survey respondents to derive estimates of forestland removals (Blyth and Smith 1979). This factor finds widespread use by forest planners and analysts assessing regional timber supply and demand scenarios. Location analyses for new milling operations rely on these factors. The current emphasis on the developing wood-based energy sector has led to heavy use of U.S. Forest Service Forest Inventory and Analysis (FIA) data and maps as they provide insights on raw material availability for this sector. In particular, the map of *"Unused wood and bark residues from timber harvesting and primary processing mills in the conterminous United States"* (Perry and others 2009) is useful in bio-energy project planning.

Logging utilization information, when combined with logging residue information obtained through physical surveys of sites where harvests have recently been conducted, gives a complete picture of a region's woody residue volumes and characteristics. Grushecky and others conducted physical surveys of harvest site residues in West Virginia in 1995 and 2002 (Grushecky and others 2004). The 2002 survey found that the average weight of wood residues left at harvest sites in southern West Virginia was 10.4 tons per acre (Grushecky and others 2004). The quantity of residue found at the 70 sites sampled in this study was highly variable and no association was found between residue volumes left in the woods and the average slope of the harvested sites. This result indicates that economic, market, and operational factors must be understood when evaluating logging efficiencies and utilization rates. Alderman and Luppold (2005) evaluated logging company characteristics and market factors for 30 West Virginia harvesting operations. Their analysis, however, was not tied to logging site-based material utilization measurements. A combined analysis that includes an assessment of the physical resource and market influences is needed to enhance our understanding of the potential for further utilization of the roundwood resource in the central Appalachian region.

OBJECTIVES

The objectives of this research were to:

1. Derive a current logging utilization factor for the central Appalachian region.
2. Identify which environmental, operational, and market factors have the strongest influence on the utilization rate achieved by logging operations.

METHODOLOGY

SITE SELECTION AND DATA COLLECTION

It was estimated that available resources would allow for sampling at 40 harvest sites during 2008 and 2009. Thirty sites were selected in West Virginia by identifying active harvesting. Harvest sites were located using logging notification forms filed with the West Virginia Division of Forestry (WVDOF) (WVDOF 2010) as

mandated under the 1992 Logging Sediment Control Act (WVDOF 2010). Under this act, all loggers are required to submit a harvest plan before timber operations commence. An equal number of harvest sites were selected randomly from 2008 WVDOF notifications from each of the three WVDOF administrative regions. Logging companies were then contacted to seek their participation. The distribution of sample sites in West Virginia reflects the distribution of active logging jobs during 2008.

In Ohio, the process of identifying active harvesting operations was not guided by a registry, since registration is not required. Nonetheless, state personnel within Ohio's Department of Natural Resources–Division of Forestry maintain awareness of logging activity and were able to provide contact information for logging contractors. Various primary processors in Ohio also were contacted and asked to provide a list of loggers operating in their region. Sampling sites in Ohio were concentrated in the eastern and southeastern regions as these regions share similar geography and markets with West Virginia. These common features allow the data from these sites to be combined with the West Virginia data to produce regional logging utilization insights and factors. Market and weather constraints in 2009 caused our site sampling effort to come up one site short of our goal of 10 sites. Figure 1 shows the locations of the 39 logging utilization study sites.

Sampling methodology was patterned after the system developed by members of the FIA group of the U.S. Forest Service's Southern Research Station. Project personnel underwent a day of field training with the Southern Research Station to review data collection procedures.

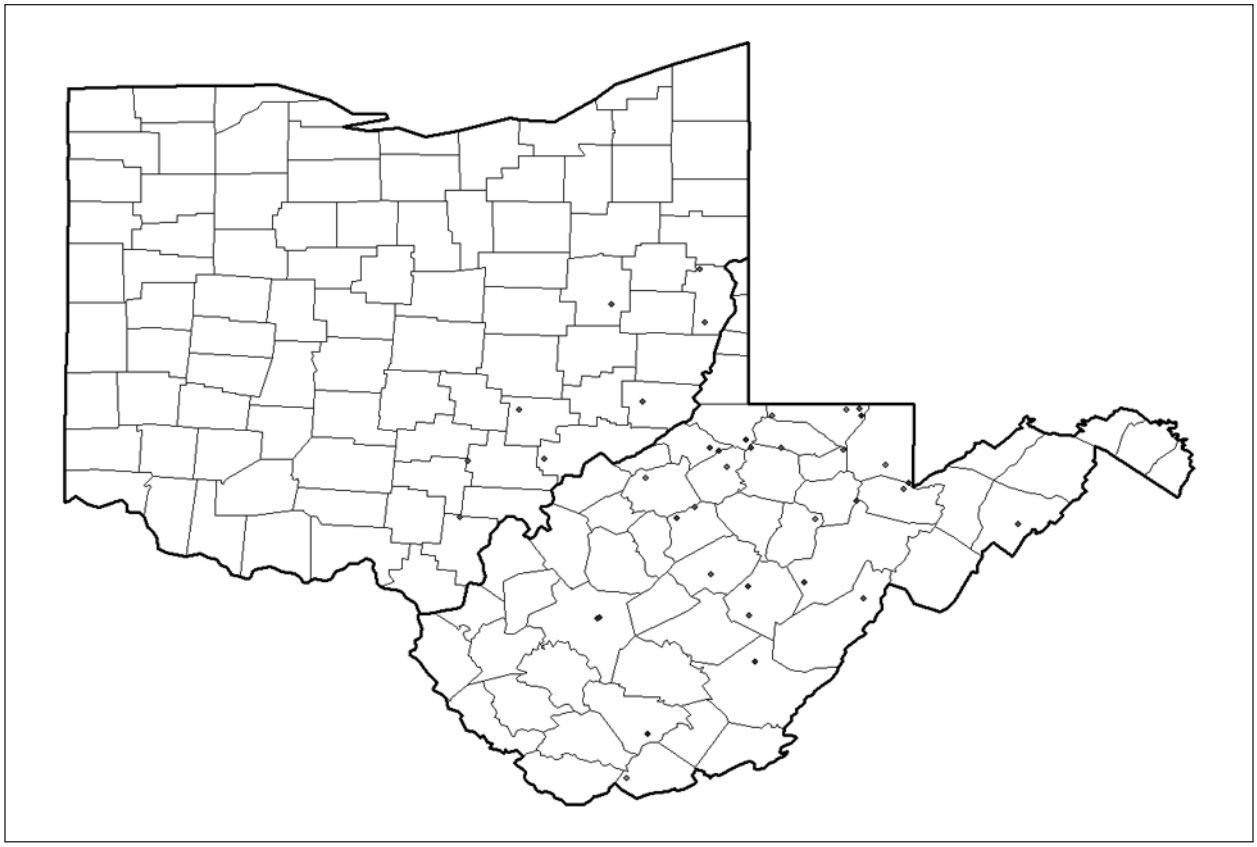

Figure 1.—Locations of 39 sites in West Virginia and Ohio where logging utilization studies were conducted in 2008 and 2009.

According to the standard sampling methodology:

> Each [felled] tree was measured from the top of the cut stump to the end of utilization. Measurements were made along the main stem in sections no longer than 16 feet until the end of utilization. The end of utilization usually is determined by the sawyer, according to particular specifications set by the receiving mill(s). FIA merchantability standards for growing-stock volume are defined as the volume in the main stem of the tree from a 1-foot stump to a 4-inch top. However, most trees are not cut exactly at a 1-foot stump, nor are they cut off at exactly 4 inches. For example, trees cut off above a 1-foot stump and below 4 inches would be considered underutilized, and that volume not utilized would be considered growing-stock residue ….. [The] other required measurement, besides d.b.h. [diameter at breast height] and end of utilization, is the top of the sawtimber portion (9.0 inches in hardwoods). This measurement allows calculation of the sawtimber and poletimber portion of the growing-stock section (Bentley and Johnson 2009).

The goal at each site was to sample 30 felled trees for utilization—both in the woods and at the landing. Sample trees were randomly selected from within the active harvest zone. Details about the logging operation were obtained from the logging contractor including: number of employees; types of equipment; names, locations, and material specifications associated with the markets to which the harvested material was being sent; loads shipped per day; harvest tract size; type of harvest being executed; and other relevant information provided by the logger. The study crew consisted of three people—two taking utilization measurements in the woods on the felled trees and one measuring utilization at the landing where log bucking and sorting to product specifications was executed.

DATA ANALYSIS

A large amount of data was collected in this study so significant attention was given to checking data and resolving data discrepancies before analysis could proceed. The utilization rates for each logging job (also referred to as "sites" throughout this paper) were based on the overall volume of utilized wood divided by the total wood volume. The total volume included both the growing stock portions and the nongrowing stock portions of sample trees. While nongrowing stock portions in the tree tops above the 4-inch diameter cutoff point were not measured, nongrowing stock portions such as cull sections along the tree's main stem and limbs with diameters greater than 4 inches were measured.

Summary statistics for several variables were calculated: in-woods utilization, at-landing utilization, overall utilization, average stump height and diameter, number of markets, and haul distances to markets. These measurement variables were summarized for the entire sample and for the West Virginia and Ohio subsamples. Summaries based on species and species-groups also were conducted. The overall utilization rate is obtained by multiplying the utilization rate for in-woods operations (felling, topping, bucking to the merchantable length) by the utilization rate for operations at the log landing (bucking to specified product lengths, bucking out unacceptable defects/sections).

Analysis of variance (ANOVA) was used to investigate whether utilization rates varied based on: 1) whether the operation was in West Virginia or Ohio; and 2) the number of markets supplied by each logging operation (α=0.10). Two-sample t-tests (α = 0.10) were used to determine whether the utilization rates and stump heights measured in West Virginia were statistically similar to those measured in Ohio. Correlation analysis was conducted to test for association between average stump height and average stump diameter (α = 0.10) among species groups.

RESULTS AND DISCUSSION

SPECIES GROUPS

At the 39 harvest operations visited, we measured 1,087 felled trees. This sample consisted of 815 felled trees measured at 30 sites in West Virginia (average of 27 trees per site) and 272 trees measured at 9 sites in Ohio (about 30 trees per site). In West Virginia, the three most prominent species being harvested during our site visits were yellow-poplar (*Liriodendron tulipifera* L.), white oak (*Quercus alba* L.), and soft maple (*Acer rubrum* L.). In Ohio, red oak (*Quercus rubra* L.), white oak, and black cherry (*Prunus serotina* Ehrh.) were the most frequently encountered tree species (Fig. 2). Species groupings used in analyses were "mixed hardwoods," "soft hardwoods," "pine," and "hickory". Two of these categories contain multiple species. "Soft hardwoods" includes several lower-density hardwood species such as aspen (*Populus* spp.), basswood (*Tilia americana* L.), blackgum (*Nyssa sylvatica* Marsh.), and sourwood (*Oxydendrum arboreum* DC). "Mixed hardwoods" includes the ashes (*Fraxinus* spp.), elms (*Ulmus* spp.), and walnuts (*Juglans* spp.).

UTILIZATION RATES

The key result of this research is the overall average utilization rate for harvesting operations in the central Appalachian region (addressing Objective 1). The average in-woods utilization rate was 83.8 percent while the average utilization rate at the log landing was 98.3 percent (Table 1). When multiplied, these two utilization rates indicate an overall utilization rate of 82.3 percent. This value means that 82 percent of the growing stock volume of harvested trees was utilized for products and 18 percent was left as residue. When the pine data are separated, the overall utilization rates for softwoods (pine) and hardwoods were 95 and 76 percent, respectively (Table 1). These rates align well with the rates determined by Bentley and Johnson (2009b) for Virginia, which were 95 and 79 percent, respectively.

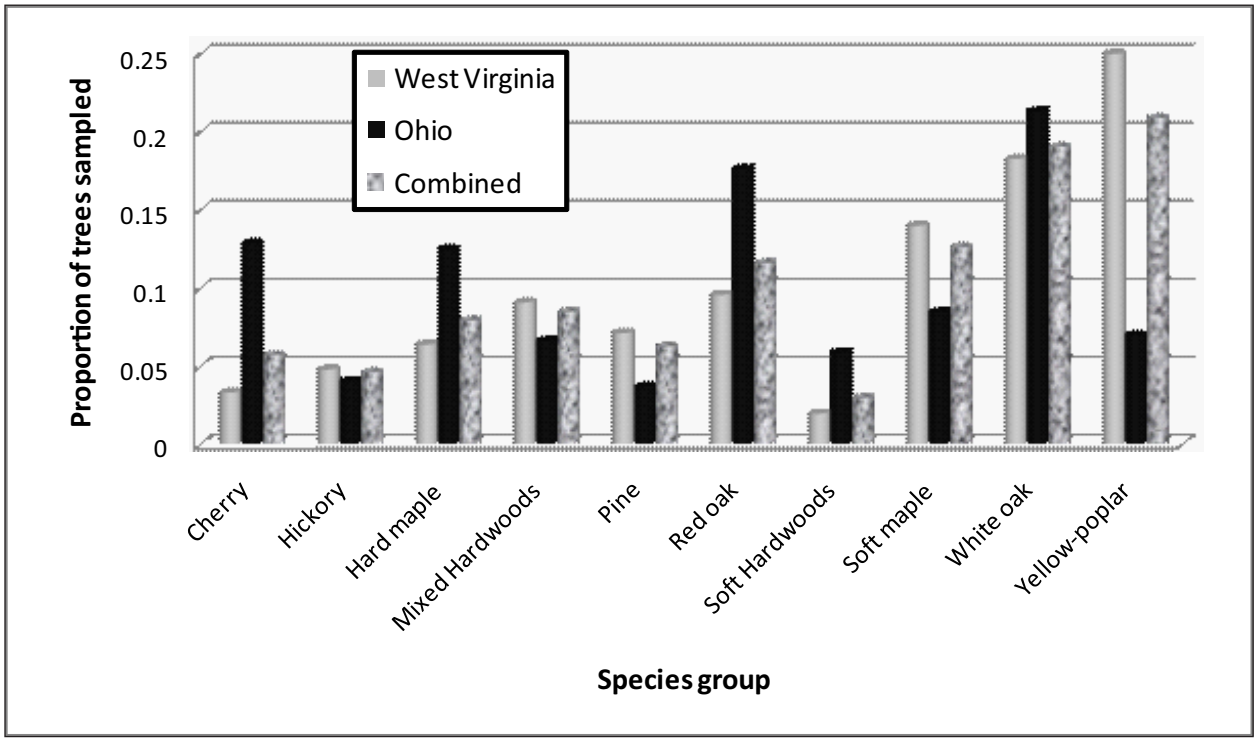

Figure 2.—Distribution of tree species examined in logging utilization studies conducted in West Virginia and Ohio in 2008 and 2009.

Table 1.—Logging utilization rates for the central Appalachian region and for state-based subgroups.

Utilization Measurement	West Virginia (n=30)		Ohio (n=9)		All sites (n=39)	
	Utiliz. value	Standard dev.	Utiliz. value	Standard dev.	Utiliz. value	Standard dev.
	(percent)					
In-woods utilization	88.6	6.6	67.7	21.4	83.8	14.4
At-landing utilization	97.8	1.9	99.9	0.2	98.3	1.9
Overall utilization	86.7		67.6		82.3	
Hardwood utilization	84.9		66.6		75.8	
Softwood utilization	94.7		96.1		95.4	

To understand how various factors influence utilization requires the further analysis of the rates that were measured at the 39 harvest sites. Of particular note is the fact that both the average overall utilization rate and the average in-woods utilization rate were lower for the nine Ohio logging jobs than for the 30 West Virginia jobs. The overall rates averaged 67.6 percent in Ohio and 86.7 percent in West Virginia while the in-woods rates averaged 67.7 percent in Ohio and 88.6 percent in West Virginia. Analysis of variance for these utilization rates indicated both were significantly different between the two state-based groups. The p-values for the tests were .0278 and .0189 for the overall and the in-woods utilization, respectively. The Welch's ANOVA model was used after the Bartlett's test indicated the variance among rates within each group displayed heteroscedacity.

The at-landing rates for the two groups were 99.9 percent in Ohio and 97.8 percent in West Virginia. These rates also were significantly different (Welch's p = .0001), but the influence of this difference on total utilization is minor compared to the in-woods rate difference. The absolute difference is small (2 percent) compared to the absolute difference for the in-woods utilization rates (21 percent).

DIFFERENCES IN UTILIZATION RATES BASED ON NUMBER OF ROUNDWOOD MARKETS

Loggers in West Virginia identified 10 types of markets to which they shipped their harvested volume: veneer, saw, peeler, and scragg mill logs; hardwood and softwood pulp; fence posts and rails; specialty products; and firewood. The nine loggers visited in Ohio identified only five markets: saw and scragg logs, hardwood pulp, wood chips, and firewood. All 39 logging operations had sawmill markets. Additionally, in West Virginia, 60 percent had softwood pulp markets, 57 percent had peeler markets, and 53 percent had hardwood pulp markets. In Ohio, 44 percent had a market for firewood and 33 percent had a market for hardwood pulp.

It is generally thought that differences in the number of roundwood markets available to a logging contractor at any given logging site will influence the logger's ability to optimally utilize the harvested trees. In this study, approximately one-half of the logging operations had a limited number of markets (20 loggers had only one or two markets) and the rest (19 loggers) had more merchandising options (three or more). The average overall utilization for operations with only one or two markets was 79.7 percent. For operations with three or more markets, utilization was higher (Table 2).

Table 2.—Number of roundwood markets and average overall utilization for all logging operations sampled in the West Virginia and Ohio region.

Markets	No. of logging sites (n)	Ave. utilization (%)
Few (1 or 2)	20	79.7
Several (3, 4, or 5)	19	85.2
Total	39	82.4

A two-factor ANOVA was performed that included the classification variables *State (two levels)* and *Markets (two levels: few and several)*. The test yielded a p-value for the overall model of 0.0003. The variable *State* was highly significant (p = 0.0003). The *Markets* variable, with a p-value of 0.0774 was significant, as was the interaction term *State x Markets*, with a p-value of 0.0486.

This result suggests that if a logging operation has more rather than fewer markets available for sales/shipment of roundwood and chips, the logging utilization rate is likely to be improved. The test results also indicate that the effect of markets on the level of utilization is different for sites from Ohio versus West Virginia. State-based evaluation of utilization for the two-level market variable shows that the difference in utilization between the groups is much greater in Ohio than in West Virginia.

HAUL DISTANCE TO MARKETS

The distance from the logging site to the product market affects the profitability associated with different roundwood products. The effect typically is not as large as the effect of changes in the price of roundwood products, but it is real and meaningful. Frequently, studies will allude to the "maximum feasible haul distance," which is the greatest distance that a logging contractor can transport logs to specific markets. If roundwood products are high-value, roads are in good condition such that travel time is minimized, and trucks can be fully loaded, the feasible haul distance is longer than in cases where these conditions are sub-optimal.

Just as all these transportation issues factor into the equation for estimating the maximum feasible haul distance, they impact the total manufacturing cost for roundwood. If the logging site is closer to the market, the trucking and related costs are lower, and the profit margin for a load of roundwood products is higher. Therefore, a logging operation with a market in close proximity can spend more time and effort in the woods and at the landing to recover greater amounts of roundwood product than would be the case if the same market were more distant. Whether loggers consciously behave in this way is not clear, but the possibility that they do provides the rationale for evaluating utilization relative to haul distances.

The average haul distances for the region are charted in Figure 3. The bars in the figure show what we expect—the average haul distance for lower-valued products (scragg logs and fencing logs) is shorter than the average haul distance for the higher-value logs. A question that arises from this figure is why the haul distance to pulp markets (pulpwood and chips, also a low-value product) appears to be one of the longest average distances. Most sites have a lot of material of pulpwood size and quality that needs to be harvested, and there is a wide geographic distribution of plants that buy pulp logs and chips. For harvest sites where these lower-value markets are closer in, the utilization rate of limbs, tops, minor species, and defective sections should

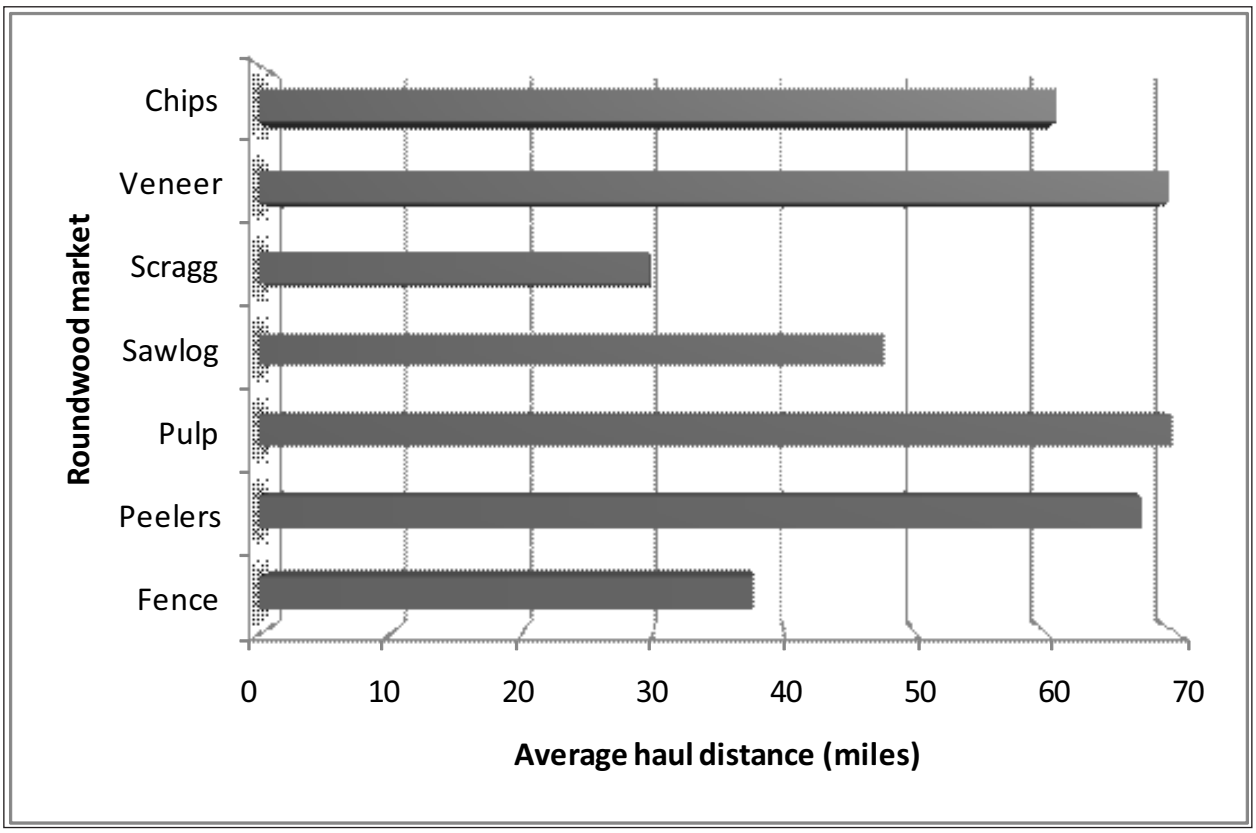

Figure 3.—Average distance from log landing to primary processing facility for 39 logging operations in West Virginia and Ohio.

be higher than for cases where these markets are closer to the maximum haul distance. When pulpwood markets are at hand, loggers report their pulpwood sales often provide the profit on their logging jobs—saw log markets alone are, at best, a breakeven proposition in today's market. For pulpwood/chip products, the average haul distance to market was 68 to 69 miles in both West Virginia and Ohio.

Since all 39 logging operations produced saw logs, haul distance from the logging site to the sawmill also is an important factor to consider. The average haul distance from the West Virginia harvest sites to sawmill markets was shorter than the distance from the Ohio sites. West Virginia loggers visited in this study hauled their saw logs an average of 45 miles while Ohio loggers hauled theirs 56 miles on average.

SPECIES-BASED DIFFERENCES IN UTILIZATION RATES

The distribution of tree species harvested at the nine study sites in Ohio varies from the distribution encountered at the 30 West Virginia sites in some important ways that may help explain differences in utilization. In Ohio, the percentages of harvested trees sampled that were black cherry and red oak were more than 5 percent higher than in West Virginia (Fig. 2). Conversely, in West Virginia, the percentages of harvested trees that were yellow-poplar and soft maple were notably higher than in Ohio (Fig. 2).

Table 3 shows the summary breakdown of utilization by species alongside the overall species distribution information for all 39 sites. Pine stems were utilized at a rate of 94.9 percent—the highest rate among all species—but they represented only 6.3 percent of the sample. Yellow-poplar stems ranked second in

Table 3.—Logging utilization, by species group, and sample tree species distribution, for 39 study sites in West Virginia and Ohio.

Species group	Regional utilization %	Utilization rank (1=highest)	Regional no. of trees	Percentage of sampled trees
Pine	94.9	1	68	6.3
Yellow-poplar	88.0	2	227	20.9
Mixed hardwoods	84.9	3	92	8.5
Soft maple	84.6	4	137	12.6
White oak	79.8	5	207	19.0
Hickory	79.5	6	50	4.6
Red oak	78.3	7	126	11.6
Hard maple	73.3	8	86	7.9
Soft hardwoods	71.4	9	32	2.9
Cherry	68.0	10	62	5.7

utilization and were the most frequently encountered (20.9 percent of the sample). Of all species groups accounting for 10 percent or more of the sample, red oak's overall utilization rate was the lowest at 78.3 percent. High utilization rates for pine and yellow-poplar can be attributed to two factors: 1) markets for these two species (groups) are dominated by pulpwood markets, which allow utilization of greater amounts of the tree; and 2) the growth form of these two species is a dominant, straight, long bole. The excurrent (single bole) form tends to have fewer defective sections than do trees with a deliquescent (forking) growth form. Branching defects and stem crook often have to be removed from trees with deliquescent form.

The degree of difference in utilization rates, by species, noted in Table 3, and the difference in the species' distributions of the West Virginia and Ohio samples, depicted in Figure 2, suggests that comparing the utilization rates of the different species groups for each state may inform our analysis of factors impacting logging utilization. Figure 4 provides side-by-side comparisons of this information. Analysis must take into account the relative size of the felled tree sample in the two states—75 percent of the 1,087 stems measured were in West Virginia while only 25 percent were in Ohio.

In both West Virginia and Ohio, the pines were the most fully utilized but they made up only 7 and 4 percent of the sample, respectively (Fig. 4). If Ohio's pine percentage were the same as West Virginia's, the overall logging utilization rate for the nine Ohio sites, which was 67.6 percent, would have been about 1 percent higher.

Yellow-poplar, having the second highest overall utilization rate, is substantially different both in terms of utilization and proportional representation in the sample, between the two states. While yellow-poplar was utilized at a rate of 89 percent at logging sites in West Virginia and represented 26 percent of the sample, its utilization rate in Ohio was only 76 percent and it composed only 7 percent of the felled tree sample (Fig. 4). These results would appear to be a clear case of how market availability impacts logging utilization. In both West Virginia and the two FIA regions of eastern Ohio where sampling was conducted, the highest-volume species, both in terms of growing stock and sawtimber, on forest land is yellow-poplar (Widmann and others 2007, Widmann and others 2009). In West Virginia, where OSB and peeler markets create strong demand for yellow-poplar, the change in yellow-poplar growing stock volume on forest land increased only 4 percent

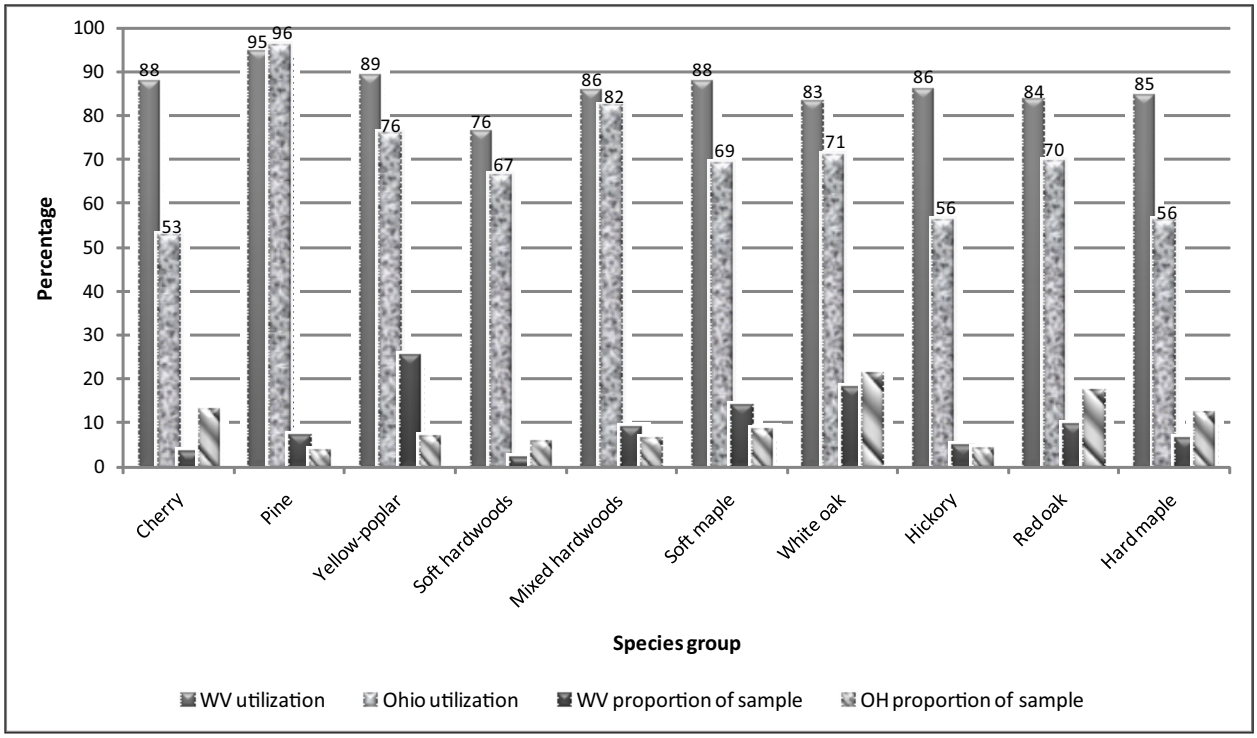

Figure 4.—Utilization rates and sample proportions, by species, for West Virginia and Ohio.

between 1989 and 2000 (Widmann and others 2007). In Ohio, where OSB and peeler markets do not exist, the yellow-poplar growing stock volume increased by 45 percent between 1991 and 2006 (Widmann and others 2009); yellow-poplar is not being harvested to the same extent in Ohio as in West Virginia despite its availability.

The utilization discussion for soft (red) maple is very similar to that for yellow-poplar. The same West Virginia OSB markets that procure yellow-poplar also utilize soft maple. Even the closest regions of Ohio (i.e., surrounding Cambridge and Marietta) are more than 125 miles from the two West Virginia OSB facilities. As a result, we see soft maple utilization rates in West Virginia of 88 percent, representing 14 percent of the harvested stems, as compared to 69 percent utilization for 9 percent of the harvested stems in Ohio (Fig. 4). The yellow-poplar and soft maple utilization situation explains approximately half of the difference in average overall utilization between the two states.

A closer analysis of the data will be required to estimate possible causes of the remaining variation in utilization. Falling saw log prices between 2008, when the West Virginia data were collected, and 2009, when the Ohio data were collected, likely enters into the explanation. Differences in product specifications (log size and quality limitations) in conjunction with available volumes and market proximity should also be considered.

DIFFERENCES IN STUMP HEIGHTS AND DIAMETERS

Data collected on stump heights and diameters provide the final piece of information on species-based differences impacting logging utilization. The average stump height for all 815 felled trees sampled in West Virginia was 9.8 inches. In Ohio, the average stump was shorter, averaging 6.5 inches for 272 felled trees.

This observation indicates that utilization of the stump section of the tree was better at the 9 Ohio logging operations than at the 30 West Virginia sites. Factors that can affect stump utlilization include felling equipment, feller skills, tree form, terrain, obstructive understory vegetation, tree diameter, and season of harvest.

The average stump diameter of the West Virginia tree sample was greater than that of the Ohio sample—20.6 inches compared to 19.8. While the value and volume associated with achieving higher utilization at the base of the tree are higher than for other parts of the tree, due to the higher quality and larger diameter of this part of the tree, larger-diameter trees are more challenging to fell. The reduction in recovered log volume associated with the 3.3-inch difference in stump height measured in West Virginia and Ohio averages 0.45 cubic feet per tree. This volume translates into a missed utilization opportunity of about 1 percent for West Virginia logging operations. Conversely, larger stump diameters typically mean larger diameters at other heights up the bole compared to trees with smaller stump diameters. Larger diameter trees tend to yield more marketable roundwood, thus increasing utilization rate.

Average stump heights and diameters for the 10 species groups are shown in Figure 5. The result of the paired sample t-test that was conducted to test the average stump heights for the species groups for West Virginia and Ohio was highly significant ($p \leq .0001$). Species with smaller average diameters have shorter average stump heights (Fig. 5). Correlation tests indicated the positive association between stump diameter and height is stronger for the Ohio data ($r = 0.62$) than for the West Virginia data ($r = 0.25$).

SUMMARY AND CONCLUSIONS

A series of 39 logging utilization studies was conducted during 2008 and 2009 in which the utilization, to a 4-inch top, of felled trees was measured. In total, 1,087 trees were measured—815 in West Virginia and 272 in Ohio. Sample trees were randomly selected from among the trees felled by the loggers at each site. The overall logging utilization factor for the region, determined in this study, is 82.3 percent.

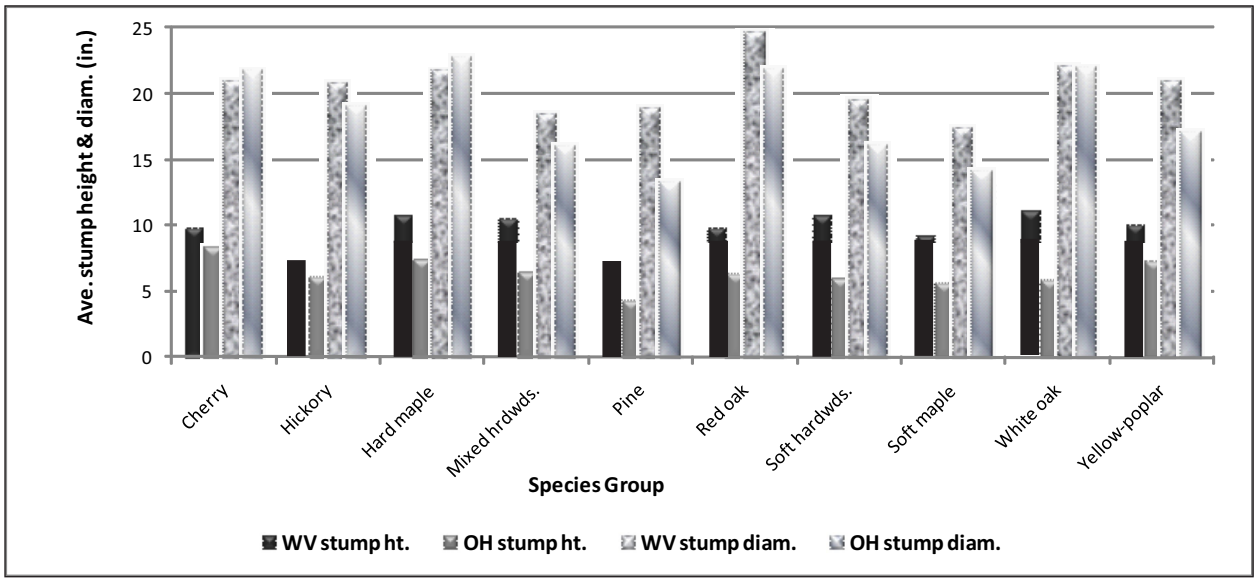

Figure 5.—Average stump heights and diameters for sample trees in West Virginia and Ohio, by species.

Average utilization rates for all species were significantly different for harvests in Ohio and West Virginia, with average rates of 67.6 percent in Ohio and 86.8 percent in West Virginia. In this study, one-half of the logging operations had a limited number of markets (one or two markets) and the rest had more merchandising options (three or more). Analysis of variance indicated that logging operations with three or more markets achieve higher utilization than operations with only one or two markets.

The distribution of tree species harvested at the 9 study sites in Ohio varies from the distribution encountered at the 30 West Virginia sites in some important ways that may help explain differences in utilization. Pine stems were utilized at a rate of 94.9 percent—the highest rate among all species—but they represented only 6.3 percent of the sample. Yellow-poplar stems ranked second in utilization and were the most frequently encountered (20.9 percent of the sample). Of all species groups that composed 10 percent or more of the sample, red oak's overall utilization rate was the lowest at 78.3 percent.

Yellow-poplar, having the second highest overall utilization rate, is substantially different both in terms of utilization and proportional representation in the sample between the two states. While yellow-poplar was utilized at a rate of 89 percent at logging sites in West Virginia and accounted for 26 percent of the sample, its utilization rate in Ohio was only 76 percent and it made up only 7 percent of the felled tree sample. This difference can be largely attributed to the availability of OSB and peeler markets in West Virginia.

The number and types of markets available to a logging contractor operating at a specific site is an important determinant of potential utilization on the logging job. The species of poletimber and sawtimber to be harvested at a site interact with markets to affect utilization potential. Species that tend to have straight, dominant boles can produce especially high roundwood product yields if demand exists for that species. Stump heights have an effect on logging utilization, but the effect is much smaller than the market and species effect.

The average stump height for all 815 felled trees sampled in West Virginia was 9.8 inches. In Ohio, the average stump was shorter, averaging 6.5 inches for 272 felled trees. The average stump diameter of the West Virginia tree sample was greater than that of the Ohio sample—20.6 inches compared to 19.8. While the value and volume associated with achieving higher utilization at the base of the tree are higher than for other parts of the tree, larger-diameter trees are more difficult to fell. The larger-diameter tree, however, can result in higher volume utilization, all other factors being equal.

A closer analysis of the data will be required to estimate possible causes of the remaining variation in utilization. Falling saw log prices between 2008, when the West Virginia data were collected, and 2009, when the Ohio data were collected, likely enter into the explanation. So too might differences in the product specifications (log size and quality limitations). Differences in the equipment used by the loggers also should be explored.

Logging utilization rates vary both temporally and spatially. Several factors—including size and location of markets, logger training, resource availability and quality, and landowner objectives—influence utilization rates. Developing timely estimates of logging utilization helps the forest industry understand resource availability and facilitates the development of new industries based on the characteristics of underutilized wood resources.

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